SOCIO-CULTURAL DIMENSIONS OF FARMING, SMALL FARM HOUSEHOLDS AND CONSERVATION AGRICULTURE IN NYANGA DISTRICT, ZIMBABWE

by

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DEDICATION

To God be the glory!

DECLARATION

I declare that this PhD thesis entitled, 'Socio-Cultural Dimensions of Farming, Small Farm Households and Conservation Agriculture in Nyanga District, Zimbabwe.' is my own original work and has not been submitted for a degree at this institution and any other tertiary institution. I also declare that all the sources cited and quoted have been indicated and acknowledged by means of complete references.

Name: Brian Fleming Mandipaza Signature..

Date……………...........................

ETHICS STATEMENT

As the author of this thesis, I declare that for the purposes of carrying this research, I obtained research ethics approval acknowledging that I have complied with all the ethical standards required. The approval was done by the University of Pretoria Research Ethics Committee.

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Title: **Socio-cultural dimensions of farming, small farm households and conservation agriculture in Nyanga District, Zimbabwe**

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ABSTRACT

Conservation agriculture (CA) has been extensively promoted in Zimbabwe as a panacea to non-viable agricultural production, continual land degradation and shifting climates. However, the long-term adoption of the introduced technology has been varied and quite lethargic and has not yet entered into an exponential uptake phase despite more than two decades of research and development investments. There is extensive literature on barriers and constraints of CA adoption in Zimbabwe, but the impact of local socio-cultural factors (farmers' prior experiences, farming practises, indigenous knowledge systems and values) on the adoption of this technology for rural farm households has largely been assumed. Improving understanding of socio-cultural factors that lead to dis-adoption of this seemingly appropriate intervention is important to achieve sustained adoption and for ensuring long-lasting impacts of agricultural development project interventions. Guided by an epistemological position, the study is designed as a single-site and in-depth inquiry grounded on people's lived realities and experiences. Data was collected from Ward 30, Nyanga District (also referred to as the ward or Ward 30), through non-participant and participant observations, life history, extended visits and document reviews triangulated with key informant interviews.

The study found that farming households in the study area face challenges such as uncertain weather conditions, infertile soils, soil erosion, weed pressure, high input costs among other challenges which warranted an intervention like CA. In addressing some of these challenges, farming households make use of conventional and other emerging farming practises to guide their farming. However, there is a discernible and significant relationship between these farming practises arrangements and the lacklustre reception to CA. Apart from farming practices, farming in the study area is guided by the supernatural but these local belief systems and culture also played a role in the unenthusiastic reception of CA technology in the area. Indigenous knowledge systems were also found to be influential in resisting CA changes that were undesirable and of little relevance at farm and community levels leading to its abandonment or outright rejection. The research also found that certain socio-cultural aspects that were missed in CA implementation led to the technology abandonment. Simultaneously, socio-cultural aspects that were incorporated in CA implementation strategy led to farmers adopting the technology as

early adopters. However, the farmers disentangled and modified the CA package to suit their local conditions. When farmers eventually abandoned the technology, the trends show that CA is replaced by conventional practises.

The study concluded that for CA and other agricultural development projects not to fall flat in Ward 30, socio-cultural factors need to be taken into account if small-scale farmers are to take up these farming methods successfully. This highlights a need to (a) collaboratively design agricultural programmes to better suit local needs and context with inclusive implementation arrangements; (b) emphasise climate resilience benefits of CA rather than economic benefits to manage rural farmers' expectations; (c) intensify multidisciplinary research that incorporates farmers' social, cultural and experiences to develop suitable and flexible CA packages.

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LIST OF ACRONYMS

AGRITEX	Agricultural, Technical and Extension Services
AIDS	Acquired Immunodeficiency Syndrome
AN	Ammonium nitrate
CA	Conservation agriculture
CF	Conservation farming
CIMMYT	International Maize and Wheat Improvement Centre
COVID 19	Coronavirus Disease
CT	Conventional tillage
DFID	Department for International Development
DoI	Diffusion of Innovations
DS	Direct seeding
FAO	Food and Agriculture Organisation
FTLRP	Fast Track Land Reform Programme
GMB	Grain Marketing Board
HIV	Human Immunodeficiency Virus
ICARDA	International Centre for Agricultural Research work in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ISCO	International Soil Conservation Organization
ISTRO	International Soil Tillage Research Organisation
MDG	Millennium Development Goals
MERCOSUR	Mercado Común del Sur
MT	Minimum tillage
NFGA	Nyajezi Farmers Growers Association
NGO	Non Governmental Organisation
NRDC	Nyanga Rural District Council
NT	No-till
PCA	Precision Conservation Agriculture
SF	Safety First
SSA	Sub-Saharan Africa
WFP	World Food Programme
ZimVAC	Zimbabwe Vulnerability Assessment Committee
ZT	Zero-till

DEFINITIONS OF TERMS

Conservation agriculture — Seen as an ideal system for sustainable and climate-smart agricultural intensification, through which farmers can attain higher levels of productivity and profitability while improving soil health and the environment.

Farming practises — A collection of principles applied for farm production processes in order to produce agricultural products.

Household — A social unit of those who dwell under the same roof a composed of children, dependents and a household head who maybe either a woman or a man. This implies that the household can be *defacto* or *dejuri* female-headed. The household can also be male-headed which was common across the study sites.

Indigenous Knowledge Systems — refer to intricate knowledge systems acquired over generations by communities as they interact with the environment. It encompasses technology, social, economic, philosophical, learning and governance systems.

Rural area — An open swath of land that has few homes or other buildings, and not very many people.

Rural farmer — Someone involved in farming and carrying out farming activities in the villages. They may cultivate food crops, mono crop, rear livestock, engage in finishing and hunting among others, but they depend on seasonal and natural conditions to carry on their farming activities.

Smallholder farmer — Farmers who own small pieces of land and engage in small scale subsistence farming. They are mostly constrained in terms of inputs use, market participation and availability of arable land.

Society — A group of individuals involved in persistent social interaction, or a large social group sharing the same spatial or social territory.

Socio-cultural factors — Conditions in a society related to common traditions, habits, patterns and beliefs present in a population group.

GLOSSARY OF SHONA TERMS

Chisi	A weekly day of rest set aside where work is forbidden.
Dara remashanga	A wooden structure used to keep crop stover for controlled feeding during the long dry winter season.
Dhiga ufe	A derogatory vernacular term that can be loosely translated to 'death by digging'.
Dziva	The appearance of a hallo around the moon and the stars giving them a dim appearance.
Hoko	A peg.
Hore	Cumulonimbus clouds.
Humwe	An indigenous traditional practice where community members come together to work towards a common goal.
Hurudza	A successful lead/Master farmer.
Jendiremeni kondirakiti	A verbal agreement to a contract not memorialised or witnessed and is not accompanied by any formalities.
Kudhara maline	The practice of plough line seeding.
Kufusa mari	A practice of reciprocal relationship of microfinance activity to invest money.
Kuminda mirefu	Refers to vast tracts of tilled land.
Kupandira	The practice of planting seeds in dry soil mostly done towards the end of October.
Kupfurira	The practice of thatching using grass.
Kuradza munda	The practice of leaving a portion of the farm to fallow to allow the soil to regain its structure.

Kurinda udyi	The practice of guarding crops against wild animals.
Kusuma	The practice of introducting to a higher authority like ancestral spirits.
Kwetsa-kwetsa	The practice of farming with a hoe.
Maganzvo	A popular practice done on a rainmaking shrine before the first rains in early October.
Mahakurimwi	Days set aside for mourning a community member where everyone is obliged to mourn the deceased and no agricultural activities are allowed.
Maricho	The practice of hiring labour to carry out a specific task over a short period usually over a day for which a given wage rate is paid or in exchange for food, soap, salt or old clothing.
Mbambara	Light winds that blow from almost all directions causing whirlwind-like activity from the end of October up to early November.
Mhare yaJanuary	A seasonal dry spell common in January and generally last between 14 and 21 days, or even a month during a growing season.
Mhondoro/svikiro	A spirit medium.
Musakwani	Decomposing tree leaves mainly found along river banks.
Njeke/ shimanyika	A local traditional maize seed which can withstand harsh conditions even in times of inconsistent rainfall.
Nyevhe	Cleone gynandra.
Nyope	A lazy person.
Pfumvudza	New and tender tree leaves that develop before the rains start.
Vakweguru	Old people who are associated with wisdom.
Wasu	A word from the Manyika dialect of Shona meaning 'bosom friend'.

Zunde raMambo	(Chief's granary) is a pre-colonial traditional social security arrangement designed to address the contingency of drought or famine.
Zviyo	Finger millet.

CONTENTS

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Ending poverty and hunger remain unaccomplished global goals and have become a pressing concern of national governments and international agencies (Food and Agriculture Organisation (FAO), 2017). In sub-Saharan Africa (SSA), food and agricultural systems are under mounting pressure. All over the region, smallholders are grappling with the interconnected challenges of climate change and increasing climate variability, declining soil fertility and declining land availability. At the same time, rising and more volatile food prices, coupled with increased food demand resulting from population and per capita income growth, place increased pressure on domestic production systems (Deininger, 2013; Laurance *et al.*, 2013).

In Zimbabwe, most rural households can no longer guarantee food security from their own production, leaving them extremely dependent on external aid in the form of inputs or even food aid. Agricultural productivity in developing countries has experienced a decline over the years from an average of 3.56 percent in the 2000s to 2.37 percent in the 2010s despite the numerous advancements made in agricultural technology development (Fuglie, Jelliffe and Morgan, 2022; Thierfelder & Wall, 2009). Over the years, underinvestment in agriculture, gaps in technology, erratic rainfall, occasional droughts have affected agricultural production, with complete crop failure in some areas due to extended dry spells (FAO, 2017; Nyagumbo *et al*., 2009). These rural small farm households often compensate low yields through agriculture extensification instead of intensification to meet the basic household food requirements (see Baudron *et al.*, 2011).

Consequently, this aggravates labour resources and production inputs that are already thinly spread and contribute to land degradation. Generally, farmers engage in unsustainable soil and crop management practises, low standard of land preparation, delayed planting, and poor crop management (Elwell & Stocking, 1988). Under such conditions, it is critical to develop strategies to substantially increase crop productivity while at the same time increasing the resilience of rain-fed farm systems, which are dominant among smallholder farmers in rural areas.

Although significantly contextualised by a long history of official pessimism about African farming systems, this context sets the stage for promoting sustainable agricultural technologies, which were meant to improve food security and land quality. Among these technologies, CA emerged as an alternative farming practice designed to address problems of low-crop productivity, soil organic matter decline, water run-off and soil erosion, which are seen as factors limiting agricultural productivity (Erenstein *et al*., 2008; Hobbs, 2007, 2008). CA is based on (a) minimal mechanical soil disturbance, (b) permanent organic soil cover by crop residues and/or cover crops, and (c) diversified crop rotations or associations with legumes (FAO, 2020).

Thus, CA was promoted in Zimbabwean communal areas as a panacea to agriculture failure and food insecurity within the country's small farm sector by both Non-Governmental Organisations (NGOs) and the government (Shaxon, 2006). Initially developed in the US, the model has arguably become a hegemonic model in discourses and policy thinking on sustainable agriculture and food security over the last two decades. Proponents of the model point out its benefits, amongst which are improved soil fertility, labour savings, improved efficiency in water use, an increase in productivity and environmental sustainability and a reduction in the cost of production and building resilience to climate change impacts (Enfors, 2009; FAO, 2000; FAO, 2018; Giller *et al.*, 2015; Kassam *et al.*, 2009; Lugandu, 2013).

Although CA was later expanded to cover large sections of rural households from 2003, and notwithstanding the benefits of the model, the reception by households has been lacklustre despite predictions that CA would transform small farm agriculture in Zimbabwe (Gukurume *et al*., 2010; Andersson & D'Souza, 2014; Brown *et al.,* 2017b). In fact, at a time of extreme food insecurity, agricultural production crisis and rural poverty, the proportion of households practising the CA component declined (Mazvimavi *et al.,* 2011), and many farm households outright rejected the CA technique.

According to Mazvimavi *et al.* (2011), Mazvimavi & Twomlow (2009), and Derpsch *et al*. (2010), the implementation of the model has been characterised by partial or selective adoption, an adaptation of the package, as well as outright rejection. This was reflected in the recorded decrease in households applying inorganic fertilisers from 71% (basal fertiliser) and 94% (top dressing fertilisers) in the 2004/05 cropping to 38% and 70% respectively in 2004/05. Basin digging also dropped from 100% farm households in the 2004/05 season to 89% in 2008/09. However, the more interesting finding is the selective adoption of the CA package by some farm households, while others have discontinued the practice altogether (Andersson & D'Souza, 2014; Boliger, 2007; Giller *et al.,* 2009; Gowing & Palmer, 2008).

Many studies with data from surveys, experiments, expert opinion, econometric modelling, etc., have sought to understand why African smallholders are not adopting CA (Brown *et al.*, 2017, 2018b; Chinseu *et al.*, 2018; Hermans *et al.*, 2020). Nevertheless, there is still little coherent understanding and almost no theoretical or empirical analyses on the constraining influences of the socio-cultural factors involved in such transactions of partial adoption, abandonment or outright rejection in smallholder African agriculture. Recurring and commonly identified reasons for the lacklustre adoption of the CA can be classified into two categories.

The first category is what is referred to as the 'goodness-of-fit' between the innovation and the potential users (Giller *et al*., 2009). Constraints cited here are the limited availability and competing uses for crop residues, weed pressure (Aune *et al*., 2012; Marongwe *et al*., 2011; Umar *et al*., 2012), capital requirements for additional fertiliser, herbicides, implements (hoes, rippers, sprayers) and, in some situations, labour requirements (Baudron *et al*., 2012; Mazvimavi, 2011). The second category, prerequisites, focuses on contextual factors that the innovation-development process cannot influence. These are factors such as relative land abundance, communal tenure arrangements (Baudron *et al*., 2012), absent or dysfunctional markets for legumes (Thierfelder *et al*., 2013a), and limited access to financial capital (see Wall, 2007). This inadequate understanding of micro-variations by science-based societies (Blaikie *et al*., 1997) often results in resource exhaustion and environmental degradation in communities and the failure of these scientific methodologies, especially in rural areas (Gadgil *et al*., 1993).

Most of these attempts to explain farmers' behaviour towards technological innovations or models like CAs assume a simplistic technology versus choice relationship where farmers evaluate the technology and choose what to adopt and what not to adopt (see Giller *et al.,* 2009). However, such explanations miss the fact that farming is a social activity in rural societies and occurs within a particular social context. Also, missing from these explanations is a critical factor in rural agricultural farming practises, the socio-cultural dynamics of farming. Very few have contemplated the possibility that the new technology may be anathema to certain socio-cultural practices guiding farming in rural societies – despite its recognised potential to overcome climate change and input cost constraints (Ghosh *et al*., 2010).

Thus, envisaging farmers' behaviour as a question of an assessment of technology and compatibility is problematic for its neglect of certain endogenous factors within societies that guides farming and may pose limits to the adoption of new technology. This was aptly captured by Sumberg (2005), who highlighted how little consideration is given to 'adoption constraints that are endogenous to the fit between the innovation and the target group', or ... whether... [CA] 'actually fulfils a concrete need from the point of view of targeted smallholders' (Bolliger, 2007). However, others continue to propose the best approaches to promote and extend CA (e.g. Kassam *et al.,* 2009) without questioning *if* (where and for whom) modified tillage systems and the CA 'package' are indeed context appropriate.

1.1.1 Socio-Cultural dimension of farming

In broad terms, the socio-cultural environment consists of both the social system and the culture of people. It refers primarily to human-created intangible elements that affect people's behaviour, relationship, perception and way of life, and survival and existence (Adeleke *et al.*, 2003). It consists of all elements such as beliefs, values, attitudes, habits, forms of behaviour and lifestyles of persons as developed from cultural, religious, educational and social conditioning (Anderson & Jack, 2002; Anderson, Lardy & Ilse, 2007; Porter, 2000), and influences the personality of an individual and potentially affect his attitude, disposition, behaviour, decisions and activities (Casson & Giusta, 2007). Since people become accustomed and familiar with behaviour patterns and learn to create rules for effectual interaction, they build expectations about how certain individuals should act in specific situations. Expectation systems are a group's anticipation of the behaviour most likely to occur if certain circumstances are brought about (Finn, 1972). As Hofstede (1980) aptly puts it: 'social systems can only exist because human behaviour is not random, but to some extent predictable'. A group's culture provides expectation systems that predict patterns of possible human interaction.

According to Douglas and Widavsky (1982), rural farmers are confronted with different kinds of fears – physical, economic, and social – and their decisions go beyond risk-utility analysis (i.e. weighing the economic benefits and costs). Hence, farmers' perceptions of the risk associated with new technology are embedded within their economic, social, and cultural environments. This includes their belief systems. These risk perceptions are likewise largely influenced by a combination of confidence and fear that, in turn, constrain and enable particular behaviours. These farmers look upon new methods or technologies with indifference and sometimes with suspicion. Also, respect for elders often results in the attitude that the old ways are best. Farmers not only fear the unknown and untried, but they also fear risk and criticism for doing something different from other farmers. This is because farmers and their families are entrenched within the society in which they live. In any society, there are strong pressures on its members to behave in certain ways. For the farmers, some of these pressures will come from within.

In all societies, there are accepted ways of doing things, and these ways are directly related to their culture, influencing farmers' attitudes and desires. There will be features of society and culture that may act as barriers to adopting new technologies in agriculture, especially among rural farmers (FAO, 1985; Nyagumbo, 1999). Other socio-cultural factors affecting the adoption of conservation tillage include the fear of change, risk aversion, and weaknesses in extensionists' promotional and technical abilities (Kaumbutho *et al.*, 1999). Culture, then, is the underlying pattern of meaning guiding the behaviour of farmers, both as individuals and as members of a collective group.

Consequently, farmers' perception of technological risk is a critical determinant of its adoption. Recent studies found that farmers' perceptions of risk are mostly influenced by cultural worldviews instead of empirical and theoretical data, in what is termed the "cultural theory of risk" (Adger *et al*., 2013; McNeeley & Lazrus, 2014). A meta-analysis study comprising 15 660 respondents found that perception of risk was higher among individuals with a high score on egalitarianism than those with a high score on individualism (Xue *et al*., 2014). Because African traditional worldviews are mainly communal and egalitarian, a high perception of risk may be expected. Several studies in Mali (Sanogo *et al*. 2017), Zimbabwe (Mubaya & Mafongoya 2016), and Kenya (Speranza *et al*. 2010) confirmed high-risk perceptions among smallholder farmers.

Aspects of culture such as social relations, for example, can become a driving force for change, allowing individual farmers to become more confident in challenging normative ideas and practices. Culture guides the behaviour of farmers, both as individuals and as members of their community. In this sense, culture also functions to bring about cooperative behaviour that enables the experiential and collective learning essential to the success of technology and its adoption. As Alejo states, ‘‘people are acting, albeit in limited but also unique ways, according to their understanding of who they are and what they want’’ (Alejo, 2000: 23). Since culture varies by society or social group, understanding cultural norms, values, and specific beliefs associated with agricultural production is important when technology is implemented.

Currently, there is a lack of debate in the literature on how socio-cultural factors affect the adoption behaviour of conservation agriculture practises in Zimbabwe. Yet better knowledge of how these factors affect adoption would help policymakers and researchers in designing more effective technologies that will be tailored to the needs of the farmers. By neglecting to examine the socio-cultural factors, including farming practises, prior experiences and value systems, and not looking at farmer responses from a social/societal lens, the literature on CA and responses to CA in rural Zimbabwe are lacking a crucial perspective. An examination of the socio-cultural aspects can shed light on the socio-cultural dimensions of farming, an identity created, prior experience and knowledge, value systems, and how these are threatened by changes that are regarded as foreign. Because these aspects are being interfered with, vital connections between the individual or household are threatened, leading to an expected response.

This study argues that the NGOs' CA programme promoted in Zimbabwe made many universal recommendations and ignored local culture and existing beliefs, or so-called ‘‘mental models’’, which led to its lacklustre adoption. The programme failed to acknowledge that farming is a societal process that does not happen in a vacuum. Farmers are citizens of their society and have a rich and complex history embedded in their societal values, prior experiences and knowledge and farming systems, and to understand what rural farmers do, one must also understand the historical events and social and economic forces they have experienced over many years. Agriculture is not only about seeds and soil, sun and rain, but also about the people who plan and produce each season's crop. In this way, agriculture is intrinsically a cultural activity. Whether he or she tills half a hectare or a thousand, each farmer is guided by the norms of his or her culture.

Chambers and Richards adopts a populist, "farmer-first" argument, asserting that agricultural institutions (experiment stations, extension services, etc..) should "build on the needs, ideas and knowledge of the rural poor" (cf. Bebbington 1994: 206). These rural farmers have considerable practical knowledge of soils and plants and constantly read their environment for clues and cues on when to act during the agricultural year; cues are taken from plants, animal behaviour, insects, and the sky (the stars and the weather). Action must be based on an understanding of the dynamics of adoption and the critical factors that determine whether farmers accept, do not accept, or partially accept innovations to increase the adoption scale and impact of innovation, such as conservation agriculture (Denning, 2001). Therefore, rather than questioning the agronomic merits of the CA promoted, this study is concerned with CA technologies' suitability to the socio-cultural realities of smallholder farming systems in Ward 30 Nyanga District in Zimbabwe.

Perhaps because of this disconnect between how researchers and rural farming communities conceptualise new technologies and integrate them into existing decision-making processes, new practices introduced by government extension, non-governmental organisations, or other research institutions are often abandoned for traditional practices after development projects have been completed (Bunch, 1999; Cochran, 2003; Yadav, 1987). As such, this research adopts an interdisciplinary and empirical approach to understand the relationship between trends in expert and rural farmer reasoning and predictions regarding the outcomes associated with the adoption of technology based on these beliefs. At the centre of my study is an interest in comparing differences between expert and locally-based socio-cultural factors regarding the dynamics of farming systems. These two knowledge systems increasingly interact in the agricultural development sector, including conservation agriculture projects, across the globe.

The inconclusive findings from the surveyed literature contain little theory on the impact of socio-cultural factors on behavioural patterns on CA rejection. An important component of the innovation decision-making process receiving research attention is discontinued adoption behaviour, which is the decision to reject an innovation after previously adopting it. Outright rejection of technology has not been analysed widely in the literature, and there are no theoretical frameworks that analyse this phenomenon. Based on the theoretical discussion, this study attempted to fill gaps by applying the concept of outright rejection, as shown in the conceptual framework diagram. It intends to build upon past studies of CA adoption by developing a conceptual framework of CA rejection that identifies factors that explain CA's use and outright rejection by smallholders in Ward 30 Nyanga District of Zimbabwe.

1.2 Research questions

Main question

How have socio-cultural factors (prior experiences, local practises, indigenous knowledge systems and values) affected the adoption or rejection of the conservation agriculture model introduced by NGOs and the government in Ward 30?

Sub-questions

- What are the specific challenges confronting rural small farm households that led to introducing the CA model in Ward 30?
- What are the emergent socio-cultural factors guiding small farm households' agricultural practice and performance in Ward 30? How are these factors incorporated into small farm households' agricultural practises?
- How do farm households that have adopted the CA packages organise their agriculture and make farming decisions?
- What aspects of these cultural practices did the conservation agricultural farming model incorporate when it was implemented in, Ward 30? What aspects of these farming practices were completely missed in the implementation of the model? How did these issues affect households' decisions on adoption or non-adoption?

1.3 Research objectives

This research seeks to investigate, examine, and analyse the extent to which local culture (experiences, local practises and values) contributed to the passive reception of the CA technology by rural farmers in Ward 30. This thesis will be the first detailed account of social aspects of farming and conservation agriculture and a first methodological analysis of small farm households, and their agricultural system, linking this to their reception of CA technology. It aims to improve our understanding of a perspective important to food security but remains little understood. By grappling with the social factors guiding the practice of farming in rural society and situating these as central in farmers' farming decisions, I hope to broaden the debates on CA. My study will be grounded on long-term research at a single site, 'that normally involves sustained engagement in the daily lives of people in naturally occurring settings or ‘fields’ by methods of data collection that capture their social meanings and ordinary activities without the meaning being imposed on them externally to understand them on their own terms’ (Brewer, 2006: 6). This forms the strength of my study as such an approach allows me to be a participant-observer of their social and cultural worlds and opens out the possibility of an understanding of reality which no other method can realise (Seale, 1998). The approach also allows me to share the same experiences as my subjects, better understand why they act the way they do and ‘to see things as those involved see things’ (Denscombe, 1998: 69).

Specific research objectives

This broad objective is further divided into four specific objectives, which are framed to inform the dissertation's structure.

- To assess the specific challenges confronting rural small farm households that led to the introduction of the conservation agriculture model in Ward 30.
- To establish the local socio-cultural factors (farmers’ prior experiences, farming practises, knowledge systems and values) that guide rural small farm households’ and how they are incorporated into farming practises in Ward 30.
- To investigate how farm households that have adopted the conservation agriculture packages organise their agriculture and take farming decisions.
- To analyse and evaluate aspects of cultural practices that were incorporated and missed in implementing the conservation agriculture model and how this affected adoption, partial adoption or outright rejection in, Ward 30.

1.4 Significance of the study

Understanding why farmers are so reluctant to adopt measures supposedly conceived in their best interests is as valid today as it was in the early 20th century (Beinart, 1984). This thesis presents an attempt to fill a knowledge gap and adds a different dimension to the growing literature on CA technology adoption and agricultural development. Currently, there is not much debates in the literature on how socio-cultural factors are affecting the adoption behaviour of CA practises in Zimbabwe, yet better knowledge of how these factors affect adoption would help policymakers and researchers in designing more effective technologies that will be tailored to the needs of the farmers. Understanding the factors that cause rural farm households to partially, discontinue or abandon the use of the CA model or package is crucial for an improved design and transfer of the recommended practices. It is also important for NGOs, government (extension workers) and policymakers to know the pattern, intensity and dynamics of adoption and abandonment of improved packages. This study assists NGOs and governments to develop appropriate technologies that better fit the needs of rural farm households. The generated information will also help design appropriate strategies for removing barriers to higher adoption of improved technologies by rural farm households and policymakers to increase food security in the country.

Additionally, identifying social and cultural factors that act as pre-cursors to affect farmer decision-making will be invaluable in developing a greater understanding of how rural farmers understand various agricultural practices and their views of introduced practises that researchers and development practitioners promote. Recognising these key factors will expose hidden assumptions and blind spots in ‘‘scientific’’ approaches that the conventional top-down development approach overlooks (Halbrendt, 2014).

Therefore, when promoting development programmes in international development, it is necessary to scrutinise its assumptions critically and to ask whether the promotion of new technologies, including CA practises, are locally appropriate and how different perspectives about agricultural beliefs and expected outcomes can be aligned to increase the success of international conservation development. When potential users identify and approve the benefits, the effort and time-saving implications of conservation tillage are soon recognised. However, agriculture in Africa is pluralist, and this is a crucial point. According to production systems or different types of agricultural producers, approaches and performances vary from one region or country to another among the main subsectors and agro-climatic zones.

1.5 The layout of the Thesis

This study comprises eight chapters. The study adopts a structured approach, with each chapter focusing on addressing a specific research objective in detail:

Chapter One provides the introduction of the study, details the research gap, covers the research questions, objectives and significance of the study. The chapter ends with an outline of the structure of the thesis.

Chapter Two provides a list of definitions of terms that were considered key building blocks to this thesis. It deals with the critical review of relevant literature for this study. The chapter also provides a conceptual framework which considers how socio-cultural factors influence farming households' decision making and participation in CA adoption. A scholarly review of empirical studies on the determinants of CA adoption in Sub-Saharan Africa is done to tease out the socio-cultural dimension gap among smallholder farmers in CA adoption.

Chapter Three starts by giving a profile of the study area where I provide the study setting and background of the community under study. I also described the methodological approach for attending to the socio-cultural factors of the farming households in the study area. The chapter also outlines the study design, sampling methods and techniques, data collection, and analysis methods. This chapter explains how the data was collected and whether the data collected managed to answer the research questions. In this chapter, the ethical clause is outlined, giving the details of how respondents were handled ethically. It finally gives an account of the challenges that were faced during fieldwork and how they were handled.

Chapter Four responds to research question 1 by answering questions about the specific challenges confronting rural small farm households that led to the introduction of the conservation agriculture model in Nyanga District, Ward 30. I started by giving a background of farming challenges in Zimbabwe and the specific challenges in the study area. I explained how biophysical, human, social, political, and institutional challenges affect the productivity of farming and households.

Chapter Five responds to research question 2 by answering questions about conventional and emerging socio-cultural factors guiding small farm households' agricultural practice and performance and how these factors are incorporated into small farm households' agricultural practises. I also started by giving a background of interventions both conventional government interceding programmes and modern agriculture technologies. I describe how farming systems, the supernatural and indigenous knowledge guide households in their farming. Importantly, I highlight how such practices impact the adoption of CA technology in the study area.

Chapter Six responds to research question 3 by answering questions on how farm households that adopted the conservation agriculture packages organise their agriculture and take farming decisions. I start by giving a background on adoption trends in Zimbabwe. I present adoption trends in Ward 30, focusing on how CA households practised their agriculture and how CA components were adapted and modified by households. The chapter also discusses the claimed benefits of CA.

Chapter Seven responds to research Question 4 by answering questions about aspects of socio-cultural practises of the CA farming model incorporated and those completely missed when it was being implemented. I discuss how this affected households' decisions on adoption, partial adoption or non-adoption in the study area. I start by giving a background of smallholder farmers' responses to CA in Zimbabwe. The implementation methodology of CA in terms of whether it had an impact on farmers' decisions to adopt the technology or not, is described. The chapter also discusses households' responses to CA components and explanations for those responses categorised as reasons for partial adoption, abandonment, and total rejection.

Chapter 8 summarises the findings and discusses the wider implications of my research. I ask what an external national or global knowledge institution can learn from a small village in Ward 30, Nyanga District, Zimbabwe. There are certainly differences in worldviews, such as causal agency, the possibility of governing climate, and the nature and role of moral responsibility. I conclude the thesis by explaining my work's original contribution to current scholarship and propose future research directions.

CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK ON CA TECHNOLOGY ADOPTION

2.1 Introduction

This chapter provides a review of the literature relevant to CA adoption, partial adoption and abandonment (dis-adoption). It does this by reviewing and comparing the various approaches to studying adoption through to abandonment found in literature, as well as discussing the merits and drawbacks of different analysis methods. This chapter also provides a critical analysis of current knowledge, including substantive findings and theoretical and methodological contributions to CA. The literature review helps justify the research and outline gaps in previous research. It also gives an overview of CA in SSA, particularly in Zimbabwe, bringing forward the merits and challenges of this technology.

Because numerous interdependencies explain the adoption decision process of a farmer, it is important to clarify and prioritise the opportunities and threats for further adoption and understand innovation processes related to CA systems. In order to do this systematically and logically, this chapter starts by defining concepts anchoring this study and moves to review CA context and adoption trends in SSA. The next section covers empirical studies on the determinants of CA adoption and abandonment followed by adoption theories of innovations system, which captures specifically the considerations within an adoption decision-making process. The frameworks were then related to the CA system exposing and identifying existing knowledge gaps. The last section is the conceptual framework that provides the basis for the analysis in this study and gives an account upon which the study is grounded.

2.2 Basic concepts

The concepts related to the technology understudy will be defined in this section, together with different terminologies used in adoption studies. Defining the adoption of CA is complicated by the complexity of the technology. Since CA encompasses a wide range of different practises, identifying adoption depends on how it is defined. Thus, this study explicitly states how terms related to the technology and its adoption are used. The terms defined are CA, adoption, partial adoption, dis-adoption and culture.

2.2.1 Conservation agriculture

According to FAO (2013), CA constitutes a package of agronomic practices whose core principles are: (i) minimum soil disturbance through reducing tillage intensity and frequency, (ii) organic soil cover, permanent or at least during critical stages, and (iii) diversification of crop species grown in sequences or associations with legumes. Due to the integrated management of available biological resources, water and soil, pooled with limited external inputs, CA aspires to make better use of agricultural resources (Friedrich, Derpsch & Kassam, 2012). The technology tends to exclude the unsustainable parts (e.g., mono-cropping, tillage, and residue removal mainly through burning) of the conventional tillage (CT) system, thereby addressing soil erosion (Marongwe *et al.*, 2011). Manual CA, promoted mainly in Africa`s poor households apply to CT through digging planting basins consisting of simple pits made by hand hoes (Mazvimavi & Twomlow, 2009). Mechanised CA is another version of CA recommended to households with animal traction and it involves using ox-drawn 'rippers' and seeders for reduced tillage (Pedzisa, 2015). The terms no-till (NT), zero-till (ZT), minimum tillage (MT) and direct seeding (DS) are used interchangeably to denote minimum soil disturbance under the collective umbrella term conservation tillage (Pedzisa, 2015).

2.2.2 Adoption

Several scholars have tried to provide a concise definition of what the concept of adoption denotes. According to Doss (2005), adoption is the level at which the meticulousness of new technologies, practises or principles are followed so that the farmer enjoys maximum benefits. Rogers (1983) defines adoption as a mental process through which an individual passes from first hearing about an innovation or a new technology to eventual adoption. Feder, Just and Zilberman (1985) define adoption as incorporating new technology into farmers' common farming activities over an extended period. This can be calculated by individuals' timing and extent of new technology utilisation (Sunding & Zilberman, 2001). On the flip side, diffusion is where knowledge of new technology is communicated through certain channels over time among the members of a social system (Roders, 2003).

Feder *et al.* (1985) make a distinction between individual adoption and aggregate adoption. Individual adoption is the extent to which a farmer uses new technology in long-run equilibrium and has full information about the technology and its potential. In contrast, aggregate adoption is the process through which such technology spreads within a region. Likewise, Thirtle & Ruttan (1987) describe aggregate adoption as a new technique spread and adopted within a population. This is the adoption rate defined as the percentage of farmers who have adopted a given technology. In defining adoption, firstly, one needs to consider if either adoption is a discrete state with binary variables (a farmer either is an "adopter" or is not one) or a continuous measure. The definition of adoption varies across empirical studies, and the appropriateness of each approach may depend on certain factors and a particular context.

Thangata & Alavalapati (2003) view adoption as a process influenced by determinants like socio-economic and environmental issues controlled by variables involving individual knowledge. Furthermore, technology adoption depends on context-specific trade-offs between the new technology and the available alternatives. Trade-offs cannot be assessed without first understanding farmers' priorities, the alternatives available to them to address the same problem and the indirect consequences of the technology (Fujisaka, 1994). Often farmers' priorities are more complex than the specific problem a technology aims to resolve. Generally, the uptake of new technology is referred to as adoption, but complete adoption is defined by certain parameters, conditions, or limits. In this study, adoption is defined as the uptake of simultaneous application of three basic CA pillars: minimum soil tillage, crop rotation, and mulching.

2.2.3 Partial adoption

"*Partial*" adoption is practising one or some components of CA technologies/practises, rather than the "*full*" package on some plots but inconsistently (Mazvimavi & Twomlow, 2009; Umar, 2013). Wetengere (2010) notes that farmers often take only some CA components or use the least involving component of a technology, which could be any individual components alone or modification and re-invention. Farmers may either gradually expand the area under CA or adopt different CA components stepwise. Partial and incremental uptake may thus be measured on an area basis or a time scale–with more components taken on over time – and there is no univocal use of the terms in the literature. Since the sequence in which different CA components are taken up may vary, some studies use the notion of diverse 'adoption pathways' (Baudron *et al.*, 2007: xi). Risk aversion also provides a possible explanation for the partial adoption of technologies by poor farmers, as smallholder farmers face significant climatic and economic uncertainties and tend to be risk-averse (Marra *et al.*, 2003). Selective adoption suggests that the incomplete use of a technical package is optimal, and thus the adoption process will end with partial adoption instead of complete adoption.

When new technologies have multiple components, they may be adopted jointly or sequentially (Khanna, 2001). Sequential adoption has been identified as adopting part of the package before adopting the whole package (Byerlee & Polanco, 1986). Factors such as profitability, risk, uncertainty, lumpiness of investment and institutional constraints were some of the main reasons for the sequential adoption of a package of technologies (Leather & Smale, 1991). In addition, Pannell *et al.* (2006) argue that adoption is not an all or nothing decision but occurs as a gradient at sequential levels. The adoption of CA involves using a bundle of innovations rather than just a single element of productivity-enhancing factors. If farmers adopt partially rather than the whole package, the productivity-improving effect of each of the components may not be realised (Otsuka & Kalirajan, 2006).

The trend towards partial adoption raises questions about the divisibility of CA, and the conditions necessary for a successful adoption process in improving the livelihoods and food security status of vulnerable households (Andersson & D'Souza, 2014; Mazvimavi, 2011; Twomlow *et al.*, 2008b). Vulnerable households are defined as families that face difficulties in meeting their basic livelihood needs. Relief agencies in Zimbabwe have extended this definition to include households affected by the HIV/AIDS epidemic (Mazvimavi, 2011). Donors have responded by promoting CA's more sustainable improved crop production technology, and relief agencies have purposely selected resource-poor households and those affected by HIV/AIDS for training and input support to implement this improved and more sustainable farming practice. For that reason, targeting has integrated a significant proportion of resource-constrained households without draught animals for land preparation and has also been affected by the HIV and AIDS pandemic, among other factors. The focus on vulnerable households and CA promotion within humanitarian relief has structured both the definition and practices.

2.2.4 Dis-adoption (Abandonment)

Dis-adoption sometimes referred to as 'discontinuance', is defined as an individual's decision to reject a technology after adopting it previously (Rogers, 2003). According to Oladele (2005), there are two types of dis-adoption/discontinuance: disenchantment discontinuance and replacement discontinuance. Disenchantment discontinuance is when an individual rejects a technology due to dissatisfaction with its performance, while replacement discontinuance occurs when an individual decides to abandon an innovation, replacing it with another. Ogunfiditimi (1993) and Kolawole, Farinde & Alao (2003) studied "abandoned adoption" to describe the discontinuation of the use of a previously adopted innovation and detail different degrees of discontinuance, namely immediate and gradual among Nigerian farmers. Alexander, Fernandez-Cornejp & Goodhue (2003) and Darr & Chern (2002) describe discontinuance among Ohio farmers who previously adopted genetically modified crops as dis-adoption. The notion of dis-adoption continues to be largely ignored in research, yet the rate of dis-adoption of innovation is as equally important as its adoption rate when determining the extent of adoption at any given time (Rogers, 2003). As a result, CA dis-adoption has largely been neglected; rarely contested, especially among organisations encouraging the technology, regardless of growing evidence of its occurrence (Arslan *et al.,* 2014; Pedzisa *et al.,* 2015). Limited knowledge of dis-adoption has not only presented a perplexing scenario for CA proponents but has also prompted critical views reported by several authors (e.g., Andersson & Giller, 2012; Baudron *et al.,* 2012; Whitfield *et al.,* 2015).

2.2.5 Culture

There are hundreds of definitions of the concept of culture (in their "Culture: A Critical Review of Concepts and Definitions," 1963, Kroeber & Kluckhohn discuss one hundred and sixty-four of them), and it is not in the scope of this study to review and analyse these. However, for this study, it is essential to understand the important dimensions of culture and its influence on human behaviour.

There are two broad orientations when defining the term culture and these shall be used in this study. The first, culture is defined as including all those ideas, values and behaviour patterns that are socially transmittable (Binford, 1968; Harris, 1968; Meyer, 1971). In the second, more restrictive sense, culture is the ideational domain of a social group (Goodenough, 1971; Parsons & Shils, 1951). Hofstede (1980: 23) defined culture as the "collective programming of the mind, which distinguishes the members of one human group from another". The mind of a people is "programmed', through group socialisation, in three specific mental-emotional processes: the values, beliefs and expectation systems of the group (Hofstede, 1980). Culture in this study will be understood following Hofstede's conception.

Farmers and their families are members of the society in which they live, and society exerts strong pressures on its members to behave in certain ways (Oakley & Garforth, 1985). In every society, there are accepted ways of doing things and these ways are directly related to the culture of that society (FAO, 1985; Oakley & Garforth, 1985). This point underscores that certain features of society and culture may act as barriers to adopting new or external technologies in agriculture, especially amongst rural farmers. This means that despite the benefits, strongly held attitudes of farmers may make it difficult for them to change (Oakley & Garforth, 1985). Culture, then, is the underlying pattern of meaning guiding the behaviour of farmers, both as individuals and as members of a collective group.

Thus, to summarise this definition, a given culture can be best described by identifying the set of values that constitutes its essence. The values of a culture are translated into norms to be operational (that is, to affect the behaviour of its members effectively). The theory presented in this study is that an analysis of these norms is of critical relevance to understanding the impact of culture upon the macro-process of diffusion and the micro-process of uptake of an innovation.

2.3 Development and trends of CA in Africa

Many SSA countries have long histories of active CA promotion among smallholder farmers (see Andersson & D'Souza (2014) for a comprehensive account of the development of CA in SSA). Notwithstanding different initial reasons for CA promotion across countries, for example, agricultural production intensification in Malawi, food security-enhancing humanitarian motives in Zimbabwe and tackling land degradation, water scarcity and productivity losses in Zambia (Andersson & D'Souza, 2014; Haggblade & Tembo, 2003), the purpose of improving agricultural productivity and sustainably intensifying agricultural production are fundamental components of all CA promotion efforts in the region.

2.3.1 CA context and adoption overview

This section starts by giving an outline of why CA is regarded as the remedy to low agricultural productivity amongst smallholder farmers. It then moves on to look at how CA has evolved in Sub-Saharan Africa focusing on adoption trends in the region and then it hones it down to the emergence of CA in Zimbabwe and the adoption trends there.

2.3.1.1 Benefits of CA adoption for smallholder farmers

CA was introduced by the FAO (2008b) as a concept for resource-efficient agricultural crop production based on integrated management of soil, water and biological resources combined with external inputs. As such, CA is seen as an alternative to conventional agriculture that uses soil tillage (Erenstein, 2002; Gowing & Palmer, 2008; Hobbs, 2007). According to Mazvimavi (2011), interest in applying CA principles to the conditions of southern Africa stretches back several decades, but the issues and problems that ignited this interest and how CA innovation systems have evolved vary across countries. Many studies on the importance of CA within the smallholders' environment have led governments and donor communities to shift their investments toward promoting this agricultural innovation (Arslan *et al.,* 2014). Most people live in rural areas of southern Africa and depend primarily on agriculture for their livelihoods. However, agroecosystems in southern Africa are affected by a multitude of problems. Soils are often sandy, thin and of low fertility. When these soils are cultivated under the conditions of low and variable rainfall typical of the region, a common outcome is moisture stress in crops and seasonal shortages of fodder for livestock. Another challenge is that small-scale women farmers represent the majority of the rural poor population, and it is imperative that agriculture development strategies must target these populations for the greatest impact. Many experts feel that CA can help overcome these problems, despite the challenges in implementing CA in areas where livestock is an important component of agro-ecosystems.

CA is a sustainable farming practice with the potential to tackle a broad set of farming challenges such as smallholder farmers' vulnerability to climate change, low crop productivity, increasing levels of soil degradation and loss of fertility and absence of draught power (Chiputwa *et* *al.*, 2011; Kassam *et al.*, 2009; Lee, 2005). The International Centre for Agricultural Research work in the Dry Areas (ICARDA) and the International Maize and Wheat Improvement Centre (CIMMYT) have shown the benefits of CA on crop yields increase, soil organic matter, water use efficiency and net revenue (Thierfelder & Wall, 2009). Uptake of CA practices leads to improved production inputs, resulting in greater profit while reducing production costs. Additionally, CA offers potential benefits due to early planting for smallholder farmers with limited access to draught power (Twomlow *et al.*, 2008). More accurately, CA allows early planting since land preparation is simplified and can be carried out before the first effective rains (Haggblade & Tembo, 2003). The technology also confirms the significance of exploiting cropping and crop diversification with legumes and cover crops instead of a fallow period, allowing improved productivity, soil quality, N-fertiliser and water use efficiency (Derpsch *et al.*, 2010; IIRR & ACT, 2005).

Adoption of CA usually results in yield increase due to a combination of factors such as early planting, precision input management and water harvesting (Baudron *et al*., 2007). Yield increase of 100% over conventional practises has been reported in most areas such that 30% will be attributed to higher input use, 25% early planting and water harvesting basins 45% (Haggblade & Hazell, 2010). For example, in Zambia yields for CA maize plots doubled and were 60% higher for cotton (Haggblade & Tembo, 2003), while in Zimbabwe, Thierfelder & Wall (2009) observed higher grain yields which signified higher rainfall use efficiency. In another study, Boahen *et al.* (2007) found that maize yields in Ghana had increased three times on CA plots than in traditional slash and burn systems. In Kenya, maize, wheat, potato, and beans yields in CA plots were 50-200% higher than in conventional systems (Kaumbutho & Kienzle, 2007). These findings support the view that CA is a model that can establish household food security for the smallholder households in SSA and help achieve the then United Nations Millennium Development Goals (MDGs) on food security (Hobbs 2007; Hobbs *et al.*, 2008).

CA is regarded as fundamental agricultural sustainable practice in dry areas like the SSA. It permits farmers to improve their yields and profitability, especially in dry areas, while saving and even improving the natural resource base and the environment (Gowing & Palmer, 2008; Marongwe *et al.*, 2011). CA's capability to reduce water stress in crops is crucial as southern

Africa experiences the hotter and drier weather brought by climate change (Hobbs, 2007; Lobell *et al.*, 2008). CA's ability to retain water (Twarog, 2006) leads to better use of rainfall and reduces crop failure risk due to drought (Erenstein, 2003; Friedrich & Kassam, 2009). CA is thus a sustainable farming practice used as an adaptation strategy to climate variability in a region that relies mostly on rain-fed agriculture (Hobbs, 2007).

Even though studies have found compelling evidence of CA benefits, it has long been a contentious issue. Gowing & Palmer (2008) and Rockstrom *et al*. (2009) report that adoption and empirical evidence of the benefits of CA in SSA have been limited. There are studies both confirming and refuting the benefits of CA. For example, Pretty *et al.* (2006) found that CA leads to increased yield gains in water use efficiency, a decline in pesticide usage and increased gains in carbon sequestering, especially for small farmers in developing countries, but refutes the claim of solving food security.

Gathala *et al.* (2015) found that zero tillage direct-seeded rice with residue retention yielded similar yields as puddled and transplanted rice. However, the authors show that direct-seeded rice lowered production costs, reduced water used and subsequently improved incomes. Similar results were observed under zero tillage maize and zero tillage wheat. Nevertheless, in the case of zero tillage wheat, it resulted in increased productivity and profitability. It depended on crop management along with residue retention. However, several studies in a recent issue of Agricultural, Ecosystem and Environment (2015) concluded that CA's benefits are context-specific and vary from region to region. As such, CA can extensively improve production and improve the food security and livelihoods situation of SSA farming households (Steiner & Bwalya, 2003; ZCATF, 2009).

2.3.1.2 CA adoption in Sub-Saharan Africa

According to Deprsch, Friedrich, Kassam & Hongwen (2010), around 1973/74 no-tillage was used only on 2.8 million ha worldwide, and 10 years later, in 1983/84. The area under this technology had grown to 6.2 million ha with more than 75% of the total area being applied in the US. By 1996/97, the area under no-till had grown to 38 million ha, with the proportion practised by the US being reduced to 50% of the total (Deprsch, 1998), and in 2009, the proportion practised by the US had fallen to 25%.

Data presented at the 10th International Soil Conservation Organisation (ISCO) Conference in West Lafayette, Indiana, in 1999, showed a worldwide adoption of the no-tillage technology of 45 million ha (Deprsch in Stott, Mohtar & Steinhardt (2001). As Benites *et al.* (2003) showed at the International Soil Tillage Research Organisation (ISTRO) Conference in Brisbane, Australia, in 2003, the area had grown to 72 million ha. In the last 10 years, the no-tillage technology has expanded at an average rate of 6 million ha per year from 45 to 111 million ha, indicating increased interest in this technology from farmers (Deprsch *et al.,* 2010).

The growth of the area under no-till has been especially rapid in South America where the MERCOSUR (Mercado Común del Sur) countries (Argentina, Brazil, Paraguay and Uruguay) are using the system for about 70% of the total cultivated area (Deprsch *et al.,* 2010). More than two-thirds of no-tillage practised in MERCOSUR is permanently under this system; in other words, once started, the soil is never tilled again. CA awareness and its adoption on the African continent were on the increase at the same time (Derpsch & Friedrich, 2010; Friedrich *et al.,* 2012). Out of the 111 million hectares presently under no-tillage worldwide (about 9% of the world's cropland (Friedrich *et al.,* 2012), 46.8% of the technology is practised in South America. Thirty-seven point eight percent (37.8%) is practised in the US and Canada, 11.5% in Australia and New Zealand, and 3.7% is from the rest of the world, including Europe, Asia and Africa (Deprsch *et al.,* 2010). To be specific, Africa's contribution to the total area under CA is still very low (1%, about 1 012 840 ha) (Hove *et al*., 2011), while Southern Africa has the lowest contribution with an estimated area of 30 000 ha under CA (Freidrich *et al.,* 2012).

Despite nearly two decades of development and promotion of CA by the national extension programme and numerous other projects, adoption has been extremely low in the smallholder sector in SSA compared to other continents such as South and North America and Australia (Derpsch, 2008; Deprsch *et al.,* 2010; Gowing & Palmer, 2008; Hobbs, 2007). While CA adoption rates remain low, dis-adoption has been widespread in most African countries (Derpsch & Friedrich 2009; Rodenburg, Büchi & Haggar, 2020). So far, the CA area is still small, but there is a steadily growing movement involving already far more than 400,000 small-scale farmers in the region for a total area of some 1 million ha in 2010/11. There has since then been a further spread in several countries, although not fully documented, such as Kenya, Madagascar, Malawi, Mozambique, Tanzania, Zambia and Zimbabwe.

In 2008/09, CA was reported in seven countries, but in 2013 there were 12 countries with an area under CA. A limited 2013 update shows that the total area of CA in Sub-Saharan Africa is more than 1.22 million ha, an expansion of some 157% from 0.48 million ha in 2008/09. However, from expert knowledge that was expressed at the 1st Africa Congress on Conservation Agriculture in March 2014, it is likely that the CA area in sub-Saharan Africa, even though it is spread over more than twelve countries, may still be slightly over 1.22 million ha (Kassam *et al.*, 2015). This contrasts with an estimated average growth rate of 7 million ha per year worldwide of no-till farming practices (Freidrich *et al.*, 2012). In the US alone, it is estimated that the decreased erosion that has resulted from conservation tillage practices resulted in savings between 90.3 and 288.8 million USD (FAO, 2014a).

Constraints to CA adoption in SSA include a low degree of mechanisation within the smallholder system; a lack of appropriate implements; a lack of appropriate soil fertility management options; problems of weed control under no-till systems; limited or poor access to credit; a lack of appropriate technical information for change agents and farmers; blanket recommendations that ignore the resource status of rural households; competition for crop residues in mixed crop-livestock systems; and the variable availability of labour (Twomlow *et al.*, 2006a). The latest estimate of the adoption of CA in SSA was provided by Tambo & Mockshell (2018), which was based on a survey of 3,155 randomly selected maize farmers across 100 selected villages from nine SSA countries (two in West, four in East and three in Southern Africa). They found that 8% of farmers had adopted the complete package of CA, while more often CA adoption is only partial.

Farmers exposed to CA have been observed developing cropping systems that are intermediates between CA and conventional systems (Penot *et al.*, 2015), including practices that address their specific production constraints (Penot *et al.*, 2018). CA uptake by farmers in Africa is not only partial in terms of the adopted practises but also in terms of the share of farm area under CA practises. In Zambia, for instance, minimum soil disturbance techniques were only implemented on 8% of the land of adopters (Ngoma, 2018), while in Malawi, Ngwira *et al.* (2014) reported that 30% of the land of adopters were under CA. Having indicated the paltry area under CA in SSA, literature on CA highlights several key reasons for the low CA adoption rates and the relatively high dis-adoption rates. The following section attempts to discuss some of the empirical studies on some of the causal factors of the adoption and abandonment of CA.

2.3.1.2.1 Empirical studies on the determinants of CA adoption

A wide variety of factors have been undertaken to analyse drivers of agricultural innovation adoption in developing countries following the Green Revolution in Asian countries about five decades ago to assess the rate, intensity and determinants of adoption. They are often conceptualised as a technical package of practices, distributed to new areas with the help of instruction (Glover *et al.,* 2017), with adoption rates representing a primary way of measuring the success and impact of this distribution (Glover *et al.,* 2016, 2019). Pannell *et al*. (2006) and Knowler & Bradshaw (2007) reviews jointly suggest that the adoption of agricultural production technology depends on an array of agro-ecological, informational, psychological, socio-economic, and institutional factors perceived attributes. Conversely, some researchers argue that this study area may have reached its apex in contributing to an advanced understanding, particularly regarding the adoption of sustainable agriculture (Knowler & Bradshaw, 2007). They postulate that the existing state of knowledge is not easily transposed with policy (Torborn, 2011).

A study by Perrin & Winkelman (1976) summarised adoption studies done by the CIMMYT on maize and wheat in six countries (Turkey, El-Salvador, Kenya, Mexico, Tunisia and Colombia). The study concluded that the disparity in the rate of new technology uptake among those countries resulted from differences in information attained, biophysical environments, inputs availability, differences in opportunities for crop market availability, and differences in farm size and farmers' risk aversion characteristics. To add to that, Feder *et al*.'s (1985) and Feder & Umali's (1993) comprehensive survey of agricultural technology adoption studies in developing countries also found that availability of labour, land tenure systems, farm size, risk, human capital and access to credit were the most important factors in influencing farmers' decisions of technology uptake.

Akter & Gathala (2014) researched the adoption of CA technology in diversified systems and its impact on productivity in three districts of Bangladesh. They indicate that where land is an extremely limiting factor, production is increased through intensive cultivation with two or more crops in a year. This research found that 82% of the operating cropland is under two or more crops. The adoption of agricultural conservation practices as a way to tackle the challenge of soil fertility depletion had become an important issue in the development policy agenda for smallholder agriculture. Diversities existed between locations, cropping systems and seasons. Also, policies targeting conservation as a measure of sustainable agriculture must consider diversities for wider technology diffusion.

Socio-economic factors such as crop profitability are assumed to be positively and strongly related to adoption decisions (Ogunsumi & Ewuola, 2005). Mazvimavi *et al.* (2012) performed a productivity and efficiency analysis of maize under conservation agriculture in Zimbabwe and showed that output was positively related to labour and seed in conservation agriculture but negatively in conventional farming. Fertilisers had a greater positive response in CA than in conventional farming. There was evidence of technical progress in CA. Technical progress was land-saving and seed-using in CA, even while it was land-using and seed-saving in conventional farming. The study also indicated that farmers produced 39% more output in CA compared to conventional farming.

In earlier studies, Meinzen-Dick *et al*. (2004) and Sheikh *et al.* (2003) underlined the value of resource endowment variables in influencing the uptake of 'no-tillage' technologies signifying that lack of assets will hinder technology uptake. Within this frame of reference, a stronger fiscal capacity to make investments and afford any losses due to uptake is expressed as greater financial capital. According to CIMMYT (1993), Langyintuo & Mekuria (2005) and Marenya & Barrett (2007), disposable income significantly and positively affects technology adoption. Such settings are usually achieved by larger-scale farms that enjoy economies of scale, greater productivity and higher farm incomes.

A study in Zambia by Arslan *et al.* (2013) found a very strong and robust relationship between the district level variation in historical rainfall during the growing season and adaptation and the intensity of adoption of the CA practises. The study found no evidence for the role of labour constraint, age, or education in the adoption decision. Another study in Zambia by Ng'ombe *et al.* (2014) found that age, marital status, access to loans and labour availability positively influenced the likelihood to adopt CA. However, the same study found that off-farm income, access to extension services, and ownership of livestock negatively influenced the likelihood to adopt CA. The geographical location in which a farmer is located and distances to the vehicular road was found to be statistically significant to affect the adoption of CA.

The natural environment as captured through agro-ecological zones also has a massive contribution to the performance of all agricultural technologies. According to D' Emdem *et al.* (2008), the agro-ecological zone illustrates the difference in natural resource quality across regions because it is impossible to capture all farm-specific characteristics. However, the agro-climate seems to be the most noteworthy basis of locational differences in uptake rates (Feder & Umali, 1993). The effect of the agroecological zone upon adoption is indeterminate as it is highly dependent on how environmental challenges affect farmers in that zone. Tsegaye *et al.* (2008) found that the initial decision to adopt CA in Ethiopia is influenced by relational locational differences in adoption rates.

Similarly, Mazvimavi & Twomlow (2009) found that farmers located in high rainfall regions with better chances of increased crop production tend to be less risk-averse and are likely to try new cropping techniques. Areas where there is high rainfall, high biomass production and limited competition for crop residues with livestock, are also areas where CA is likely to be adopted. However, Haggblade & Tembo (2003) reported high adoption rates in low rainfall areas where benefits of CA could be realised from moisture conservation. These findings indicate that agroecology also plays a significant role in the adoption of CA.

According to Becerril & Abdulai (2010), technology adoption involves using a bundle of innovations rather than just a single element of productivity-enhancing factors. Most studies on CA adoption in SSA (Zambia inclusive) such as Mazvimavi & Twomlow (2009), Kassie *et al.* (2010), and Arslan *et al.* (2013) have shown that most small-scale farmers hardly adopt the whole package of CA: minimum tillage, permanent soil cover and diversified crop rotation. The studies have shown that small scale farmers tend to adopt only some of the components - usually the minimum tillage and herbicides used in the initial stages. Kassie *et al.* (2010) argue that if farmers adopt partially, rather than the whole package, then the productivity-improving effect of each of the components may not be realised. So, to realise the full benefits of CA, the use of a full package is advised (FAO, 2001; Ito *et al.*, 2007).

The review above reveals that it cannot be automatically assumed that CA will benefit the farming system and rural livelihood simply because benefits are shown at the plot level. A farming system consists of many interacting components and is subject to a range of biophysical, socio-economic, and cultural constraints. Technology can only be considered a successful 'innovation' that is likely to spread when fully embedded within the local social, economic, and cultural context (Leeuwis, 2004). Thus, the suitability and adoption of new technology in one place, for example, observed for CA in South America, does not imply that the conditions for adoption necessarily exist in SSA (Bolliger, 2007; Gowing & Palmer, 2008).

2.3.1.2.2 Empirical studies on the determinants of CA abandonment

Though there has been a plethora of literature on the adoption of CA technologies/practises, there are a few empirical studies about the abandonment of innovations (e.g., Dinar & Yaron, 1992; Pedzisa *et al.*, 2015a; Walton *et al.*, 2008; Walton *et al.*, 2009) and there exists a significant knowledge gap when it comes to the abandonment of CA technologies/practises (Carletto *et al.*, 2007; Neill & Lee, 2001). Abandonment comes about due to many reasons, including lack of sufficient information, financial constraints and an unsuitable environment. According to Rogers (1983), abandonment of technologies occurs due to "*disenchantment discontinuance*" meaning it is abandoned if the benefits produced by the technology are perceived to be less than the cost of continued use. Abandonment may also happen when farmers replace current technology with a more efficient technology which is known as "*replacement discontinuance*"

The trends of abandonment usually reported in the literature show that conventional ones often replace newly adopted technologies owing to numerous factors such as economic problems because of reductions in incomes, natural disasters and climate uncertainty (Kolawale *et al.*, 2003; Oladele, 2005; Oladele & Adekoya, 2006). Neill & Lee (2001) examined reasons for the abandonment of a conservation practice called "maize-mucuna", viewed as yield increasing, risk-reducing and labour saving for rural households in Honduras. The study findings indicate that farmers with longer experience and who mostly depend on maize production are unlikely to retain the technology. Equally, seasonal labour bottlenecks in Madagascar have been reported as the reason for the abandonment of a labour intensive low external input rice production system (Moser & Barrett, 2003).

In another study, the phenomenon of "*replacement discontinuance*" was investigated by Walton *et al.* (2008) who looked at factors affecting US cotton farmers' adoption and abandonment of soil sampling techniques. They concluded that farmers in the US were more likely to abandon grid soil sampling, even though they have been using it for a longer period; significant effort is needed to manage grid sampling, thus leading to discontinuance. Factors positively related to technology retention were age and long experience with soil sampling technology.

In their study, Pedzisa *et al.* (2015a) found that farmers with larger household sizes, more farming experience and beneficiaries of NGO free inputs were more likely to continue practising CA, whereas wealthier farmers were more likely to abandon CA. One explanation for this is that wealthier farmers own livestock and are more inclined to return to conventional tillage using draught power. Another related reason is that wealthy farmers struggle with labour access on-farm as their wealth derives from off-farm employment. In contrast, Mazvimavi & Twomlow (2009) and Nyamangara *et al.* (2014) found that large-sized households tend to have more farm labour and are considered more likely to adopt CA, which is widely viewed as a labour and management intensive technology. Through farming experience, farmers can leverage the knowledge accumulated over time and experiment more confidently with new technology, and experience may be linked to management capacity and risk preferences. Pedzisa *et al.* (2015a) concluded that the absence of support from NGOs led to the abandonment of CA and suggested that ongoing support should be extended to CA farmers. However, this raises questions about the sustainability of CA in developing countries.

In another study, following two seasons data in Zambia, Chomba (2004) found that farmers who had access to agricultural support programmes were likely to abandon CA practices the following season. Once farmers fail to realise the benefits of CA practice, the removal of programme inducement could have resulted in discontinuing the technology. Even though the study managed to track practices carried out by farmers over two years, it could not establish whether abandonment was likely to be temporary or not. According to Pedzisa (2015), the technology adoption choice is an inherently dynamic process best modelled as a repeated decision conditional on past decisions and the current/expected economic environment. She further pointed out that agricultural economists know far less about factors influencing technology retention or abandonment than the one-time discrete decision on whether or not to adopt a technology.

The abandonment of technologies is mostly driven by farmers' economic, structural considerations and asset portfolios (Lapple & Donnellan, 2009; Tura *et al.,* 2010). As in the work of Barham *et al.* (2004), they found that abandonment is less likely to happen in technologies that involve significant sunk costs. In another study, Neill & Lee (2001) reported that off-farm income and the opportunity cost of land (looking at the distance to the main road) correlate with abandonment. Barrett *et al.* (2006) concluded that households that suffer shocks that deplete their farm and non-farm cash earnings or critical labour, land and livestock assets (which require cash to replenish) become more likely to discontinue using the technologies with which they had previously experimented. Shocks thus lead to endogenous disinvestment, which reinforces the permanent income losses associated with the initial adverse shock. A study by Lapple & Donnellan (2009) showed that full-time farmers managing a more intensive farming system are less likely to abandon technologies in organic farming. The authors also note that better access to marketing outlets and quality of information are more important factors than subsidies in encouraging farmers to adopt organic farming.

A review of the above shows that the authors did not address the issue of abandonment when it comes to “partial” abandonment of CA technology/practices (D’Souza & Mishra, 2016). It should be noted that the literature also falls short in discussing the role of socio-cultural factors in the abandonment of CA technology/practices. Sub-Saharan African farmers’ decision to abandon CA is not random. A better understanding of the contribution of social and cultural factors in agriculture, particularly in the abandonment and total rejection of CA technologies/practices, is needed, especially in developing economies. The current study will fill this gap by establishing the socio-cultural factors that lead to CA practises abandonment and outright rejection.

2.3.1.3 Emergence of CA in Zimbabwe

In Zimbabwe, NGOs have been instrumental in introducing and promoting CA. The most common CA package promoted through these NGOs is a manual on hand hoe-basin system that focuses on the creation of planting basins in the dry season, in combination with CA principle 2, permanent soil cover (Andersson & D'Souza, 2014; Hove & Twomlow, 2007; PRP, 2005; Twomlow *et al.*, 2006). This technology of using basins is locally labelled ‘conservation farming’ (CF) to differentiate it from the other CA practices promoted in the region (Pedzisa, 2015). This option was promoted mainly to address the draught power shortages in the communal areas, which delayed planting and resulted in low crop yields. Planting basins thus increased the returns on donor-provided input packages. According to Andersson & D'Souza (2014), NGOs made input support conditional on observable basins in farmers’ fields in many instances.

Numerous international and local NGOs implemented the combined CF/humanitarian relief projects of the Protracted Relief Programme, a multi-donor initiative to assist crisis-struck Zimbabwe (see Andersson & Giller, 2012). CA promotion targeting mechanised and commercially oriented smallholders was developed in the shadow of this humanitarian aid programme, but mechanised CA has played a minor role in the claimed success of CA in Zimbabwe (Marongwe *et al.*, 2011). Built around the humanitarian relief context in which it was promoted, the clear definition of CF in Zimbabwe also accentuates ‘good management, which refers to the resourceful use of inputs, timely implementation and precise operations (Andersson & D'Souza, 2014). This emphasis is also reflected in the concept of Precision Conservation Agriculture (PCA) (Twomlow *et al.*, 2008a). Again, this stress on good or precise management can be understood in the context of the country-wide humanitarian relief effort and the agro-ecological circumstances prevailing in Zimbabwe’s Communal Areas (formerly known as Native Reserves). Initially, CF was promoted across 13 districts in the semi-arid areas of Zimbabwe (www.prpzim.info/) through the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), which provided technical assistance to more than ten NGOs under the United

Kingdom's Department for International Development (DFID) Programme Against Malnutrition (PAM) in 2004 (Mazvimavi, 2011).

The kind of CA that has been promoted in practice is an eight-component package that involves winter weeding, digging basins, crop residue mulching, targeted application of small doses of manure, basal and top-dressing fertiliser, timely weeding and cereal-legume crop rotation. The CA adopted is also a manual system of creating plant basins that act as planting stations for the crops (Twomlow *et al*., 2006). Each farmer created a 50mx50m CA plot during the dry season, with rows of planting pits. Composted kraal manure or plant compost was placed in the prepared basin and basal fertiliser if available. With this option, farmers plant their seeds in pits with the first effective rains of the season (Marongwe *et al.,* 2011). The programme began working with selected innovative farmers (Master farmers) to demonstrate the benefits of CA before using them to train the ultimate beneficiaries of the programme – the poorest and most vulnerable farmers. Having discussed the context in which CA was introduced in Zimbabwe, the following section looks at how the technology was received.

2.3.1.3.1 CA adoption trends in Zimbabwe

Even though CA has been successfully adopted and adapted to local conditions by commercial farmers in the last two decades (Derpsch & Friedrich, 2009), adoption by smallholder farmers, particularly in Africa, has remained behind. As pointed out in the section before, the decision to start CA practices in Zimbabwe was not, in most cases, voluntary because NGOs selected farmers who first participated in CA promotion from vulnerable households facing production constraints (Mazvimavi, 2011). Since these NGOs provided free inputs, the number of farmers practising some form of CA increased from less than 20,000 households during the 2006/07 cropping season to approximately 120,000 households during the 2009/10 cropping season (Mazvimavi, 2011). During the 2010/11 farming season, approximately 300,000 households were practising CA, of whom almost 40% were spontaneous adopters who did not receive free inputs but learned the technology from their neighbours.

According to Mazvimavi *et al.* (2012), there was mounting evidence that less vulnerable households were also taking up aspects of the package with no external incentives. Nevertheless, despite a relatively high number of households implementing CA, arable land under CA remained low. At the commencement of the 2010/11 season, CA was cultivated on 141,334 hectares, which represents approximately 5% of the area allocated to maize (Marongwe *et al.,* 2012). Among the farmers who continue to practise CA, many have modified the package and generally adopted some technology components like digging planting basins while leaving out other recommended practices. In addition, winter weeding, mulching and crop rotation have hardly been adopted. The adoption of the soil cover principle remained low due to competing uses for crop residues while preferences hampered crop rotation practices for growing cereals that provide staple food over legumes (Mazvimavi, 2011; Pannell *et al.,* 2014). Winter weeding has been considered to be labour intensive and coincides with other off-season activities.

Adoption of CA was also hampered by increased demand for labour, weed control and fertiliser inputs (Kerr, 2014; Ndlovu *et al.,* 2014; Nyamangara *et al.,* 2014) and inadequate quantity or quality of technical support (Giller *et al.,* 2009; Mazvimavi & Twomlow, 2009). Other reported constraints include a lack of knowledge, perceived complexity of the technology, inappropriate or lack of tools, and a lack of herbicides (Johansen *et al.,* 2012; Marenya *et al.,* 2017). Furthermore, CA was usually promoted as a whole or indivisible package which meant that all three principles had to be adopted to realise its benefits (Giller *et al.,* 2009).

For most Zimbabwean farming households, the practicality of just planting crops without ploughing the land first has been questioned; hence CA uptake goes against their esteemed traditional beliefs (Kassam, 2010). CA principles seemed unusual to many farming households, and this new technology and its benefits could not be seen over traditional farming methods. Pannell *et al.* (2006) argue that the uptake of CA is more complicated than simple standard technologies because of the multi-components and multi-years through which small scale trialling, modification and eventual adoption of technologies occurs.

A further requirement of CA encourages mulching, meaning practices such as crop residues become mismatched with crop residue as livestock fodder during winter (Aune *et al.,* 2012). Many reports and research studies have pointed to the challenge of crop residue retention and trade-offs between different uses in crop-livestock farming systems, which are dominant in rural Zimbabwe (Giller *et al.,* 2009; Rusinamhodzi *et al.,* 2013; Umar *et al.,* 2012). In communal areas where communal grazing lands are the source of dry season feed, the use of crop residues as soil cover in CA means forcing an opportunity cost in the form of livestock feed (Akpalu & Ekbom, 2010; Nyathi *et al.,* 2011; Valbuena *et al.,* 2012). In Zimbabwe, free-range livestock can graze on crop residues, which are a communal resource after harvest.

The CA technology also accentuates crop rotation as food security, but it was a constraint as most Zimbabwe rural farmers prefer producing maize because it is a staple cereal (Haggblade & Tembo, 2003; Mazvimavi *et al.,* 2008). Farmers found planting legumes in permanent basins a challenge because of the promoters' insistence on following recommended spacing (Baudron *et al.,* 2007). In planting basin-based CA systems, crops such as groundnuts when being harvested 'make it difficult to avoid soil disturbance as groundnuts have to be pulled out of the soil, which will compromise the CA principle of 'minimum soil disturbance' to a certain extent (Thierfelder *et al.,* 2013).

Another principle of CA was weed management, yet Anderson & Giller (2012) identified weeds as the "Achilles' heel of CA". The finding is true as many CA rural farming households in Zimbabwe abandoned CA due to labour shortages for weeding and land preparation, at least during the first years of the technology uptake (Anderssona & D'Souza, 2014; Silici *et al.*, 2011; Mashingaidze, 2013). Because most households are resource-poor, controlling the weeds is a challenge since farming is done manually.

Many scholars have argued that CA techniques are not easy to adopt by resource-poor households, especially those with challenges of draught power and labour, as is the case with some rural farmers in Zimbabwe (Twomlow *et al.,* 2008). According to Grawboski (2011), several challenges make CA complicated because of issues of scarce water and drought, low biomass production and acute competition between conflicting uses, such as soil cover, animal fodder, cooking/heating fuel and raw material for habitat. Even though there is hype around the widespread adoption of CA in Zimbabwe, the available evidence suggests that it has not been fully adopted (Giller *et al.,* 2009).

Other NGOs introduced and promoted mechanised CA techniques that rely on improved equipment such as ox-drawn rippers and direct planters to address the perceived labour constraints (Johansen *et al.,* 2012; Marongwe *et al.,* 2012). Notwithstanding, the mechanised CA uptake has also been disappointing, suggesting that other more binding challenges such as farmer perceptions about CA and institutional factors beyond the farm gate prevent its adoption (Andersson & D'Souza, 2014; Nyamangara *et al.*, 2014). The overall number of farmers practising some form of CA declined after 2011 when some NGOs stopped providing free or subsidised inputs (FAO, 2015). Subsidies made fertiliser inputs more affordable and thereby contributed to increased adoption, but such solutions are unlikely to be sustainable in the longer term (Ward *et al.,* 2016) and may also indirectly de-incentivise the use of organic soil amendments (Khataza *et al.,* 2017).

The subsequent failure of the CA programme in Zimbabwe can be argued as development that was inappropriate, with technically oriented solutions and management practices that did not address complex ecological issues and hence failed to provide long-term sustainability for local farmers (Agrawal, 1995; Gadgil *et al*., 1993; Woodley, 2002). This inadequate understanding of micro-variations by science-based societies (Blaikie *et al*., 1997) often results in resource exhaustion and environmental degradation in communities and the failure of these scientific methodologies, especially in rural areas (Gadgil *et al*., 1993). One reason that can be put forward for the failure of these kinds of programmes is the exclusion of endogenous factors such as indigenous knowledge systems, culture, and prior farming experience of the rural farmers.

2.3.2 Theoretical models of CA adoption and dis-adoption

Information on how smallholder farmers make decisions is important in determining strategies for agricultural development. Some entrenched theoretical models describe factors that impact the adoption of innovations instead of a single huge theory describing all aspects of technology uptake by farmers. The traditional order of the development of theories has generally been in the order of profitability (Griliches, 1957; Mansfield, 1961), farm size (Feder *et al.,* 1985), risk and uncertainty (Feder *et al.,* 1985; Sunding & Zilberman, 2001), information gathering (Feder & O’Mara, 1982; Feder & Slade, 1984), human capital (Huffman, 1974; Wozniak, 1994), labour supply (Huffman, 1980) and learning by doing and learning from others (Bandiera & Rasul, 2007).

This research has situated CA dis-adoption within the agricultural technology adoption body of knowledge and has been informed by Diffusion of Innovation (Rogers, 2003) and Risk-averse households (Antle, 1987; Mendola, 2007; Taylor & Adelman, 2003) theoretical perspectives. Adoption of agricultural technology is a product of complex interactions between individual farmers, perceived attributes of the technology, in this case, CA, and 'frame conditions or the environment in which they operate (Dadzie & Acquah, 2012). The selected theoretical frameworks are suitable for this study as their combination covers all relevant aspects: the Diffusion of Innovations [DoI] covers the decision-making unit and its social system, while the Risk-averse households cover behaviour in farmers' decisions.

The DoI and Risk-averse households frameworks embrace perspectives of developing-country agriculture (Ndah *et al.*, 2014; Spielman, 2005), hence are appropriate for the analysis, which focuses on Zimbabwe. In addition to contributing unique but complementary perspectives on dis-adoption, the two theories are widely used in determining the adoption of agricultural innovations, including CA (e.g., Corbeels *et al.*, 2014; Lalani, Dorward, Kassam & Dambiro, 2017). The section below will start by looking at the diffusion of innovation, reviewing relevant literature on the adoption of farming technology and diffusion discussing the merits and drawbacks of each. The section after discusses the second theory of risk-averse households, focusing on expected utility and safety theories.

2.3.2.1 Diffusion of Innovation theory

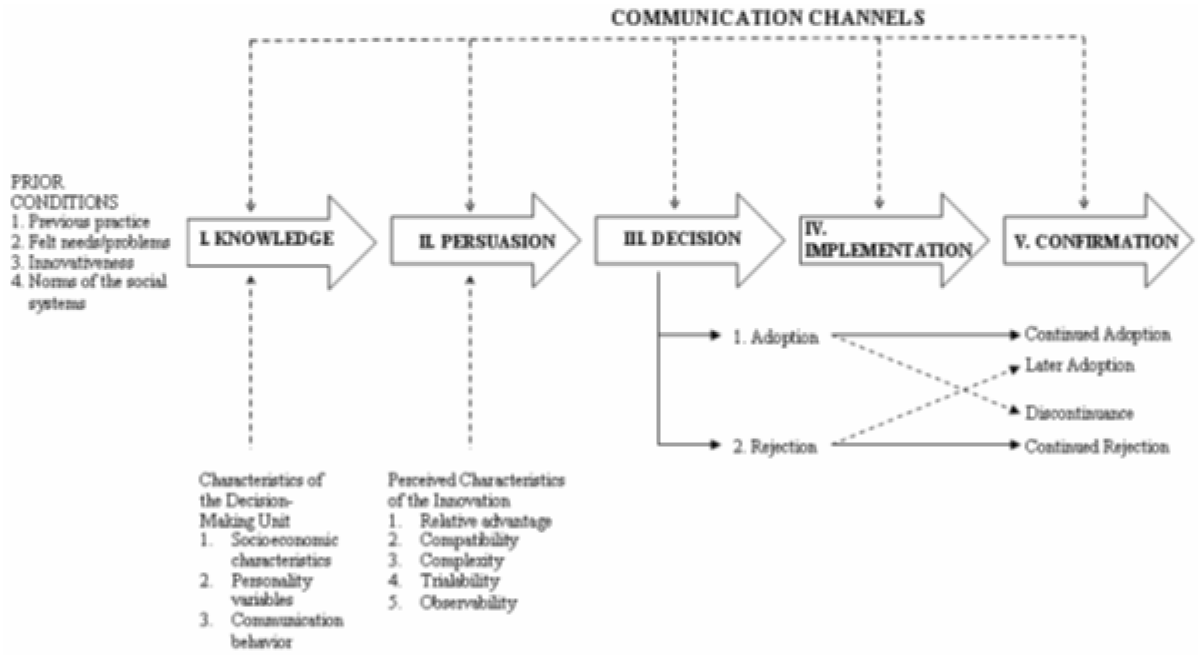
The process of adopting new technology has been researched for many years, and one of the most popular adoption models, diffusion of innovation theory, is described by Rogers (2003). He defines diffusion (aggregate adoption) as the process in which an innovation is communicated through certain channels over time among the members of a social system. This definition distinguishes the following four elements: (i) the technology that represents the new idea, practice, or object being diffused, (ii) communication channels which represent the way information about the new technology flows from change agents (extension services, technology suppliers or project promoters) to final users or adopters (e.g., farmers), (iii) the period over which a social system adopts a technology, and (iv) the social system. Adding to that, Fisher, Norvell, Sonka & Nelson (2000) elucidate that diffusion is different from adoption in that it is the process by which new technologies are spread among users while adoption is said to be an individual internal decision.

According to this theory, individuals go through five phases to adopt a new practice or behaviour (Gregor & Jones, 1999; Rogers, 2003). These phases are (i) knowledge, whereby a person becomes aware of an innovation and has some idea of how it functions. In this step, an individual learns about the existence of innovation and seeks information about the innovation. "What?", "How?" and "Why?" are the critical questions in the knowledge phase, (ii) the persuasion stage is when a person forms a favourable or unfavourable attitude toward the innovation after he/she knows about the innovation, (iii) decision stage whereby a person engages in activities that lead to a choice to adopt or reject the innovation, (iv) implementation stage - a person puts an innovation into use, and (v) confirmation stage in which a person evaluates the results of an innovation-decision already made and the individual looks for support for his/her decision.

This study will hone in on the implementation and confirmation stages of the innovation-decision process whereby perceived innovations are put into practice, and it is also where challenges on the use of the innovation often emerge (see Moser & Barrett, 2003; Neill & Lee, 2001). As farmers start using the innovation, real experiences and perceptions arise, a process out of which dis-adoption is a possible outcome (Rogers, 2003). Investigation of the implementation stage generally lacks in technology uptake literature despite its importance in conceptualising or determining (dis)adoption. According to Pannell *et al.* (2006) and Ndah *et al. (*2012), the (dis)adoption decision process is mainly informed by perceived attributes of the innovation such as perceived complexity; relative advantage; compatibility with felt needs, existing (farm) management regime, beliefs or values; personal experiences (mainly during implementation stage) and the nature of the social-political system. A Model of Five Stages in the Innovation-Decision Process is presented in figure 1 below.

Given that all potential adopters in a social system do not adopt new technology simultaneously, adopters can be classified, depending on when they adopt the technology. Rogers (2003) classified adopters into five categories: innovators, early adopters, early majority, late majority, and laggards. The innovators are the *risk-takers* and pioneers who lead the way. They are the venturesome and educated persons in society. The second group, early adopters, climb on board the train early and help spread the word about the innovation to others. They include the social leaders, the most popular and educated persons in the society. The third group, the early majority, makes a deliberate attempt to adopt the innovation and acquire information through the many informal social contacts at their disposal. The innovators and early adopters convince the early majority and give assurance on the sustainability of an innovation. The fourth group who is the majority wait to ensure that the innovation is in their best interests. These are the individuals who are highly sceptical and resist adopting until necessary. The fifth group known as laggards are highly sceptical and, in many cases, they never adopt the innovation. Those that fall in this category include the traditional, lower social class in society. According to Mahajan, Muller & Srivastava (1990), these categories are imperative because they can help target new prospects for new technology, assist in developing marketing strategies to penetrate the various adopter categories, and assist in predicting the continued acceptance or rejection of a new product.

Figure 1: A model of five stages in the innovation-decision process



Source: Rogers (2003). Diffusion of Innovations, Fifth Edition. The Free Press

For Rogers (2003), innovators are keen on experiencing new ideas. Thus, they are ready to cope with unprofitable and unsuccessful innovations and a certain level of uncertainty about the innovation. The boundaries of the social system limit early adopters more. Since early adopters are more likely to be opinion leaders or hold leadership roles in the social system, other members come to them to get advice or information about the innovation. Sahin (2005) observed that leaders play a crucial role at virtually every stage of the innovation process, from initiation to implementation, particularly in deploying the resources that carry innovation forward. Even though the early majority have a good interaction with other members of the social system (Rogers, 2003), they do not have the leadership role those early adopters have (Sahin, 2006). However, their interpersonal networks are still important in the innovation-diffusion process (Sahin, 2006). The late majority includes one-third of all members of the social system who wait until most of their peers adopt the innovation (*ibid*).

Although the late majority are sceptical about the innovation and its outcomes, economic necessity and peer pressure may lead them to the adoption of the innovation (Sahin, 2006). Laggards have the traditional view, and they are more sceptical about innovations and change agents than the late majority. Because of the limited resources and the lack of awareness-knowledge of innovations, they first want to make sure that innovation works before they adopt. Within the agriculture sector, Rogers (2003) provides a linear model of the diffusion process (see figure 2 below).

Figure 2: Diffusion as a linear model

Source: Rogers (2003). Diffusion of Innovations, Fifth Edition. The Free Press.

In addition to the above diffusion theory, Rogers (2003) further identified several characteristic determinants that render an innovation apt for easy adoption. These perceived attributes are comparative advantage, complexity, trialability, observability and compatibility. Comparative advantage is the degree to which an innovation (CA) is perceived better than the idea it supersedes (conventional agriculture). It is positively related to its rate of adoption. For instance, the adoption rate of CA will be high if the target groups of adopters perceive it has significant advantages over conventional farming and other practices in their vicinity. Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use. The complexity of an innovation perceived by members of a social system is negatively related to its adoption rate.

Trialability is the degree to which an innovation may be experimented with on a limited basis (field level) or adopted in stages (zero or minimum tillage; crop rotation; mulching, one at a time). The higher the trialability of the innovation, the higher the chances of adoption. Observability is the degree to which observers can see the results of an innovation. The higher the observability of the innovation, the higher the adoption rate. If CA increases yields visibly (or decreases costs visibly, such as by saving labour), then there is a high possibility that it will be adopted. Compatibility is the degree to which an innovation is perceived as consistent with the existing values, experience and needs of potential adopters. The more the innovation is compatible, the higher the chances of adoption.

Fliegel (1993) and Feder & Umali (1993) proposed a more widely accepted, non-linear approach to the adoption of agricultural innovations as opposed to the Rogers (2003) linear approach. Unlike the linear approach, which tends to restrict diffusion to a rational, planned process that relies on institutions such as government departments, a non-linear approach views the farmer as a passive individual who responds to random forces related to social participation and communication (see figure 3 below).

Figure 3: A linear approach to the adoption of agricultural innovations

Source: Jackson et al. (2006)

The challenge of diffusion and implementation of innovations in agriculture should not be considered simplistic. These processes will not be automatically successful because there are sufficient financial resources, agricultural experts, awareness of adopters, access to innovation etc. In the past century, the experiences of many countries (particularly less developed ones) have often proved unsuccessful in the modernisation of agriculture and rural development. Although the activities were (sometimes) carefully prepared, generously financed and otherwise supported by the governments of these countries and influential international organisations, the expected outcomes have not occurred (Petrović *et al.*, 2004). Little or lack of acknowledgement on the impact of culture by promoters and proponents of technology on the diffusion and implementation of innovation, especially among smallholder farmers, has contributed to the demise of these programmes.

Most studies (see Arensberg & Niehoff, 1964; Barnett, 1953; Foster, 1962) seem to have been more interested in the role of innovations as elements of cultural change rather than the influence of culture upon innovation. Although diffusion studies such as Pedersen (1951), Graham (1956), and Rogers (1962 & 1971) recognise the predominance of cultural factors upon the diffusion and adoption processes, very few attempts have been presented on the impact of culture upon the diffusion and adoption processes. In the section below, I will describe and discuss the nature of the cultural factors that affect the rate of diffusion and the rate of adoption of innovations. I will also discuss how cultural norms affect the diffusion rate of innovations at a macro-level and how relationships exist between cultural integration and individual adoption at the micro-level.

2.3.2.1.1 Cultural norms and the diffusion process

The interconnectedness of the various actors in the CA innovation system (network) at community, village and regional levels, and beyond can influence the rate of adoption. For one to understand the impact of culture upon diffusion, it is imperative to realise that the diffusion of innovation never operates in a vacuum but within the boundaries of a social system. The specific nature of this social system depends upon the type of innovation being considered; for example, "in most farming studies, the social system is defined as a farming community, often a county. It is also possible to think of the social system in terms of age, income, social class or any other criteria of market segmentation" (Robertson, 1971). Given the purpose of the study, it is appropriate to consider a social system as the result of a social stratification process through which cultural values are distributed among its members. Every community has its stratification system; however, it is rarely the amount of stratification but rather the rules according to which this stratification is operated which differentiate one system from another. These rules are the cultural values and norms of a society.

Amid the diverse norms found in a social system, one is significant to my study: the norm that prescribes the behaviour individuals will follow concerning novelty and change. Commonly, some cultures value novelty and change for their own sake. Rogers (1962, 1969) was influential in providing a theoretical framework to account for these differences. He put forward two ideal types of societies: the traditional one, which inclines towards resisting the new, and the contemporary one, in which norms tend to favour innovativeness and welcome change systematically. According to Rogers, the main scope in which contemporary and traditional social systems are at variance is the level of technology, the level of education, the degree of cosmopolites, the existence of a "rational mind", and the ability to empathise. Even though the framework is important in contributing to the analysis of the influence of culture on the diffusion of innovations, one must be aware that the traditional-contemporary norm is one way in which culture may apply its impact.

Conventionally, it is valuable to recognize that innovation is always perceived through a given number of specific attributes such as compatibility, relative advantage, complexity, divisibility, etc. (Rogers with Shoemaker, 1971; Zaltman & Lin, 1971). Of these attributes, the one which is of particular significance here is compatibility which refers to the extent of consonance existing between the given characteristics of the innovation and the central values of the socio-cultural system under consideration. Several studies have been conducted which demonstrate how innovations have failed to diffuse because of a lack of compatibility with the existing norms of the socio-cultural system. For example, Foster (1962) points out that agricultural extension programs in Buddhist countries have encountered problems in pest control because the religious prohibition against taking life in any form was rationally irreconcilable with the direct approach to the problem through insecticides.

From the discussion above, it appears logical to reaffirm that the diffusion rate of innovation among the members of a particular social system depends upon the nature of the relationship between the perceived attributes of the innovation and the central values (or norms) of the social system. The diffusion rate will be high (A high rate means a larger percentage of the social system members adopt the innovation in a relatively short period) when the perceived attributes of the innovation are compatible (consistent) with the central values of the social system. Additionally, the diffusion rate will be low when the perceived attributes of the innovation are incompatible (inconsistent) with the central values of the social system. Having discussed how cultural norms and values affect the diffusion rate of innovation within a particular social system, I will now discuss the influence of socio-cultural factors on the individual rate of adoption in the next section.

2.3.2.1.2 Cultural integration and individual adoption

Cultural integration refers to the relative degree of conformity between an individual's behaviour and the central norms of the socio-cultural system of which he/she is a member. In order to understand the dynamics of cultural integration and individual adoption, it is critical to be aware that every individual does not adhere to the culture of their society to the same level. People who are highly integrated strictly observe the norms in their culture, while poorly integrated people are sometimes referred to as "deviants" or "marginal individuals." Generally, high social status is associated with a high degree of integration, while a low social status is associated with a poor level of integration. In another way, the members of any given social system do not look like the homogeneous mass that we seem to imply, but each one is an individual with their attitudes and cognitions. An individual's adherence to their culture is thus determined by their position within the socio-cultural hierarchical system of their society. Linton (1945) points out that such a position is commonly referred to as their social status. The set of behaviours an individual is expected to follow according to their status is called his role, which becomes the operationalisation of status.

The influence of culture upon the individual's decision to adopt or reject an innovation can thus be expressed at two equivalent levels: at the abstract level, where it is expressed in terms of values and status, and at a more practical level in terms of norms and role (Dubois, 1972). The rate of individual adoption of an innovation by a member of a particular social system depends upon his level of integration within the socio-cultural system under consideration. In general, this means the rate of individual adoption will be high (in terms of the quickness with which the adopter goes through the stages of the adoption process) when the potential adopter is deeply integrated within his socio-cultural system and when the social values of the system favour novelty and change. It also means the rate of individual adoption will be low when the potential adopter is a relatively marginal member of their social system and when the social values of the system favour novelty and change. Finally, it also means the rate of individual adoption will be low when the potential adopter is highly integrated within his socio-cultural system and when the social values of the system resist novelty and change (Dubois, 1972).

To summarise the implications of the diffusion theory towards the adoption decision process of agricultural innovations to CA promotion, especially for smallholders in Africa, it helps to visualise the entry points for a population of potential adopters and the diverse reactions of farmers *vis-à-vis* the technology. It also follows from applying Rogers' diffusion model that technology uptake, especially amongst smallholder farmers, can be hesitant from the beginning to finally accelerate at the final stage. Alternatively, it could ascend slowly and plummet again towards the final phase. Rogers' diffusion model helps to illuminate the fact that not all potential farmers can take up technology simultaneously, or are worthy of adopting it. Whilst some farmers will find an innovation attractive to them at different stages during the diffusion process, with varied reasons responsible for their behaviour, some will eventually find it not attractive at all. As such, the hang-on-to-old conventional farming practices at all costs no matter the magnitude of promotion efforts put forth. In summary, Rogers' (1993) insights help to research if and how the CA programme used the characteristics of innovations (relative advantage, compatibility, trialability, observability, and complexity) in their adoption. The concept of diffusion will be used to analyse the spread of CA in the ward.

In the above discussions, I have also attempted to show that the relationship between culture and innovation is deeply intertwined. But this link is overlooked in the studies of CA abandonment highlighted above. The rate of diffusion and the adoption rate of innovation within a socio-cultural system is critically dependent upon the nature of the system's cultural values and norms. Conversely, the consequences of accepting innovation can be such that some aspects of the cultural system in which the innovation occurs may be affected. In such cases, a cultural change movement is generated. The innovation contributes to the development of a cultural system rather than being affected by it. The next section discusses my second theory, i.e., the expected utility and safety-first theory that explains farmers' decision-making, especially in resource-poor farming households like the ones in the study area. It is the basis of many studies as it focuses on the dual character of smallholder households as both families and enterprises and thereby considers the consumption side of smallholder decision making (Mendola, 2005).

2.3.2.2 The expected utility and safety-first theory on risk-averse households

Farming is a business for smallholder farmers with concomitant risks. Risk aversion theories are often highlighted in the literature describing peasant household behaviour (Antle, 1987; Mendola, 2007; Taylor & Adelman, 2003). As such, risk is an integral part of decision-making processes in farming, especially in developing countries (Keil & Nielsen, 2012). Some of the risks and constraints smallholder farmers face are climate change, erratic rainfall patterns and more frequent extreme weather, the small markets, unstable market prices, poor infrastructure and farm diseases. These challenges have a significant bearing on farming household livelihoods, resulting in a change in farmers' behaviour in resource allocation decisions, which varies from one farmer to another given their socio-economic circumstances (Mendola, 2007; Shahabuddin *et al.*, 1986).

According to Hardaker *et al.* (1997), the risk is uncertainty or imperfect knowledge with exposure to unfavourable consequences. Taking a risk means allowing the possibility of failure or loss in attaining one's desired objectives. The most significant sources of risk for farmers are yield uncertainties and prices that have a direct bearing on-farm productivity and profits. The farmers' mindset toward risk largely determines how they approach perceived opportunities and challenges on their farms. Therefore, ascertaining the attitude of farmers towards risk is an important first step in understanding their behaviour and coping strategies they normally adopt to mitigate the effects of risk they constantly face within the environment that they operate (Dadzie & Acquah, 2012).

There is evidence that poor smallholder farmers are risk-averse (Binswanger, 1980, 1981, 1982; Binswanger & Sillers, 1983; Dillon & Scandizzo, 1978; Moscardi & de Janvry, 1977; Lence, 2000; Harrison, Lau and Rutstrom, 2007; Thomas, 1987), and that their production and economic environments are characterised by a high degree of uncertainty (Roumasset, 1976). Many studies have also shown compelling evidence that risk and uncertainty have major influences on the rate of adoption of rural innovations (e.g., Beal, 1996; Feder, 1980; Feder & Umali, 1993; Herath *et al.*, 1982; Just & Zilberman, 1983; Lindner, 1987; Lindner *et al.*, 1982; Marra *et al.*, 2003; Sattler & Nagel, 2008; Shapiro *et al.*, 1992; Weisensel & Schoney, 1989). Furthermore, risk preference which refers to people's attitude toward risks (Dadzie & Acquah, 2012), might influence farm operations and management decisions (Akhtar *et al.,* 2018) like participation in different enterprises and choice of adaptation mechanisms. According to Ghadim, Pannell & Burton, (2004), risk variables that impact the adoption of innovations would include farmer's perceptions of the riskiness of the innovation; farmer's uncertainty about the innovation; farmer's potential to learn about risk and reduce uncertainty through trialling the innovation; and farmer's attitudes to risk and uncertainty. In congruence with this, farmers' attitudes to risk have been researched for their significance to on and off-farm decision making.

Numerous approaches focus on measuring levels of risk aversion among farmers and determining the factors behind such attitudes. Dillon *et al.* (1978) grouped such approaches under the following headings: (a) economic anthropology; (b) econometrics; (c) risk programming; and (d) expected utility and safety-first theory. Young (1979), Lins *et al.* (1981), Robison *et al.* (1984), and Gomez-Limon *et al.* (2003) redefined the categories as (a) direct estimation of utility function; (b) experimental methods; and (c) observed economic behaviour. Direct utility function estimation and experimental methods seem to be variants of each other as both make use of personal elicitation techniques such as surveys and games. Observed economic behaviour, on the other hand, covers Dillon's econometric and mathematical programming classifications.

Economic anthropology has been useful in exploring human risk behaviour using tools of both economics and anthropology. Many of the models in both economics and anthropology have a basis in some form of utility maximisation. Individuals are considered to pursue the satisfaction of their needs and wants, but how such pursuits are rationalised and actualised differs from one person to the next. March (1988), for instance, observed that risk preferences affecting life decisions not only depend on values of possible outcomes or rewards but also levels of individual aspirations. This is easily translated in agriculture when farmers are faced with production risks and relative rewards. Newbery (1977) further highlighted the subjective and anthropologic nature of decision-making by acknowledging the risk-sharing value of sharecropping in agriculture. Farmers in this instance preferred the security of a partnership arrangement even though it may have meant sharing profit with others and earning less. Other researchers have aptly qualified risk attitudes and related decision-making as a function of individualised utility-seeking profiles and community patterns (Barlett, 1980; Chibnik, 1978; March, 1988; Newbery, 1977).

Econometric and mathematical programming approaches are based on the observed economic behaviour of farmers. Bardsley & Harris (1987) estimated farmers' risk aversion coefficients using pooled time-series and cross-sectional data from Australian broadacre agriculture. Lence (2000) used a generalised expected utility model fitted to farm data in the US to estimate farm operators' time preferences and risk attitudes. Moscardi & de Janvry (1977) used a combination of approaches to explain attitudes toward risk using socio-economic and structural variables that characterised peasant households in Mexico. Risk attitude assessments through mathematical programming were mostly based on cropping pattern selection (Brink & McCarl, 1978; Gomez-Limon *et al.,* 2003; Wiens, 1976).

The influence of economic thought on the adoption of innovations led Just & Zilberman (1983) to propose a theory of technology adoption under uncertainty using the expected utility and safety-first framework. This model contends that economic constraints, such as access to capital or land, significantly affect the adoption decision. Thus, the farmer's decisions are derived from maximising expected utility (or profit) subject to his inputs (availability of land, labour and credit). This model is the most commonly used for adoption studies of agriculture and agroforestry technologies (Mercer & Pattanayak, 2003; Negatu & Parikh, 1999).

In contrast to the previous theory of Rogers (1995) about an individual's decision-making processes, Lipton (1968) argues that the expected utility and safety-first theory is used to understand individual decision making under uncertainty. Bernoulli introduced the mathematical expression of the expected utility hypothesis in the 18th century (Anderson *et al.,* 1977). According to Bernoulli, choices and decisions made by people are based on preferences over alternatives that maximise their expected utility rather than expected monetary values (Levy, 2006; Schumann, 2006). This ultimately means resource-poor and wealthy people may display different preferences for risk. The fundamental behavioural concept in expected utility theory is that of risk aversion (Quiggin, 1992). Risk aversion is a central feature of the challenge of choice under uncertainty (Moschini & Hennessy, 2001). The shape of a decision maker's utility function depicts their risk preferences (Hardaker *et al.,* 2004). The decision maker's utility function has a positive slope over the entire range of payoffs, which implies that a greater payoff is always preferred to a lower one.

Chayanov (1924) postulated that the aim of any smallholder household was simple reproduction rather than profit maximisation. He proposed that understanding consumption and production inside the household means a unique form of decision-making that differentiates smallholders from any other production unit under capitalism. He also argued that the smallholder economy could not be studied by applying profitability-oriented capitalist economic principles. His expected utility maximisation theory involves a trade-off between the drudgery of farm work and the income required to meet the consumption needs of the household. According to Friis-Hansen (1995), Chayanov argued that the smallholder household would use its own family labour for agricultural production according to its internal equilibrium. This equilibrium is determined by equating the household demands and needs with the drudgery involved in meeting them.

At the centre of the expected utility and risk aversion theory is a trade-off between profit maximisation and risk aversion. Roy (1952) was the first to suggest the idea of "Safety First". According to this theory, individuals consider outcomes below a certain value as a "disaster", and what constitutes a "disaster" depends on the individual. In addition, when making decisions about uncertain prospects, individuals' first consideration is to minimise the probability of reaching disaster, hence the name "Safety First" (SF). The SF theory considers the problem of extreme poverty and food insecurity in rural smallholder farmers (Haim & Moshe, 2009; Mendola, 2007). Combined with the recurrent effects of natural hazards, these characteristics might change smallholder households' behaviour regarding technology uptake (Koundouri *et al.,* 2006; Sekar & Ramasamy, 2001; Tambo & Abdoulaye, 2013). The SF decision-making theory seeks to minimise the probability that farm household income falls below a certain level and better suits risky and subsistence rain-fed agriculture under climate change (Arnade & Cooper, 2012; Haim & Moshe, 2009; Qasim, 2012).

In rural areas, where most people rely on rain-fed agriculture and are at risk due to weather conditions, farmers protect themselves against climate uncertainties and build their livelihood resilience. Indeed, risk management involves cost, and subsistence farm households with poor assets may adopt self-protection to meet their subsistence needs and deal with starvation in case of a bad harvest (Mendola, 2007; Qasim, 2012; Sekar & Ramasamy, 2001). The socio-economic characteristics of the households could affect their decision about the adoption of new technologies (Koundouri *et al.*, 2006; Tambo & Abdoulaye, 2012). It is important to indicate that farm household has an income goal to achieve, and that income goal is also seen as a disaster level since temperature and precipitation could be determinants (Abdoulaye & Sanders, 2006; Fisher *et al.*, 2015; Sekar & Ramasamy, 2001; Wossen *et al.*, 2017).

Smallholder farmers display risk aversion behaviour in their decision making (Binswanger & Sillers, 1983; Moscardi & de Janvry, 1977) out of necessity because they must secure their household needs from their current production or be food insecure. Because they are resource-poor, there is no room for aiming at higher income levels by taking risky decisions (Lipton & Longhurst, 1989). A risk-averse household chooses a consistent consumption stream to a changing one, which entails a low-risk portfolio choice of productive activities in contexts of incomplete capital markets or underdeveloped institutional arrangements (Umar, 2013). Innovative behaviour/technologies, especially in rain-fed agriculture in rural areas, involve risk and uncertainty.

According to Weeks (1970), the uptake of technology, either inputs or crop, means risk-taking and uncertainty-bearing because owing to its newness, there is no previous experience upon which to foretell the outcome. Under conditions of imperfect knowledge (uncertainty), there is not a single marginal physical product for each factor, but a probability range within which the actual marginal physical product for any factor will be each year, and the range may be great (Umar, 2013). Risk preferences are a result of resource constraints and capital market imperfections faced by decision-makers. Thus, differences in preferences may be due to differences in access to institutional arrangements that enable households to pool risks across time (Umar, 2013). Risk, along with asset-poor initial conditions, may contribute to making small farm households inefficient and persistently poor (Dercon, 2009). Households first opt for safety, and from the safe alternatives, they choose based on expected utility and possibly expected income.

According to Popkin (1980), many of the norms and procedures of smallholder societies are embedded in considerations of subsistence and survival; the village is not only a ritual and cultural unit but also an important part of smallholder economic life: a source of rights and resources. Smallholders are concerned with uncertainty when evaluating economic strategies. They prefer strategies with low but certain returns to strategies with high but uncertain returns (Umar, 2013). Criticisms levelled at the expected utility maximisation theories are that their sphere of analysis is limited to the household, and the theories can therefore not say anything about the development of society. In addition, the theories treat the household unit as a single decision-making unit and do not consider gender relations, division of labour and smallholders' external relations (Friis-Hansen, 1995).

In Zimbabwe, smallholders were initially provided with free inputs to encourage the adoption of CA technology to measure its effects. Adopting new technologies exposes farmers to risk, especially smallholders who cultivate small areas for food staples with limited ability to purchase inputs (Pannell *et al.,* 2014). Risk-averse and resource-constrained farmers are seldom willing and able to try new technologies (Arslan *et al.,* 2014; Pannell *et al.,* 2014). Smallholders in Zimbabwe allocate most of their resources to produce food staples and consume most of the staples they produce (Johansen *et al.,* 2012). Cash earnings from the sale of surplus products tend to be trivial, and, in the virtual absence of off-farm earnings, smallholders confront severe liquidity constraints (Ndlovu *et al.,* 2014; Nyamangara *et al.,* 2014). This reduces their ability to invest, particularly when new technology does not provide immediate benefits (Shiferaw & Holden, 1998). The temporary provision of free inputs was considered necessary to overcome risk aversion and the liquidity constraints that inhibit adopting technologies like CA. The discussion above has shown that adopting new technology is viewed as a risk by smallholder farmers, and one factor that determines risk is culture. The following section is a discussion on how these two are interlinked and affect adoption.

2.3.2.2.1 Influence of culture on risks

Douglas & Widavsky (1982) point out that rural farmers are confronted with different kinds of fears – physical, economic, and social – and their decisions go beyond risk-utility analysis (i.e., weighing the economic benefits and costs). Hence, farmers' perceptions of the risk associated with new technology are embedded within their economic, social, and cultural environments. These risk perceptions are likewise largely influenced by a combination of confidence and fear that, in turn, enable and constrain behaviours. Oakley & Garforth (1985) further point out that many rural societies look upon new methods with indifference and sometimes with suspicion. They state that farmers not only fear the unknown and untested, but they also fear criticism for doing something different from other farmers and respect for elders often results in the attitude that the old ways are best.

Contemporary studies have shown that cultural worldviews mostly influence farmers' perceptions of risk instead of empirical and theoretical data, which is called the "cultural theory of risk" (Adger *et al*., 2013; McNeeley & Lazrus, 2014). A meta-analysis study found that perception of risk was higher among individuals with a high score on egalitarianism than those with a high score on individualism (Xue *et al*., 2014). Because African traditional worldviews are mainly communal and egalitarian, a high perception of risk may be expected. Several studies in Mali (Sanogo *et al*., 2017), Zimbabwe (Mubaya & Mafongoya, 2016), and Kenya (Speranza *et al*., 2010) confirmed high-risk perceptions among smallholder farmers. Since culture varies by society or social group, understanding cultural norms, values, and specific beliefs associated with agricultural production is important when introducing agricultural technology.

2.3.3 Conceptual framework

The study is grounded in two different theoretical perspectives of technology adoption that have been used in past studies: diffusion of innovation theory and expected utility and safety first on risk averse households (Antle, 1987; Mendola, 2007; Rogers, 2003; Taylor & Adelman, 2003). Information dissemination is at the centre of the innovation diffusion theoretical perspectives, and adoption is viewed as a series of linear stages from knowledge acquisition to persuasion, decision, implementation and finally confirmation stages (Rogers, 2003). The expected utility and safety first theoretical perspective states that risk is an integral part of decision-making processes in farming, especially in developing countries (Keil & Nielsen, 2012). This study integrates the two theories to develop a conceptual understanding of the research problem.

Conceptually, Lugandu (2013) stated that the decision to adopt or not adopt CA is a function of farmers' perceptions of CA compared to other farming practices or technologies. Analyses of current literature show that there are diverse barriers to CA adoption that are dependent on the setting and community that the program takes place in (context) (Lee & Gambiza, 2022). A barrier is defined by Lee & Gambiza (2022) as a physical, social, financial or informational obstacle that prevents successful adoption and implementation of CA's three key principles. According to Lee & Gambiza (2022), there are variables identified in literature as determining non adoption of CA that are dependent of context: cultural resistance to change; the unique social, cultural and political context of smallholder farmers; and the 'mindset of the plough'. Cultural resistance to change can arise when traditional agricultural practices are questioned and farmers are shown new techniques (Hove & Gweme, 2018). This stems from the broader enabling environment of the social, cultural and political context (Mutenje et al., 2019). Understanding these variables and how they influence adoption are important in developing strategies for promoting the use of no-till CA.

This conceptual framework maps out the underlying drivers that led to the lacklustre adoption of CA innovation in Ward 30, Nyanga District. By identifying drivers in multiple domains (farming practices, farming values, indigenous knowledge systems, and farmers' experiences), the framework provides a comprehensive conceptualisation of underlying drivers of abandonment and outright rejection; including their complex interactions and how they affect smallholder farmers' experiences, perceptions, and ultimately the decision to reject or abandon CA. The framework emphasises that the complexity of drivers underlying rejection and abandonment decisions demands a robust examination of triggers in all four domains to generate a broader understanding of the multiple pathways so that CA is not a misfit.

Therefore, the framework provides dual benefits. It provides a comprehensive understanding of CA's complex rejection and abandonment drivers and provides a troubleshooting guide to improve the design and implementation of project-based agricultural interventions seeking sustained adoption. While providing a succinct account of multiple pathways to rejection and abandonment, the framework reinforces systems approaches and a shift in focus from outputs to agricultural research and development processes. While the rejection and abandonment framework has been developed in the context of Ward 30, Nyanga District, it could be usefully applied more widely. It can be utilised to conceptualise the dis-adoption of similar project-based innovations in agriculture, forestry and sustainable land management among smallholder farming communities across sub-Saharan Africa. Figure 4 below shows the conceptual framework on non- adoption of a new technology by farmers.

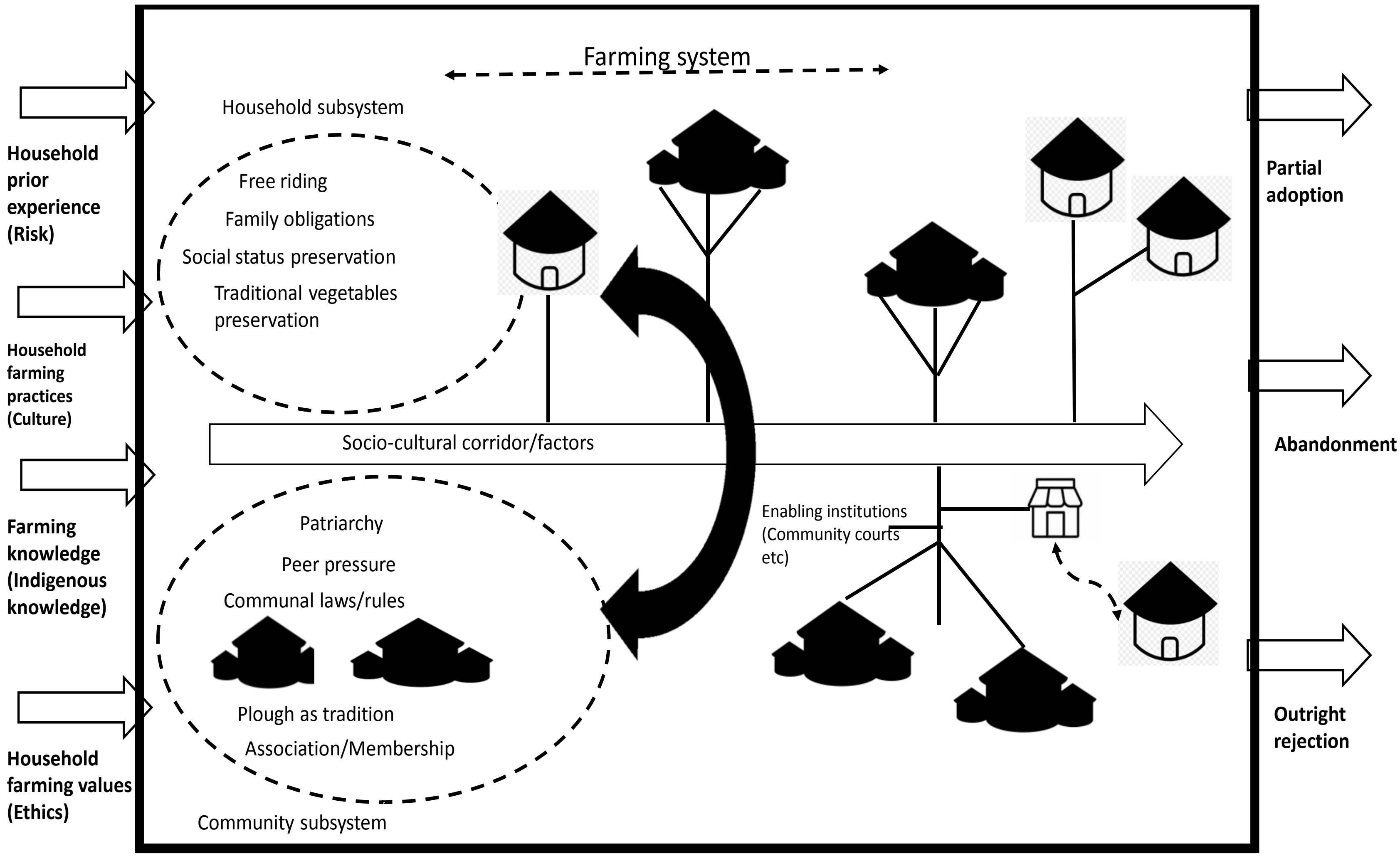


Figure 4: A conceptual framework model for understanding socio-cultural constraints on CA adoption

Below is a discussion on how each social limit affects a household's decision making on technological innovation such as CA:

Risk: How individuals and communities adapt to risks will depend on various thought processes, values and ethics (Adger, 2009a, b; Lorenzoni, *et al.,* 2007; Wolf, *et al.,* 2010). Factors such as risk perception, habit, social status and age operate at individual decision-making levels and constrain collective action. Individual adoption hinges on whether an impact, anticipated or experienced, is perceived as a risk and whether it should (and could) be acted upon. Individual and social characteristics, in particular risk perception, interact with underlying values to form subjective and mutable limits to adopt that currently hinder society's ability to act. Such limits could preclude adoption at societal scales.

Prior farming experiences correlate with how psychological and thought processes influence household/individual actors to react in the face of existing or anticipated risks. People may employ a wide range of cognitive strategies in the face of current or future threats, ranging from denial and apathy to helplessness, uncertainty and acceptance. Consequently, these cognitive traits may influence whether farmers will adopt, partially adopt or reject the technology outright. Therefore, introducing a new technology like CA might not be successful due to cognitive behaviour, which can act as a social barrier because of the belief that uncertainty will be too great, and farmers will be reluctant to accept the risks associated with implementing adoption action. Especially, low-wealth farmers are often reluctant to adopt technologies because they need a stable income, especially when returns to adoption are unclear or will only bear fruits in the future.

Culture: Individual or household farming practices resulting from people's culture and traditional beliefs can help or hinder efforts to adopt any new technology (IIRR & ACT, 2005). Differences in culture may explain differences in perceptions, approaches towards adoption, and diffusion of new technologies. Shared values and understandings can play a large role in prescribing how decisions are taken in adoption. This is because farmers do not till or farm their fields in a vacuum but have a rich and complex history and what they do is a result of historical events they have experienced over many years. In certain instances, this may present obstacles to implementing effective and logical adoption action (Jones, 2010) and farmers are unwilling to deviate from traditional practices and adopt more appropriate and sustainable strategies.

Therefore, different societies, cultures, and sub-cultures approach foresight in different ways and, in some cases, that acts as a hindrance to the adoption of innovation.

Indigenous knowledge: Knowledge in any field empowers those who create and possess it with the capacity for intellectual or physical action (ICSU, 2003). The indigenous knowledge system is knowledge developed by the farmers through their lived experiences or generational knowledge in their respective rural settings. It, therefore, is endogenous and fairly easy to accept and less likely to be rejected as alien compared to scientific knowledge such as CA. Furthermore, knowledge of ecosystem dynamics gained from historical experience become culturally embedded and is an important part of developing adaptive management strategies (Berkes *et al.,* 2000). Farmers face many problems associated with their farming practices, and often implement management practices to solve them, which evolve into indigenous knowledge systems. In certain instances, indigenous knowledge may present obstacles to implementing effective and logical adoption action, and farmers are unwilling to deviate from established systems to adopt more appropriate and sustainable strategies. Ultimately, adoption or outright rejection of CA is a function of farmer's perception about it weighed against other indigenous farming practices.

Ethics: Any limits to adoption depend on the ultimate goals of adoption, which are themselves dependent upon diverse values. The centrality of values demonstrates that limits are defined by ethical principles. There is an important distinction between (1) approaches that seek to define risks of a technology that is tolerable, and hence avoid system failure and unacceptable cost, and (2) other approaches that see adoption as part of a wider process to enhance the well-being of society. Whatever the social goals of adoption, the existence of diverse, and sometimes incommensurable, values held by the actors involved in decision-making around adoption can act as limits if these values are not deliberated. The values that underpin adoption decisions become more diverse and contradictory as one moves from small scales and single agents to larger scales and multiple agents. Values in society are not held in isolation and are different for different stakeholders with levels of influence and power over their own destinies.

Although the conceptual framework has emphasised the impact of the four social limits, it is important to note that these four factors by no means constitute all social-cultural barriers to adoption. Rather, they serve as a useful starting point for exploring the complex nature of socio-cultural barriers to adoption and form the basis for the conceptual framework used in this study. This issue is under-researched and needs to be explored further, not least because culture is not static - all cultures and places change over time and because what is deemed to have intrinsic social value also changes over time.

2.4 Chapter summary

This chapter has reviewed past studies on the factors influencing the adoption of agricultural technology and demonstrated that the reality of the adoption of agricultural innovations in Africa is a much more complex issue. A literature review shows that most adoption studies have considered single technology, yet CA is a packaged technology. Issues of dis-adoption are critical in addressing effective targeting and packaging of the CA technology. There is currently scant information and few empirical studies on dis-adoption. In the literature reviewed, partial adoption, dis-adoption and outright rejection have been acknowledged in contemporary literature, with limited empirical evidence. The chapter also made an in-depth review of concepts and adoption theories which have subsequently been applied as frameworks for analysis in the respective chapters of this thesis. Although the selected theories and concepts all provide frameworks with the potential to study the CA adoption process, each theory or concept has its strength and limitations in the conceptualising process. This is reflected mostly in the specific angle/dimension each focuses on concerning the adoption decision process. It is realised that most of these theories or concepts capture either one or two of the many necessary perspectives that explain the inherent complexity of CA adoption.

Although CA can address low productivity and soil degradation problems, adoption remains very low, especially in SSA. The current trend among most smallholder farmers is to adopt CA partially by picking only those components that fit into their current farming system. In addition, the waiting periods for CA benefits to manifest are too long for smallholder farmers, discouraging them from adopting the practice. However, proponents of CA posit that the benefits of CA can be realised even under partial adoption and in the short term. Furthermore, they attribute the problems of CA adoption to the complexity and packaged nature of the technology.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Given the dynamic, complex, and under-researched nature of my research topic, a rich and in-depth qualitative study was undoubtedly the most suitable research methodology. This was also the case in Agranoff & Radin (1991), Marshall & Rossman (1995), De Rond & Bouckchikhi (2004), and Kenis & Oerlemans (2004), who used qualitative studies due to the complex nature of the topic. Numerous methods were used in this qualitative ethnographic case study to collect information within the natural setting of Ward 30 to gain a greater understanding of the impact of socio-cultural factors on CA adoption. The methodology and research design description for this case study is addressed in this chapter. The methods used to collect and analyse the data from field notes and transcripts from fieldwork included non-participant and participant observations, interviews, life histories, extended visits and document reviews. These methods were important to the emergence of the themes used in the data chapters of this study.

This chapter aims to give a background of the study area, present the philosophical assumptions underpinning this research, and introduce the research strategy and the empirical techniques applied. Thus, this chapter addresses the methodological approach that was used to conduct this thesis. It is organised into three sections. The first section deals with the profile and a description of the study area and physical and socioeconomic characteristics. The second section is a discussion of the methodology and methods of data analysis used for this research. At the end of this chapter, I highlight the limitations and challenges of the study and also examine the positionality and reflexivity of the whole study. I then end with ethical considerations that came from the methods used in this study.

3.2 Profile of the research area

This section describes the specific local context of the study area. It is organised into two sections. The first section looks at the study setting looking at the community being studied, bringing culture to the case study while the second section is the justification of the area.

3.2.1 The study setting

Providing context of the study area is important in investigating household farming practices since that presents the political history of the area, the agricultural activities and the culture of the people. Also, grounding this analysis of community local cultural farming practices will help provide some insight into other similar locations and should answer the questions central to this study.

Nyanga (see figure 5 below) is a rural district in the eastern province of Manicaland and lies to the north of Mutare in Zimbabwe. It is located between 18.9° and 18.6° S latitude and 32.6° and 32.9° E longitude (Chirenje *et al* ., 2013). It shares borders with Mozambique to the east, Mutasa District to the south, Makoni District to the West, and Mutoko District to the North. The district is made up of 31 administrative wards and 443 villages. It covers an area of 5 897.82 $km^{2,}$ of which 28% fall under natural region one, while 24% fall under natural region two. The rest of the district falls under natural regions three, four, and five (ZIMSTAT, 2012). The district has a population of 125 688 with 60 021 males and 65 667 females (ZIMSTAT, 2012).[1] It has 85 primary schools and 28 secondary schools in the Nyanga district with a total enrolment of 30 388 pupils and 11 097 students, respectively. Thus, the literacy rate in the district is 87% (ZIMSTAT, 2012).

Like most districts in Zimbabwe, agriculture is the mainstay of the economy of Nyanga district. It has communal and resettlement areas, with its population largely working as smallholder farmers cultivating various garden types that include rain-fed uplands and wetlands in the valleys (Soper *et al*., 2002). For this reason, the district is renowned for producing timber, potatoes, stone fruits, flowers and mushrooms. In addition, Nyanga is also known for being the only district in Zimbabwe that produces potato seeds (Nyanga Rural District Council Ten Year Strategic Plan 2013). Nyanga District is renowned for its cool temperatures and beautiful scenery, making the district a prime tourist destination in Zimbabwe. The tourist destinations include Mt Nyangani, Nyanga National Parks, Mutarazi Falls, Ziwa Ruins, Pungwe Drift, Honde View, Nyangombe Swimming Pool, World View, white water rafting and trout fishing (Nyanga Rural District Council, viewed 20 July 2020, http://www.nyangardc.org/).

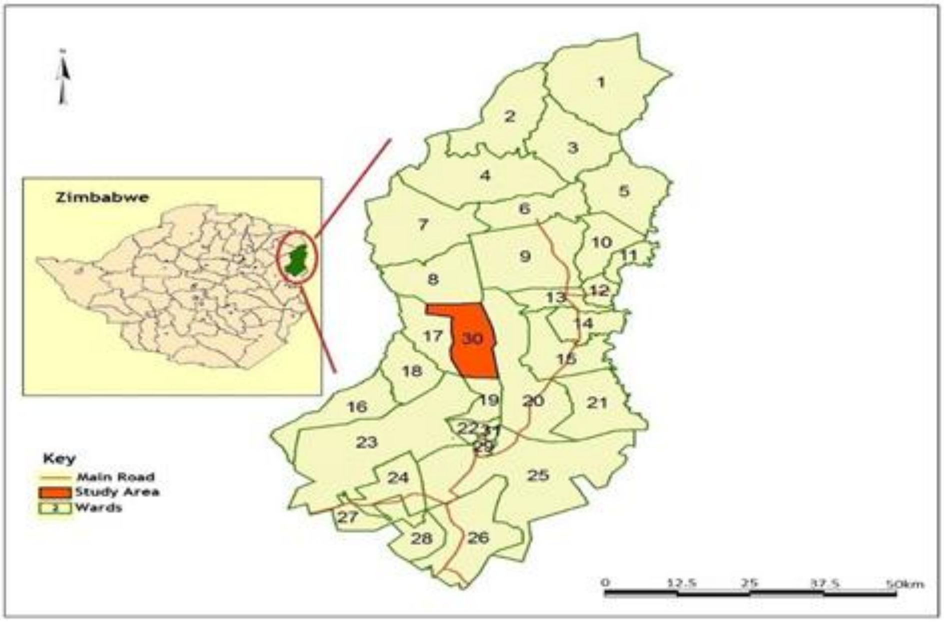


Figure 5: The map of Zimbabwe showing the location of Nyanga and its wards

The district has all five agro-ecological zones. Ward 30 (see section 3.2.2 for choice and justification of the ward), like other areas in Region IV, is subject to periodic seasonal droughts and severe dry spells. Almost all rainfall occurs between November and March, with December to February the wettest months (Muir-Leresche, 2006). Average annual (i.e. seasonal) rainfall varies largely between 650 and 1 500mm, but areas to the east of the highlands and more particularly to the south-east are significantly wetter, reflecting the direction of the prevailing south-easterly winds. In most seasons, rainfall and temperatures are favourable for cultivation even in the lower areas, but uneven distribution through the season may be critical (see Soper *et al.*, 2002).

The district has a considerable range of vegetation types, as might be expected from variations in altitude, climate, and soil. A useful review is given by Bassett (1963) for the "Inyanga Intensive Conservation Area" (land alienated for white farming and other purposes), complemented by Brinn (1987) for the "communal lands". Bassett distinguishes six broad vegetation types, largely due to altitude and rainfall, while there are variations within them according to soils. In the tropical valley and lowland forest in the south-east in the Pungwe and Gairezi valleys, the common species in the wetter areas are *Albizzia gummifera* and the drier areas are *Parinari* *curatellifolia, Uapaca kirkiana*, *Brachystegia boehmii* and *Julbernadia globifera*. There is particularly abundant growth of *Upaca kirkiana* on sedimentary soils of the Gairezi Facies. Evergreen mountain forest in the high rainfall areas south and east of Mount Nyangani and the Pungwe gorge common species are *Ilex mitis* and *Macaranga mellifera* (see Soper *et al.,* 2002).

The district's nature and distribution of soils are strongly dependent on both the composition of the parent material and the climate. Rainfall in the district varies considerably, from highlands with mean annual rainfall above 1 000 mm to the lowlands where mean annual rainfall can drop to an irregularly distributed 750 mm. The soil types will therefore also be different. In the highlands, the soil profiles are moist most of the year, and the major soil process is ferralitisation, characterised by intense weathering and leaching. Therefore the regolith is deeply weathered, and the effect of the parent material is minimal due to "total hydrolysis". The soils formed are mature, deep, red, clayey and permeable, with a stable structure on convex slopes, extremely weathered and leached (see Soper *et al.*, 2002). The study area is predominantly a Kalahari sand escarpment, but soils differ within specific locations. Soils are mainly moderately leached, light to dark grey granitic sands. These are deep sands with very little silt. These granite-derived sands are inherently infertile and susceptible to erosion (see Soper *et al*., 2002).

3.2.1.1 The study community

Ward 30 comprises communal areas and a resettlement scheme with a total population of 3 062 (1 429 males and 1 633 females) and 748 households (ZIMSTAT, 2012). There are several clusters of villages under different headmen and village heads, and the traditional jurisdiction is under Chief Saunyama. The headmen and village heads report to him. Ward 30 is found in the lower-lying areas, where a distinct wet and dry season occurs, and the rainfall becomes more erratic and variable as the altitude decreases. Limitations imposed by low and erratic rainfall as well as inherently infertile soils do not only limit agricultural potential but also threaten the very livelihood of the community. The major soil processes are moderate weathering and clay illuviation. The mature soils are less weathered and leached than in the highlands. On mafic rocks, the soils are deep, red and clayey, while on granitic rocks, soils are highly variable, both because of position in the catena and because of variable mineralogy of granitic parent materials. All are characterised by a good distribution of the various sand fractions with a significant amount of coarse sand (Nyamapfene, 1991). Most soils are coarse sand, but the texture in the subsoil can range from coarse sand (<5% clay) to clay (up to 50% clay). So the soil is dolerite soil. Therefore, the soils have been strongly weathered and leached, resulting in low base saturation and an iron-rich clay fraction in which the only clay minerals are of the kaolinitic type. Such soils have low inherent fertility characteristics and belong to the ortho-ferrallitic group (DR & SS, 1969). The predominant agricultural practice is small-scale mixed subsistence farming. Most smallholder farmers in ward 30 use cattle for draught power and predominantly use the mouldboard plough for land preparation.

I purposefully chose to study Ward 30 using households from the resettlement scheme and not the communal area due to easy of entry as I had contacts rather than careful application of a sampling scheme. Households are beneficiaries of the government resettlement programme of 1980 under the Intensive Resettlement Phase I, and they resettled from different districts and provinces. The resettlement process ultimately sought to address the three major dimensions of the national land resource in the country, namely, historical inequality in distribution, optimality of use, and long term sustainability (GoZ, 1999a). This resettlement scheme was the focus of state-initiated agricultural development seeking to modernise smallholder agriculture. The resettlement scheme consists of 14 villages numerically named from village one up to fourteen. In addition, the following facilities were provided; 1) two elementary schools, all with teacher housing built by the government and one built by missionaries and two missionary high schools; 2) dip tanks, provided based on 800 to 1000 head of cattle or approximately 600 livestock units per dip and serving a maximum radius of 6 kilometres; 3) a centrally located rural service centre accommodating a resettlement officer and staff of one clerical officer and one field orderly; 5) an AGRITEX worker for every 200 families; 6) a cooperative development worker; 7) an animal health assistant; and 8) a mission hospital and staff to serve between the villages (GoZ, 1999).

After independence, four models were used to plan and implement resettlement projects with models A, B, C and D. Each of these has its own structure and internal dynamics. The study area is under Model A resettlement, a villagised model with the main focus to benefit the landless from congested communal areas. Each household has an individual residential plot (0.5ha) within the village block, individual arable land (5ha.), communal grazing land and communal water points, and other social services, and tenure is in the form of permits. These permits, enforced by the Resettlement Officers, were issued by the Ministry of Lands, Agriculture and Rural Resettlement under the strict conditions that a resettled farmer relinquishes all traditional rights, if any, that were held in the communal area (GoZ, 1985). It is also characterised by the resettlement of black smallholder farmers on land acquired by the state from former commercial farmland that historically fell under large-scale white settler ownership and operation or corporate control (GoZ, 1985).

3.2.1.2 Bringing the angle of culture to the case study

Ward 30 is varied in its ethnic and social diversity, and rich in its culture due to considerable diversity. Its cultural heritage is made up of many ethnic, tribal and social groups and is represented in various forms: such as rituals, customs and beliefs. The ward composition includes mixed ethnicity groups due to some migration from one region/district to another. The main ethnic groups are Manyika and waBarwe tribes. Gender is of significance in the Ward 30 community as well. Women remain largely limited in their livelihood options as access to education, economic freedom, and livelihood options remain overwhelmingly male-favoured, especially in rural areas. A traditionally patriarchal social setting and cultural assumptions governing women's role in society reinforce the restrictive and often discriminatory opportunity structure within which women are expected to behave (Niraula & Morgan, 2000). The husband has the final decision in the family, but consultation and discussion with the family are common on minor household issues. Some of the minor issues women decide on are buying kitchen supplies, selling small amounts of commodities such as garden vegetables and managing poultry. Most male and female villagers acknowledged that even though different parties control the income-generating activities and crop/animal sales, the use of the money is shared and discussed together within the household (especially between husband and wife).

It is also a popular norm for farmers to help another member in the village or a farmer to help his/her extended family members with ploughing their fields and to assist with other tasks without receiving payment or harvest share. This is especially the case when people are old, ill, or someone has died. Village members provide labour based on their availability. In return, the farm owner provides free meals and drinks, and this is known as *humwe*[1] in the ward. In the

[1] An indigenous traditional practice where community members come together to work towards a common goal.

event of a funeral, it is customary for households to leave their farming to go and offer moral support to the mourning family. In this case, women will help with fetching water and food preparation while men undertake other responsibilities.

Misunderstandings and conflicts are discussed in a village court in the presence of village members. Issues discussed vary from livestock straying into the fields of neighbours to personal issues like infidelity. Although households sometimes have differences, they will still work together during communal activities and share responsibilities such as maintaining/building communal infrastructure.

In terms of socialisation, rules regulating the relationship between male and female farmers are not rigid in the Ward. Both male and female farmers interact and discuss with each other in public (in shopping centres, residential front yards, or in a local bar). However, not everyone frequents such public spaces to engage with their social network. Nevertheless, this loose relation can indicate that farmers are open and interested in socialising, exchanging and sharing experiences and knowledge as well as casual information.

3.2.2 Choice and justification of the area

Nyanga district has a fairly long history of agricultural development programmes implemented by NGOs since the country's independence in 1980, as well as agricultural services provided by the government. The smallholder setting of farming operations is typical for Zimbabwe (see Soper *et al*., 2002). The study area has an agrarian profile necessary for this study and is a reasonably representative sample of Zimbabwe as a whole and its surrounding neighbours include Mozambique, Malawi and Zambia. Agriculture in the study area is organised at the household level, with the community at large playing supportive roles. The smallholder nature of farming activities based on local culture and the demography of the study area make it a suitable choice as a field laboratory to explore the interplay of local farming experience and agricultural development programmes, as well as interventions by NGOs and how that affects local farming practices.

The commercial farmers who had farms before the Fast Track Land Reform Programme (FTLRP) in 2000 in and around the Nyanga district grew horticultural crops such as flowers and fruits on their estates. Therefore, the area has been exposed to modern farming technologies because of these commercial farmers who practised large scale farming in the district over the years. Peasant agriculture in the district has, as elsewhere in Africa, undergone considerable changes in the 21st century, introducing new crops and cultivation methods. This provided an opportunity to assess the development of household farming practices alongside a long history of the influence of the early introduction of modern technologies used by commercial farmers to grow their crops close to the study area. As expected, some peasant farmers worked as paid labourers on these estates, and as such, adopted or adapted some of the farming practices introduced by the commercial farmers. Adopting such practices had a significant influence on the development of local farming practices in the study area. As a result, many farmers in the district have incorporated modern technologies in their agricultural activities, generating 'hybridised' household farming practices that were interesting and important to examine in this study.

3.3 Research methodology

The methodology outlined in this chapter followed the non-modernist approach to farming and sought to embrace the ontological and epistemological diversity of farming and allow farmers I met to tell stories about their lives. I start by problematising the methodology, and the next section presents the paradigm debates that anchor this study. The following section discusses and justifies why I used ethnography as a research approach for examining the role of socio-cultural factors in farming in Ward 30 Nyanga District. Following this, I outline the five methods used for answering my four research questions to gather an account of farming stories told by household farmers which is followed by a discussion on narrative and discourse as methods of data analysis. The next section moves on to highlight the study limitations and challenges I faced, then a section on reflexivity and positionality, followed by ethical considerations. The concluding section is the chapter summary.

3.3.1 Problematising the methodology

Given that the primary aim of the research was to examine the role of socio-cultural factors in the slow adoption or outright rejection of the CA model, my methodological approach needed to be capable of capturing ontological and epistemological diversity in farming. Following Country *et al*. (2015), my approach was to also give voice to the nonhumans, and heed the bodily, sensory, feeling and affect, processes and moments that emerge from interactions. This is to turn to a more-than-human methodology that decentres the researcher, allowing for the stories of people on the ground to be elicited (Whatmore, 2006). I was aware that my research site was not only a ground for physical interactions but encompassing interactions among all the beings (humans and animals), effects, memories and relationships that co-constitute it (Ingold, 2000). With this in mind, I discuss paradigm debates used in this study to capture the socio-cultural practices of farmers' farming fields in Ward 30, Nyanga District, below.

3.3.2 The research paradigm and sampling

As indicated in Chapter 1, the role of local farming culture (experiences, local practices, norms and values) in the slow adoption or outright rejection of the CA model as a method of agriculture and food security for rural households was investigated, examined, and analysed. This indicates that the research was exploratory, explanatory and descriptive.

According to Cuthill (2002) and Taylor *et al.* (2002), exploratory designs are conducted on research problems where few or no earlier studies to refer to or rely upon to predict an outcome have been conducted. Such studies focus on gaining insights and familiarity for later investigation or undertaking research problems in the preliminary stages of being understood. This exploratory research objective investigated the under-researched area of household socio-cultural farming practices and how that influences the slow or outright rejection of CA.

The research was explanatory insofar as it sought to explain the experience and perspectives of rural farming households with the CA programme. The focus was on seeking, providing and evaluating the influence these two areas have on each other, explaining a fundamental relationship that is important and/or meaningful. The study was also descriptive as it documented and described the complexities of farming, the influence of socio-cultural factors, the differences of opinions on issues and how the differences influence the results (Merriam, 1998), as well as the process and use of data that was collected (Marshall & Rossman, 1999).

However, the exploratory design is beset with various limitations. Cuthill (2002) and Taylor *et al.* (2002) postulate that, in general, it utilises small sample sizes. This makes it impossible to generalise the results to the larger population. Because of the latter limitation, definitive conclusions about the findings cannot be made. Even though it provides significant insights into a phenomenon, it fails to give definitive conclusions. My interview with the agricultural extension officer based in the study area confirmed that there was a list of villages (14) in which he performed his duties. These were then subjected to stratification based on closeness to each other and then random sampling was used to select them. Random numbers were allocated and these were used to select villages that were studied. The assumption was that the closer the villagers are together, the more likely the farmers belonged to the same social groups and that are used to deliver extension programmes by the extension officer. When farmers receive messages in the same group, any difference in their farming practices cannot be attributed with confidence to different groups to which the extension message was delivered, but are likely to be as a result of the farmers' preferences and perceptions. Preferences and perceptions can be important in knowledge production and technology adoption.

When I selected the villages, I used purposive sampling of both households and key informant individuals who participated in the study. With regard to the households, I had 15 households which I selected for the study and divided into three categories. The first category consisted of those households that partially adopted the technology and were still using it (five households). The second were those households that had adopted the technology but had since abandoned it (five households). The last category consisted of households that rejected the technology outright (five households). I carried out interviews with all the elders (men and women) and children (above 12 years of age) in every selected household. Regardless of the differences in age, everyone except children below 12 participated in all farming duties (sowing seeds, hoeing, weeding, fertilizer application, crop harvesting and thrashing, post-harvest food processing, storage, transportation, staple food crop, legume and vegetable production) and domestic chores (preparing food, laundry and other hygienic activities).

I drew selectively key individuals such as spirit medium, village leader and elders who participated in this study were selected based on their knowledge, expertise and roles in certain aspects of the study. Certain individuals have played key roles in rural agriculture and the implementation of CA, others are custodians of culture and their knowledge of certain cultural aspects and their meaning is unrivalled. The flaw of this design is that it is often unstructured, thus leading to only tentative results that have limited value to decision-makers. There are also arguments that the design lacks rigorous standards of data gathering and analysis (Cuthill, 2002: Taylor *et al.*, 2002).

3.3.2.1 Stance towards theory and induction

As noted above, this study is designed from a constructivist perspective and thus built on the understanding that there is no neutral standpoint or objective truth from which to discern the purpose of human development. As such, this study attempts to sincerely elicit, understand, and present other perspectives and experiences – with the understanding that such perspective builds "craft knowledge" relevant to the formulation of agricultural development programmes and the realm of academic discourse appearing in peer-reviewed literature. Thomas (2010: 576) argues that the purpose of the social scientific endeavour should be to develop "exemplary knowledge unselfconsciously based on abduction gained and offered through phronesis rather than through theory". At this point, abduction is "the development of an explanatory or theoretical idea", or put another way, "a fluid understanding that explicitly or tacitly recognises the complexity and frailty of the generalisations we can make about human interrelationships" (Thomas: 2010: 577).

This research position acknowledges the utility of inductive analytic strategies approaches to conceptualise and interpret data while recognizing limitations given the "sheer contingency of social life and human agency" (Thomas, 2010: 577). While this position may seem to argue against efforts to "generalise" findings, one can instead argue that a case study approach may provide insights on "what" is not generalisable and offer findings critical to new conceptualisations of problems or directions in reform. Evidence may also add to the existing body of case knowledge, perhaps confirming findings from earlier studies or adding a more nuanced understanding or perspective to prior findings. The relation of these lenses to issues of "quality" is discussed below.

3.3.3 Ethnography: an approach for exploring and creating an account of ward 30 farming practices

This study is built around a standard of trustworthiness as opposed to truth. A trustworthy standard is how the researcher can "persuade his or her audiences (including self) that the findings of an inquiry are worth paying attention to, worth taking account of" (Lincoln & Guba, 1999), in Hesse-Biber & Leavy, 2011: 48). This research seeks to provide a trustworthy account of the topic of inquiry by following eight criteria for qualitative research identified by Tracy (2010). The criteria are: (i) worthy topic (ii) rich rigour (iii) sincerity (iv) credibility (v) resonance (vi) significant contribution (vii) ethical and (viii) meaningful coherence. These criteria are presented, defined and discussed concerning this research in table 1 below.

Table 2: Eight criteria for qualitative research

Criteria for quality	Explanation	This case
Worthy topic	The topic is relevant, timely, significant, interesting	*Identifies socio-cultural factors and dilemmas involving CA and offers an alternative understanding of adoption constraints*
Rich rigour (reliability)	The study utilised sufficient and appropriate: theoretical constructs, data collection and analytical methods, time in the field, context	*Described in the methods section*
Sincerity	The study was characterised by researcher transparency	*See section on positionality and reflexivity*
Credibility	Research influences or effects audiences through evocative representation, naturalistic generalisations, transferable findings	*Researcher sought out diverse voices and member-check findings and interpretations iteratively*
Resonance	Research influences or effects audiences through evocative representation, naturalistic generalisations, transferable findings	*Research designed to speak to "farmer local socio-cultural factors" and "CA" discourses*
Significant contribution	The research contributes: conceptually, practically, morally, methodologically, heuristically	*The research sought to conceptually and practically understand the possibilities of including farmers' experiences, local practices and values in agricultural development programmes.*
Ethical	The research considered ethics: procedural, situational and culturally specific and relational	*I followed guidance as directed by the chief; Headman (sabhuku) and village elders in the ward.*
Meaningful coherence	The study: achieved what it set out to do, used appropriate methods and procedures and meaningfully interconnects literature, questions, findings and interpretations	*Described and outlined in this thesis chapters.*

Adapted from Tracy, 2010

With this in mind, below, I used ethnography as a suitable methodological approach for capturing the socio-cultural practices of the farming fields of farmers in Ward 30, Nyanga District.

3.3.3.1 Ethnographic research

Ethnography studies people in their natural settings seeking to document that world in terms of their behaviour and its meaning to those people. It places in doubt the variables that quantitative research analyses and examines people's socio-cultural practices instead. Also, it does not follow the sequence of deductive theory testing because it is in the research process that research problems come to be formulated and studied. Brewer (2000: 6) defines ethnography as:

> The study of people in naturally occurring settings or 'fields' by methods of data collection which capture their social meanings and ordinary activities, involving the researcher participating directly in the setting, if not also the activities, in order to collect data in a systematic manner but without the meaning being imposed on them externally.

According to McCall and Simmons (1969), ethnography is distinctive in three ways: Firstly, there are no distinct stages of theorising, hypothesis construction, data gathering and hypothesis testing. Instead, the research process is constant interaction between problem formulation, data collection and data analysis. Secondly, ethnography brings various techniques of inquiry into play involving attempts to observe things that happen, listen to what people say and question people in the setting under investigation. Thirdly, the observer is the primary research instrument, accessing the field, establishing field relations, conducting interviews, writing field notes, using audio and visual recordings, reading documents, reading and transcribing and finally writing up the research. So ethnography has a large constructional and reflexive character, and it is essentially the observer who stands at the heart of ethnography and its open-ended nature.

My research approach to understanding the cultural dimension in rural farming practices and technology adoption drew on two theories: phenomenology and constructivism. According to Walsh in Seale (1998), phenomenology focuses on the intersubjective constitution of the social world and everyday life, and it is the most evocative conception of the ethnographer's role. Scheutz (1964), in a seminal essay on *The Stranger,* shows how a social group has its own cultural pattern of life – folkways, mores, laws, habits, customs, etiquette, fashions etc., that, as far as its members are concerned, are taken for granted, are habitual and almost automatic. Scheutz's concept of the 'stranger' provided a model for my research as I used participant observation to treat the familiar world of 'members' as anthropologically strange to expose social and cultural construction. This was particularly demanding because I was studying a group I was familiar with, which nevertheless presented an ideal attitude of mind for me to pursue.

The second approach is constructivism, which believes that society is to be seen as socially constructed based on how its members make sense of it and not as an object like reality (see Filmer *et al.*, in Seale, 1998). It is derived from classic ethnographies in the Chicago tradition of the 1920s and 1930s, what Woods (1996: 32) refers to as the 'main line' of interactionist ethnography. A symbolic interactionist theory underpins this, and these theorists concern themselves with the subjective meanings and experiences of individuals (Hitchcock and Hughes, 1995). The emphasis here is on human beings' use and interpretation of symbols and social life as constructed by 'generating meanings and making interpretations within small social groups' (ibid. p.34).

However, an altogether different version of ethnography has also emerged from constructivism, which urges a break with all objective scientific inquiry ideas. This perspective is not about seeing ethnography as a revelation of social construction, but rather as participating in the construction of the social world. The research participated in constructing the social world by trying to understand the perspectives of an individual farmer or shared meaning of the farming practices of the farmers in Ward 30. It was achieved by following the interpretive case study approach described by Crowe *et al*. (2011) below.

3.3.3.1.1 In-depth case study

The main data collection method used for this study was the case study. Simons (2009, as quoted in Hesse-Biber & Leavy, 2011: 256) defines a case study as:

> In-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a "real-life" context. It is research-based, inclusive of different methods and is evidence led. The primary purpose is to generate an in-depth understanding of a specific topic … to generate knowledge and /or to inform policy development, professional practice and civil or community action.

Case studies are useful for answering the 'How' and 'Why' questions about a contemporary phenomenon within a real-life context. In a case study, the researcher explores a single entity or phenomenon bounded by time and activity. The case-study observation explores deeply to analyse intensively the multifarious phenomena that constitute the unit's life cycle with a view to establishing generalisations about the wider population to which that unit belongs. This was useful for this study which focused on socio-cultural factors of households in the ward. The units for the case study were selected to reflect the variations in farming practices and decisions that guide households. The study went down to the scale of the individual households. Similar to Yin (2003), I was able to elicit the experiences of the smallest unit in the field. The case studies focused on fifteen households I identified in a village set up in a resettlement area.

The ultimate objective was not to develop a predictive theory but to convey the "story in its diversity, allowing the story to unfold from the many-sided, complex, and sometimes conflicting stories that the actors in the case have told me" (Flyvbjerg, 2006: 238). I considered this research to be the study of a single case, agricultural development programmes in Zimbabwe, in which I followed two different strands: rural farmer traditional practices and the CA programme implemented in Ward 30, Nyanga district. The defining characteristic of the case study approach was its focus on just one instance of the object that was to be investigated. Occasionally, researchers use two or more instances, but, in principle, the idea of a case study is that a spotlight is focused on individual instances rather than a wide spectrum. The logic behind concentrating my efforts on one case rather than many was that insights were gained from looking at an individual case that can have wider implications, and importantly, that would not have come to light through the use of a research strategy that tries to cover a large number of instances. This research aimed to illuminate the general by looking at the particular.

Although I have highlighted the advantages of doing this study under a case study, generalisation is not always possible although Denscombe (1998: 36-7) makes the point that "the extent to which findings from the case study can be generalised to other examples depends on how far the case study example is similar to others of its type". Ethnographic researchers attempt to understand how culture works, and as Lutz points out, many methods and techniques are used in that search. The other data collection methods framed by the case study strategy I used are discussed below.

3.3.3.2 Research methods

Given my research questions, the methods I used helped with supporting the execution of five tasks: (a) elicit in-depth individual discussions related to the research questions, (b) deliberately included voices from a range of perspectives, including marginalised groups and individuals, (c) situated and made sense of data collected within broader national and international discourses, (d) identified and analysed key concepts and issues; and areas of convergence, divergence and heterogeneity in the data collected, (e) provided multi-focal feedback on researcher interpretation of data (Edwards, 2011). To meet these needs, I drew on a variety of data collection and analytic techniques.

Therefore, in this section, I describe how I used research instruments in the field to gather information on household farming practices, socio-cultural factors and the subsequent impact on the adoption of CA. I start by discussing non-participant observations followed by participant observation techniques. I then discuss how I used the life history technique in my quest to understand how farming practices have evolved, followed by a discussion on key informants interviews. I also discuss the extended visit technique, and finally, I look at document review as a technique and how I used it to collect data.

3.3.3.2.1 Method I: Non-participant observation

According to Fraenkel and Wallen (2009), non participant observation is when a researcher does not participate in the activity being observed, but rather ‘sit on the sidelines’ and watch. Similar to Puri (2011a), before undertaking any non-participant observation of farmers in Ward 30, I asked for and received free, prior and informed consent from those being observed. After obtaining the permission, I started my fieldwork from September to October 2018 doing overt non-participant observation. I started with non-participant observation to learn and explore the lifestyle of the ward, particularly in the context of where they live without being bothered that they are being observed by an outsider (see Stahler & Cohen, 2000). The non-participant observation was useful for understanding the physical, social, cultural, and economic contexts in which study participants live, the relationships among and between people, contexts, ideas, norms, and events, and people's behaviours and activities (see appendix 5).

The period during which I conducted the non-participant observation coincided with the time farmers practised rainmaking ceremonies which are done towards the onset of the farming season (September to November). I sought permission from the village headman, who allowed me to attend the ceremony and got an opportunity to use the non-participant observation method at a community level. I observed what farmers were doing (for example, by interpreting their body language and gestures) and what they were not doing. Non-participant observation helped me level out my biases from other methods and reveal differences between what farmers say and what they do. Attending the rain making ceremony allowed me to have an open-ended discussion on the wider context under which natural manifestations like droughts are understood and the interventions available to society as a whole. Additionally, it helped in understanding how the broader social context mediates farm households' responses to changes in climatic conditions. The intention was to enable an analysis of social and cultural dimensions of farming in the society, but also, it was oriented towards how these factors limit adaptation to changing climatic conditions experienced in the recent past.

Overt non-participant observation can be biased through the observer effect when people change or seek to improve an aspect of their behaviour because they are aware of being observed. However, things went very smoothly during the rain making ceremony because most farmers embraced me since I am from the area. Therefore, I would say that by not interrupting or obstructing the ceremony, the approach of non-participant observation helped me to understand how farmers naturally behave and take action in traditional ceremonies. This opportunity also helped me identify and amend the main themes and questions I used in other methods such as life history.

To strengthen my relationship and develop trust with farmers at a community level, I also visited marketplaces and social gatherings such as appeasement ceremonies, weddings, funerals and unveiling of tombstones, and village courts. While there, I would join in their conversations to give my opinion, carry out several open-ended discussions, and take their views without the prior structure of interviewing guidelines. These kinds of discussions created good relationships between my informants and me as a researcher. Further, such incidents brought many other important opportunities for me to stay in touch with farmers, whereby I became known to most farmers in the ward and developed their trust over time. As the researcher, I also gradually gained confidence and would eat with the farmers as well. However, I also learned that as much as I was studying other people, I was also being studied, such as how I ate, my marital status and with whom I spoke.

I also attended ward farming gatherings and meetings convened by the Ministry of Lands and Agriculture to experience and observe the interactions among the households and government representatives. These public meetings demonstrated the interactions of the households and their leaders and gave me an insight into their challenges and issues of power relations. For example, the command agriculture inputs programme ward meetings for farmers from September to December 2019, were very informative for collecting observational data. These command agriculture meetings would then require follow-up meetings by the headman and his village, in which I would also participate fully as an attendee. Mainly I noted keynote speakers' comments and presentations regarding these programmes during the meetings. As I continued to participate in many activities in the ward, the farmers' trust in me increasingly developed, particularly towards the latter stage of the command inputs distribution programme (towards the end of December). This was to the extent of sharing their thoughts on the relationship between farming and politics through informal discussions. In some cases, I sat in public spaces after government officials left the meeting place and listened to people talking and commenting on the agricultural programmes in the ward. Using the inductive ethnographic method allowed me to match my study area's socio-cultural issues, farmers' knowledge systems, farming activities, and how farmers felt about promoting agricultural development programmes in the ward.

3.3.3.2.2 Method II: Participant observation

According to Fraenkel and Wallen (2009), participant observation is when a researcher participate in the situation or setting they are observing. As part of an ethnographic approach, participant observation is 'not an external method administered on research subjects like questionnaires or lab tests, …[but]…it is a way of being with familiar and unfamiliar life-worlds.' (Clifford *et al*., 2010: 117). Cook (2003: 127) adds that participant observation involves researchers 'deliberately immersing' themselves in the worlds of cultural groups, to participate as well as observe the 'everyday rhythms and routines' of groups and communities. After being immersed at the community level from September and October of 2018, I became less of an observer and more of a participant at the household level in the everyday routines and experiences of the farmers starting in November of the same year.

In my case, I decided to start participant observation in November because the first rains had fallen, and farmers were beginning to work in their fields. I intended to explore how these farm households did their farming, what socio-cultural factors have traditionally guided their farming decisions and their perceptions of natural factors affecting their farming practices. This also allowed me to bridge the gap between farmers and, as an outsider, engage with all my senses and emotions, and make notes on observable patterns.

Participant observation helped me create spaces and discuss with farmers individually or in groups during *humwe* and *Zunde raMambo*[2] to obtain firsthand accounts of farmers' understandings of issues, including their views on these farming practices (see appendix 4). I also made sure I would have a personal diary which I kept for self-reflection such as lessons learnt and personal feelings, including impressions, reactions, problems and surprises, changes in plans, and the nature of my identity and relationship with farmers and places (Crang & Cook 2007; Fetterman, 2010; Laurier, 2010). I participated in many field activities such as tilling with an ox-drawn plough, planting seeds, weeding in the field and *kurinda udyi* (guarding crops against wild animals). This provided me with a fundamental understanding of how farmers' culture, norms, and knowledge systems in the ward guide actions and govern individual and collective behaviours in their real and everyday lives. It further helped me investigate how local farming practices are acquired and transformed through cultural modes of transmission, such as storytelling, observation, and action learning.

As I continued to participate in farmers' fields, the farmers increasingly became more open to me and shared their thoughts through informal discussions on the now complicated and strained farmers' relationship with extension and veterinary officers of the ward. The fact that farmers

[2] Zunde raMambo is a practice of growing and storing grain for use during the time when food supplies are low.

could comfortably engage with me on political matters in a district generally known to be politically volatile made me realise that most farmers had embraced me as part of their community. Additionally, farmers also carried out their cultural practices, such as singing songs to charm the rain to fall without noticing that somebody was observing them from outside. This is in line with (Phuthego & Chanda, 2004) literature that participatory observation is helpful where there is potential for respondents to conceal or even forget to mention traditional knowledge. Some studies have shown that respondents give researchers what they think they want to hear and not necessarily what they do (Peters, 2002; Tembo, 2003), so participatory observation was used to circumvent such problems of intentional and unintentional hiding of respondents' practices. Participant observation not only allowed me to gain direct access to the local farming system in question but also allowed me to develop long-term close relationships with the participants (Bryman, 2012).

Even as I was fully immersed in households farming practices, Flick (2009: 128–129) adds that the researcher still needs to maintain a professional distance; otherwise, they will risk 'going native' and lose the 'critical external perspective and unquestioningly adopt viewpoints shared from the local inhabitant'. While sharing the same spoken language with the participants, the researcher should know how the geographical and interactional context develops and shapes the language (Crang & Cook 2007). As much as participant observation captures the present, I also needed to reconstruct farmers' biographies and memories of weather events in the ward. This is where the qualitative life history interview can complement participant observation, as discussed below.

3.3.3.2.3 Method III: Life history interviews

Informed by participant observation, the life history interviews were conducted informally, and the questions emerged from the natural conversations I had with participants (Fetterman, 2010). The researcher acts as a respectful facilitator rather than an enquirer, bonding with and sharing the meanings of life with the participants (Atkinson, 2012).

I used the life history interviews approach to draw out life stories of farmers that naturally occur as part of everyday life in situ. The gathered information has a natural fidelity to what and how the stories are told (Plummer, 2001), whether factual, poetic, or metaphorical (Atkinson, 2012). I engaged in life history with the selected households every Friday between November 2018 and May 2019 because it is a *chisi* day.[3] This is a holy day identified in a week on which any form of work, especially in the fields, is prohibited. Farmers use this day to rest and socialise. I had discussions with households to understand the history of farming practices such as *humwe* in the study area. For example, I asked about the history of the farming practice of pooling resources together and why it had been abandoned in the past, its purpose and relevance, the revival and current operation of the scheme as a climate coping mechanism including its weaknesses. I also had informal discussions with household leaders to explore subjective accounts of their experiences and observe changes in farming approaches through time. For example, I asked farmers to recall the most and least favourite weather events or seasons, a drought the farmers still remember, how it began and reasons they thought those events happened, and the decisions and coping mechanisms they used.

Besides carrying out life history at a household level, I also used this approach with individuals such as spirit mediums, village headmen, and community and lineage elders. I had discussions with community leaders to understand the history of farming practices such as *Zunde raMambo* in the study area. For example, I asked about the history of this social welfare system, the revival and current operation of the scheme as a climate coping mechanism, its relevance and its strengths and weaknesses. I also asked about the impact of the transition of the *Zunde raMambo* scheme from the chief level to the current village level and whether that had been a success or not. These discussions with leaders were to explore subjective accounts of their experiences and community events. This approach allowed them to penetrate deeper than any other approach in telling their stories and presenting their views. I also explored both the mundane daily weather experienced and abrupt and abnormal weather events such as long dry spells and droughts and how they are constructed to form weather stories. I also explored my subjects' life experiences and their meanings to these experiences in the ward. According to Harrison (2009) and Plummer (2001), life history examines how participants' life experiences are weaved into and reflect the body, history, and society. Gysels *et al.* (2002) pointed out that life histories generate reflections on topics that would otherwise remain implicit because they are taken for granted.

[3] A weekly day set aside in which work is forbidden

Life stories themselves can be triangulated through interaction with people other than the research participant. I employed a combination of instruments to collect life history information. I observed and informally interviewed other people who interacted with my selected households, including children, siblings, in-laws, relatives, and friends. In life history research, trust is an important precondition for successful data collection. Trust was established through constant interaction and confidentiality. As trust and rapport were established over the year, data quality improved, and the households divulged intimate details of their lives that would not have been recorded in a survey or focus group settings. It is worth pointing out that although Fridays were initially solely dedicated to each household's life history, it was an ongoing process throughout the research.

3.3.3.2.4 Method IV: Expert/Elite interviews

Expert and elite interviews have some similarities. The former may or may not hold a powerful position but has special knowledge related to his/her profession, while the latter holds a powerful position and can make decisions (Bogner *et al.*, 2009). Dexter defines both types of interviewees as ‘any interviewee...who in terms of the current purposes of the interviewer is given special, non-standardised treatment’ (Dexter 2006: 18). This technique allows the collection of valuable information from knowledgeable members of society. These subjects also represent dominant discourses on how things should be run, although their views may not necessarily reflect the lived reality of all the people in the ward. Expert and elite interviews were used to explore explanations, reflections and justification of CA and other agricultural development projects in the ward from the elite/expert’s point of view.

For this research and in Ward 30, elite individual semi-structured interviews were used to gather information from the District Administrator (DA), ward councillor and veterinary and extension officer (see appendix 1). The interviews followed a protocol articulating a series of open-ended questions designed to elicit voice and potential in vivo codes. The protocol included several probing questions. At the beginning of the interview, I asked for permission to voice-record the interview based on prior informed consent with each informant for later transcription as I did not have enough time for taking notes. These recorded interviews were then transcribed, translated and organised to carry out further analysis. I continuously amended the guiding questions of the interviews according to the emerging themes from the initial interviews or observations. This allowed me to refine my understanding of the ideologies and beliefs expressed and to be led by the participants' own sense of what was significant about these.

For this research and in Ward 30, expert interviews involved asking *svikiro* and *vakweguru* who are equipped with expert knowledge in socio-cultural farming practices, social and cultural gatherings and history of farming in the area (see appendix 2). This method is similar to life history interviews because both were conducted at the field site. In contrast, I conducted the elite interviews formally (and professionally). While doing these interviews, I adopted Hochschild's (2009) proposal to conduct a probing and open-end semi-structured interview to allow full articulation of opinions. The interview guide was designed with open-ended questions to allow flexibility to pose further questions (if not listed) based on the conversation.

In this study, I used unstructured interviews to solicit more information from the DA. Descombe (1998) argues that unstructured interviews go further in emphasising the interviewee's thoughts. My role was to be as unintrusive as possible by introducing a theme or topic and then letting the DA develop his ideas and pursue his or her train of thought. Unstructured interviews also allowed the DA to use his own words and develop his own thoughts. The interview was used to generate information on the objectives and activities of agricultural development programmes and how they were being carried out in the study area. For example, I asked about the history and successes of agricultural development programmes in Ward 30 with specific reference to CA and ended up covering the recently introduced command programme by the government. Descomb (1998) notes that allowing interviewees to 'speak their minds' is a better way of discovering things about complex issues, and generally, this type of interview has its main aim of 'discovery' rather than 'checking'.

Data was also gathered about the roles of programme recipients and providers to determine whether the programme providers are facilitators or dictators because the nature of the roles played by experts is known to influence the programme delivery system and its effectiveness (Chambers *et al.*, 1989; Tembo, 2003). Tembo (2003) argued that how NGOs deliver the development programmes to participants dictates the nature of their knowledge acquisition.

The interview with the extension officer was used to gather data on how they disseminate technologies to farmers. Information and data were gathered on the type of meetings conducted, field visits, ways of contacting farmers, and how farmers contact extension agents. I also visited farms used to demonstrate new technologies, such as hybrid crop varieties, to see the technologies being promoted and disseminated to farmers in the study area. Data was also gathered about official recommendations on crop varieties, types of inorganic fertilisers, crop planting dates, weeding regimes, livestock breeds and general farming practices considered suitable for the study area.

My interview with the ward councillor provided ward-level information on agricultural development programmes, technological farming, and local demographics. This helped me refine my understanding of the ideologies and beliefs expressed and only be led by participants' own sense of what was significant.

3.3.3.2.5 Method V: Extended visits

Repeated household visits were done as an ethnographic way of grounding truth (Rubin, 2016) in the cross-sectional data collected using non-participant and participant observations. Selected household visits in each village enabled me to gather data on other off-farm activities that households are involved in because the time of my visit was not farming season. The extended visits lasted long hours and sometimes took the whole day, including participating in a range of tasks such as brick making, thatching and carpentry. Data gathered from this technique enabled me to explain how farmers allocate their time during the off-farming season and the decision-making of households that were useful in answering socio-cultural issues in agriculture. The households visited were purposely selected, but households that I had worked with the first time were maintained since they were already part of the broad project.

3.3.3.2.6 Document review

Most settings in contemporary society are literate, and much of everyday life is organised around the production and use of documents. These are valuable resources for ethnographic study. Official statistics, for example, are documents. Nevertheless, from an ethnographic point of view, they are often understood in terms of their social production rather than their truth. Another kind of key document is the official record. Records are central to work in large organisations and are made and used following organisational routines. Such records construct a 'privileged' reality in modern society because they are sometimes treated as objective documentation. However, like official statistics, such records should be interpreted by the ethnographer in terms of how they are written, how they are read, who writes them, who reads them, for what purposes and with what outcomes.

For my research, published research and documents about the study area were obtained from the archives and libraries of Nyanga Rural District Council (NRDC). The Zimbabwe Statistics Office provided data on demographic factors of the study area. Data about agricultural programmes implemented in the study area were also gathered from retired officers and files kept by officials in the Ministry, NGOs, and private companies. Rainfall and temperature figures for the study area were obtained from the Meteorological Department in Zimbabwe.

A detailed literature review was undertaken to establish the conceptual framework and theoretical underpinnings of development programmes carried out both worldwide and specifically in Zimbabwe, including the study area, from the turn of the millennium to recent times. The literature review allowed me to summarise and synthesise existing literature to identify problems and dilemmas, identify under-researched areas, and provide opportunities to develop a new perspective. I do not consider the literature review to be a static part of my research. Rather, it evolved based on issues, problems, and ideas that emerged through data collection and analysis. I continued to seek out, read, and analyse new documents such as newspapers and published articles during the research process. The approach to finding new documents included targeted searches of relevant academic literature and grey literature, bibliographic treeing (identifying new sources based on citations from identified articles), and extensive conversations with relevant human sources who pointed me in new directions. Questions and perspectives related to data collection and analysis led to inquiry on emergent concepts and topics. I used a social-ecological systems approach to guide my review (Ehrmann & Ritz, 2014). Articles were identified using various search engines (e.g. Google Scholar). The terms typed in the search engine included conservation agriculture, adoption, non-adoption, sub-Saharan Africa, smallholder farming, farming systems, socio-cultural and climate change.

In the following section, I discuss how I used a multi-method approach of narrative and discourse analyses after I compiled and transcribed my data to help me understand the subjective realities of individual farmers and community elders.

3.3.4 Narrative and discourse as methods of data analysis

Qualitative data analysis is the range of processes and procedures whereby the researcher moves from the data that has been collected into some form of explanation, understanding or interpretation of the people and situations being investigated. The research involved two types of data: the stories told by the farmers, stories about their lives as narratives and the interviews with experts/elites and publication materials.

Employing narrative analysis on life stories is mainly to maintain the flow and entirety of stories without fragmenting them (Atkinson, 1998). A narrative analysis of the farmers' experiences and weather stories in the ward allowed me to explore how they dealt with climatic hazards and to discover how socio-cultural or institutional aspects influenced local adaptive capacity (Paschen & Ison, 2014). The use of discourse analysis was more suitable for analysing the use of language in interviews with experts/elites and publication materials. Discourse in this context is defined as the 'specific constellation of knowledge and practice through which a way of life is given material expression' (Doel, 2009: 490). Analysing discourse reveals how processes, phenomena, knowledge and power are structured and emerge from interaction within a social context (Nikander, 2008). Two levels of analysis were used for this study: a contextual level and a textual level. The former examines the macro-level of a hegemonic constitution in places where discourse circulates, while the latter allows for close consideration at the micro-level of meaning-making (Nikander, 2008). This method was useful for interrogating the production of farming knowledge in the field, and the resulting analysis is presented in Chapter 8.

Since the duration of the first stage of my initial fieldwork was about nine months, partial data analysis started while data collection was already underway. I often summarised my annotated fieldwork diary to describe and record activities I engaged with and made daily first-hand analyses. According to Bryman (2012) and Creswell (2013), data analysis is seen as comprising six steps: transcribing data, reading and familiarising oneself with the data, coding and creating themes, defining and validating themes, and analysing. For narrative analysis (Riessman, 2008), I specifically looked at the content and structure of life and natural manifestations of stories like droughts, told and untold by farmers. In examining the wider themes, stories were also compared and contrasted. For discourse analysis (Doel, 2009; Potter & Wetherell, 1987), I would be looking specifically at the use of language, both spoken and textual, in constructing claims about conventional farming practices and CA technology.

Thematic content analysis was used for the methods highlighted above and analysis was done manually. The emerging themes and concepts were identified in line with the research questions and objectives. Themes relating to risk aversion by smallholder farmers, socio-cultural factors and household farming experiences were drawn. The identified themes were also used as building blocks of the conceptual framework. Quotations and narrations extracted from key informant interviews, participant and non participant observations and repeated household visits were used to explain information regarding socio-cultural factors, and CA dynamics.

3.3.5 Study limitations and challenges

While it is acknowledged that the data collection methods are not without their limitations, it should be noted that there were also some challenges experienced in the field. Although a well-thought-out field plan preceded the fieldwork, the challenge of COVID 19 resulted in me not being able to do extended visits as I had anticipated. In my proposal, I had indicated that for extended household visits, each participating household was going to be visited three times during the duration of the study. I could only go back into the field once in February 2020, and then the hard lockdown started in April the same year. The measures I put in place to reduce the risk of contracting and also spread the virus was that I made sure that I clean my hands with alcohol based hand rub or soap and water before wearing my mask which covered my nose, mouth and chin every time I was meeting participants.

The study's main limitation was that I could not get any representative of Concern Worldwide because the organisation is no longer operating in Zimbabwe. Their closest offices are in Malawi now, and I could not travel there due to financial challenges. Efforts to find someone who worked on their programme in Ward 30 or Nyanga District proved fruitless. However, this did not compromise my research since the DA office has an archives library which has files and other related publications of programmes that have been implemented in the ward which included the Concern Worldwide CA programme. From these I was able to conduct research into how the programme was rolled out in the area among other things.

Another challenge that I faced was that the issues that I was investigating at communal level relied on informants' recollection of events, rather than recorded data, and since the enquiry stretched well back into history, some respondents had difficulties in accurately recollecting precise figures or even the sequence of events. Consequently, most of the data were based on estimates and event sequences had to be carefully examined.

Institutional bureaucracies in government departments also presented a challenge to the research process. Institutional ethics and bureaucratic arrangements prevented the informants from responding to topics or questions that they deemed sensitive. These sensitive topics included issues on funding of programmes, internal policies and institutional arrangements for decision making. Informants were also not willing to discuss matters about their relationship with the government, including the influence they may or may not have in agricultural implementation and related policies, including CA programming in government. It took me about three months of continuous interaction and assurance that the information was for academic purpose for the informants to accept me and open up.

3.3.6 Reflexivity and positionality

Since the 'self' is a key instrument in research and self-reflection is an integral part of the research process, addressing how the researcher is positioned in this study becomes imperative. Hesse-Biber & Leavy (2011: 13) define reflexivity as "the questioning of one's place and power relations within the research process". When using ethnography as a data collection method, positionality is vital because 'it forces us to acknowledge our own power, privilege, and biases just as we denounce the power structures that surround our subjects' (Madison, 2012: 8). Since I was engaged in collecting and interpreting data, it was critical to explore and seek to understand the biases, assumptions, and expectations brought into this research. This required a reflection on my positionality to the research topic, interviewees, and site before engaging in research and continuous reflection during the research period (through memoing).

In answering the call for reflexivity for this study, I took special care when engaging with and inquiring about the farmers' cultural practices and social lives. There was a need to be cognisant of culture, experience, interests, perspectives, insecurities and fears, among other things, of interviewees and their perspectives of the researcher and the research being conducted. In the event of an uncomfortable situation or misunderstandings that arose, I navigated them with sensitivity and in ways that dignify and honour the perspective and confidentiality of the interviewees.

Though widely contested, researcher positionality argues that the researcher's position has an impact on all aspects of the research process as it influences the researchers thinking and practices, including the choice of processes and the interpretation of outcomes (Rose, 1977; Sikes, 2004; Foote & Bartell, 2011). I, therefore, took into account my positionality in the execution of the study concerning CA, the participants and the research process. My positionality as an 'insider' from Ward 30, village 9 shaped my critical stance on the CA programme promoted in the area. In this framework, I was an individual who possessed intimate knowledge of the community and its members. It offered insights that are sometimes difficult or impossible to access by an outsider. The values of shared experience, greater access, cultural interpretation, and deeper understanding and clarity of thought are closely tied together and inform one another in various ways. As an insider, I used member checking to avoid the dilemma of bias and add credibility to my research.

Lincoln and Guba (1985) are often cited for their discussion of "member checks" or "member checking," one of five approaches they advocate toward adding credibility to qualitative research. The authors describe the member check as "the most crucial technique for establishing credibility" (p. 314) because it requires the researcher to go back to participants and gain participants' input on the researcher's data, analytic categories, interpretations, and conclusions. In my research I followed up with in-depth interviews which allowed me to "assess intentionality" (Lincoln and Guba, 1985) on the part of the participants while also allowing participants the "opportunity to correct errors" and/or give additional information, among other things.

3.3.7 Ethical considerations

The data required for this study entailed close interaction with people from different sectors of society, including grassroots ethics, which formed a fundamental element of the data collection process. Ethics are a fundamental component of modern-day research and, as such, require meticulous attention. According to Guillemin & Gillam (2004), there are at least two major dimensions of ethics in qualitative research. There are procedural ethics, which usually involve seeking approval from a relevant ethics committee to undertake research involving humans, and the "ethics in practice", or the everyday ethical issues that arise in the process of doing research. The general principles of research ethics include fundamental rights of human dignity, autonomy, protection, safety, maximisation of benefits and minimisation of harms (Markham & Buchanan, 2012).

A major limitation of social research is the entry and acceptance of investigators into the community by respondents. The area chief and village headmen enabled me to get permission to access villages to collect data. I applied for and received ethical clearance to conduct this research from the University of Pretoria. Four main ethical considerations came up concerning this research: informed consent, privacy, confidentiality and anonymity, and ownership of data.

(i) Informed consent - All respondents were provided with full information on what the study was about, including why they have been chosen to participate. Informed consent was done verbally and in writing with all interviewees to explain the purpose and benefit of the research and explain the nature of participation. They were then given up to two weeks to decide if they were willing to participate. Follow-ups were made to those who had not responded within the two weeks (see Appendix 6 for consent form).

(ii) Privacy - All interviews were conducted in private in places where the respondents were comfortable. All farmer interviews were conducted in their homesteads, while the key informant interviews were conducted in the key informant's offices. No challenges were faced with regard to privacy.

***(iii) Confidentiality and anonymity* -** To maintain interviewee confidentiality, I did not identify interviewee names. The names of the interviewees are only available to my supervisor and me. I did not identify names because some interviewees wanted to offer sensitive information, and highlighting that everyone would remain anonymous alleviated any doubt and kept all the gathered knowledge equal. However, some respondents felt that signing consent forms and audio recordings compromised the anonymity component; hence, they refused to sign or be audio recorded.

***(iv) Ownership of data and conclusions* -** All respondents were assured that all the data collected will solely be used for academic purposes. Some respondents asked for a copy of the dissertation once it is completed to assure that the study was indeed for academic purposes. Electronic documents and voice recorded data are kept on a password-protected computer.

3.4 Chapter summary

This chapter provided a detailed characterisation of case study areas describing the climatic conditions, soil characteristics, vegetation and crops grown. This was followed by the justification of using ethnography to explore and examine socio-cultural farming practices and their impact on the adoption of CA in Ward 30, Nyanga district. The combination of ethnography research method, non-participant and participant observation, life history interview and expert/elite interviews research tools, and narrative and discourse analysis was used in comprehensively addressing my four research questions. Key to this methodological approach was the awareness of and openness to the plurality of farming practices among the different farmers in Ward 30.

CHAPTER FOUR: DECLINING CROP YIELDS: HOUSEHOLD FARMING CHALLENGES AND COPING STRATEGIES

4.1 Introduction

Since the 1960s, average cereal yields have nearly doubled in the rest of the world, whilst they have stagnated in smallholder agriculture sectors in Africa (Huang *et al*. 2002). Consequently, attempts to improve crop yield have been the preoccupation of many African governments after gaining independence. Since the 1920s the African agricultural space has been a scene for numerous agricultural experiments, from the introduction of mixed agriculture to conservative farming (Wolmer & Scoones, 2000). In the last two decades, CA has been heavily promoted (particularly in southern Africa) as a strategy to improve food security and reverse soil degradation in the face of climate change (Giller *et al.*, 2009; Mafongoya *et al.*, 2016). As Baudron *et al.* (2012: 394) observed, 'contemporary attempts at agricultural intensification in African agriculture continue to be informed by conservationist concerns', although, unlike earlier interventions, they are 'based on minimum-tillage and retention of a mulch of crop residues through the technical package CA.

In an effort to replicate the reported CA beneficial effects and arrest high soil degradation rates, CA has been promoted in many sub-Saharan countries, including Zimbabwe. However, like in many African smallholder settings, adoption rates of CA remain minimal (Kassam *et al.*, 2009), despite more than two decades of research and development investments. For example, the proportion of the total cropland area under CA in Zambia and Zimbabwe is lower than 1% compared to South America, where about 50% of the cropped area is cultivated without tillage in CA systems (Corbeels *et al.*, 2014). Where adoption has been observed, not all components have been embraced due to biophysical (soils, climate and topography), socioeconomic and institutional factors, and technology characteristics (Baudron *et al.*, 2007; CIMMYT, 1993; FAO, 2001b; Kaumbutho & Kienzle, 2007; Langyintuo & Mekuria, 2005; Shetto & Owenya, 2007). Place and Dewees (1999) noted that African adopters' social, economic, and cultural characteristics are more intricate, limiting the dissemination and adoption of new CA technologies.

Chapter 3 discussed the research design and the methodological approach adopted to fulfil the purpose and answer the questions of the current research study. The rationale for choosing the qualitative research paradigm and the data generation methods were outlined. This chapter provides a context to the challenges farming households face, which led to the introduction and implementation of CA in rural agriculture and focused on a local rural ward division in Nyanga District, Manicaland Province in Zimbabwe. The chapter is organised as follows: In the first section, I provide a brief overview of the challenges of smallholder farming and food security in Zimbabwe. The second section discusses the challenges smallholder farmers face in Ward 30 and the coping strategies, and how some of these have become catalysts for CA abandonment. The chapter ends with a summary and contribution to the whole thesis.

4.2 Challenges of smallholder farming and food security in Zimbabwe

Zimbabwe`s agricultural sector was once recognised as the engine of the country's economy and impetus for economic growth, giving the country the status of the 'breadbasket' of the southern Africa region in the 1980s (FAO, 2009; Miles, 2010). That mantle has since been lost, and the agricultural sector has been in crisis since the turn of the millennium, while the country is now a net importer of staple grains in order to boost food security for the poor rural communities (Dhewa, 2009; Miles, 2010; FAO, 2015). For example, in the 2015/16 season, it was estimated that between 650 and 700 thousand tons or about one-third of the total domestic maize demand were imported that year (FAO, 2015). At the beginning of the period in 2000, the then President launched the Fast Track Land Reform Programme (FTLRP), which redistributed about 20% of the country's total land through the compulsory acquisition of white commercial farmers' land and by creating small to medium-sized land holdings from what were previously large-scale farms (Commercial Farmers Union).

The land reform brought in significant changes in the agrarian sector, with the most notable being shifts in agricultural production and marketing patterns. As a result, the country has been experiencing a structural maize deficit, resulting in a reversal of its status from being the largest net food exporter in Southern Africa to that of a food deficit country. To satisfy the national maize requirement of about 1.8 million tonnes (for both human and livestock consumption), Zimbabwe has to rely on regional imports (mainly from South Africa, Zambia and Malawi), which have been increasing in recent years. However, low regional maize supplies are also driving up prices, and the country`s regional trading partners are also struggling with maize shortfalls, thus exacerbating food insecurity. In general, maize yields across SSA remain stubbornly low: the average across sub-Saharan Africa from the period 2007-2016 was 1.9 tons/ha, although there is significant variation between countries (FAO 2017b) whereas, the average yield for Zimbabwe over the same period was only 0.7 tons/ ha.

Like many other countries in Southern Africa, the country faces challenges in the smallholder agricultural sector. Decreasing crop yields in smallholder farming systems continue despite technological innovations such as improved hybrid seeds and fertilisers. For example, from 1970 to 2000, maize yield averaged 0.8t/ha for the smallholder sector compared to 3.9t/ha for the commercial farming sector (Agritex, 2015; Andersson, 2007). In terms of agricultural potential and disparity, most of the land area allocated to smallholder farmers in Zimbabwe lies in the marginal agro-ecological areas (Scoones *et al*., 2011). Small-scale farming is characterised by low productivity, limited access to markets and lack of competitiveness, limited extension services, frequent adverse weather, and poor access to finance and inputs. Only 7% of small-scale farm areas are under irrigation, while 80% of rural farmers do not have access to savings and lending schemes (Mutambara, 2016).

Post-harvest difficulties lead to significant food losses: 60% of rural households store crops in unimproved facilities (Zimbabwe Vulnerability Assessment Committee (ZimVAC), 2013). The capacity of smallholder farmers to adapt to challenges they face in agricultural production is often limited by socio-economic and institutional factors (Munyani, 2012; Uddin *et al.*, 2014). According to Mafongoya, Rusinamhodzi, Siziba, Thierfelder, Mvumi, Nhau, Hove and Chivenge (2016), crop productivity on many smallholder farms in Zimbabwe and many African nations is constrained by a combination of factors such as low soil fertility, insufficient and inappropriate fertiliser application, erratic rainfall, lack of improved cultivars, labour constraints, and in some situations, inappropriate tillage practises.

Many households in the rural areas are net food buyers: they do not produce enough food to meet their needs through to the next harvest season, purchasing up to 65% of their maize from markets. Food purchases make up 56% of household expenses (ZimVAC, 2015). The country also has highly volatile food prices, increasing by more than 30-40% in a season (World Food Programme (WFP), 2017). Price instability, especially during the lean season, compromises households' ability to access adequate food year-round through markets. Due to this, many farmers are trapped in abject poverty, experience food insecurity, and have poor nutrition (Sanginga & Woomer, 2009). A Bulawayo24 News article, 09 August 2019, reported that more than half of Zimbabwe's fifteen million people already needed food aid after the drought in 2019, according to the government and aid agencies (Bulawayo24 News, 27 December 2019).

Manicaland province, where Nyanga district is found, is characterised by erratic rainfall, sandy soils, hot, dry weather exacerbated by climate change and very little to no agricultural turnovers. According to the Zimbabwe Meteorological Service, daily minimum temperatures have risen by approximately 2.6°C over the last century, while daily maximum temperatures have risen by 2°C during the same period (Brown *et al.*, 2012). This has seen the province experience extremes of weather over the past two decades, including dealing with 10 droughts, decreased freshwater and destroyed biodiversity (Chakwana, 2015). The rains have become so erratic in the district that the United Nations Development Programme predicts agricultural production-Nyanga`s main livelihood source for nearly three quarters of the population could decrease by up to 30%, which could lead to an increase in hunger and poverty (Chakwana, 2015).

This leaves farmers to live under risky conditions and vulnerable because they have few assets to fall back on and limited ability to recover from climate extremes. Many farmers grow low-value cereal crops that depend on a short rainy season, a practice that traps them in a constant cycle of poverty and hunger. According to ZIMVAC, a committee that regularly conducts socioeconomic food-security and livelihoods short-to-medium-term vulnerability assessments, the province had the second-highest proportion of households with inadequate water for domestic and agricultural use in all Zimbabwe, standing at 40.4% in 2016 (ZIMVAC, 2016).

Household-level vulnerability in the province is influenced, amongst other factors, by inequitable land distribution, low education, poor infrastructure, gender inequality, dependence on climate-sensitive resources, poor health status, and HIV/ AIDS (Muzari, 2014). The perpetual challenges and poor performance faced by smallholder farmers cause the food security situation to remain fragile, with households exposed to a wide range of recurrent shocks every year. Production and productivity of maize grain have been declining. Household access to food is constrained by poverty, declining remittances, low productivity, inadequate employment opportunities, high food prices and recurrent weather shocks, economic instability, low growth, deflation and lack of liquidity.

4.3 Challenges to smallholder farming

The majority of crop production in Ward 30 is based on subsistence agriculture implemented by resource-poor farmers. They face a mix of interrelated risks and challenges which threaten their livelihoods and food security. Uncertain weather conditions, lack of draught power and high levels of soil degradation are some of the constraints facing and hindering small-scale agricultural productivity. Droughts or long dry spells worsen the situation, often resulting in complete crop failure and perpetuating poverty among these rural households. The challenge of agricultural sustainability has become more intense in recent years, with climate change, water scarcity and degradation of the ecosystem negatively impacting these poor farmers. This section presents the challenges limiting households' agricultural productivity in Ward 30 today. Below is a detailed account of challenges posited by households in the ward divided into biophysical, human, social, political and institutional categories for identification and discussion.

4.3.1 Biophysical challenges

Poor soil fertility and nutrient availability are widely acknowledged as the major biophysical limitations to agricultural production in the continent (Tittonell & Giller, 2013; Vanlauwe & Giller, 2006). The absence of a conducive biophysical environment to achieve optimal yields required for food security and improved livelihoods was highlighted as a challenge by most farmers in the ward. The following subsection identifies and discusses some of the key biophysical challenges in Ward 30. It details how uncertain weather conditions, infertile soils and soil erosion affect agricultural productivity among farmers.

4.3.1.1 Uncertain weather conditions

Farming systems in SSA are dominated by smallholder farmers and rain-fed basic grains production, but rainfall patterns across the continent are increasingly poorly distributed with severe dry spells (Sennhenn *et al.,* 2017). The last 30 years have seen the warmest surface temperature, reduced rainfall and more frequent droughts (Global Environment Facility (GEF), 2013). Zimbabwe has not been spared from the effects of global warming.

The crop growing season in Ward 30 is now characterised by intermittent and prolonged dry spells of variable length occurring at any stage, increased flash floods, a general delay in on-set of rains and an abrupt end to the season. These trends could be observed when analysing rainfall data during the period the study was being carried out where effective rains (>25 mm) were realised by the end of October in 2018 while in 2019, rains did not start until mid-November, and much later, early to- mid-December in 2020.

Since the turn of the millennium, uncertain weather conditions have impacted crop production in Ward 30 because most of these are resource-poor, rain reliant farmers'. In this rainfed or dryland farming, which farmers are tied to, crop production depends heavily on in-season spatial and temporal rainfall distribution. The yearly variation makes planning various agricultural activities difficult for many households due to the inability to accurately time rainfall onsets. The crop growing period normally starts from November to April, and rainfall distribution is very poor, while mid-season droughts are a common feature. Crops face the brunt of the effects of climate change through decreased rainfall and longer seasonal dry spells, causing evaporation losses of 10-13 mm per day (Lovell, 1998), leading to moisture stress in crops because farmers do not have access to irrigation. These factors render the sector highly sensitive to increasingly frequent extreme heat, erratic rainfall patterns, droughts and floods, all of which have significant negative implications for food security. For example, changes in the timing and duration of the rainy season can jeopardise crop yields and have devastating livelihood impacts on poor smallholder farmers whose window for planting is now limited to November to February. These temperature increases, changes in rainfall patterns, changes in extreme weather events, and reductions in water availability all result in reduced productivity.

While the agriculture system is highly dependent on precipitation, dry spells are common in the region, and farm households in the study area had knowledge and experience of these weather events. According to community elders, dry spells can happen even during good rainy seasons.

Certain months are generally known as months of very low precipitation. Drawing from experiences and knowledge of local farmers, the month of January is known to have relatively less rain in the rainy season, and long dry spells are experienced, which sometimes compromise crop growth. The locals call these dry spells "*mhare yaJanuary*", and the difference between harvesting and not harvesting for many farmers is how crops usually withstand the January long dry spell. According to local knowledge, seasonal dry spells "*mhare yaJanuary*" generally last between 14 and 21 days, or even a month during a growing season. However, these long dry spells are not unique to Zimbabwe, and have also been reported across Southern Africa (Mupangwa *et al*., 2011; Tadross *et al.*, 2007; Usman & Reason, 2004). These dry spells tend to affect crops planted during the early months and are typically hard on maize, which requires reasonable moisture and is not drought tolerant.

Nevertheless, most farm households produce maize, as demonstrated by the increase in maize yields in the small farm sector in the 1980s. The good rains during February often prevent the failure of the maize crop However, sometimes these January dry spells are long and so severe that farmers lose crops. An old member of the community shared her experiences:

> We know that the month of January has no rains. But sometimes the dry spells can last the whole month, while the sun is very hot. Under such situations, the crops can feel the stress and are highly compromised. Sometimes these crops are lost altogether as they fail to recover after the February rains. People have lost crops here because of the January dry spells. I have lost crops also, as you can see this year. This is not new here. We are getting used to this.[4] (Mbuya Chipadze, Interview, Ward 30, 22 January 2019).

The year she was referring to was the 2019/2020 rain season when the first rain of the season fell on 17 November, and farmers started to plant maize. While there was rain in December and planting continued there were no rains through January into early February. Farmers had started weeding, which exposed the crops and soil to the scorching sun killing much of the maize crops. Only a few farmers that had fields in swamp areas survived, but the long spells also compromised these crops.

[4]Interview with Mbuya Chipadze, Ward 30, Nyanga District, 22 January 2019.

Using their knowledge and experiences of weather patterns, farmers understood seasons when dry spells will be long and those where they will be regular and used such knowledge in their crops decisions. In the past, farmers could work around the dry spells and had always managed to achieve harvests. However, findings show that these dry spells have become unpredictable, have increased in frequency, and happen even outside the known month of January. For example, farmers talked of a dry month of December in 2015/16 when rains failed to fall during Christmas. Mbuya Rukodzi remembered:

> The Christmas period is a period of rain. Rain fall throughout Christmas and sometimes force people to stay indoors. We grew up like that. Every farmer knows that if there are no rains in early December, there will not be enough rain towards the end of December to plant crops. However, that year, the skies were empty. There was not even a drizzle. We lost crops grown in November and did not manage to plant again since the rains did not return in January.[5] (Mbuya Rukodzi, Interview, 30 January 2019).

The effects of long dry spells were visible during fieldwork, as most fields under conventional agricultural practices fared badly. These crops were suffering heavy moisture deficit, and others were a complete write-off, as shown in figure 6. The maize crops were affected just before the tassel stage, a critical stage that requires adequate moisture, which meant yields had been affected. The challenge of uncertain weather conditions in the study area concurs with other studies which recognise that climate variability has an impact on the food security of households depending on rain-fed agriculture (Devereux & Maxwell, 2001; Fischer *et al.*, 2002; Kurukulasuriya & Rosenthal, 2003; Mendelsohn *et al.*, 2000;). Other studies like Mupangwa, Walker, & Twomlow (2011) indicate that climate variability also contributes to low agricultural productivity in the rural setup.

[5] Interview with Mbuya Rukodzi, Ward 30, Nyanga District, 30 January 2019

Figure 6: Maize crop in a conventional field

Besides the challenge of "*mhare yaJanuary"*, the rains are highly variable, and farmers complained that the rain season had increasingly become inconsistent. Farmers indicated that it was increasingly difficult to know when the season begins and ends as the commencement of rains varies greatly every year. For example, in the 2016/17 year, which was considered a wet season, the rain had started in October, and the following season 2017/18, the rain only came in mid-November, and the 2018/19 season was considered a dry season as rain good enough for crop production started to fall in December. Farmers observed a particularly worrying trend where rains start very late and stop early, making it difficult for farmers to plan and reducing crop yields

Such fluctuations in rain onset in farming seasons have resulted in farmers planting maize as late as January in some seasons, resulting in low yields because plants fail to reach maturity. The study found that the maize varieties available or chosen by farmers for planting in the ward required a growing period of 100-140 days, but the maize crop only received 90 days of rainfall when planted in January. According to the Commercial Farmers Union (2016), ideally, planting should happen between 15th and 30th of November, but the intra-seasonal drought experienced early in the season precludes any planting before mid-December. According to the Ministry of Agriculture (2012), the consequence of late planting is that farmers miss key but short planting windows since the rainy season seems to have shortened in Zimbabwe. This is a significant problem since all households' agriculture is rain-fed, and most plant medium maturing hybrid maize varieties require at least 800 mm of well-distributed rainfall. The late planting has a negative effect on the crop yield among farming households. As others have observed, annual variability makes selecting crop types and varieties and planning planting dates critical, yet also difficult, for successful cropping in rainfed systems (Hussein, 1987; Kinsey *et al*., 1998; Raes *et al*., 2004).

Out of curiosity, I asked farmers why they do not consider farming large portions of small grain crops such as sorghum, pearl and finger millet as they stand a better chance in conditions where rain fluctuates. The farmers shared that farming is defined by one's ability and success in growing maize. It is a staple, and it brings social prestige among people in the community, and any farmer who does not harvest enough of this staple crop is regarded as a failure. Even in a season such as 2018/19 when the rains were good enough for planting crops came in December; I could see most farmers still planting maize as late as the end of January. The farmers argued that they could not do farming without planting maize. Instead, they would rather take the chance and "at least be seen" to plant maize even if it is late and fail to reach maturity because planting maize is the meaning of farming in the ward.

This is because maize provides the staple diet for households in the district and ward. Therefore, there is an expectation for every household to be self-sufficient and be able to feed themselves. Socio-cultural values or social expectations shape farmers' crop choices in the ward and, in this instance, a preference for maize as a staple food. These expectations are known as norms, which are deeply ingrained in people's attitudes and beliefs. They not only determine how other people think an individual should behave; they determine what behaviour the individual feels is correct. It is now customary to plant maize crops, and people grow up to believe that that is 'the only correct way of farming'. Even if the benefits of other crops are explained to them, their strongly held attitudes may make it difficult for them to change. The behaviour and sentiments of households also agree with the utility maximisation theory in that households are more interested not in profit maximisation but in maximising their utility through assurance of home consumption. They do not aim at profit maximisation brought by the change to small grain crops, but at contingent, utility maximisation found in farming maize with which they have experience.

In the absence of an understanding of the changes in weather patterns in the ward, many people in the study area draw on their existing knowledge and beliefs to explain the unpredictable weather. There is also a nearly strong tendency for people to hold themselves individually or collectively responsible for these changes, as I explain below.

4.3.1.1.1 Explanations of severe weather patterns as a message from ancestors

Most farmers agreed that changes in weather patterns were taking place. Their justification for this argument ranged from changes in tree behaviour, seasons, rainfall patterns and environmental changes to altered wind patterns. However, the meaning attached to fluctuating rains varied mostly according to the level of exposure to various sources of information and the age of farmers. Older farmers (between 46-70 years) do not believe that dry spells and fluctuating rains are a result of climate change, whereas younger farmers (between 25-45 years) speak about climate change although there is limited knowledge of what it is and how it manifests. They tend to associate drought spells with climate change, although they agreed that droughts have a long history in the region.

However, explanations of climatic fluctuations correlated with several other factors, including the level of education, age and experiences with the occurrence of natural events. Therefore, it is not surprising that the elderly, who still hold traditional beliefs that conform to indigenous knowledge systems in their agricultural practises, associated the changes with the wrath of their ancestors. Most of the older farmers had not attained any level of education, and their explanations were guided by experiences and the history of similar occurrences. The position and understanding of climatic changes emerged in conversations with elderly members of the community, as highlighted below:

> We just hear that it's climate change but we are not sure what to believe. Why should climate change? If it is time to rain it must just rain isn't it? That is what used to happen. If it did not happen, we performed ceremonies to appease the spirits. These leaders have

stopped performing these rituals and we are being punished for it.[6] (VaShava, Interview, 05 February 2019).

VaShava (78) has lived in Ward 30 since a young age. He herded cattle and ploughed the fields as a young man, married and ploughed the fields as an adult. He had seen good and bad years and spoke proudly of the old and traditional ways of doing things. He shared how farming was guided by traditional practises led by ancestors and spirit mediums. He understood land as belonging to the ancestors and that there are approved ways of doing agriculture. He believed that transgression often results in punishment, and people in the area had transgressed a lot in their farming practice, he said with sadness.

VaShava was not alone in his interpretation, and similar explanations emerged with other elder farmers, including leaders (the chief and headmen). They pointed to certain behaviour by community members, which has attracted the wrath of the ancestors. Such behaviour was discouraged in the past. They pointed to behaviour such as promiscuity amongst young people, women who wear pants, use of discourteous words, failure to respect the elders and certain traditional beliefs, unstable political climate and political positionalities. There was consensus that people had failed to consistently observe *chisi*, that people talk bad about the day and that such behaviour attracts punishment. One form of punishment by ancestors is in the form of droughts or when rains are withheld.

Some old heads in the community have attributed the dry spells and droughts to punishment from spirit mediums (locally known as *mhondoro)* in the area because some community members support the opposition political party Movement for Democratic Change (MDC). To them, it could not be a coincidence that when the opposition party was formed in 1999, the community started to experience long seasonal dry spells and persistent droughts. They point out that the opposition party has promised to take back land allocated during the FTLRP and give it back to the white people when voted into government. They believed this angered the ancestors, especially those whose lives were lost during the liberation struggle fighting for the very land. As a result, they imposed droughts as punishment and disapproval of the opposition party and,

[6] Interview with VaShava, Ward 30, Nyanga District, 05 February 2019

therefore, needed appeasement. One strategy used to respond to uncertain weather conditions is performing rain-making ceremonies.

4.3.1.1.2 Rain-making ceremony as a response strategy to changing weather patterns

Discussions with most community elders revealed that they believe that the climate change experienced in the ward through fluctuations in weather patterns can be corrected by appeasement of ancestors through performing a rain-making ceremony. Therefore, rain-making ceremonies are a central feature of farming culture in the ward. When households were settled in the area in the early 1980s, rain-making ceremonies were performed in every village and taken very seriously. Regardless of whether they believed in the ancestors or not, each household would contribute some grains such as *zviyo* (finger millet), mealie-meal, and a chicken to make the ceremony a success. Older women who practise celibacy brewed traditional beer using the finger millet. The village head and community members approach their chief, who goes before *svikiro* (spirit medium) to inform those known as *kusuma*[7] so that the ancestors know. At the same time, members of local communities who had committed abominable sins were called upon to confess to their ancestors.

However, the spread of Christianity amongst people led to rain-making ceremonies losing their relevance, and people stopped attending because it was not part of their beliefs anymore. Apart from Christianity, rain-making ceremonies were not properly done because Western education gave too much credit to "science", leading to disrespect for cultural and moral practices. As a result of the ongoing seasonal dry spells and inconsistent rains, rain-making ceremonies have been revived since 2010 and are compulsory for every household to participate in the ward. Those who do not take part are fined. If a person resists these expectations, those around him will show their disapproval. Because most people like to feel acceptance and approval from those around them, they tend to follow such behaviour expectations.

Subsequently, the research found that the preparations for the rain-making ceremony hindered some farmers from adopting the CA programme. Because the ceremony takes so much time to prepare, some farmers could not work to the maximum efficiency on their CA farms. In addition,

[7] *Kusuma* means introduction to a higher authority like ancestral spirits

the time that they were supposed to dig basins or collect mulch for their fields is also the time they are supposed to be cutting firewood and grinding finger millet for the ceremony. These farmers had no time to focus on their CA farm because it was not compatible with existing beliefs, leading to the abandonment of the programme. Rogers (2003) identified compatibility as one characteristic determinant that renders an innovation more or less apt for easy adoption in his diffusion theory. The findings show that CA innovation failed because it was perceived as inconsistent with some households' existing community values, practices, and needs. Even though CA proponents argue that the technology is suitable for areas like Ward 30, this finding shows that local beliefs and values such as rain-making ceremonies can contribute to the lacklustre reception of CA in smallholder farming households.

4.3.1.2 Challenge with soil erosion

Annually, Africa loses an estimated 500 million tons of sediment, mainly soil and topsoil (FAO, 2018). As a result, over the past five decades, yields of cereal crops in SSA have stagnated at less than 1.5 t/ha due to soil erosion, although the yield potential of most crop varieties exceeds 5 t/ha (FAO, 2010). Yields stagnated at less than 1 t/ha for legumes, although the potential averages more than 2 t/ha. A Zimbabwean study of soil nutrient loss through erosion found that an erosion rate of 30t/ha/year, typical of many communal subsistence farmers, removed half the applied fertiliser. The replacement of these lost nutrients at a national level would cost US$2.540 million each year (http:www.sardc.net/imercsa)

Similarly, Ward 30 has dominantly highly erodible soils. Most farm soils are mainly moderately leached, light to dark grey granitic sands. These granite-derived sands are inherently infertile, susceptible to erosion, and too acidic for food production. The loss of topsoil and, subsequently, its quality due to runoff has a cumulative effect on soil quality (see figure 7 below). When farm erosion occurs, this decreases agricultural yields, which undermine households’ abilities to invest in inputs, further causing a decline in soil quality (Barrett, 2008). Sanchez (2010) argues that efforts to replenish soil fertility are a primary requirement for breaking the cycle of poverty and increasing food security in Africa.

Figure 7: A farm experiencing topsoil erosion due to runoff

The very erosive rainfall characteristic in the study area is also another cause of erosion on household farms. When the erosive rains fall, the fine mud forms a hard crust that seals the soil surface, making it difficult for rainwater to soak. Once a crust is formed, the rain washes over it instead of seeping into the soil. Surface run-off is then generated quickly, and it increases rapidly. Drops falling on a flat granular surface commonly produce small impact craters (Rice, 1977). These rainfall raindrops have high intensity for a low duration, causing runoff induced erosion by dislodging individual soil particles on arable land. It often comes in thunderstorms, particularly in the months of the rainy season (November and December).

The rains are particularly violent during the start of the rainy season. This is also the time when the soils in the fields crack due to high temperatures and are bare of any crop cover. This has to be understood against the background that plants protect soil from erosion in several ways. Crops help break the force of raindrops because they hit the plants first, breaking into small droplets that fall more gently to the soil surface. In addition, crop roots physically hold the soil in place. Furthermore, plants and their roots provide an environment for earthworms, ants, termites and moles. These creatures construct underground tunnels which help rainfall soak into the ground and reduce runoff. Plants that have many stems that grow close together, like grass, help the soil absorb water by providing thousands of little holes through the soil surface. Also, plant stems act as little dams, slowing runoff as it flows over the land, allowing more rain to soak into the ground. Dead leaves lying on the ground (the moribund) protect the soil from the impact of raindrops and shade it from the sun. With time, the dead vegetation rots and becomes part of the soil, adding organic matter, which helps it absorb water.

In Southern Africa, the average drop size is such that when it hits the ground, it's travelling at about 20km/hr. Normal raindrops attain velocities ranging from under 1m/sec (3,6km/hr) to 9m/sec (32.4km/hr) (Makwara & Gamira, 2012). It is evident then that heavy thunderstorms, which are received in the area, are vastly effective as erosion agents, especially at the commencement of the rainy season. In the end, due to farm soil erosion washing away topsoil, there is a reduction in land productivity, and in some cases, a farm is abandoned. The high risk of crop failure attributed to soil erosion due to climate variability in the study area has also been reported by Lema & Majule (2009) in their study of the impact of climate variation and change on agriculture in semi-arid areas of Tanzania. This suggests that the findings of this study are not specific to only Ward 30 and will be exacerbated since climate change projections indicate reduced cultivation times of >20% by 2050 compared with 2006 (Thornton *et al*., 2014). With the effects of soil erosion discussed in this section also comes the challenge of losing soil nutrients which leads to infertile soils, as discussed below.

4.3.1.3 Challenge of infertile soils

About two-thirds of Zimbabwean soil is sandy, especially where smallholder areas are located (Mapfumo & Giller, 2001). These soils are inherently infertile and have a low potential to sustain agricultural production under continuous cultivation (Mapfumo & Giller 2001); and are particularly deficient in nitrogen, phosphorus and sulphur (Hikwa *et al*., 2001). Apart from low inherent nutrient content, the sandy soils have low organic matter, water holding capacity, bases and poor soil structure to support crop production. In some areas, nutrient imbalances have been reported and attributed to the use of suboptimal fertiliser rates and consequent nutrient mining and extreme acidity (Mugwira & Nyamangara, 1998; Zingore *et al.*, 2008). Current production systems coupled with high rates of population increase have also led to an accelerated loss of soil fertility, with the total extent of severely degraded soils due to agricultural activities estimated at over one million km^2 (Vagen *et al.,* 2005).

While moisture is a major determinant of crop success, in rain-fed agriculture systems, and sufficient moisture depends on rain. Good quality soils are a critical component in crop production, and, subsequently, the fields. When soil quality is not good for crop production, farmers often augment soil fertility by using inorganic fertilisers like compound D and top dressing fertilisers like ammonium nitrate (AN). Discussions with farmers show that yields have been dwindling even in seasons when they receive good rains like the 2015/16 farming season. Lack of or inadequate application of fertiliser has been a contributing factor to the continual yield decline. According to Verde & Matusso (2014), this challenge is most acute in SSA because most smallholder farmers practise rain-fed agriculture, and soil fertility depletion is the most frequent biophysical cause for declining per capita food production. Many households in the study area cannot afford them due to prohibitive prices, and in cases where they make a sacrifice by selling their livestock, the fertilisers are sometimes in short supply leading to poor harvests.

The research found that farming is the main source of livelihood and continual cultivation since they have settled in the area (1980) has been one major contributing factor to reduced organic matter in the soil, causing the soil to become 'tired'. Looking back, most farmers remember their first ten years when they arrived, the soil had enough nutrients to feed crops, and they experienced bumper harvests every season. For example, during the first decade of resettling (1981-1991), farmers would harvest between 2.5-3 tons/ha and beans 1-1.5 tons/ha). Most farmers are now harvesting 0.5 tonnes/ha while harvesting 0.2 tonnes/ha of beans (AGRITEX, 2015). Zingore *et al*. (2008) and Masvaya *et al*. (2010) found that nutrient deficiencies and imbalances are more severe in fields of resource-poor farmers who do not have livestock manure to apply in their fields. Ward 30 showed similar results in other research findings.

This was evident when I looked at the health and general crop outlook, especially maize, which looked stunted with yellow discolouration compared to maize with manure that had large leaves extending off each internode and leaves totalling eight to twenty-one per plant. Even though the manure might not be enough to cover the whole field for households with livestock, they spread it on a portion they want to plant maize (their staple food) and concentrate their effort on that area for maximum yield returns. What is important for the farmers is to have a guaranteed staple harvest and ensure food security for the household. This does not mean that household farmers do not consider other crops such as cash crops as a means of economic security, but their first priority is food security. They know that once the rains come and are consistent in that season, they are guaranteed a harvest and food for the family. This finding tallies with the safety-first theory, which argues that when households make decisions about uncertain prospects (trying cash crops in this instance), individuals' first consideration is to minimise the probability of reaching disaster and aim for safety first (food security).

4.3.1.2.1 Farming households' response to infertile soils

Due to the high price of fertiliser, manure - a crucial endogenous resource - is being used by households who own livestock for their farms to respond to infertile soils and improve soil fertility in the ward. The use of manure has become popular among farmers because it is readily available, free for them, and does not require any training. Most farmers realise that planting crops without manure or fertiliser results in unhealthy crops, especially maize, whose leaves discolour to a yellowish colour indicating nutrient deficiency.

Due to the bulkiness of manure, individual households use ox-drawn scotch carts to transfer it from homesteads to the fields (see figure 8 below). In some instances, households use the traditional social system known as *humwe*, where people pool resources such as carts and oxen and carry manure to the field for fellow villagers who provide free labour (For more on *humwe*, see Chapter 5 section 5.2.2.3). Households with large cattle collect manure in heaps and apply it later through broadcasting, especially on a plot they want to plant the staple maize crop. The research found that farmers generally broadcast manure instead of spot application in plant stations which is viewed as more effective in providing plant nutrients due to labour bottlenecks.

Figure 8: A farmer offloading manure into heaps in the field from a scotch cart.

During my discussion with older farmers in the ward, I noted that they are more cautious and not willing to compromise on food security and they insist that maize must be planted in portions where the manure has been applied. In contrast, young farmers do not mind applying manure and planting cash crops on the fields, especially if a cash crop promises good returns. A young farmer, *mukoma* Joramu, who is willing to risk food security for good returns on a cash crop, explained:

> Farming is just like a game of cards where one must gamble. I remember a few years back when I planted flowers on a field that I initially wanted to put maize on after I heard how good the fetching price of flowers was going to be on the market. The gamble paid off and when I got the money I went to people with maize and bought it for my family. It turned out to be a good investment[8]. (Mukoma Joramu, Interview, 15 February 2019)

Mukoma Joramu is one of the more educated farmers in the area who went up to high school, owns some livestock, but generally is a resource-poor farmer. He perceives farming as not risky

[8] Interview with mukoma Joramu, Ward 30, Nyanga District, 15 February 2019

because he has relatively little to lose or gain compared to “rich farmers” who apply fertiliser bought at a very high price. His decisions and thinking are probably more influenced by the level of education that shapes some of his worldviews regarding farming and risk-taking. He was willing to receive greater returns even if the risk of obtaining them was high. The case above is consistent with the work of Adesina & Zinnah (1993), Mauceri *et al*. (2005), Sanni (2008) and Bryan *et al.* (2013), who argue that younger smallholder farmers are relatively more progressive and are typically less risk-averse while older farmers are risk-averse. In contrast, older farmers tend to view farming as a way of life and have a strong emotional connection with the use of traditional farming methods (Akinola, 1987).

The study also noted that farmers who do not own livestock to provide manure use other endogenous resources such as applying decomposing tree leaves, locally known as *musakwani*, mainly found along river banks. These farmers prefer this method of enhancing soil fertility to spending their time providing labour on farms of people who own livestock in exchange for a cart of manure. A common approach farmers use when applying *musakwani* is to prioritise a small area for maximum yield outputs. This method of enhancing soil nutrients is not unique to this area but has been a trusted method for soil fertility for ages, particularly in regions of agriculturally marginal potential.

Households who do not own livestock that can provide manure or do not have labour to collect *musakwani* shared that they traditionally leave a portion of their farm to fallow, locally known as *kuradza munda,* to allow the soil to regain its structure. The length of the fallow period varies according to the type of soil, but usually, farms are left to fallow for a minimum of two years, after which they are used again. In ward 30, the decision to leave a field fallow is a matter for an individual household to decide on. This is unlike in some areas where it is agreed upon by a group of households who select areas to create a uniform piece of grazing land for the village herd. Instead of planting all twelve acres and getting a mediocre harvest, farmers plant crops on five acres, concentrate their efforts there, and leave the remaining acres to regain their soil structure. The research also found that fallowing is practised by some farmers who own livestock to make the farm soils ‘rest’ and regain their structure and fertility. They shared that soil is a living organism that gets tired, just like other living organisms. Mai Tumbare shared the analogy of physiology to express how she feels about her farm soil when she explained:

> This soil is not different from me. Over a period of time, as I work and toil, I get tired. The same applies to the soil on our farms. It has been supporting crops for all these years so it also gets tired, and will need to rest at some point because if you fail to look after it then it will also not look after you.[9] (Mai Tumbare, Interview, 2 March 2019).

While doing field observation, I realised that one disadvantage of leaving the land fallow is that weeds grow up to maturity and produces seeds, and these are moved around other areas by livestock and wind during the winter grazing period, especially the 'concern' type. In some cases, farmers burn the weeds as a way to control weeds. However, weeds are a recurring problem mostly due to labour bottlenecks, and the section below discusses how this affects agriculture in the study area.

4.3.2 Human and social challenges

The challenge of weeds is the 'Achilles heel' in most manual cropping systems due to lack of resources. The section below looks at the challenge of low availability of labour and how that subsequently leads to weed pressure among households in the study area.

4.3.2.1 The challenge of crop weeds

According to Baudron *et al*. (2012), the labour peak at the time of first weeding is a major determinant of the land area harvested because farmers who cannot mobilise enough labour at first weeding are forced to abandon parts of their fields. Likewise, the labour challenge highlighted in the section above leads to the challenge of weed pressure on most farmers in the ward because they cannot afford early and frequent weeding.

Two labour peaks characterise the farming calendar in Nyanga District and surrounding areas; one at land preparation and planting in November-December, and the other at the first weeding in January. Since most farmers use conventional farming methods in the study area, land preparation and planting start only after the onset of the rains for farmers who own draught

[9] Interview with Mai Tumbare, Ward 30, Nyanga District, 02 March 2019

power as ploughing requires moisture to soften the soil. Although households with farming implements such as ploughs and cultivators can use them for controlling weed growth, thus saving labour, they still face a labour peak during the weeding period; a cultivator does not eliminate the need for manual weeding between plants in the same row. In contrast, household farmers who lack resources such as oxen or farm implements and cannot hire labour experience more labour intensive weeding periods, as they use hands and hoes than those with implements.

Most farmers in the area do not apply herbicides that help control weeds because of socio-cultural reasons (see chapter 7 Section 7.4.3) and lack of resources, especially financial resources. They struggle with broadleaf and grass type weeds starting from planting up until harvesting. Many farmers use time-consuming family labour as they cannot mobilise resources for paid labourers. Thus, at the time of first weeding, the labour peak is a major determinant of the land area harvested, even for farmers who own farm implements and are well resourced. The failure to control weeds in the farms means the weeds eventually mature and produce seeds, leading to continuous weed pressure on crops and subsequent lower crop yield for households.

The research also found that the study area is a patriarchal society where the division of labour by gender is clearly defined. Weeding is left to women and children alone, as highlighted in the excerpt from an interview below:

> My duty as a man is to work with oxen or any other farm implements and it ends there. The issue of weeding does not concern me; it's what women and children must do. Society measures my being by the area I ploughed; if people pass through and see crops in weeds on my farm, my wife is the one who will be viewed as not serious.[10] (VaGwerume, Interview, 8 February 2019).

This social setup puts much pressure on women to weed crops and balance them with other household chores, eventually resulting in many households failing to control weeds in their crops, eventually affecting the quality and yield. This finding is consistent with Chivinge's (1990) study, which found that in Zimbabwe, smallholder farmers spend more than 75% of their

[10] Interview with VaGwerume, Ward 30, Nyanga District, 08 February 2019

time hoe weeding in the peak period of November and February. The time spent on this task is usually by female members of the family and children who, in many cases, end up failing to attend school regularly.

Discussions with farmers in the area also revealed that weed pressure had doubled since 2008 compared to years before due to a new type of unfamiliar weed that grew on their farms shortly after using seeds donated by the NGO, Concern Worldwide. Farmers have since named the weed ‘concern’ (see figure 9 below) because they are convinced the seeds came inside the donated maize seeds. The ‘concern’ weed has since spread to other household farms that did not use the donated seeds due to the communal grazing set-up where animals move freely and transfer weed seeds from one place to another.

Figure 9: A field with "Concern" weed named after the NGO before maturity

Following the challenges with the ‘concern’ weed, many farmers in the area now negatively perceive agricultural development programmes implemented by donors. The advent of ‘concern’ weed led to farmers viewing the CA programme with “suspicion” because of this experience. Most farmers felt that their livelihood had been compromised, which led to a breakdown of trust between the community and donors.

4.3.2.1.1 Farming households' mechanisms used to cope with weeds

The research found that cattle ownership and financial ability to invest in farm implements determine the kind of weeding technique a household uses on their farms in the area. Most farmers use conventional practices because they cannot afford herbicides (see figure 10 below). Most households without draught power use mechanical weed control mechanisms such as hand pulling and hoeing, while those who own cattle use mouldboard ploughs, cultivators and ridgers to control weeds in their fields.

Figure 10: A farmer practising secondary tillage using a pair of oxen and cultivator for weeding in a maize field

Very few farmers (mostly the more resourced) reported that they practise crop rotation as a weed management mechanism rotating mostly maize and legumes (beans, cowpeas, groundnuts). They shared that weed pressure is better as some weeds are suppressed if legumes (beans or cowpeas) follow on a maize portion and vice versa. To achieve this, farmers increase legume seeding rates (beans or cowpeas) relative to recommended rates (see figure 11 below). High-density sowing means crops completely cover the ground and suppress the weeds, blocking sunlight to the ground, and making germination of weeds difficult. The seeds of the weeds then decompose in the soil and die, substantially decreasing. However, the disadvantage of high-density sowing is that yield is compromised if there is not enough basal and ammonium nitrate to apply to the crop.

Figure 11: High density sowing of beans to suppress weeds

4.3.2.2 Lack of draught power

Draught animals provide approximately 80% of the power used for farming in developing countries (Pearson, 1993). Current farming practises revealed that draught animal power is a critical component of farming in crop production in households in Ward 30. The use of draught animals was introduced to overcome farm size imposed by reliance on hand cultivation since each household in the area was allocated 12 acres. However, there is a general shortage and decline in numbers of this power source, which usually results in untimely ploughing and planting, and ultimately reduced crop yields. In some cases, some households no longer own cattle due to several reasons, such as economic hardships (selling cattle to meet financial needs) and death caused by droughts and diseases.

For many households in the ward, livestock, especially cattle, are important contributors to total food production for their role in providing draught power for land preparation. Draught animals remain the most cost-effective power source for small and medium-scale farmers. Households in Ward 30 use trained oxen for ploughing and weeding, whereas those without hire them. The animal-based farming system demands less labour for the entire farming cycle compared to the manual systems. Discussions with households without draught power revealed that they accepted that farming without cattle would never be a success and could not compete with people who had cattle. The reason for this belief amongst them is that conventional farming practices are dominant, and anything outside these practices is not considered the norm. This plough culture as the acceptable farming system in the ward is also enhanced by the government's preferential treatment of farmer with draught power when distributing free input. Mai Razaro shared her dissatisfaction and complained:

> Most of us without draught power are only considered for farming programme free inputs when people with draught power have been allocated what they feel will be enough for the farming season. When you do not have draught power, people around here automatically think you cannot do any meaningful farming and you are considered unproductive[11]. (Mai Razaro, Interview, 17 October 2019).

Most farmers use oxen as the primary source of traction power for primary cultivation and transportation of materials to and from fields. The research found that standard farm implements for households who own draught power consist of a plough, harrow, ridger, cultivator, and scotch cart. Field observation revealed a significant correlation between the size of tilled cultivated land and the number of draught animals owned. Farmers who own more than four draught oxen usually finish tilling their farms, whereas those who had none or less left a large farm area fallow. This lack of draught power has reduced crop yields for these households even though they can produce more crops if draught power is available.

Livestock production also constitutes a very important component of the agricultural economy in the study area, a contribution that goes beyond direct food production to include multipurpose uses such as capital accumulation. As in most rural communal areas, livestock reduces the risks associated with crop production. They also represent liquid assets that can be converted to cash at any time, adding further stability to the production system. Livestock reduced the financial burden on the farmers in the event of crop failures as they could be sold. Furthermore, livestock is closely linked to these households' social and cultural lives, for whom animal ownership ensures varying degrees of sustainable farming and economic stability. Highlighting the

[11] Interview with Mai Razaro, Ward 30, Nyanga District, 17 October 2019.

importance of cattle ownership and how it is linked to farming in the ward, Mai Chiga, whose husband left to get formal employment so that they could rebuild their herd that had died due to a mysterious disease shared:

> We have never seen a field day being held on a field of someone without draught power here. How is that possible? In our culture, farming is using plough. For one to be taken seriously and be considered a Master farmer, you must have tilled your farm properly with a plough. (Mai Chiga, Interview, 26 October 2019.)

Mai Chiga has been a farmer who owned cattle and used them to provide draught power since she was resettled in the area in 1981. She has won farming awards during agricultural shows to showcase the best agricultural products in the ward. However, since she lost all her livestock due to continuous droughts and diseases, she has never been able to produce enough food for her own consumption, nor has she made it onto the nomination list for farmers who compete in the ward agricultural show.

To address the lack or shortage of draught power, farmers make some institutional arrangements to access them through a practice known as ‘share-rearing’ in which livestock owned by one household are reared by a different household. This practice is usually found between friends or close relatives, and the carer is not paid for this task but uses the cattle for draught power. A household without draught power may request to take care of cattle belonging to families or friends with large heads and would, in return, use the livestock to till their land. Share rearing arrangements can also be organised with aged couples who cannot spend the day herding cattle. In some cases, a family where the father lives in the urban area and the family visits during the offseason could also practise share rearing. ‘Share-rearing’ depends on the strength of social capital possessed by a household within the community, and people with many social networks could easily practise ‘share-rearing’ and enjoy the related benefits.

Besides ‘share rearing’, farmers also provide labour on farms doing activities such as helping to plant crops, weeding and harvesting in exchange for draught power. While this is a very popular practice, farmers reported that one of the biggest challenges was that owners prioritised their own fields before sending the draught power to do contract work. In some cases, owners are also reluctant to have their cattle hired and work in their absence. As a result, farmers without draught power ended up planting crops late. The challenge of late planting is reported in the literature by Tattersfield (1982), Phillips *et al*. (1998), and Raes *et al*. (2004), who state that a narrow optimum planting window characterises Southern Africa and yields of crops like maize declined by at least 5% per week through planting delays.

Looking at the crucial role draught power plays in how farming is practised in the ward, one would assume households would make all the effort to own a few of them. However, discussions with farmers revealed that it is expensive for them to purchase their own. While some farmers in other areas use alternative means of draught power, such as donkeys, the research found that not a single farmer in the ward owns or uses donkeys for traction even though they are cheaper to buy. The farmers pointed out that the reason was due to the social meaning attached to their ownership or their use for tilling. Farmers revealed that donkeys were generally perceived as the poor man's oxen, which led to farmers not using them due to the social connotations even though they could help with tilling their fields. VaChiposi, who does not own draught power, shared:

> Have you seen any donkeys around this area? They are not even seen as anything. Using donkeys is not even an option because people will just laugh at me. I would rather work for someone and hire oxen to till my fields.[12] (VaChiposi, Interview, 18 August 2019).

The quote above shows that the lack of draught power not only affects planting time but is widely believed to be a good indicator of farming ability in the ward by many people. In the study area, farmers expressed the importance of 'doing things right', according to the culturally prescribed criteria of the area. Farmers not only plant their crops on time but also gain prestige by articulating socially rewarding practices and using cattle for ploughing.

Due to lack of resources, very few farmers own tractors in the ward, even though discussions with households reveal that many would wish to own one. Gosh (2010) postulates that tractors are known to achieve the greatest savings in terms of time and labour, although with relatively

[12] Interview with VaChiposi, Ward 30, Nyanga District, 18 August 2019

substantial expenses. Only three households own a tractor, and all of them reported that the tractors were bought with the help of their children and not from farming profits. Gosh (2010) argues that owning a tractor as an individual is rarely possible for farmers with small cultivation areas, as tractors are mostly appropriate for large-scale commercial farming.

Even though the ward has three tractors that can be hired for tilling, many households reported affordability as a hindrance to hiring it because it costs US$70 per acre. Farmers who afford to hire a tractor for tilling are mostly those who have formally employed husbands or those who get remittances from their children. My interview with the District Administrator of Nyanga revealed that supporting household farmers through subsidisation is not sustainable due to the constrained public resources. In rare cases where the government offers tractors for households, popular sentiments among households were that the tractors are used for other businesses besides tilling, not serviced, and not adequately fuelled for use.

Findings of the study revealed that a District Development Fund tractor was no longer working as it broke down, and in rare cases when it is working, the demand is too high. Although the study was not exploring the relative profitability of using alternative tilling technologies, households who own draught power highlighted that they find it relatively cheaper to use their own resources than to incur financial costs of hiring a tractor even though it is faster and results in early planting. In conclusion, the absence of or poor functioning political and agricultural institutions in the area, as discussed in this paragraph, has impacted the performance of agriculture.

4.3.3 Political and institutional challenges

In this section, I examine how political and agricultural institutions affect agricultural production in Ward 30. First, I discuss the impact of traditional leadership on land productivity, and in the next section, I discuss how ineffective government inputs distribution schemes affect limited agricultural production in the study area. The last section discusses the challenges of the shortage of extension officers and poor extension services in the area.

4.3.3.1 Impact of chiefs as custodians of the land on productivity

When Zimbabwe adopted its new Constitution in 2013, it recognised the role of traditional leadership, which operates alongside modern state structures. While it seeks to strengthen the role and status of traditional leaders, this new Constitution strictly regulates their conduct as well. Traditional leaders help to deliver government services in most rural parts of the country and sometimes have undue control and influence in these areas.

Historically, traditional leaders are the custodians of the land and other natural resources in their respective jurisdictions. However, legal frameworks around communal land management create a high degree of ambiguity and potential for overlapping roles between traditional and state institutions. While the Communal Lands Act suggests that rural local governments are the custodians of land within their respective jurisdictions, section 18(1) of the Traditional Leaders Act[13] seems to allocate to chiefs some power over the allocation and management of communal land. In practice, traditional leaders allocate and manage land, blurring the competency boundaries with rural local governments. Thus, conflicts and power struggles between traditional and elected structures regarding the allocation and management of communal land are common in the study area.

A close analysis of power dynamics in the ward reveals an acute contestation between government actors and traditional leaders over who has the power to register land rights, allocate and administer land, and resolve land disputes. In practice, such grey areas in land allocation have created rent-seeking opportunities for some traditional leaders who now solicit bribes despite the assured monthly salary they are paid by the government. In some cases, traditional leaders have acted like proxy governments in the ward by allocating land the government would have allocated for co-operatives. This “double allocation” challenge is very common in the ward and has led to rising tensions between the groups allocated the same piece of land. Such incidents lead to the cessation of production in cooperative farms, which also affects productivity and the demonstration of new farming techniques carried out for the benefit of farmers.

[13] Chapter 29:17 Act 25 of 1998

These power struggles between traditional leaders and elected government officials have also impacted the environment due to overcrowding of people and livestock. The area faces a challenge of an influx of illegal settlers who have been allocated pieces of land by the chief with the help of headmen since 2010, even though Ward 30 is a planned resettlement scheme. Visible from the mountain top are scatterings of crude, grass-thatched huts built by these illegal settlers. They do not have proof of ownership or land titles but remain defiant despite several warnings to leave the area from the District Administrator and District Land Committee, who have the power to allocate and manage land.

The farmers are viewed as illegal because Ward 30 was set up as a state-initiated agricultural development programme seeking to modernise smallholder agriculture shortly after independence in 1980 (see Chapter Three on the background of Ward 30). Because there is not enough land, the settlers were allocated pieces of land in grazing areas, which has had a negative cumulative effect on productivity. Draught animals are becoming malnourished as grazing lands have decreased due to land occupation. Thus, many people can no longer plough their fields without the help of these animals. Many farmers are forced to postpone farming at the onset of the rains while waiting for cattle to become stronger and when the soil is less hard, which takes away 'the expected benefits associated with early planting.'

The overcrowding due to the illegal settlers and the number of families resettled in the area from 1980 has increased since new families have nowhere to move, resulting in land degradation. The accelerated land degradation owing to pressure from both humans and livestock is having a telling effect. There is no denying that the immense population pressure arising from its rapid growth has taken its toll on the land. Sometimes cattle tracks or roadways and furrows provide starting points for gullies (see figure 12 below).

Due to pressure on the land in the area, farmers now graze their herd close to their fields, a sign of the shortage of grazing land as opposed to a few years back when they had enough grazing land. Because livestock has a multipurpose role, many households are unwilling to dispose of them, which has led to more livestock, implying overstocking and, therefore, overgrazing. Overgrazing represents a major factor contributing to the deterioration of the land quality, ward and district’s productivity of the grazing areas. Subsequently, high levels of erosion (gully/rill sheet wash) are evident even on gentle slopes and in fairly steeply falling areas draining into the area’s rivers.

Figure 12: Land degradation happening on a footpath for people and livestock

The uncontrolled cutting of trees used for burning bricks has also led to the area experiencing serious runoff during the rainy season leading to further erosion. Empirical observation of the study area shows that the increase in deforestation is due to illegal settling and rising demand for firewood by households since they do not have access to electricity and do not use alternative energy sources. This observation supports findings on the causes of erosion from Kebede *et al.* (2010) in their study of energy use and economic development in sub-Saharan Africa. The current social challenge of illegal settling and poverty contributes to erosion and physical degradation through soil sealing since growing population numbers rely on natural resources for their livelihoods, putting increasing pressure on reduced rangeland areas (Wagner *et al.*, 2015).

In 2016, the permanent secretary in the Ministry of Lands, and Rural Resettlement, Dr Douglas Mombeshora, issued the following statement: “Given the elaborate carefully considered planning undertaken in resettlement areas that considered ecological aspects, such as natural resource management and conservation, as well as issues of viability, the Government will not tolerate illegal settlements that have mushroomed in undesignated areas including grazing and catchment areas of dams and rivers. Any person occupying rural land without an official temporary permit issued by the District Land Committee[14], an offer letter or permission of the Ministry of Lands and Rural Resettlement is deemed an illegal settler." (Herald, 11 October 2016).

Even after this strong warning by a senior government official, discussions with households reveal that corrupt chiefs and headmen continue to be involved in the illegal allocation of land in the area. According to the villagers, the general lack of willingness by the government to attend to this problem is political. To them, the development of economies of patronage has been a major feature from around 2010, closely linked to the transformation of state institutions (institution of traditional leaders) and remaking of ZANU-PF powers (Chigwata, 2016). Control and land allocation have been the source of immense political capital for the ruling ZANU-PF party, as partisan access has been used to win votes in the countryside.

4.3.3.2 Ineffective government inputs distribution schemes

According to Easton & Sommers (2003), the government is expected to carry out programmes that incorporate people's ideas to develop policies that address the needs of the people. Despite numerous policy interventions and programmes meant to address the farmers' challenges in Zimbabwe, the reality is that smallholder farmers still face many problems.

Farmers in the study area lamented that since the turn of the millennium, the government had neglected them compared to their support in the early 80s when they were resettled. In describing the state and farmer relationship dynamics, the District Administrator of the ward revealed that Ward 30 represented a nationalist project in which farmers existed for the state where they were mandated to produce commodities for the country's good, industriously. Paradoxically, many of these households did not mind being state labourers as explained in Chapter 3 on Ward 30 background. Seeds (e.g. cotton, maize and wheat), fertilisers, and pesticides were provided by

[14]The Committee is responsible for the allocation and management of land in resettlement areas. Like the Rural District Development Committee, the District Land Committee draws its membership from representatives of the national government at the district level, officials from the relevant local authority and traditional leaders, among others.

the state, which recovered the costs through a stop order system that made the state the sole market for all crops in which inputs had been advanced.

In the period between 1980 and 1990s when the state was ever-present through the Department of Agriculture and Extension, whose motorised staff reduced risk by providing technical advice on diseases, pest control, and coordinating marketing to the state. With inputs in hand and assured markets for every crop sown under contract through the Grain Marketing Board (GMB), the state provided a lighter yoke to the farmers in the ward. However, the government's role in supporting the farmers has diminished over the years, leaving farmers frustrated and affecting crop production in most poor households that cannot afford inputs. Giving a comparative analysis of government support just after being resettled in the area and the situation after the turn of the millennium, Amai Chikosi explained:

> When we were resettled, we used to get a lot of support from the government in the form of inputs and training from extension officers so that we could sell our grain to GMB, but that has since stopped. We are just on our own and we are left to carry the burden of feeding the nation through GMB on our own. Ever since the government stopped the proper support they used to give us, we just produce for ourselves or even fail to produce enough for our own consumption.[15] (Mai Chikosi, Interview, 28 November 2019).

The farmers appreciated the government's efforts in introducing the Command Agriculture in the 2016-17 growing season - a farming input subsidies program as an intervention programme to increase agricultural productivity (Scoones, 2017). Command farming is a loan that gives farmers seeds and fertiliser, and farmers will take their harvest to the GMB and help farmers be food secure. Agricultural inputs are essential in the production process, and their supply at appropriate prices and locations is vital. However, the command farming programme is a source of frustration for most farmers because the seeds and fertilisers are not distributed on time, resulting in late planting. Even in cases where inputs are distributed late, resulting in poor or no yields, the government will still demand the loan to be repaid in full, forcing farmers to sell their livestock to repay their loans, thus leaving them in worse financial positions. Some farmers end

[15] Interview with Mai Chikosi, Ward 30, Nyanga District, 18 August 2019

up avoiding these programmes as they revealed their opinion in the form of silent resistance. This can be cited as poor strategic planning on the part of the government, leading to silent resistance and a negative attitude on government farming programmes and most farmers abandoning participation.

Another government programme, Operation Maguta, an input scheme run by the Zimbabwe National Army to boost production and food security, launched in 2005, was also not popular among farmers. Farmers pointed to the partisan distribution of inputs, leaving most farmers with no alternative to purchasing inputs. Pazvakavambwa (2009: 3) noted, “There was gross abuse of this scheme resulting in the squeezing out of genuine farmers, secularised input distribution, and the diversion of inputs to the black market by unscrupulous profiteers.” The major challenge of the operation was the selection of beneficiaries for the program, and since the inputs were free, local political leaders would demand a share; hence very few common villagers were taken aboard the program. If one were labelled an opposition activist or a sympathiser, they would not enrol in the program.

Another problem was that the input scheme did not work with existing agriculture extension workers in the ward but relied on soldiers not familiar with the sector. In 2013, the government launched the agriculture Input Support Programme (AISP) for the 2013/14 farming season. AISP intended to distribute the input packs through the GMB. However, it was noted that this became the major challenge as GMB suffered perennial logistical challenges in deliveries resulting in not delivering inputs on time. Farmers also incurred high transport costs to the GMB depots to check on inputs' availability and collect them.

4.3.3.3 Shortage of extension officers and poor extension services

According to Hoddinott & Skoufias (2003), agricultural extension (also known as agricultural advisory services) is crucial in promoting agricultural productivity, increasing food security, improving rural livelihoods, and promoting agriculture as an engine of pro-poor economic growth. The extension approach that the officer in the study uses is the training and visit system. This is a highly decentralised scheme that offers intensive training and follow-ups by the extension worker and makes extension agents' activities more accessible with the idea of increasing agricultural extension services effectiveness. In this approach, the proven agricultural practices, usually from research centres, are translated into packages of innovations that are passed down to farmers through training. The World Bank has aggressively promoted this extension approach (Benor & Baxter, 1984; Howell, 1988).

The study found that the content of most of the training offered by the extension officer to the farmers has not changed, but there has been a repetition of what people were taught about 40 years ago when they were resettled in the area. For example, the training offered placed more emphasis on farm mechanisation, livestock, and cash crops which tend to be a male domain and less focus on food crops which seem to be a women's domain as dictated by culture in the study area. The research also found that extension services offered do not suit the current agricultural farming system challenges such as climate change and its impact on decreasing farm yields which cannot be ignored. Many farmers pointed out that farming has become more difficult due to changes in weather patterns. They needed more extension officers in their area to help them with information on the best ways of farming. Most of the farming decisions taken by farmers are based on past experiences only, whereas, ideally, they would prefer to combine their own experience with advice from experts (extension officers). Discussions with farmers revealed that most farmers lacked an understanding of climate change and how they could adapt. Additionally, the farmer training had also failed to address farmers' needs, such as reducing farm drudgery as most of them are women and the elderly. This is evident as many households still use hand hoes and other mechanical ways of weeding their crops, such as hand pulling, which are both labour and time-intensive.

The current extension worker to farmer ratio of 1:800 also makes it difficult for extension workers to pay attention to individual farmers' needs (The Herald, 22 September 2018). In rare cases, the extension officer only visits the farm once per farming season. The farmers also found it difficult to visit the extension officer due to limited mobility and the long distances they had to travel to attend some agricultural programmes. This is because the training is carried out at designated venues situated far away from farmers' homesteads. The lack of support has had a huge impact on maize yields since the fall armyworm outbreak in 2014, and the extension officer has offered little advice on how farmers can control it.

For an agricultural revolution to succeed, ideally, extension officers should be receptive to farmers' problems, ideas and suggestions which can be incorporated into the extension message and passed on to researchers. Farmers in the ward have different views regarding their relationships with extension officers, but in general, they are seen as not receptive to farmers' ideas, young and inexperienced, and trying to enforce their theory-based learning into farmers' fields where practical actions are often different. For example, the ward extension officers often advised (sometimes putting pressure on) farmers to use maize hybrid seeds or act based on some scientific reasoning. In contrast, farmers prefer using indigenous maize seeds because they are adaptive to the study area environment and guarantee yield compared to hybrid seeds. Some farmers also argued that the introduction of new technologies did not mean they were always effective. However, it is worth noting that the extension officer agrees that sometimes farmers are more knowledgeable; for example, he acknowledged that farmers' knowledge concerning weather conditions was better than his. Based on empirical data from Ward 30, I argue that farmers were also knowledgeable in a range of farming practices, such as management of seeds, pest management diseases and weather forecasting (For more detail see Chapter 5). As such, farmers' expertise gained through rich experiences need to be acknowledged by development practitioners and their promoters.

The research found that the shortage of extension officers and poor extension services hindered CA adoption in the study area. Most farmers abandoned CA in the subsequent years after initially adopting the technology due to frustrations after they could not get enough support and information since CA is a skill-intensive technology. The diffusion of innovations model identifies access to information as the key factor determining adoption decisions (Rogers 2003). This model sees changes as a linear process in which innovations generated by agricultural research are passed down to farmers through extension agents (acting as modes of communication), to farmers who are recipients of the innovation. Looking at the situation in the study area, one can argue that innovations like CA, which is viewed as skill-intensive farming practices, will be difficult to introduce and adopt for most households due to the challenges of extension services. Adopting a new farming practice carries certain risks, and extension workers can help farmers improve their risk management skills. They can help farmers recognise and understand their problems and assist them in making better farm management decisions.

4.4 Chapter summary

The chapter identified and explained the specific challenges confronting rural small farm households, which led to introducing the CA model in Nyanga District, Ward 30. Several factors such as climate change, lack of draught power, soil erosion, land degradation, weeds, political dynamics of the area and soil infertility have a huge impact on farming and subsequently reduce crop yields. The chapter also described strategies to mitigate these farming challenges at the family and societal levels. From discussions with farmers in the ward at different age levels (young and old) and across gender, the chapter identified that almost all of them had acquired knowledge based on continuous engagement in experiential learning within the socio-cultural and natural environment in which they live. This shows that farming practices are acquired through people's lifelong engagement with each other and their environment to maintain and transfer the existing context-based farming practices. Being engaged with the aforementioned ethnographic accounts from Ward 30, one can see that farming practises should be understood as a flexible, practical and context-based phenomenon rather than as bounded and fixed in a certain place (such as schools) or within a particular group of people. Based on the ethnographic material from Ward 30, some farming challenges also led to farmers abandoning the CA programme. Information provided in this chapter also provides building blocks for Chapter Five on conventional and emerging socio-cultural factors guiding farming households to mitigate farming challenges being experienced.

CHAPTER FIVE: CONVENTIONAL AND EMERGING SOCIO-CULTURAL FACTORS GUIDING SMALLHOLDER FARMING

5.1 Introduction

There is mounting pressure on food and agricultural systems in SSA. Throughout the region, smallholder farmers are faced with interrelated challenges of climate change and increasing climate variability, as well as a decline in soil fertility. Concomitantly, rising food prices coupled with increased food demand due to population growth and per capita income growth put increased pressure on domestic production systems (Deininger, 2013; Laurance *et al.*, 2013). Under these conditions, the use of agricultural technologies such as CA is believed to be a strategy for making smallholder farmers economically viable units while at the same time increasing the resilience of rain-fed farming systems to climate variability (Corbeels *et al.*, 2014; Friedrich *et al.*, 2012; Giller *et al.*, 2011; Thierfelder & Wall, 2010; Verhulst *et al.*, 2012). In addition, FAO (2011a) postulates that it is an approach to managing agro-ecosystems for improved and sustained productivity, increased profits and food security while enhancing the resource base and the environment. It is conceptualised as a set of agronomic practices encapsulated in three principles of: (i) no or minimal mechanical soil disturbance; (ii) permanent soil cover or crop residue retention; and (iii) crop diversification or rotation (Haggblade & Tembo, 2003).

However, in Africa numerous barriers have been identified which impede the adoption of sustainable and conservation-oriented agricultural practices among smallholder farmers (Moon & Cocklin, 2011; Rodriguez *et al.*, 2008). A disconnect between CA aspirations and the effective delivery of that farming system at 'ground level' has largely been disappointing because it ignores the specificities of farmers' practical and socio-cultural realities (Kalliny & Hausman, 2007). The most common reason cited is that farmers are not the pure profit maximisers of economic models but are influenced by social norms, cultural beliefs and socio-psychological factors. In addition, the characteristics and attitudes of farmers include an oft-reported reluctance to change (Burton *et al.*, 2008). Farmers tend to be strongly influenced by perceptions of what constitutes 'good farming' amongst their farming peers (Burton, 2004a, 2012; Burton *et al.*, 2008; Rodriguez *et al.*, 2008; Ryan et *al.*, 2003) (Cope *et al.*, 2011; Edwards-Jones, 2006; Rodriguez *et al.*, 2008).

Having discussed the challenges confronting rural small farm households which led to the introduction of the CA model in Chapter Four, this chapter brings out the functions, relevance and roles of the socio-cultural factors in guiding small farm households to navigate some of the challenges in the ward. It will also examine the role socio-cultural factors play in guiding household farming practises and contextualising the corresponding farmers' understanding of their environment but most importantly how that contributed to the lacklustre reception to CA adoption. Contextualisation of socio-cultural factors helps in understanding farmers' decision making rationalities. Branching away from the psychological view, which argues that knowledge is perceived within the learner and his/her preparedness associated with the pre-existing mental structure (Bloor, 1983; Geber, 1977), I will go beyond such debates. I will be drawing on a greater extent of ethnographic accounts of experiential knowledge in terms of how farmers acquire knowledge through interaction with other farmers under a complex set of cultures. This chapter starts with a discussion on farming systems in the ward and how the supernatural and indigenous knowledge guide farming among households. Finally, the chapter summary is presented to overview what the chapter achieved and its contribution to the thesis.

5.2 Farming systems, the supernatural and indigenous knowledge

In rural societies, farming is a social activity that draws on labour from the family, neighbours, and social networks in society. Social norms and principles direct it under the guidance of traditional leaders and spiritual mediums. Relatedly, the performance of agricultural activities is guided by societal rules and certain taboo systems, which are mostly observed without question. Some of these systems have a long heritage and have been passed through generations and are regarded as a central part of people's lives. In vulnerable communities, like Ward 30, agriculture brings about intimate social cooperation among primary and secondary social groups such as families and village communities, which has developed into a strong tradition of community farming. In this section, I discuss the factors guiding farming in the study area. The first section explores the farming system of Ward 30 followed by how farming is run as a social activity at individual household level looking at sources of labour and contracts and then resource pooling at the community level (*Zunde raMambo* and *humwe*) in Ward 30. The next section discusses how farming is believed to be guided by supernatural powers, and the final section looks at the role and place of indigenous knowledge systems in the area.

5.2.1 Farming system

Drawing from life history interviews, agriculture in Ward 30 has been in existence since time immemorial. From the Stone Age era to today's digital era, people have relied on agriculture to meet their basic food needs and gain an income. Mixed farming systems dominate in Ward 30 with most households engaged in crop and livestock production. The main farming system in the ward is the integration of crops and livestock through the use of animal draught power for agricultural activities such as ploughing. The plough is indispensable and is the most common tillage implement used by most farming households in this area. The adoption of the plough is linked to Ameroy Alvord, who introduced the 'modern' plough in Zimbabwe, which then became a major farming tool in the 1930s. According to Wolmer & Scoones (2000), the introduction of the plough was seen as a key event in the evolution of African farming because it was an improvement on the hand hoe that was used by African farmers. Relatedly, ploughing with oxen is seen as a key component of a mixed farm system, and the plough is essential farming equipment for the 'progressive' farmer. It is used for primary and secondary tillage in various field operations, including ploughing, row-marking (for crop establishment), ridging, and weeding. The plough is preferred over hoes as it is faster and enables one to cultivate a larger piece of land in a short space of time.

When the rains come there is no more familiar sight in Ward 30 than draught power pulling a plough on farms. Like their fathers and grandfathers before them, for most households, ploughing remains more or less the same now as it was hundreds of years ago. The role, importance and social status associated with plough ownership in Ward 30 cannot be overstated as the following case illustrates.

Tendai Chiradze and Casper Mugoni used to be the laughingstock of their community in their village. The couple did not have cattle or a plough for tilling and their farming was not fruitful. Because they did not yield much from their crops, they had little money and no food to eat. They had to buy almost all their food, which quickly ate away at what little money they had - combined only about US$15 a month - and left little to nothing for other expenses.

“Our children would go to school, but we were not keen on paying school fees. We were happy when they would be shooed away from school for not paying,” Tendai says. Their attitude toward their children’s educational problems was not due to not caring but rather indicative of how difficult and desperate life was for them and the need for every little bit of help. “We would go with them for piece jobs and work in other people’s fields so that we would hire a pair of draught power and the plough as well.”

But in early 2000, a savings and lending group, locally known as *Kufusa Mari* (Shona term meaning investing money) was introduced in their village which they joined. Group members taught each other how to set financial goals and work toward them. Through the savings group, each member would regularly contribute an agreed-upon amount to the group’s collective savings. If someone needed a loan for an expense, they could make a request to their group, which would approve or deny it. At the end of the savings period in late 2000, all the money the group had saved through the monthly contributions and interest from loans was then divided out amongst the group members in a share-out.

“*Kufusa Mari* managed to empower us as a family,” they said. “Speaking for us, we were empowered because back then, for us to survive, we would rely on other people`s draught power and plough. Every summer when the rains come, we would have to go to work piece jobs in exchange for these. But now, through *Kufusa Mari* savings, we managed to buy our own cattle and the plough as well. We can now farm all our land and also plant in time.”

Today, as you walk around Tendai and Casper’s homestead, the signs of progress are everywhere after they managed to buy the plough and draught power: livestock they have amassed roaming happily, a latrine they built for improved sanitation and hygiene, proper buildings for livestock to keep them warm and healthy, their ox cart, and a four bed-roomed house which they have built from selling produce off their farm.

"Before we had all this, we were nobodies. People would point at us," Casper says. "But now our name is big. We feel delighted, and we feel like we are people amongst other people because we have bought assets. If we had not got draught power and a plough, we would have died of poverty. Even when CA was introduced in this ward, we did not attend a single meeting because we are content with how we are farming and what we are producing in our fields. We are a true testimony that there is no technology or innovation that will come near using a plough and draught power. Ours is a rags to riches story, thanks to the plough. We will never stop using it no matter what". She smiles and says with a sparkle in her eye.

In another case to show that households acquire ploughs for a number of reasons; with the most basic being that it made preparing fields much easier, reducing the labour involved while effectively extending the growing season as it was possible to prepare the land much more quickly. This was explained by VaChipendani in his late 80s who grew up using hoes but bought a plough when he started his own family:

> *VaChipendani*: Once I bought my own plough it was different, it was much easier to use.
> *Brian Mandipaza*: In what way was it different?
> *VaChipendani*: It was different because with a hoe you could only till a small area, while with a plough I work a big field. With a hoe it would take a month to clear the land, but with a plough only a few days.[16] (VaChipendani, Interview, 20 October 2019).

The above cases evoke the extent to which farmers view the importance and role of draught power and the plough, with farming experiences and practises, as some of the core anchors upon which farming is built in Ward 30. Furthermore, the case elicits what farmers view as success in their farming operations and the community. Owning draught power, ploughs and other agricultural implements has allowed the Tendai, Casper and other families in Ward 30 to utilise their land more efficiently, helping them to better cope with food insecurity and improve their livelihoods. In contrast, the use of hoes for farming is viewed as a backward and dated practise.

[16] Interview with VaChipendani, Ward 30, Nyanga District, 20 October 2019

The research found that due to entrenched beliefs and traditions that proper farming happens when one uses draught power and a plough, and how it speeds up farming work impacted on CA uptake negatively. While CA programme promoters encourage using the hand hoe for minimum soil disturbance, most farmers experience with that is that of drudgery. Ploughing is an entrenched tradition that farmers accept unquestioningly. If you questioned any Ward 30 farmer who you found ploughing why he was doing so, he would assume that you were extremely ignorant. Most farming households found the CA programme as a step backward because it did not utilise locally valued farming assets. They had negative comments about CA and ended up abandoning or completely rejecting the innovation. As pointed out in the diffusion theory by Rogers (2003), for an innovation to be successful or to be adopted, it must be compatible with the existing values or culture of potential adopters. In the following case, the CA principle of digging basins using hand hoes was not easy to adopt for some villages because it was not compatible with observed experiences, culture, and values. Even though CA promoters felt that the technology would be suitable for smallholder farmers like those in Ward 30, this finding shows that local experiences contributed and played a huge part in the dreary CA reception observed in the area.

Reliance on family labour also guides the farming system and distinguishes the ward from commercial farming enterprises, which employ wage labour. Family labour is used to meet most of the on-farm labour requirements. However, this feature does not rule out the use of hired labour in periods of labour bottlenecks, nor the sale of their own labour outside the farm on an ad hoc basis. Labour as a resource is also the main input in the production systems of agriculture in the area. Key to the inter-household sub-system is the production relationships between farmers, which enable access to draught power by those not owning animals. These arrangements involve cash, reciprocal labour, lending, payment in kind and other agreements between farmers. Even though these farming labour practises are popular and help in crop production, they have contributed to the abandonment and outright rejection of CA technology for most households (for more detail, see section 5.2.2.3).

Livestock such as goats, sheep and pigs are an integral part of almost all households, with cattle constituting the bulk of domesticated animals. According to Muchena, Piesse, Thirtle &

Townsend (1997), the value of animals in the mixed farming systems of Zimbabwe has been the subject of several investigations since Danckwerts' (1974) pioneering study, which estimated that the subsistence value of cattle was four times their sales value. This is equally true in Ward 30 because cattle contribute draught power, which increases the cultivated area and reduces labour bottlenecks and drudgery; they provide transportation, which can be an important off-season income source; they provide manure, which increases yields and maintains soil fertility; they increase the protein content of diets by providing milk and occasionally meat; lastly, they can be a source of cash income, but may often be sold within the community, rather than for slaughter (McIntire *et al*., 1992).

Livestock feature as living savings can be converted into cash whenever the family needs it, is a security asset influencing access to informal credits and loans and being also a source of collateral for loans. In many rural regions, especially where financial markets are absent or non-existent, livestock stocks or herds are a source of asset accumulation and a measure of prosperity. Livestock stocks or assets can be mobilised at any time, for planned expenditures such as children's school fees and bride wealth, or unplanned expenses such as the illness and death of family members. This livestock asset could be seen as a "bank account" and it is also an important source of family savings that can be used in years of low crop production, reducing income insecurity and household vulnerability The livestock's social functions correspond to the symbolic values associated to each species and the use of animals for the fulfilment of a set of rituals and social obligations of families and communities. Livestock is also used in traditional rituals, ceremonies and festivities and is given as a gift in worship (e.g. installation of ancestral spirits, ritual slaughter and bride wealth).

Over the years, changes in biophysical and socio-economic conditions have led to a shift in cultivated crops and general agricultural production patterns. The individual farming system is driven strongly by social goals, such as ensuring food security, whilst the economic goal (income generation) has become difficult to attain due to the persistent challenge of climate change coupled with the debilitating economic state in the country. Dent, McGregor and Edwards-Jones (1993) noted that smallholder farming systems have always had a high dependence on social aspects of the family and community.

The major food crops grown in the area are maize and groundnuts, while beans and sunflower are the major cash crops. Maize accounts for most of the land under cultivation because it provides the staple food for households. Cotton was once the main cash crop, but discussions with farmers revealed that most have stopped growing it. The major constraints associated with growing cotton are that it is labour intensive, and farmers were experiencing diminishing marginal returns. This has been due to escalating input costs in the face of meagre increases in producer prices. Sunflower is another cash crop widely grown by farmers, although it is largely regarded as a “widow’s crop” in local circles because it is easy to grow and is sold early in the season, providing greatly sought-after cash for immediate needs such as the payment of school fees. However, part of the harvested crop is retained on the farms for use as animal feed, although the quantities are still insignificant. The early harvesting and marketing of the sunflower crop and the financial relief it provides to most households could be the reason for the crop’s limited use as livestock feed. Cowpeas and sweet potatoes constitute the less dominant crops.

Nevertheless, cropping in the area is also practised in contexts where the risk of drought is high due to a late start to the rainy season, mid-season droughts and an early end of the rainy season. Unlike production in the large-scale commercial agricultural sector, local cropping systems are guided by a complex and skilful adaptation to conditions of nature rather than manipulation of the environment. Intercropping maize and a legume is a system of farming that is at the heart of how farming is a time honoured practise in Ward 30. Contrary to Thierfelder *et al*. (2012), who found that farmers in Malawi practise intercropping due to land shortage, labour and draught power shortages and as a response strategy to climate change. The research in Ward 30 found that farmers intercrop for two main reasons. Firstly, the intercropping system improves farm soil - a practise they were taught by the extension officer. Farmers also explained that besides the sweet beans and cowpeas fixing nitrogen in the soil, the leaves of these legumes in intercropping provide a thick canopy that cover up the soil, preserve moisture, and help suppress weeds. Secondly, most farmers intercrop maize with a legume (beans or cowpeas) to reduce labour constraints and lack of draught power, which contributed to CA being rejected because the technology encouraged monocropping when it was introduced. Some farmers do not have the labour to plant crops separately; thus, intercropping allows them to plant two different crops simultaneously.

The dynamics of intercropping as a farming practice and how it led to CA rejection is discussed in detail by one farmer Mai Mazvimbakupa:

> I cannot afford to have different farms with different crops where I can do monocropping, because that means all the farms would need to have basins and mulch first before planting and I do not have enough labour for that. I am now so used to intercropping that when CA was introduced in this ward and the promoters encouraged monocropping I did not even consider adopting the technology. When I consider how intercropping helped me to solve the challenge of labour shortage, how easy and a fast way it is as well, I will not change it for anything. It is like killing two birds with one stone.[17] (Mai Mazvimbakupa, Interview, 23 October 2019).

Explaining how lack of draught power has led her household to practice intercropping and reject CA in the process Mai Runde said:

> All my cattle died when the January disease (theileriosis) swept across this area and now I do not have any draught power to help me till my land. Each year I have to hire from other farmers by working in their fields in exchange for draught power whilst in some cases I pay cash if I have enough money after selling my farm produce. I mostly do intercropping because the money or labour I provide to farmers with draught power will be enough for two acres or three acres at most. Under such circumstances, the best strategy for me is intercropping as it allows me to plant a variety of crops together. For example, I plant maize and beans together while I also intercrop groundnuts and sunflower. This practise has worked well for me and when CA was introduced I could not join because I did not see it as a better option than the practice of intercropping. In fact, considering my situation, I was not

[17] Interview with Mai Mazvimbakupa, Ward 30, Nyanga District, 23 October 2019

going to abandon intercropping that has worked for me all these years while CA was going to need even more from me.[18] (Mai Runde, Interview, 24 October 2019).

In response to observed changes in weather patterns, crop diversification (mostly early maturing) also guides household farmers to minimise risk and maintain crop productivity to ensure food security. Diversification is mainly from four major food crops, namely maize, sunflower (*Helianthus annuus),* beans, cowpeas (*Vigna unguiculata),* sweet potatoes, and groundnuts (*Arachis hypogaea),* while farmers rarely plant cash crops. The decision to plant a variety of crops was after farmers realised that dependence on key crops such as maize only had left them exposed to harvest failures due to threats like drought, insect pests, and diseases. Besides being a staple crop, the advantage of maize reported by farmers was that in the years when weather patterns were not as unpredictable, it was the least labour intensive crop to process. The system of different crops has advantages; for example, sunflower is grown due to its higher tolerance for lower rainfall.

Crop diversification has been a huge success for the farmers because they use traditional varieties such as sweet potatoes, and pumpkins which they have nurtured for generations. Every household's priority is to ensure the long-term preservation of crop seed biodiversity every time they harvest so that there is enough seed for the coming season to enable diversification. During field observation, I also observed that the relative importance of each of these crops to the farmers is seen from the proportion of land allocated. For most households, much of the land is allocated to planting maize crops because it provides the staple, followed by beans, groundnuts, sunflower, and sweet potatoes.

Discussions with farmers found out that in-as-much as the farming practise of crop diversification is a popular climate change response strategy, it was an impediment to CA adoption among some households. The various crop varieties that farmers are supposed to plant using basins as recommended by CA technology made it a misfit – as shown in the following quotes:

[18] Interview with Mai Runde, Ward 30, Nyanga District, 24 October 2019

I could not fully embrace CA technology because I could not imagine having to dig basins for groundnuts, sunflower, beans, cow peas and maize as recommended by the promoters. My challenge is on how to manage that since labour is a challenge and even if I were to consider hiring people for *maricho* I do not have the resources to pay those part time labourers. For that reason, I just found that the way I do my farming and what CA technology requires one to do was not compatible and I had to reject the technology.[19] (Mai Chidziva, Interview, 27 October 2019).

Mai Mebho was even more explicit:

CA technology and crop diversification in a rural set up is never going to work. Who has the energy and time to have at least four plots where you are supposed to dig basins as if there is nothing to occupy us during our off season? We just listened to the promoters talking and we left everything that they were saying right where we held the meeting.[20] (Mai Mebho, Interview, 28 October 2019).

As seen in the above excerpts, intercropping and crop diversification farming practises are regarded as the best way of farming by most farming households as climate change response strategies and are now ingrained into how they feel farming ought to be done. For most of these farmers, the introduction of CA was a misfit because it clashed with established systems of farming and did not offer better comparative advantages. In fact, it was viewed with suspicion because farmers now have a system that has worked for them over the years and are not willing to give that up for something new. The reluctance to try a new technology such as CA because of the belief in a farming practise that has been done for generations led to the lacklustre reception to the programme in Ward 30. As highlighted in Chapter 2, DoI theory, Rogers (2003) identified several characteristic determinants that render an innovation more or less apt for easy adoption in his diffusion theory. One of the perceived attributes is comparative advantage: the degree to which an innovation (CA) is perceived better than the idea it supersedes (intercropping). This

[19] Interview with Mai Chidziva, Ward 30, Nyanga District, 27 October 2019.
[20] Interview with Mai Mebho, Ward 30, Nyanga District, 28 October 2019.

finding reveals that CA is perceived as not having significant advantages over intercropping which addresses labour bottlenecks and draught power challenges.

As seen above, agricultural production in the ward faces several unpredictable risks. Intercropping and crop diversification are some of the practises that guide farmers to manage risks due to changes in weather patterns. According to Rao & Willey (1980), Powell *et al.* (2012), and Sileshi *et al.* (2012), farmers aim at yield stability under risky climatic conditions. More diversified cropping systems may also compensate for crop loss of one species, thus increasing overall system productivity (Rusinamhodzi *et al.,* 2012). Therefore, the risk of total crop failure in multi-cropping systems is lower than in sole cropping systems. As pointed out in the theory discussed in Chapter 2, risk aversion is an integral part of the decision-making processes in farming, especially in developing countries (Keil & Nielsen, 2012). The farmers in Ward 30 are averse to risk when looking at farming decisions and the choice of crops. This tallies with the risk-averse theory, which argues that smallholder farmers display risk aversion behaviour in their decision making (Moscardi & de Janvry, 1977; Binswanger & Sillers, 1983) out of necessity as they have to secure their household needs from their current production or be food insecure.

5.2.2 Trends in land preparation and cropping practices

As climate-induced extreme events, such as drought, increasing temperatures, and mid-dry season continue to enervate people's livelihood strategies in the study area, it has become urgent to devise innovative, resilience enhancing and practical ways to deal with these events and their associated impacts. There are two main practises guiding farmers in preparing land for agricultural production. The land is ploughed in winter, or a single ploughing operation followed by planting is done after the first effective rains.

A farming practise guiding most farmers in Ward 30, especially those with draught power when doing land preparation, is ‘winter ploughing’ as a form of risk management. This is tilling of the fields immediately after harvesting is finished or, at the latest, immediately after the end of the rains between May and July before the hot September-October tropical sun dries up the ground. Essentially, farmers deep plough their lands while still moist; trying to plough most lands, especially the predominantly sandy soils, is difficult after August since they will have formed a hardpan. However, those with red clay soils can still plough, although the result is often many big clods that need to be broken further with a roller.

There are three major advantages to 'winter ploughing'. Firstly, it helps to reduce weeds, especially couch grass (*tsangadzi, uqethu*) dominant in the area where long creeping roots are exposed to the sun by tilling. Secondly, it also destroys pests such as maize stalk borers in their pupal stage by exposing them to the sun. Thirdly, it loosens the soil, making it more porous so that rainwater can percolate instead of flowing away superficially and being lost to crop roots and plants.

Winter ploughing also enables farmers to efficiently move in and plant with minimum tillage operations when the rains come. The seed is drilled by hand within furrows opened up by ox-drawn ploughs. Another advantage of winter ploughing is that cattle used for ploughing will still be strong to pull the plough since pastures will be in abundance at that time, unlike ploughing after the first rains when the ox is weak due to overwork. Additionally, the cost of inputs, especially inorganic fertilisers, has led to farmers reviving winter ploughing because it buries weeds and other vegetable matter under the soil where they decay and enrich the field as manure. Weeds that the plough cannot cover can be harrowed away and turned into compost manure.

Even though the practise of winter ploughing brings a lot of advantages such as spreading labour, controlling weeds and destroying pests, the research found that there was tension between the practise and CA technology adoption in Ward 30 as the following case illustrates. VaChihombori is well known in Ward 30 as a successful lead/Master farmer (locally known as '*hurudza*'). His household always makes sure that they keep eight strong beasts to pull the plough. He uses four beasts (two spans) to pull the plough. As soon as he finishes harvesting VaChihombori embarks on winter ploughing the whole field, changing his spans, as part of land preparation. When the CA promoters came to introduce the farming technology, VaChihombori had already finished doing winter plough on his farm. He really wanted to be part of the CA programme but when the promoters and ward extension officer found that his whole field was ploughed, they could not give him the free inputs. They argued that he would not be allowed to join the CA programme because it was already impossible to follow the principle of minimum soil disturbance since the whole field had been ploughed. VaChihombori felt that he had been unfairly treated since he was one of the lead farmers in the area and could have helped promote the programme by producing a bumper harvest. Out of anger, he swore to never join the programme and continue with winter ploughing which has worked for him and his family for all these years.

An emerging practise that guides farmers in the study area is phased or staggered planting, which helps spread risk and the demand for labour and harvests over several months. The first phase is 'dry soil planting', locally known as *kupandira,* which is mostly done towards the end of October. With the challenge of inconsistent rains, waiting for the onset of rainfall is not an adequate strategy. Dry seed planting is a practice when the soil has insufficient moisture to trigger germination at the time of sowing. The dry planting method is regarded as an emerging practise of adapting to low rainfall conditions caused by climate change, and it increases the chances of harvesting. Farmers seed the crop into dry soil a few days before the expected start of the rainy season. The advantage of this practise is that seeds are already in the soil when the rainfall starts and can immediately start to germinate. This is especially important because the rainy season is no longer enough to provide adequate moisture during the whole cropping cycle in the ward. Most farmers who do dry planting start with maize, the staple food which provides food security. The research found that farmers mostly use a traditional maize seed known as *njeke* or *shimanyika* because it is readily available and can withstand harsh conditions even in times of inconsistent rainfall. VaMandangu, who has been practising dry farming since he was a young boy, living in his father's compound, explained:

> I mostly practise dry planting with traditional maize seeds because they will be readily available and even if they do not germinate, I can replant unlike hybrid seeds which I have to purchase. I usually start my farming early by planting my seeds before the rains and when the rains start, the seeds are already in the ground and can germinate. If the rains end earlier than anticipated my maize crop will already be at maturity stage and will not be affected by the January dry spells. That way, I am always guaranteed a harvest since these crops are drought resistant.[21] (Mai Mandangu, Interview, 21 October 2019).

[21] Interview with VaMandangu, Ward 30, Nyanga District, 21 October 2019.

The adaptation strategy highlighted in the interview above is not new for farmers in rural areas. Akinnagbe & Irohibe (2014) reported that in Tanzania, to avoid crop production risks due to rainfall variability and drought, staggered planting into dry soil before the onset of rains is very common for many farmers. For example, according to Liwenga (2008), in Mvumi, Tanzania, planting activities are normally carried out some two to three weeks before the expected time for the onset of the rains. Nevertheless, despite the advantage of a faster start, planting into dry soil also poses the risk that germination is initiated by a precipitation event that is not the start of a rainy season. In this situation, the crop can start to germinate but then die during subsequent drying of the soil and seedling. In other situations, there is also a risk that if the seed stays for a long period in the soil without sufficient moisture to trigger germination, high temperatures can cause loss of vigour, or it can be damaged or eaten by insects or other animals (Cooper *et al.*, 2008; Benin *et al.*, 2016).

The second phase guiding farmers in Ward 30 is the early planting window where they target to plant their crops when the first rains fall, which is mostly the first and second week of November. This ensures maximum use of intermittent rains, and crops such as maize, groundnuts and sunflower are mostly planted during this period. The 'normal' planting phase is done mid-November to mid-December, and this is when the majority of farmers plant their crops such as maize, cowpeas, and beans. Most farmers who would have missed planting maize in the preceding period mentioned above use this opportunity but mostly use a variety that matures early. 'Late' planting is done after mid-December to any time into the new year.

Nevertheless, despite the high values of initial soil moisture that allow for immediate germination associated with late planting, this period fails to provide an adequate amount of rainfall during the vegetative stages and especially during the reproductive stages of maize development, which occur towards the end of the rainy season. The research found that crops such as sweet potatoes are mostly planted after January to bring diversity to the ward because they do not grow big leaves or branches like stems. This means it does not require more nutrients, food, water and sunlight for survival.

CA proponents and promoters recommend planting to begin as soon as the first effective rains are recorded. Early planting is critical in light of the documented yield decline of about 1% for every day of delay in crop establishment (FAO 2006; Baudron *et al*., 2015). However, even though studies have shown advantages of early planting, the research found that farmers in the Ward 30 were reluctant to plant most of their crops with the first effective rains leading to the lukewarm CA adoption. A combination of trust in their indigenous seeds that have adapted to the local conditions (see section 5.4.1) and prior experience has taught them to stagger planting. This helps them spread the risk posed by climate change - an adaptation strategy that has worked for many years. The following case brings out how staggering in planting as a farming practise contributed to the abandonment of CA adoption in the ward:

Village twelve is a popular village in Ward 30 known for coming together during *humwe* when it comes to farming. The households work as a group when they do early, normal and late planting. When the CA programme was introduced in 2010, they helped each other to dig basins during the off season and followed all the recommendations from the CA promoters such as early planting, which led to a bumper harvest for most households. In the second year of adoption, 2011/2012 season, Mai Guriro, did not have money to buy CA inputs, thus abandoning and pulling out of the village CA *humwe* practise. After abandoning CA she went back to conventional farming practices and staggered her planting and also used some traditional seed varieties. The 2011/12 season had inconsistent rains and one of the driest in the living memories of most farmers. Most crops of household farmers who had followed recommendations and principles of CA such as planting with early rains were affected by the persistent dry spells that followed soon after planting. In contrast, Mai Guriro who staggered her planting and had crops from normal and late planting, she had a good harvest that year because the rainfall distribution was better during the second part of the season. She was the only person in the village who had enough to feed her family and surplus to sell to the GMB. Households who had done CA as a farming practise only had enough for their families and for the first time most of them did not have surplus to sell and in the process could not get any income from farming to purchase inputs for the following season. In the 2012/13 season, all the farming households in village twelve abandoned CA and reverted to the conventional farming practises of using indigenous seed varieties and staggering of planting they have known for many years and that was how the CA programme ended in the village.

Weeding is done using an ox-drawn plough with the mouldboard removed, an ox-drawn cultivator, or by hand. The actual task is carried out as soon as weeds emerge or when weeds start to be a menace. The frequency depends on the type of crop. This frequency is as low as once in maize, regarded as a weed tolerant crop, and as high as five to six times in cotton and sunflower. Household farming systems also portray a varied use of both organic and inorganic fertilisers. Kraal manure is the most important organic fertiliser used. The manure is dug out of the pens and left to decompose further for some time. The manure is then either broadcast or applied in rows, depending on the availability of supplies. A wide range of application rates have been observed, ranging from 5 to 30 ton/ha for the maize crop (Goto, 1995). Inorganic fertiliser is mainly applied to maize and beans. Basal fertiliser is used in some areas, and the application method is either at planting or after emergence. Compounds D is used as a basal application for most crops, but where manure is used, the farmers do not apply basal fertiliser, while AN is mainly used for top dressing crops. The risk posed by erratic rains, critical shortages of cash and labour bottlenecks are factors that militate against more moderate and recommended fertiliser applications by farmers in the district. Inorganic fertilisers are also not economically priced to the sale value of most crops.

In the analysis of the trends in land preparation and crop practises above, the main lesson one can draw from this is knowledge of when and how much rainfall or rainfall distribution an area will face will not result in farmers changing their agricultural practises in response to the predicted climate anomaly. This is despite rainfall being recognised as the most important climate parameter affecting smallholder farmers yields (Vogel, 2005) under rain-fed agriculture. The study showed that not even the late onset of rainfall or knowledge of increased risks involved in maize production is enough to change farmers from using the plough for tilling and the maize dominance culture. One way to explain it is that farming practises are not isolated from the rest of the society's culture and cannot be treated as a purely technical subject. They influence and are influenced by other aspects such as food preferences and family relationships, among other factors.

5.2.2.1 Individual farming households labour arrangements

According to the International Labour Organization (2017), the agricultural sector employs an average of 54% of the working population in Africa. The organisation of crop production varies amongst different households but is organised around family farming, relatives and neighbour labour mobilisation, several types of sharecropping, community resource pooling, labour tenancies, and hired wage labour. The types of conventional farming labour practices guiding agricultural production in the study area can be broadly classified into three categories: family labour, hired labour, and resource pooling.

Labour is a critical component for farming, and family labour is an important source of the workforce in Ward 30. Most of the farm production is done manually because farm mechanisation is virtually nonexistent and, having access to necessary labour for agricultural production directly affects the levels of household farm productivity and income. Additionally, labour is also used in off-farm economic activities, thus providing additional income to the household.

Family labour is based on kinship ties, and it is the traditional backbone for many farmers. The labour is drawn from the nuclear family and sometimes extended family relatives co-opted to increase the labour supplies (Moyo *et al.*, 2009). It also includes young children who are allocated tasks such as planting and herding livestock, as the following case illustrates. VaChikomo's livelihood relies on farming only and he has 11 children from one wife who provides most of the farm's labour. VaChikomo is a traditional man whose way of thinking has shaped his view on the roles played by his wife and children in his household. He argues that people must have as many children as they can to help in providing labour on the farm. His household rarely uses hired labour or do labour exchanges because his children do all the farm work from ploughing, planting seeds, weeding, and harvesting. His farming activities are always done on time because labour is always readily available compared to other households who have to wait for hired labour. Some people prioritise their fields first before availing themselves as hired labour.

The importance of family labour in farm work for agricultural production also implies that the availability of family labour is a prerequisite for a household to increase farm size or finish ploughing all their twelve acres. This is evident at the Chikomo household as they have never failed to plough and plant all the twelve acres (allocated for every household) since he was resettled in the area. Not only has he always managed his farm well, but he has also increased his farm size to eighteen acres because of readily available labour from the family. In contrast, households with small numbers of family members find it difficult to finish tilling and planting their farms due to lack of labour and lack of resources to hire seasonal or task-contracted labour.

Despite somewhat large families in the study area, available and effective family labour remains a constraint to farm production in most households. Labour shortages have long been established as the most limiting factor in smallholder agricultural production (Ruthernberg, 1980). In cases where a farmer has inadequate family labour to complete the farm tasks, hired labour is used. There are two types of farm tasks in which hired labour is most usually used in the study area. First is when the farm tasks require physical strength, such as land preparation, weeding and harvesting. However, it is worth mentioning that the research found that hired labour is frequently sought by households who get remittances or by wealthy households with enough capital to pay for the labour. Secondly, hired labour is also used by labour-deficient farmers such as those headed by a female or older person who cannot fulfil physically demanding tasks such as ploughing. Wage labourers are hired on a seasonal basis during critical labour bottlenecks, such as land preparation, planting, weeding and harvesting times.

Different household farms, crops and seasons have different labour requirements in the study area. Even though most families in the study area have adequate labour within the family to cover day-to-day operations, peak periods of labour demand - especially farming activities such as land preparation, sowing, transplanting, weeding, harvesting and threshing - necessitate getting additional help. Hired labour is mostly used for crop weeding and harvesting, while most of the tasks including land preparation, planting, fertilisation and crop scouting are performed by the family. There are two types of hired labour to address these labour challenges, and they guide farm labour arrangements in the study area, namely seasonal labour and task-contracted casual labour. There is a distinct difference between task-contracted labour and seasonal labour. First, the duration of work in task-contracted labour is much shorter, casual/piece work and typically less than a week, but occasionally a few weeks longer than that of seasonal labour. Second, labourers are recruited from within the village or nearby villages. The most common form of hired labour amongst the households in the ward is task-contracted labour known as *maricho* in the study area. Below is a discussion of how farmers hire labour to supplement their family labour.

Task-contracted labour

Maricho involves hiring labour to carry out a specific task over a short period, usually over a day for which a given wage rate is paid. The wage rates received for *maricho* in the ward since 2010 ranged from US$3 to US$5 per day. In 2009, between US$1.00 and US$1.50 was paid per day for piecework. The daily wage rates are differentiated based on the kind of tasks performed and the crops involved. Energy demanding tasks such as weeding, for instance, command higher wage rates of US$5 per day in comparison to less demanding tasks such as planting, which attracts US$3 per day. As the following case illustrates, the farm wages earned by some labourers from labour sales are reinvested in family food production. Mukoma Tinei is a farmer who works as a part-time tractor driver for an elderly couple whose children had bought their parents a tractor for ploughing. Mukoma Tinei uses the money he earns from wages as a tractor driver to buy inputs such as seeds and fertiliser for his own farming activities, and if there is extra, he hires pieceworkers to assist his family.

One variant of *maricho* is task-based or *mugwazo,* in which the wage rate is tied to completing a certain task such as weeding a particular land area or several crop lines. *Mugwazo* in Ward 30 is standardised for the different farm tasks. For instance, the *mugwazo* for weeding across all the crops is the completion of 20 crop lines, whilst that for threshing maize is processing 400 kg of grain. The second variant is time-rated *maricho,* which involves working for a specific amount of time, usually an eight-hour workday. The time-rated farmers consider their tasks to be sensitive and more difficult to monitor than *mugwazo*. For example, the use of piece rates in planting maize and fertiliser application can result in workers not applying all the seed into the holes and fertiliser to all the crops to complete their tasks in the shortest possible time. Women are preferred for tasks that were considered to require ‘care’ and ‘patience’, such as planting maize seed, while men are used in more arduous tasks such as de-stumping fields.

The research found that most households with crop surplus, especially beans, maize or groundnuts, use task-contracted casual labour extensively for farm work and pay the labourers with crops. A Master farmer VaChimbo, for example, uses task-contracted casual labour for his maize and beans farms for one week and pays the labourers one bucket of maize (about 16 kgs) per day. Since the season of high demand for task-contracted labour (October to March) coincides with the time when poorer households exhaust their maize stocks, these labour arrangements provide an important opportunity for households to survive during the lean period. However, the study found that in cases of drought or long dry spells that lead to a production failure, demand for task-contracted labour will considerably decrease because of the farmers' general lack of working capital. Therefore, the task-contract labour is an unreliable income source for the poorer segment of the rural population.

Englund (1999) and Devereux (1999) rightly argued that task-contracted labour is neither an arrangement of wealth-sharing nor an informal transfer between the rich and the poor. Rewards are paid as returns on the labour provided based on a commercial exchange. On the other hand, it is also true that villagers share the feeling of moral obligation whereby wealthy farmers should provide other villagers with opportunities to engage in task-contracted labour. Thus, the labour arrangement conveys the image of both an economic contract and a social obligation (Whiteside, 2000; Ellis *et al.*, 2003; Bryceson, 2006).

The research found that even though task-contracted labour is popular in the study area, there is a correlation between the amount of time spent providing casual labour, own-farm production and CA abandonment. CA households who provided task-contracted labour could not balance the time required on their CA plots, which needed timely weeding, continual attention, and time spent carrying out *maricho*. Rogers (2003) identified several characteristic determinants that render an innovation more or less apt for easy adoption in his diffusion theory. One of the perceived attributes is comparative advantage: the degree to which an innovation (CA) is perceived better than the idea it supersedes (task-contracted labour). This finding reveals that task-contracted labourers perceived CA as not having significant advantages over their immediate needs during a lean period. This finding is in tandem with the work of Whiteside (2000), who pointed out that the need to engage in task-contracted labour to obtain an immediate supply of food may mean less labour input for own-farms in a less timely manner during this critical farming period. This may result in a smaller harvest and lock some households into a vicious cycle of food insecurity. For this reason, Devereux suggested that task-contracted labour can be an erosive survival strategy when farmers neglect their own farming activities (Devereux, 1999). Although CA proponents argue that the technology is suitable for areas like Ward 30, this finding shows that the local farming practise of task-contracted labour arrangements contributed to the lacklustre reception of CA in the area.

Seasonal labour

Apart from the task-contracted labour, households also rely on seasonal labour arrangements. The rainy season in Ward 30 sees many seasonal labour contracts where labourers are employed for several months. Farmers in the ward also recruit relatives (extended family) to work as paid or unpaid labour. This kind of arrangement occurs with relatives staying either permanently or temporarily with them during the rainy season. The relatives recruited in this arrangement mostly come from poor socio-economic backgrounds.

Seasonal labourers predominantly come from other villages, and in some cases, kin-relation is found between the employer and labourer. More often, these contracts are only for one season and the labourer leaves the household when their contract expires and rarely returns to the same employer in the next season. Seasonal labourers are used for a specific crop, mostly cash crops, as well as for any farm task, depending on the agreement made between the employer and labourer. The farmer makes all farm management decisions, and the work of the labourers is closely monitored and supervised.

The seasonal labourers receive their payments either in cash or share cropping (see next section). Wages are also paid in kind in the form of daily food, and some employers provide accommodation for the labourers if they are not from the surrounding area. Payment in cash is made every month or once at the end of the contract after harvest, but the amount to be paid is agreed upon at the beginning of the contract. In some cases, maize or cash agreed upon in the contract is received in advance, depending on the trust between the two parties. In such a scenario, theoretically, the farmer bears the risks of product failure and decline in the product price. Therefore, the seasonal labour contracts practised in the study area can be regarded as contracts containing a risk-sharing characteristic of share contracts. However, the study found that in many cases, contracts are renegotiated to enable farmers to share the risks with the labourers according to production level, as the following case below illustrates:

Mbuya Chipendo, an elderly widow aged 70 years, used a seasonal labourer between October and April 2019/2020 and provided food and accommodation. She and the labourer agreed in advance that ten bags of maize would be paid to the labourer after harvesting. However, due to the erratic rain experienced last season, Mbuya Chipendo’s maize harvest from her farm was much less than expected. Mbuya Chipendo renegotiated the agreement with her labourer and paid him seven bags of maize.

This characteristic of some seasonal labour contracts provides merits to both the farmer and labourer in the context of Ward 30. For farmers, it provides a means of risk-sharing in highly uncertain conditions of agricultural productivity, which is affected by climate change. For example, the national production of maize in 2005 was less than 1.3 million tons due to unfavourable weather, while that in 2007 reached 3.4 million tons (GoZ, 2009). Under these situations, the risk-sharing arrangement with labourers in a seasonal labour contract can help ameliorate the employer's income shock.

The research also found that some seasonal labour contracts are breached. This usually comes from the unequal power relation between the farmer and labourer and represents a clear disadvantage for the latter. In the cases above, the amount of bags of maize at the end of the contract is renegotiated according to the production level. This arrangement is similar to that of a share contract because the employer and labourer share the risk of production. In a typical share contract practised elsewhere in developing countries, employers and labourers receive less income when the production level is low, thus sharing the production risk.

The research also found that seasonal farming labour is mostly mobilised around kinship networks in the study area. Households reported that they brought in their relatives to stay with them to perform seasonal labour because offering employment to relatives is sometimes used to avoid high farm wages, and payment can be made irregularly if money is unavailable. This reason is that relatives are believed to be more understanding of one's financial difficulties compared to a stranger.

Employing relatives is highlighted by the local saying '*chawawana idya nehama mutorwa ane hanganwa*', which loosely translated means it is best to share with your kinsmen rather than strangers because they easily forget what you would have done for them. This is exemplified by the case of VaMutigwa's household, where the uncle employed his orphaned, teenage school dropout, nephew. The boy`s siblings are too young, which meant he had to get a seasonal job to supplement his income to allow him to meet his family's needs. The young boy alternated his payment methods between wages and maize or beans for food throughout his stay at the farm. Besides the supposed flexibility in payment that comes with hiring relatives as seasonal labourers, farmers also pointed out that relatives are trustworthy and would help watch over other workers. This, in turn, curtails thefts of farm produce. Consequently, they are also given preferential tasks that require trust. For instance, one of the younger nephews is responsible for running the informal butchery and the grinding mill when the farmer is not on the farm. The other workers might not declare all the money collected from these activities if he is not there.

Rogers (2003), in his theory, argues that innovation must be compatible with the existing values, past experience, and needs of potential adopters. The more compatible the innovation is, the higher the chances of adoption. Similar to task-contracted labour, the research found that though seasonal labour arrangements are popular in the study area, they were one of the main reasons for the total rejection of CA due to incompatibility. The amount of time spent away from one's field providing seasonal labour meant the labourers could not consider CA programme uptake as it required farmers to be continually present. The need to engage in seasonal labour to obtain wages or immediate food supply meant no labour input for their own farms, leading to total rejection of the CA programme. Even though CA proponents argue that the technology is suitable for smallholder farmers, this finding shows that the local farming practise of seasonal labour arrangements in Ward 30 contributed to the poor reception of CA seen in the area.

Sharecropping labour arrangements

Labour for crop production is also organised and guided through sharecropping and labour tenancy arrangements in Ward 30. The sharecropping arrangement is popular among cash strapped households because it minimises cash outlays to pay wages and enables access to scarce food and cash crop production resources. The first type of sharecropping involves neighbours or extended family relatives who provide farm labour to a farmer without receiving a monetary wage but are given a share of the produce. The farmer provides agricultural inputs, as well as accommodation and food for the relatives. This is illustrated by VaChirongo's case, whose farm had beans and maize grown on four and eight acres of land, respectively. He hired two of his nephews to augment his nuclear family labour (wife, two adult sons and a daughter) and had this to say:

> We can't afford to pay them a monthly wage. We agreed to stay together and eat the same food. At the end of the season, depending on the maize and beans, we give them a share of the crop which they shared amongst themselves (my three children and two nephews). In the 2018/19 season, we harvested sixty bags of maize and twenty bags of beans and I gave them twenty bags of maize and eight of beans which l sold on their behalf and gave them the money. They use this money for their personal requirements such as clothing, as I provide them with food.[22] (Interview. Vachirongo, 05 July 2019)

The second type of sharecropping involves resource-poor farmers who cannot farm all their land and therefore opt to lease out a portion of their farm in return for a share of the crop on a seasonal basis. The landlord (farmer) only provides the land, while the agricultural inputs and farm labour are supplied by the lessee (tenant). The sharing of output is either predefined by the two parties or at the discretion of the lessee. Acceptance constitutes a verbal agreement to the contract, locally known as *jendiremeni kondirakiti* (gentleman's contract). These contracts are not memorialised or witnessed and are not accompanied by any formalities. From all the

[22] Interview with VaChirongo, Ward 30, Nyanga District, 05 July 2019

household farmers in the villages that I held an informal discussion with who have a farmer-tenant contract, the contracts were unwritten but dependent on the sanctions of communal relationships rather than the formal force of law.

One such case of sharecropping was agreed upon between Sekuru naMbuya Mukwe (landlord), an elderly couple who have scaled-down their agricultural operations due to old age and VaJangano (tenant). The elderly couple insisted on receiving a quarter of the harvest without contributing anything except their farm for the 2018/19 season. They tasked the tenant to grow maize on two acres, which provides a staple diet, and another acre of beans for them. They then left the other nine acres to the tenant. This arrangement earned them twenty-two bags of maize and five bags of beans.

My discussions between Sekuru naMbuya Mukwe and VaJangano revealed that they both preferred a long contract because it allows farm improvements for the old couple who are the landlord. The longer the contract, the more likely the tenant invests on the land. For the VaJangano, it reduced transaction costs and brought a sense of security. While doing field observations, I found that some of the investments and improvements Sekuru naMbuya Mukwe put on their rented farm included manure that boosted soil fertility and enhanced farm security using barbed wire fences to control livestock. A look at the findings of sharecropping arrangements shows that it is a farming practise that is organised to navigate risk in farming. Under the theory of risk-averse households, one of the most important factors mostly considered by especially poor resourced households when making a decision is risk. Newbery (1977) highlighted the subjective and anthropologic nature of decision-making by acknowledging the risk-sharing value of sharecropping in agriculture. Farmers in this instance preferred the security of a partnership arrangement even though it may have meant sharing profit with others and earning less. Apart from family labour, households also use shared labour arrangements and pool resources together locally, known as *humwe* and *Zunde raMambo,* as discussed below.

5.2.2.3 Community shared farming labour arrangements

Shared labour systems can meet high labour requirements but also have considerable community benefits. Shared labour in some parts of Zimbabwe has proven to be highly popular, with substantial social capital and knowledge sharing benefits. Farmers are engaged in work-sharing arrangements in which labour was pooled for purposes of helping labour-constrained counterparts meet their labour needs during critical farming periods. It has been a critical benefit for extremely vulnerable households, particularly the elderly and chronically sick. This section looks at how farming is done at the community level using the systems of resource pooling - *humwe* and *Zunde raMambo*.

Description of *humwe* farming practice

There is a general agreement among scholars that *humwe* has been in existence in rural communities for centuries, dating back to at least the 1800s (Bhila, 1982, Kajese, 1987; Munyuki-Hungwe, 2011). *Humwe* is a work party through which community members provide extra labour to help each other in farming activities (Bhila, 1982; Shutt, 2002; Anderson, 2002; Manona, 2005). Manona (2005) emphasises this notion and posits that *humwe* is an organised labour party that occurs through a reciprocity relationship within a community. The practise is mostly done for agricultural activities, including carrying manure, land preparation, planting, weeding, harvesting, threshing, and winnowing.

Besides agriculture, *humwe* is used to achieve other development initiatives like building houses, construction or maintenance of cattle dips and water projects in communities in the ward. Furthermore, the practise is an occasion for community members to share knowledge, skills, and experiences on farming and socio-economic issues at the individual, household, community, or national levels. This practise still exists in some parts of Zimbabwe as a community-based development practise since it is anchored on community culture and socio-moral values. Additionally, households and communities continue to benefit from the practise in diverse social, economic, and spiritual perspectives (Madziva, 2011; Mararike, 1999).

Purpose and principles of the *humwe* practice

Humwe works as a platform that helps uphold socio-cultural values in the ward as it enables socialisation, transfer of knowledge and skills among farming households. From the discussions I had with community elders and village headmen, *humwe* has four apparent characteristics. Firstly, it is ward or village driven; secondly, it is built around the ward socio-cultural values and norms; thirdly, it promotes solidarity and peace in the village or ward through enabling interactions among people and lastly, it is specific because it addresses needs at household level in a village.

Discussions with farmers revealed that *humwe* is practised on a rotational basis as village members help each other achieve farming results. The rotation system of the *humwe* practise is mostly done by people who live in the same village, have known each other well for some time and are bound by common cultural views. This signifies that *humwe* is associated with fairness in the way it is practised among village members. This, they explained, helped to rebuild social capital, reciprocity, and altruism. One case of altruism was when a master farmer, vaRwodzi, offered his scotch-cart free of charge to vaChipendo during *humwe* to carry their farm produce when they were harvesting during the 2019/20 season. This shows that *humwe* occurs through a shared reciprocal relationship among community members. In addition, depending on the task at hand for which *humwe* is organised, a household invites a core team of people in the village who have the relevant skills and expertise. However, this does not mean that those without relevant skills are excluded. If one does not have the required skills, it is always an opportunity to attend and learn from others, hence, a learning platform. As noted from the oral histories and literature (Manona, 2005; Leedy, 2010; Madziva, 2011), the reciprocal principle illustrates that members of the village are motivated to help others because they expect to get assistance when they need it from the same people.

Revival of *humwe* farming practise in the ward

While *humwe* had lost its place in the study area in recent years, the concept has re-emerged due to climate change, HIV/AIDS pandemic, and addressing CA labour constraints (see Chapter Seven section 7.3.2.1 for more detail on this). Following the farmers' reflections on *humwe* practice, the research found that this practise is now guided and premised on the concept of interdependence, a realisation that undertaking farming alone often results in limited achievement. This comes out of the realisation and acknowledgement that individuals have limited resources for personal and household development.

Nyaumwe & Mkabela (2007) postulate that at the beginning of the farming season, the genuine need of all families in smallholder communities is to plant crops timeously to avert famine. The ideas of these authors on timeous planting in rural households illuminate the empirical data on why *humwe* is being revived in the study area. In the past, a household called for a day or even two of *humwe* at the beginning of the rainy season to get help ploughing the fields. It attracted many people from the village who arrived with their yoked cattle and ploughs. On the day of the *humwe*, men started very early to plough the fields while women followed behind sowing maize. In a single day, a household would have about ten acres ploughed and maize sown at the same time. Currently, the practise is structured so that instead of a single household calling for *humwe*, it is now a collective effort where farmers come together as soon as the first rains are received in the ward. Households plant an acre of maize for each household using conventional farming practises and move to the next household until each member has an acre of maize planted on their field timeously with the first rains. Discussion with farmers who revived this practise revealed that in a group of ten households who come together, each would have an acre of land planted in a day's work. Households have realised the importance of early planting, taking into account climate change being experienced in the ward, which ultimately impacts food insecurity and livelihoods. In addition, farmers emphasise planting maize early through *humwe* since maize provides the staple food for households in Ward 30.

The concept of *humwe* is also now a philanthropic farming practise guided and necessitated by the HIV/AIDS pandemic in the study area. It is now being organised to help vulnerable groups such as widows, child-headed families and the elderly. For example, in the 2017/18 season, village heads in the ward called for groups from every village for *humwe* that lasted four days each of land preparation and planting for child-headed families. This resulted in the preparation and maize planting of five acres of land for almost every child-headed household in the concerned villages, which ultimately reduced vulnerabilities and enhanced food security for these homes. Apart from being used as one of the anchors in community farming, *humwe* also provides a platform for community politics like disputes over homestead boundaries. This finding suggests that *humwe* radiates a community's social life as it manifests community ideologies through shared values and behaviours that strengthen social cohesion.

The research also found that farmers now use harvesting time to compare and share indigenous seeds from their farms during *humwe* in the ward. Women, in particular, are engaged in seed sharing practises, so they develop knowledge associated with the classification and characteristics of seeds that are drought resistant in the face of climate change. They prefer to mix indigenous seeds with a hybrid because they are more adaptable to climate variability and extreme weather events and more resilient to pests and diseases. Farmers, particularly older ones (both men and women), are often interested in saving pure seed breeds, which they share with others through exchange or sometimes as a gift (usually a small amount). Ultimately, they attain respect, initially from people who share grain and gradually from larger groups or ward members, as they may share more seeds through social networks or kin groups. During harvesting, *humwe* also allows farmers to analyse if a neighbour has better indigenous seeds than they have and then negotiate and exchange. For example, Mbuya Mutape had been seeing a gradual decline in the quality of her seeds and subsequently her harvest every year for the past five years and when VaChikwenjere, who is a well-known farmer in the ward, called people to come for *humwe* at his farm, she saw that as an opportunity to analyse his better seeds and negotiate for an exchange. She found *njeke*, an indigenous type of maize seed that is locally known to be drought resistant which she tried in her field during the 2019/20 season. For the first time in five years, she reported that she had a surplus for selling to the GMB compared to other years where she only had enough for her own consumption.

The above example evokes the extent to which farmers view the importance of community knowledge (or knowledge systems), farming experiences and expertise, and practises as some of the core anchors upon which farming is built. Additionally, *humwe* is a response to limits or scarcity whereby households constantly depend on one another for farming through sharing or pooling their resources (financial, material and labour) and peer learning. Farmers learn experiences and practises from others in the village to be better informed. This suggests that *humwe* plays a crucial role in providing a learning platform in the community. Furthermore, through its rotational system, participants do it voluntarily and joyfully, indicating the socialisation aspect embedded in the *humwe* practise.

However, despite the benefits of *humwe* as a farming practise, there are weaknesses associated with it. There was general agreement amongst the views from household farmers that in some way *humwe* encourages laziness because people tend to shift their development responsibility onto their neighbours. They know that if they do not work on their tasks, they can organise *humwe* and invite neighbours to work for them. However, it is worth mentioning that the study found this problem to be minor in all the villages I carried out my study.

Description of *Zunde raMambo*

Zunde is a Shona word that has multiple related meanings. Mararike (1999) provides insight into its meaning: it may mean a large gathering of people taking part in a common activity or plenty of grain stored for future use or informal, in-built social, economic and political mechanisms. The Chiefs allocated land for the collective production of cereals for needy households. This common land is the *Zunde*. The prefix “ra” (raMambo) means “belonging to”, and mambo is the chief. Therefore, *Zunde raMambo* literally means the chief’s gathering of grain or ‘the chief’s granary’. It should be noted that *Zunde raMambo* is an extension from *Zunde raBaba*, which literary means father’s field, a food security arrangement within a polygamous family (Vambe, 2011). *Zunde raMambo* is a community food security practise in Zimbabwe which focuses on crop production under the administration of a chief.

Historically, it is a traditional social security program designed to protect vulnerable groups, such as widows, orphans, the sick, the elderly and those affected by disasters caused mostly by climate change, like cyclones and drought. In Ward 30, my study area, there is reserved arable land for agriculture specifically set aside to grow crops that will be stored at the chief`s granaries. The chief selects days in a month (the 28th day of each month) devoted to his subjects to work in the *Zunde raMambo* field. When distributing the grain, it is normally witnessed by village heads for transparency and accountability.

Purpose and principles of *Zunde raMambo* farming practise

Zunde raMambo is an important component of village food security in times of drought and hardships. A field is set aside for the chief`s *Zunde* where the whole community provides labour, and the produce is used to feed the disadvantaged within the community and feed guests who are usually hosted by the chief. During drought seasons and whenever harvest has been significantly poor, several households in Ward 30 rely on such informal safety nets due to the lack of government support. This safety net aims to develop the self-sustenance of the community and minimise the vulnerability of people through the provision of food. This explains why cash crops such as cotton and tobacco are not grown on *Zunde raMambo*; such crops are grown by individual farmers. This indicates that the initiative's purpose is to provide food to the needy and not to make money.

A household should have participated in the farming activities with others at the chief's communal land to benefit from this safety net. This shows that cooperation is an important value in *Zunde raMambo* practise. Other important principles associated with *Zunde raMambo* include community members upholding moral values of respecting the chief through following rules and regulations of the community. Households contribute to the *Zunde* through volunteering inputs such as maize seeds, manure, draught power, farming implements and giving up their time to work in the field. They use duty rosters and take turns to work in the *Zunde* field doing activities such as ploughing, planting, weeding, and harvesting, working together for the common good.

Revival of *Zunde raMambo* farming practice

In the 90s, the *Zunde* at the chief level was abandoned due to a combination of reasons in the area. The research found that the introduction of the government supplementary feeding programmes called Food for Work, introduced after the 1992 devastating drought, was one of the reasons this practise was abandoned. Many households would not attend to the *Zunde* field because they knew that the government would provide food relief in the event of poor harvests caused by droughts. The introduction of farming education programmes (e.g. Master farmer) and great yielding hybrid maize varieties enabled households to produce enough food to feed their extended families. It also led to people not relying on *Zunde raMambo* for food security.

This traditional practise has evolved from 2010 into a platform that guides small farm households' farming practises. The *Zunde raMambo* in Nyanga district is a practise that is being revived as a coping mechanism in response to growing difficulties such as climate change. Due to the increased droughts and long dry spells in the past few years within Ward 30 and other areas of Zimbabwe in general, the community realised the acute need to provide food for orphans and other disadvantaged members of the community. As a result, the community decided to revive the *Zunde raMambo* to become self-sufficient in food production. The HIV/AIDS pandemic also contributed to the revival of *Zunde raMambo* in response to the community's concerns about the rise in the number of orphans and child-headed households. Orphans and child-headed households are closely associated with the problem of food insecurity.

Historically the *Zunde* concept existed at the chief hierarchical level and was headed by the chief in the area. Currently, out of the 14 villages this research focussed on, each village has an allocation of land by the chief where villagers farm cereal crops (mostly maize) and every *Zunde* is led and organised by the village headman. All the households in the village provide labour to cultivate this field, unlike when it was done at the chief level. Village headmen provide land, and villagers provide free labour. The product is used to feed the disadvantaged within the village when their own food supplies have depleted. The key players who form the *Zunde* committee are from the community, such as schools, the ward hospital, AGRITEX, community health workers, ward councillors, and village headmen.

Part of the *Zunde* crop may be sold, and the proceeds used to purchase inputs such as seed and fertiliser or even fund orphans through primary school. *Zunde* work is carried out once every month, and people usually work 2.5-3 hours per individual because of the large number of households in the ward. Each household only contributes labour approximately once a month. Both men and women can provide labour, although it is predominantly female it varies depending on the seasonal *Zunde* activities. A register is kept to account who worked in the *Zunde* field on a particular day. Community members are exempt from working in the *Zunde* fields if they have a death in the family or are looking after ill people.

Instead of being sorely set up to replenish the chief's granary, farmers now make *Zunde raMambo* a platform for practical learning, interaction, and sharing farming ideas and practises among household farmers. Most of the ideas, peer learning and knowledge sharing is from Master farmers when they attend the *Zunde raMambo* field. Learning has become easy and attainable as one does not need to set aside private time to learn from the Master farmers. In describing how *Zunde raMambo* has become a guiding factor of farming in the area in one of our informal discussions, a well known Master farmer in the village explained:

Instead of just coming and focusing on ploughing and planting, we have made *Zunde raMambo* a platform where those who are knowledgeable and doing well in their fields teach others. Interestingly, it's not only us the Master farmers who know everything, we also learn from fellow farmers as well.[23] (Interview. VaChisvo, 12 July 2019)

The quote above and informal discussions with farmers stressed the situated nature of knowledge acquired through practise and continual learning. In the process of carrying out the *Zunde raMambo*, the practise provides opportunities for community members to work closely with master farmers in the village and share knowledge, skills and experiences on crop growing, soil science and animal management.

Another important point to note is that farmers learn different things from different people in the multiple roles and relationships they hold. This shows that the process of learning is integrated into social practise while farmers are participating in various aspects of farming and socio-cultural practises. It is interesting that in such a practise, learning is not a one-way process of learning from Master farmers to other farmers, but through interaction and participation, which acknowledges the expertise of all farmers. In this informal context learning takes place through the complex web of overlapping social roles and relationships.

Even though *Zunde raMambo* serves an important purpose in how farming is done in the ward, there are challenges that farmers experience with this farming practise. One of the problems reported by households was the prohibitive costs of inputs which compromise the effectiveness of the *Zunde raMambo.* This high cost of inputs results in limited use of high yielding varieties leading to low output. Another challenge in the *Zunde raMambo* practise is that work on land preparation and planting of crops is usually left too late when the rainy season starts. The shortage of draught power for village households means most of them give priority to plough their land. Almost every year, work on the *Zunde raMambo* fields starts in January because most households will be busy in their respective fields until then.

[23] Interview with VaChisvo, Ward 30, Nyanga District, 12 July 2019

It should be highlighted that despite *Zunde raMambo* having weaknesses noted above, I gathered that they hold it in high esteem in my discussions with most households. Households in the ward agree that *Zunde raMambo* is important because it is a local initiative where help is easily accessible to widows, orphans and the elderly in the community whose food security is compromised. Farmers explained that the *Zunde raMambo* was more sustainable and brought a sense of ownership that the "food-for-work" programmes from the government and food handouts from Non-Governmental Organisations (NGOs) did not. Farmers also shared that it makes them proud to feed the needy in their village rather than wait for outsiders to offer help since it is their culture to look after each other.

Although *Zunde raMambo* is a brilliant social arrangement helping maintain food security, the research found that it contributed to the demise of CA in the study area. In any society, there are strong pressures on its members to behave in certain ways. The headsman's expectation of people to conform in certain ways enables insights into the dilemmas and the trade-offs farmers face at each stage of the decision process. This brings out how opinion leaders play a role in preventing or stimulating the spread of innovation in a ward. According to McEachern & Hanson (2008), opinion leaders are specific persons within a community who greatly influence other people's opinions. Discussions with households revealed that the social obligation to work in the *Zunde raMambo* field became a hindrance to CA adoption, leading to abandonment for some households. For these households, practising timely weeding on their plots as encouraged by CA promoters for maximum yield returns became a challenge as they sometimes had to be at the *Zunde* community field. Due to societal pressure to conform, fear of being a social outcast or being seen as someone in defiance, these farmers were forced to abandon their fields to attend community work, leading to the abandonment of CA innovation. Because farmers and their families are members of the society in which they live, there are strong pressures on its members to behave in certain ways. For the farmers, some of these pressures will come from within the society. In all societies, there are accepted behaviours, and these ways are directly related to the society's culture, where no one is seen as an isolated individual. As Rogers (2003) points out in his diffusion theory, this shows CA was not compatible with the community values and traditions of *Zunde raMambo* in the study area, which led to its abandonment. Even though CA proponents argue that CA technology is suitable for smallholder farmers like the ward, this finding shows that the local farming practise of *Zunde raMambo* arrangements contributed and played a role in the jaded reception of CA seen in Ward 30.

5.3 Farming as guided by the supernatural

North (1994) argues that beliefs and taboos operate to regulate social order and behaviour by penalising non-conformity to prevent disorder, and as such, work as informal institutions. This contributes to building social pressure on individuals to conform to societal norms and can be argued to be a strategic response for individuals to maintain benefit or power or avoid the depletion of resources (Wilson, 1980). The role of belief systems as an institution is strongly evident in Zimbabwe, similar to most parts of rural Africa, where there is a long history of belief in the spirit world (Gordon & Gordon, 2006).

According to Mugabe (2010), Zimbabwe's local weather and climate are assessed, predicted, and interpreted by locally observed variables and experiences using combinations of plants, animals, insects, and meteorological and astronomical indicators. In this section, I discuss the meaning, importance and relationship between the supernatural and agriculture as multiple taboos and beliefs that characterise the study area. I start with a discussion of taboos; then, I highlight spirit mediums' involvement in agriculture. I also discuss the notion of *mahakurimwi* and then finally a discussion on *chisi* day.

5.3.1 Taboos involvement in agricultural productivity

A taboo can be translated as a prohibition, referring to what one is not allowed to do, objects that one must not come into contact with, words that must not be uttered, and places that must be avoided (Ruud, 1960). They link individuals to their ancestors and living relatives. Sharing the same taboos allows people to identify with their clans and ethnic groups (Lambek, 1992). By not or selectively observing traditional taboos, individuals bring dishonour to their ancestors and can be socially alienated from their community (Ruud, 1960).

Likewise, the villages in Ward 30 have an oral tradition, whereby the village elders play an important role in communicating local taboos to the households. Older adults interviewed during the study were asked where the beliefs were derived from, and the common response was that it has been passed down their families and reasons behind the beliefs and taboos were seldom known. In addition, taboos are often adhered to out of fear and people believe that violating taboos invites misfortune in the form of illness, crop failure, or even death. The study found that some of these beliefs and taboos hindered the adoption of CA technology, as illustrated by the following case. One of the taboos in village 14 is that people must not work in their fields during the offseason as it coincides with the time spiritual forces through the spirit mediums of the area will be replenishing soil nutrients in farming fields. In contrast, CA promoters encourage basin digging during off-season farming to do planting with first effective rains. Due to societal pressure to conform, fear of being a social outcast or being seen as someone in defiance, these farmers were forced to dig basins after the first rains and could not find enough mulch to cover the soil. By leaving the principle of basin digging late and trying to collect mulch after the summer season had started due to taboos led to an increase in farming labour, which led to the abandonment of CA innovation.

Another belief and taboo that impacted the adoption of CA technology, when it introduced herbicide use in CA plots, was that spirit mediums and village headmen (in certain villages) believe that herbicides in the fields anger spirit mediums because they destroy certain plants that are significant in the spiritual world. Due to these entrenched beliefs about herbicides most households in the ward did not take them even though they were part of free inputs supplied by the project promoters. The research found that most of these households that did not use the herbicides experienced weed pressure more than those who applied it, and it impacted CA uptake. Farming households who experienced weed pressure on their CA plots had negative comments about CA (without commenting on their refusal to use herbicides) and ended up abandoning the innovation. As pointed out in the diffusion theory by Rogers (2003), for an innovation to be successful or to be adopted, it must be compatible with the existing values or culture of potential adopters. In the following case, the CA principle of digging basins off-season or using herbicides was not easy to adopt for some villages in the ward because it was not compatible with observed local taboos, and adoption could not happen. Even though CA promoters felt CA technology would be suitable for smallholder farmers like the study area, this finding shows that local taboos contributed and had a huge part in the dreary reception of CA seen in Ward 30.

5.3.2 Spirit mediums involvement in agricultural productivity

In Zimbabwe, agrometeorological information is provided by the Meteorological Services Department in the Ministry of Environment, Water and Climate through radio, television and daily or weekly newspapers. The research found that some of the major flaws with the available information are unreliability and poor timing, while the content and frequency of dissemination is inadequate. In cases where the information is available from experts, it is often packaged in a way farmers cannot understand and need guidance.

In Ward 30 households believe that spirit mediums (*svikiro/mhondoro*) are actively involved in crop production. Another function of spirit mediums is perceived as guardian angels who oversee communities in their day-to-day lives. Hence, it was found that when communities embark on any developmental projects such as CA, they consult spirit mediums first, and they believe failure to do so leads to unsuccessful programmes.

The belief among households is that these spirit mediums ensure that there is enough rain, the weather is suitable for crop growth, and that pests and wildlife do not destroy the crops. The households acknowledge the positive agricultural role and contribution played by the spirit mediums through agricultural rituals. A popular ritual done on a rainmaking shrine before the first rains in early October is known as *maganzvo*. The narratives of the elders (*vakweguru*) reveal that spirit mediums and spirituality play a very important role in climate-related issues vis-à-vis the agricultural development in Ward 30. The phenomenon of climate change and variability seems to be highly related to the existence of spirit mediums, and their anger is also highly connected to preceding weather-related calamities. In support of this finding, Jiri, Mafongoya & Chivenge (2015) assert that in Southern Africa, spiritual rainmaking ceremonies are at the heart of many traditional societies such as Nyanga District. Moreover, Jiri *et al.* (2015) revealed that these rituals are performed by conducting prayers, using medicine portions, brewing and drinking traditional beer, and dancing under trees, amongst other activities to manipulate the falling of rain. The activities are considered effective in yielding positive results amongst African indigenous people.

Although these community people do not measure and record climatic data, such as formal climate monitoring, they can predict the average onset dates for rainfall through observation based on lifelong experience in their area. Farmers revealed that they sometimes pragmatically mix their traditional weather knowledge with the information they get from experts, the radio or newspapers. My discussion with Sekuru Tsara, a local rain-making spirit medium, revealed Ward 30 had developed intricate systems of gathering, predicting, and interpreting the weather by observing the behaviour of insects, plants and animals, enabling them to respond appropriately. This traditional knowledge has been guiding their decisions on when to prepare land for planting and crop selection.

The research found tension between the CA innovation principle of early basin digging, indigenous weather forecasting systems and knowledge shared by some local rain-making spirit mediums. For example, CA promoters encouraged the CA principle of basin digging to be carried out soon after harvesting, but in some villages in the ward, the process was deferred until the local rain-making spirit medium had predicted that the rains were imminent towards the end of October. The farmers shared that it did not make sense to dig basins soon after harvesting without confirmation of rains for the coming season from the rain-making spirit medium. They did not want to risk spending time in the fields digging basins only to find out the year would be a drought, like in 1992 where they did not receive any rains in the area. The farmers have a greater trust and value in these indigenous weather forecasting systems from these opinion leaders instead of Western meteorology. In all societies, some men and women make decisions on behalf of others or who are respected by others and therefore influence their attitudes and behaviour. Most farmers would rather opt for practises that have been proven over a long time and passed from generation to generation. Again, as pointed out in the diffusion theory by Rogers (2003), and similarly with the issue of local taboos, CA was not successful or adopted because it was not compatible with existing beliefs or farming practises of potential adopters. In the following case, CA was not easy to adopt for some households in the ward because it was not compatible. As pointed out in the diffusion of innovation theory by Rogers (2003), farming is embedded in the area, and adoption could not happen. Such a local belief system among households points to their role in the disappointing reception of the CA programme in Ward 30, even though promoters had high hopes that the technology would be successful in the area.

5.3.3 *Mahakurimwi* involvement in agricultural productivity

Among the households in the study area, funerals have a sacred character. If a death has robbed a family and community of one of its members, the whole community is obliged to mourn the deceased. The village headman ensures that all agricultural activities are suspended for two days. These days of mourning are known as *mahakurimwi* (days of no agricultural activities) because these days play an important function in promoting social solidarity. Commonly, farmers have to leave their farming even at critical periods to go and attend funerals within or in neighbouring villages. Such a show of support for one's kin and friends is expected to be reciprocated in the future when misfortune strikes one's household, and these norms qualify as social arrangements. As the following case illustrates, these social arrangements impact how agriculture is practised and can disrupt the effectiveness of agricultural innovations such as CA.

In the second year of CA adoption in 2011, village nine had three families with funerals in November. The village headman and other elder community members suggested that instead of the funerals happening concurrently, they had to be held one after the other to show solidarity to the deceased families. The village headman also ruled that people had to observe two days of mourning for each family, which meant six days were set aside for *mahakurimwi*. While households observed the *mahakurimwi* period, the first rains also came, and people could not go to their fields. Most households who had dug CA basins could not plant with the first effective rains as encouraged by promoters but ended up missing the crucial early planting window period, which impacted their CA crops. This finding shows how an expert agricultural innovation such as CA was at odds and incompatible with socio-cultural living and farming in the area. When such situations happen, as pointed out by Rogers (2003), people usually opt to overlook or abandon projects introduced by outsiders no matter how good they might seem and follow their culture for fear of being a social outcast or being in defiance. It was stated earlier that social expectations would determine the way others expect a person to behave, which become norms for that society. These norms are deeply ingrained in people's attitudes and beliefs. They not only determine how other people think an individual should behave; they determine what behaviour the individual feels is correct. Therefore, the norm of *mahakurimwi* is a local farming value system that contributed to the lukewarm reception of the CA programme in Ward 30 even though proponents of the technology argue that it is the best farming remedy for these areas.

5.3.2.4 The notion of *chisi* involvement in agricultural productivity

Territorial spirits are believed to be the guardians of the land and have to be honoured by having a special day of rest set aside for them (Bourdillon, 1987). Households in Ward 30 reported that the special day set aside in their area is called *chisi,* which is observed every Friday. The general concept of *chisi* in the community is that people are not allowed to do any agricultural activity or work the soil on a Friday. Farmers believe that non-observance of *chisi* spells disaster for the individual and the community, and usually, punishment comes in the form of insufficient rain, drought, or pests. However, farmers also reported that c*hisi* avails them time to rest, maintaining a healthy labour force that is vital for productivity.

The research found that *chisi* impacts how agriculture is practised and even on the adoption of CA. Discussion with farmers revealed that farmers who fail to observe the day are viewed as outcasts and rebels, and sometimes as punishment, households do not allow them to join their labour sharing arrangements group. For example, in 2010, mai Chikondi, a widow, failed to observe *chisi* when out of desperation; she watered her tomato nursery in the garden, which had become very flaccid due to the simmering October heat. When word spread in the village that she had failed to observe *chisi*, she was viewed as rebellious, and people were afraid that her actions might result in the area receiving insufficient rain. When other households came together for *humwe* labour sharing arrangements to dig CA basins and mulch collection, mai Chikondi was not included in the group. She could not practise CA that year as she did not have enough labour resources to dig CA basins and collect mulch (see Chapter 6 on how CA was practised in Ward 30) and abandoned the technology. In another incident in a separate village, in the first year, CA was introduced and inputs were delivered on a Friday - *chisi* day. Households could not go to collect the inputs due to fear of breaking the law of *chisi*. All of the households in the village did not join the programme because the promoters assumed the farmers were not keen on CA. As alluded to earlier on *mahakurimwi*, this finding indicates incompatibility and tension between socio-cultural ways of farming in the area and western agricultural innovations that are introduced. Again, when faced with a choice of something foreign and local, people usually opt for something local no matter how good it might seem and follow their culture for fear of being a social outcast or being defiant. Even if the benefits of other methods are explained to them, their strongly held attitudes may make it difficult for them to change. Culture is not a random collection of customs and habits but has been evolved by the people to help them in their conduct of life. Each aspect of the culture of a society has a definite purpose and function and is related to all the other aspects of its culture. Therefore, the culture of following *chisi* was another local farming value system that played a part leading to the lacklustre reception of the CA programme in Ward 30.

5.4 Indigenous knowledge systems and their role and place

Smallholder farmers' traditional farming practises are a form of indigenous knowledge - which is knowledge produced by local people based on lived experiences (Sinclair & Walker, 1999; Peters, 2002; Lado, 2004; Phuthego & Chanda, 2004). According to Tella (2007), indigenous knowledge is a systematic body of knowledge acquired by local people through the accumulation of experience, informal experiments, and understanding of their environment. The indigenous systems of crop production in Ward 30 emerged over years of cultural and biological evolution and represent the accumulated experiences of the local farmers. These systems guide small farm households and have become an adaptive mechanism to sustain the livelihood of farmers as they continue to experience challenging environmental conditions. Farmers face many problems associated with their farming practices, and hence some farmers' management practises are deployed to solve the problems they experience. This section looks at knowledge systems guiding farmers in the ward, and I will start by discussing seed selection and storage, then move to weather forecasting and indicators and end with diseases and pest control.

5.4.1 Seed selection and storage

According to AGRITEX (2012), the Zimbabwean agricultural sector is largely characterised by small-scale farming and low productivity. This low productivity is partly due to the limited use of hybrid maize varieties and associated technologies (FAO, 2012). Even though hybrid maize has been proven to produce high yields, agriculture as a source of livelihood is under threat due to the high price of inputs, especially seeds. These rising input costs are also increasingly leaving farmers vulnerable to fast-changing climatic challenges. These pressures force them to continually search for new cost-efficient ideas and farming practices for agricultural production, help them cope with climatic risks, and farm in more environmentally friendly ways.

In response to all the challenges highlighted above, local farmer seed systems are becoming the dominant seed system and now constitute the backbone of agricultural production in Ward 30. More than 20% of Zimbabwean smallholder farmers use either retained or open-pollinated maize seed, and this figure is rising (Magiya, 2015; World Bank, 2015). Indigenous seed systems and community seed banks help manage climate risk where increased climate variability is a reality. These seeds give farmers affordable access to a wide range of quality seeds improved through farmer selection over the years. In the Nyanga district, just like other parts of the country, the rainfall patterns have shifted. The growing period has shortened: whereas the season used to start in October and last until April, now it can start as late as December and end in February.

The local seed varieties provide an important safety net for cash-strapped farming households who cannot afford to purchase seeds every year. The farmers save money because of their seed systems, including farmer-saved seed and farmer-to-farmer exchange, especially during community activities such as *humwe*. The use of hybrid seeds, as encouraged by experts, is a challenge for farmers because they need to be protected from weevils using pesticides, which is often unaffordable. They consider the expense unnecessary because local traditional maize seeds can be stored without pesticide use. At any rate, the local seed is a traditional way to save money. This open-pollinated seed has adapted to farming households' soil over the years and represents considerable savings, and perhaps a certain amount of security as some of their traits are high-yielding, drought-tolerant and early maturing. This also cushions farmers from climate-related risks such as long dry spells and droughts that are experienced frequently. The advantage and security of the local seed over hybrid was highlighted by one household, namely vaChikondo. In the 2015/16 season, many households relied on free new hybrid maize seeds supplied and encouraged by the government while discouraging local maize seed varieties during the command agriculture programme. At the same time, most hybrid maize harvests for the district were a complete write-off due to long dry spells experienced at the maize tussling stage. VaChikondo family on the other hand had used indigenous seeds managed to harvest something.

In another case, a farmer, Mbuya Fondo, shared that maize she grew from her own seed out yielded the certified seed of a new variety tried in the 2015/16 season and says she sees no reason to change yet. This shows that certified seeds are not necessarily better, despite the insistence of the sellers. The seed selection process emerges as integral to planning Mbuya Fondo's crops, what to plant and when; a process of experimentation that demonstrates ingenuity. The seeds she considers the best are selected from mature plants, and factors such as shape, size, and colour of the products are used, while in other crops, only bright coloured and large-sized seeds are selected for planting. Besides physical selection, in some cases, her selection of the best seeds is made by soaking them in water. Only seeds that sink to the bottom of the container are selected and considered the best. These two cases above show that risk aversion is a central feature among smallholder farmers, as highlighted by the risk-averse households theory.

According to Talawar (2005), the quality of stored seeds depends on strategies a farmer employs to prevent storage pests, insects and unfavourable temperatures. For seed storage, farmers consider several issues to maintain their seed viability and knowledge on temperature regulation for seed germination, seed storage timing, and repellents for pest control. Most farmers' maize cobs are dried in a ventilated rondavel (a traditional circular African dwelling with a conical thatched roof) where families prepare their meals (see figure 13 below). Seeds are stored in these huts because the smoke that comes from fire acts as a repellent to insects and keeps the seeds safe.

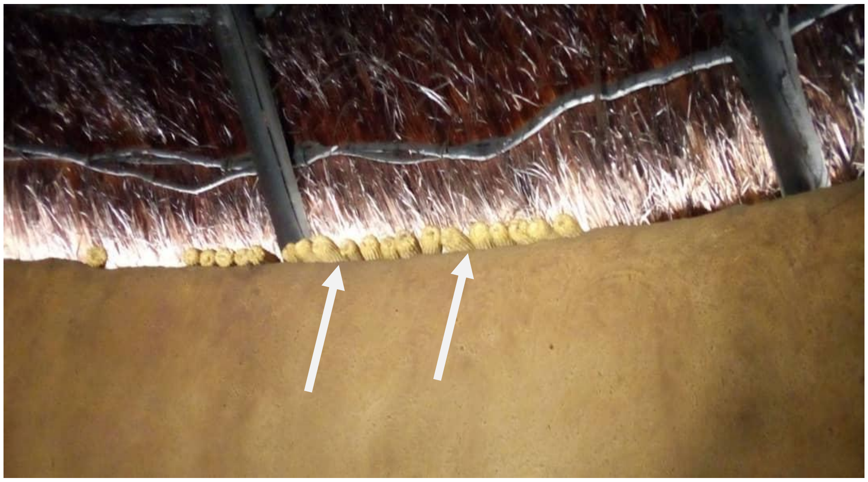


Figure 13: Maize cobs selected for seed in a ventilated room

When farmers decide against keeping maize on cobs, it is shelled in winter and treated with dried, ground aloe vera to protect them from weevils. The de-coned seeds are protected from over-drying by covering them with leaves or other specially prepared mixtures before the seeds can be winnowed to separate it from the chaff. They are stored in bags or clay pots which also minimise the risk of over-drying. Most seeds, if cleaned and stored properly, will remain viable for many years.

However, traditional seeds do not enjoy consensus support among actors in the rural smallholder agricultural sector. For example, the ward extension officer is sceptical, especially looking at the output levels. He pointed out that even though traditional maize seeds can withstand harsh conditions, they produce few lines of between seven to eight lines in a cob compared to a hybrid maize variety which produces between eleven and twelve even in seasons of good rainfall. He argued that although traditional seeds ensure food security, they will not produce enough for selling to the GMB. However, discussions with most farmers reveal that their decision to use traditional seeds is that they are concerned with food security first and not profit maximisation. Like the expected utility and safety first theory, there is a trade-off between profit maximisation and risk aversion in smallholder farming households. Individuals consider outcomes below a certain value as a "disaster", and what constitutes a "disaster" depends on the individual, and in the case of Ward 30 farmers, food insecurity is a disaster, not a lack of profits.

The research found that farmers' trust and reliance on indigenous knowledge of traditional seeds locally known as *njeke* seed as opposed to the use of hybrid maize seeds, which promoters insisted for CA plots, created tension. This led to outright rejection by some farmers. There were costs involved with buying hybrid seeds, with many farmers lacking the financial resources. Therefore, farmers opted for their good quality and lower-cost seed rather than adopt a hybrid seed. They were unsure how it would perform in their fields, especially after the area's 2015/16 new seed variety debacle. As demonstrated under demonstration plots in the ward, the potential yield was of little interest to farmers, especially if it meant increasing the danger of facing an even lower output than is normally achieved using proven local seeds for production. Farmers' understanding of food security is based on what eventually gets into their storage system, which determines the nature of their farming practises. Farmers adapt knowledge to suit their livelihoods and are keen to avoid costs where necessary.

Consequently, farmers' notions of food security and wealth are based on self-sufficiency in food production and not directly related to income generation to buy in food. It is safe to conclude that farmers' knowledge is grounded and based on past performances and results. When the past performance has resulted in high yields, it becomes useful knowledge, which is retained for as long as it remains useful and productive. At such a point, Western technologies are treated as alien and will fail to displace them as displayed with seeds used in the CA programme. In addition, this shows that farmers' indigenous knowledge systems play a role that can hinder the adoption of CA technology, as seen by the tepid reception of the technology in Ward 30.

5.4.2 Tree leaves and fruits as weather indicators

Discussions with many community elders revealed that the appearance of new leaves on certain trees guides or indicates that the rainy season is approaching. For example, when *musasa* (*Brachystegia spiciformis*) and *mikute* trees (*Syzygium cordatum*) start developing *pfumvudza*, the new and tender leaves, farming operations must start. Early appearance of leaves means rains will be early, and late appearance means the rains will be late as well. This observation and understanding has helped farmers prepare early on the type of crops and seeds to use in the ward. For example, suppose *pfumvudza* comes late, usually mid-November. In that case, they try to plant early maturity crop varieties, and when it comes early, usually early October, they know they can have a good harvest even from late maturity variety crops. Farmers also know that an abundance of baobab fruits and *shuma* is a sign of drought, and if the fruits are few, it means that rains will be good. A common interpretation in the ward of why trees bear so much fruit in a drought season is said to be 'God's way of ensuring people's survival in periods of food scarcity'.

5.4.3 Birds and insects as weather indicators

Ward 30 has an abundance of birds and insects that guide farmers by displaying certain behaviours at the onset of and during the rainy season, and that behaviour can foretell rainfall patterns. For example, when *svosvemukange* (safari ants) are seen carrying termites in one line to their hole, it foretells the rainy season is about to start, and land preparation should start. Farmers also know that the sign of a dry season is shown by ants that come into houses searching for food. Besides ants, households also believe that when a type of termite locally known as *nhenhe* comes out, it is a sign of good fortune to the ward as far as agriculture is concerned. In contrast, when they experience the gathering of locusts, then the season is of hunger and famine. In response, farmers prepare for tough times by preserving food and planting drought-resistant varieties and focusing on gardens with indigenous crops such as yams.

Farmers also shared that they listen to the sound of the *haya* bird, a type of cuckoo *(clamator glandarius)*, to predict rain. It is believed that once it starts singing, it is calling for replenishment of rainwater, and often, two-three days after its 'call', rains start falling. Some noises made by frogs and toads are also considered to indicate fair weather the next day by farmers. The ward farmers' knowledge of rainfall prediction corroborates Speranza *et al*. (2010) findings that local farmers possess knowledge on the use of local indicators, such as plants, birds, insects, and astronomy, in predicting rainfall. Kijazi *et al*. (2013) attest that people use the behaviour of animals and plants to predict the coming agricultural season weather pattern. Chang'a *et al*. (2010) show that this type of indigenous knowledge is important in farm decision-making to respond to anticipated poor yields. Malunga farmers in Tanzania also use Senegali phenology to predict rainfall in the study to forecast the upcoming rainy season (Elia *et al*., 2014).

5.4.4 Astrological and meteorological weather indicators

Sekuru Tsara, the local rain-making spirit medium, explained that as the rainy season approaches, the wind direction can guide households to tell the nature of the coming season. From the end of October up to early November, light winds blow from almost all directions, causing whirlwind-like activity. The farmers know that when the wind, called *mbambara,* blows from the eastern side bordering Mozambique, the rain season is on its way, and if the wind is continuous, it 'means' that more rains will come. Besides wind direction, farmers also study the type of clouds to know if the rainy season is approaching or if the rain will cause damage to crops. For example, when cumulonimbus clouds locally known as *hore* are seen rising farmers know that heavy rains that can cause damage to plants are on their way.

The appearance of a hallo (*dziva*) around the moon and the stars, giving them a dim appearance, indicated that the rains are imminent in the area. The farmers' use of celestial bodies to predict rain is corroborated using the moon and the stars by Chibelela farmers. These farmers use the moon's shape and colour as signs to predict a season of either sufficient or scarce rainfall. They also use the movement of stars to make inferences about the rainfall patterns for a specific season of the year (Elia *et al*., 2014). Equally, in Uganda, the farmers use local indicators, such as phases and shapes of the moon, to predict upcoming weather (Orlove *et al*., 2010).

Although farmers, community elders and the local rain making spirit medium spoke highly of traditional knowledge weather forecasting methods, climate change and the increasingly variable weather patterns in Nyanga district like everywhere, have led to a decline in these locally observed variables, making it difficult for farmers to predict the weather for the coming season. My discussion with experts such as the ward extension and veterinary officer on local indigenous weather indicators encouraged caution as they were sceptical about the accuracy of such methods. They argued that farmers should abandon the indigenous ways of weather forecasting because it was no longer reliable. Human activities, temperature changes, and the introduction of new pesticides and deforestation contribute to insect population changes. They further pointed out that indigenous weather indicators could not be proven scientifically; therefore, it was futile because insects respond to changes in humidity and temperature with various behaviours that cannot be relied on to forecast the weather. These arguments by the extension and veterinary officers reveal the tensions between indigenous knowledge systems and science. An investment in mindset change to not view indigenous knowledge as inferior or superior to science is required.

5.4.5 Households crops disease and pest control mechanisms

Like any other place in Zimbabwe, insect infestation and diseases that impact crop production have increased. The research found that the ward is prone to natural hazards such as droughts and prolonged dry spells triggering pest and disease occurrences in farmers' fields. Most farmers in the area rely on indigenous pest management approaches to manage pest problems because it is often cheaper than applying chemical pesticides. In addition, there is much concern and negative perceptions caused by cultural beliefs over the dangers of chemical products among many farmers. The research also found that pesticides are misused when used because the instructions are often in English, which many farmers misunderstand. As a result, farmers guess on the quantity or ratio of chemicals to be mixed with water, which exposes them and the crops to danger. There have been reports of people suffering from severe skin rashes and headaches because of incorrect use of chemical pesticides in Ward 30.

When insects, pests or diseases threaten farmers' crops, the majority of whom are poor, they turn to indigenous chemicals that can prevent infestations or kill the pests. Traditional healers in the ward are mostly custodians of the natural heritage, which includes medicinal plants. These healers sometimes charge a token such as chickens when they provide indigenous pesticides but do not charge for the knowledge shared. Products and materials which are already in the home and around the farm are mostly used. When controlling pests and diseases, it is very important to ensure that the problem is correctly identified. Knowledge of pests and diseases will help decide whether the problem is caused by a pest, a disease, a mineral deficiency in the soil or an environmental factor. An elder member of the family usually does this. One farmer explained:

> Proper identification should be the first step in controlling the problem and, more importantly, in preventing it from happening again. My memory is key and it works like an identification book in identifying diseases and pests. You need to remember if the disease or pest came years back and recall how you controlled it. If it is new, then you will have to try different natural chemicals until you see improvement.[24] (Interview. Sekuru Matongo, 18 August 2019)

While doing field observations, I observed an emerging farming practise adopted by many farmers called companion planting (see figure 14), which means growing certain plants to protect other plants from pests or diseases. Pests are deterred by the companion plant or attracted to the companion plant rather than the crop. All the farmers in the area are fighting the fall armyworm, which has infested the ward for a third consecutive cropping season. One of the ways is farmers using garlic as a companion crop with maize because many pests avoid garlic. Some farmers also make scarecrows to prevent pests and animals from reaching their plants. The disadvantage with this is that they keep pests away from a plant but do not kill them. The research found that farmers use rabbit urine to control aphids and red spider mite (*Tetranychus evansi*) in garden crops such as tomatoes. The other pests which affect tomatoes included red ants, blister beetles,

[24] Interview with Sekuru Matongo, Ward 30, Nyanga District, 18 August 2019

leaf-miners and variegated grasshopper, mainly *Zonocerus variegatus*. Farmers also reported that other cultural practises involve hand-picking and destroying visible insects.

Figure 14: Companion planting of maize crop and garlic in a conventional field

The introduction of herbicides as part of the CA package was alien to socio-cultural beliefs in the ward and viewed with suspicion. This reveals the tension that is sometimes seen between expert programmes and rural farmers. Some households prefer using natural ways of farming as opposed to scientific approaches. Many farmers use indigenous knowledge with a deliberate intention to accommodate conditions that exist at the local levels associated with the environmental, economic, social and cultural realities of the area. These local belief systems on herbicides, indigenous knowledge systems, and realities among households help point and explain the role they played in the unenthusiastic reception of the CA programme even though promoters had high hopes that the technology would be successful in an area like Ward 30.

5.5 Chapter summary

This chapter investigated the socio-cultural factors guiding small farmer households' agricultural practices and performance and how these are incorporated into households using empirical evidence in Ward 30, Nyanga District. The findings indicate that farming systems in the study area present a host of production constraints identified as major setbacks leading to low productivity. The findings also indicate that traditional practices such as *humwe* and *Zunde raMambo* have evolved with the changing times to remain relevant platforms on which households discuss and share knowledge, skills and experiences on farming. They also maintain social solidarity, social reproduction, production, culture, tradition and are an important site for resources which has boosted agriculture in Ward 30. The findings also show that farming in the ward does not happen in a vacuum, but it is highly spiritual. However, the supernatural ways that guide farming in the study area also contributed to CA technology's abandonment and total rejection. The findings indicate that farmers perceive indigenous knowledge systems as effective, especially in the inconsistent weather patterns caused by climate change. These knowledge systems are appealing and compelling as they are cheap and not complicated as they are passed from generation to generation and tested in the food production systems of these farmers. However, they were also a hindrance to CA adoption. The findings further show that indigenous knowledge practises do not exist in an original, unchanged condition; these practises have been, to some extent, influenced by conventional practise.

CHAPTER SIX: PATTERN AND ADOPTION DECISIONS IN THE WARD

6.1 Introduction

Kassam, Friedrich, Derpsch & Kienzle (2015) reported that it is estimated that, worldwide, there are now some 106 million hectares of arable crops grown each year without tillage in CA systems. Even though the technology has been widely promoted, adoption rates are very (s)low and often partial, the benefits for farmers vary greatly and remain highly contested, and impacts seem to be context-specific (Kassam *et al.*, 2009; Bwalya & Friedrich, 2009; Derpsch *et al.*, 2010; Erenstein *et al.*, 2012; Baudron, *et al*., 2012; Arslan, *et al*., 2013; Zira *et al*., 2013).

Often, farmers who have adopted CA tend to do it partially, either practising some components or adopting CA on fields but inconsistently (Mazvimavi and Twomlow, 2009; Umar, 2013; Penot *et al.*, 2015Holden et al., 2018) due to mulch constraints and planting legumes for crop rotation (Baudron *et al*., 2007; Mazvimavi, 2011). Farmers who adopt CA have been observed to develop cropping systems that are intermediates between CA and conventional systems (Penot *et al.*, 2015), including practises that address their specific production constraints (Penot *et al.*, 2018). CA uptake by farmers in Africa is not only partial in terms of the adopted practises but also in terms of the share of farm area under CA practises. In Zambia, for instance, minimum soil disturbance techniques were only implemented on 8% of the land of adopters (Ngoma, 2018), while in Malawi, Ngwira *et al.* (2014) reported 30% of the land of adopters to be under CA. Assertions in the literature of incremental or even exponential uptake in some areas (Bunderson *et al.*, 2009; World Bank, 2012) are juxtaposed with evidence of dis-adoption and limited or partial uptake elsewhere (Mazvimavi *et al.*, 2011; Mazvimavi & Nyamangara, 2012; Arslan *et al.*, 2013).

Chiputwa, Langyintuo & Wall (2011) assert that owing to the heterogeneity of the farmers' perceptions, livelihood objectives and socio-economic profiles; households tend to select and adopt components of the CA technology as it fits into their lives and their pace. It was observed that farmers initially adopt what they feel is the most relevant part and then follow other principles at a later stage (Mazvimavi, *et al*., 2008). This is particularly evident when CA targets households of varying resource endowments. Pedzisa *et al.* (2010) suggest that risk aversion contributes to piecemeal adoption because smallholder farmers in Zimbabwe have weak mechanisms to absorb risk and are inclined to adopt the less risky components of CA technology first.

Conversely, by adopting only parts of the CA package, smallholder farmers reduce the benefits of the technology (FAO, 2001; Ito *et al*., 2007). Equally important, questions and controversies have emerged regarding the ability of CA to achieve the many virtues that proponents assert it embodies. For instance, the universal applicability of CA's three main principles – (1) minimal soil disturbance, (2) permanent soil cover and, (3) crop rotation (and crop diversification) both individually and in combination, has come under scrutiny. Others question the applicability of CA principles in the context of diverse, smallholder farms and farming systems (Giller *et al.*, 2009; Guto *et al.*, 2011a).

The spread of CA in SSA regions is well documented, but there are few details about the specific patterns the adoption process followed in each country. Available literature report, predominantly, on factors facilitating or constraining the adoption of the system with less country-specific literature on the pattern the adoption process followed. Hence, this chapter aims to ascertain the basic patterns of adoption of CA in Zimbabwe based on the experience of Nyanga District, Ward 30. Since the introduction and promotion of conservation farming, the adoption behaviours of farmers were diverse and, most importantly, were not properly documented. In fact, Knowler & Bradshaw (2007) reported that reviews of CA studies in recent times are showing that a few, if any, universal factors that influence the uptake of new technologies and the factors that determine local adoption are highly contextual and tend to vary due to differing local and ecological conditions. It is thus important to analyse adoption patterns of farming households within a dynamic framework since these farmers are not of the same resource and social endowments. The chapter also documents farmers' perceptions and experiences of adopting CA and examines these issues through the lens of the practises and understandings or so-called "mental models" of farmers in Ward 30 and situates these concerning a wider body of literature on CA adoption.

This chapter is a discussion on, firstly, how farmers adopted the CA package, moving to modification of the system and how they organised their agriculture and made farming decisions. I will also discuss why and how farmers modified the system because understanding what influenced farmers' decisions and why they modified certain CA components leads to the development of appropriate technologies. This is followed by a discussion on the trends of CA in Ward 30. Finally, a chapter summary is presented to overview what the chapter achieved and its contribution to the thesis.

6.2 CA adoption trends in ward 30

Different factors determine the adoption of different agricultural innovations and technologies (Akudugu *et al.*, 2012), which is highly evident in Ward 30. In this section, I will start by describing the characteristics of farming households that adopted CA because it helps promoters of CA know the kind of households to target and develop appropriate technologies. The next section discusses how households organised their agriculture. I look at the pattern of *humwe* farming practise in CA, the pattern of dual CA and conventional plots, and sources of inputs for CA plots. The section following that looks at how CA components were modified to suit local conditions with specific reference to the pattern in planting methods and times basin digging, crop stover, weed management practises, application of organic manure, crop rotation practises and fertiliser application.

6.2.1 Characteristics of households that adopted CA

Conservation agriculture was introduced in Ward 30 in the year 2008. Its promotion essentially targeted vulnerable farmers. However, farmers in Ward 30 were not necessarily of the same resource and social endowments. Different household characteristics influence technology adoption differently. Across the ward, there was no significant difference in the numbers of male and female-headed households targeted by Concern Worldwide. This is despite the fact that NGOs deliberately target female-headed households for relief assistance (Mazvimavi *et al*., 2010). The study found that households that adopted CA were mostly hand hoe or ox-plough based farmers while non-adopters were mostly farmers who are perceived to be rich in the community and use or hire tractors, own large numbers of livestock and those with access to remittances. This suggests that the type or scale of a farmer and level of mechanisation can determine the willingness of a farmer to shift from practising conventional farming to CA practises. Many of the farmers who are resource-poor used few purchased inputs. The main output of their farming activities is consumed directly, and only a minor proportion of their farm output is marketed.

In most households that adopted CA, farming is a family activity that requires the help of every man, woman and child who is old enough to work and for whom the farm provides their main source of income and livelihood. The average size of a family who adopted CA was eight, whereas those who did not adopt were five. This could imply that the source of labour for the smaller household sizes is limited, hence not adopting CA. Likewise, an increase in population is regarded as one of the reasons that could necessitate uptake of CA since the innovation is capable of increasing food production, which fights food insecurity (ACT, 2008). Household labour and norms of reciprocity, collectivism, and altruism, *humwe,* were more common than hired labour because the socio-economic status of the farmers who adopted does not warrant them to afford hired labour. Children usually helped with planting, weeding, and harvesting. Most farmers could not hire extra labour due to lack of resources and generally pursue extra jobs, such as *maricho,* as coping mechanisms. Therefore, farming is one source of income that requires time and labour for many of these households.

The education level had less to do with targeting the procedure of Concern Worldwide, but it is important in understanding or assessing the ability of farmers to appreciate and grasp new principles or concepts. The research established that the farmers who had formal education adopted CA as early adopters as compared to the rest of the households who were laggards and had doubts. This could be because advancement in formal education is associated with an increase in specialisation in technical skills that make farming, including CA, more attractive. According to Matata *et al.* (2008), if most farmers can read and write, they can eventually follow technical recommendations. Those without formal education are mostly exposed to informal community education and training activities, which might mean that they learn through seeing or participatory methods, which could explain why they adopted CA a year later. The role of education on adoption in the ward tallies with the theory of diffusion of innovation which views the process of adoption of innovation as a mental one through which an individual farmer passes from an initial stage of encounter (hearing about) with innovation to its final adoption (Hagget, 2001). Conventionally, very few farmers adopt a new farming system or technique on its advent. Rogers (1995) observed a slow start in the adoption of innovation (16% of early adopters), and the rate of adoption increases with time as the majority (68%) adopt the innovation until it is common to every farmer. Thereafter, a small group of farmers (16%), referred to as laggards, adopt innovation very late (Hagget, 2001; Knowles & Wareing, 1976).

The research found that young farmers were more open and excited about CA adoption than older farmers in Ward 30. This finding is similar Diederen *et al.* (2003a) study who found that adoption levels of new farming practices are higher among the young and educated farmers than older and less educated farmers. The lower adoption rates among older farmers could be attributed to the prevailing mindset rooted in conventional farming practices and negative perceptions of conservation agricultural practices. This was created and reinforced by national formal agricultural education and training programmes when farmers resettled after 1980 in the area, promoting the use of farm implements and conventional practices. Older farmers, on their part, tend to be less educated and more conservative in their approach to farming which makes them less likely to open up to new farming innovations; hence none adopted CA techniques.

The study also found that although most households are female-headed households, the decision to adopt or not adopt CA lay beyond their wishes, implying that other forces influence their decision. Literature on the theory of planned behaviour recognises that not all behaviour may be under an individual's control, with behaviour ranging on a scale from complete control through to total lack of control (Ajzen, 1991). In the context of Ward 30, although women lead most households due to rural-urban migration, men make decisions due to the conservative patriarchal set-up where men lead decision-making. Even though that is the case, there was a strong dominance of female farmers who adopted CA in the study area because some will be acting on delegated responsibility from their husbands, who are mostly absent from their homesteads for various reasons.

Like farming everywhere, households have to manage risks associated with their environment and socioeconomic but have less room to manoeuvre or limited options than well-endowed farming systems.

6.2.2 How CA households practised their agriculture

CA introduced in Ward 30 had eight components in its guidelines which came as a standardised package promoted by Concern Worldwide. These techniques were winter weeding, digging planting basins, application of crop residues, manure application, basal fertiliser, top dressing fertiliser, timely weeding, and crop rotation. Considering that adoption was not the same for Ward 30, in the subsequent description of this section, I use the term "adoption" to indicate actions that farmers had taken to at least try one component of CA on their farm regardless of the incomplete CA package. Therefore, the measure of adoption that I am using here should not be viewed as full CA adoption by the Ward 30 farming community. The section below thus looks at how farmers organised their agriculture and took farming decisions on some of the CA components promoted in the area.

Humwe farming practise in CA programme

CA promoters recommend that the ideal period for digging planting basins is the post-harvest dry season because it allows CA farmers to plant with the first effective rains in November, the beginning of the rainy season in Zimbabwe. The combination of basins with precise input application and early planting results in higher yields. Basins capture water and retain moisture, and enable seed germination. Basin digging also ensures that inputs are not broadcast but precisely placed ensuring manure or fertiliser is not wasted as it is only applied where it is needed, on the crop basin. This is sometimes called a precision application of variable agriculture inputs.

In line with CA promotion in the study area, farmers dug their basins between July and October, which is the dry season upon adoption in their first year. Locally this was called '*kwetsa-kwetsa',* meaning 'farm with a hoe'. Firstly, land preparation took place soon after harvesting in May/June, which involved clearing grass and stumps from the previously cropped plots on an area of about 0.25 ha (Twomlow *et al.*, 2008). Weeding was done using implements such as hand hoes and machetes that disturb the soil as little as possible. The importance of weeding before land preparation is to ensure that the plot is weed-free at basin preparation and prevent the dispersal of weed seeds.

Farmers used hoes to make planting basins with pegs, known as *hoko* in the local language, inserted on the far ends, tied with a wire or a string stretching approximately 50 m in length and 50 m in width for precision. An average plot of 50 x 50m produced about 10 222 basins in total. The inter-row spacing of 75 cm was wide enough to allow for intercropping (Twomlow et al., 2008), even though it was not practised because promoters encouraged mono-cropping. According to Oldrieve (2009), soil removed from the basin is put on the downslope side for use in covering up the basin to prevent the soil from being washed back into the basin and acts as a barricade for water overflowing from the dug basin. Three evenly spaced maize seeds were planted in the basins and covered with 2–3 cm of the remaining soil whilst ensuring that the basins are free of clods and stones to ensure high plant population and germination, which helps reduce the need for replanting (Oldrieve, 2009). The choice of plants depended on the farmer, but most farmers preferred to plant maize under CA because it is a staple crop.

The basins the farmers dug during the first year of adoption enabled them to plant the maize seeds after the first effective rains, which came at the end of October because the basins had captured rainwater and drained naturally. Seeds were placed in each basin at the appropriate seeding rate and covered with clod-free soil. This also enabled the precision application of either organic or inorganic fertiliser as it was applied directly into the pit and not broadcasted, which is usually done in conventional practises. According to Twomlow, Urolov, Jenrich and Oldrieve (2008), early planting alluded by farmers in the study area promotes timely planting and reduces the risk of crop failure, even under drought conditions, due to the concentration of water and available fertiliser in the basins.

Most farmers, especially women, who were involved in basin preparation during the first year of CA adoption pointed out that it was a laborious task to dig the whole 50 x 50 m plot size without help since they mostly relied on family labour. In the second year, to address the laborious nature of basin digging faced in the first year, some farmers dug basins in sandy soils because it is easier to dig basins when dry than in clay soils. However, the solution of digging basins on sandy parts of the fields to avoid too much drudgery was unsuccessful. This was because the basins were destroyed by wind due to dust storms that frequent the area, as well as animals that roam freely in unfenced fields due to communal grazing rights in the area.

As in all societies, small groups of people can come together for a common purpose or activity. After experiencing the labour bottlenecks in basin digging, farmers incorporated *humwe* which reduced the labour requirement for individual farmers on their respective CA plots through working in sequence from one field to the other for respective members. This labour arrangement was mostly among women because they are faced with more challenges such as caring for children and finding what the family would eat each day. In addition, there is a division of labour within the community 'fundamentally' based on gender, which is widespread in this area as a cultural practice.

This social practice helped lessen drudgery associated with basin digging as households would spend approximately two hours on a single household 50 x 50m CA plot before moving to the next household plot. In contrast, before this arrangement, each farming household would spend approximately a month, depending on the number of adults. Each person who attended *humwe* would bring their hoe, while some brought pegs (known as *hoko)* and strings. The practice was mostly done early in the morning until midday before the sun became too hot. Farmers felt it is part of the members' responsibility, which can be punishable as an offence if they do not attend or expectations and obligations are not met by individuals for not supporting others. Mai Chirongo, a widow who was part of the women who was involved in *humwe* for basin digging, shared how it worked below:

> When we found that digging pits using family labour or when you are alone was a gruelling task, we decided to work as *humwe*. We would even share tools and met three times a week. Work would begin at 5:30 a.m. We realised that for the basin digging component to work, we needed to provide equal support and start as early as possible. Besides making the workload easier, *humwe* also provided us with a platform to encourage and share knowledge with each other.[25] (Interview. Mai Chirongo, 27 September 2019)

[25] Interview with Mai Chirongo, Ward 30, Nyanga District, 27 September 2019

In agreement Sekuru Mukondo also said:

> As with our famous saying from our forefathers who said *chara chimwe hachitswanye inda* (There are some life problems/challenges, which a person cannot effectively solve without the help of other people) we have always relied on *humwe* when we have a heavy workload. We found that basin digging drudgery solution would be to do *humwe*.[26] (Interview. Sekuru Mukondo, 29 September 2019)

The quotes above are in tandem with the findings of Wagstaff & Hearty (2010), who argued that shared labour systems could meet initially high labour requirements and have considerable community benefits. Additionally, shared labour in parts of Zimbabwe has proven to be highly popular, with substantial social capital and knowledge sharing benefits. Shared labour has been a critical benefit for extremely vulnerable households, particularly the elderly and chronically sick. These community shared responsibilities defy the norm based on market-oriented production that requires the payment of services in cash for profit-making purposes (Moyo, 2010). In the study area, *humwe* is a form of social capital that individuals draw upon in time of need without direct cash payment. For most household farmers, *humwe* is a social capital that has long been recognised also as a form of wealth that is highly prized. On the contrary, development experts expect payment to be made for such labour use. In addition, this demonstrates that farming is a social activity guided by local norms and expectations on how to behave.

The research also found that the approach of practising *humwe* to address basin digging labour challenges was also appealing to some households who had not adopted CA due to scepticism of labour shortage concerns in its inaugural year. In his theory of diffusion of innovation on who adopts innovation and when Rogers (2003) uses the concept '*late majority*' to explain the behaviour of such farmers. This group constitutes 34% of the potential adopting population, and they wait to make sure that the innovation is in their best interests. These individuals are highly sceptical and resist adopting until absolutely necessary (Rogers, 2003). The following case illustrates how the incorporation of *humwe* into CA farming helped Mbuya and Sekuru Chikepe try the farming innovation.

[26] Interview with Sekuru Mukondo, Ward 30, Nyanga District, 29 September 2019

Mbuya and Sekuru Chikepe are an old age couple in their 70s who stay with their one grandchild. When CA was introduced in the ward, the couple did not join the programme because the concept of minimum soil disturbance and not using the plough is not their culture and how they have been farming for the past 45 years. Besides the plough being their culture, they also were sceptical about the demands of basin digging as they are no longer strong enough to use the hoe due to old age, while it was also a difficult task for their one grandchild to dig basins on the 0.25 ha required by project promoters. After seeing the success and yield improvement from most farmers on their small CA plots, the old couple decided to also join through *humwe* in the second year.

According to Umar (2013), the development of norms such as the one illustrated above is aimed at spreading risk and helping offset resource constraints. Such practices are part of what Scott (1976) referred to as the moral economy of the peasant distinguished between technical and social arrangements. Under social arrangements, he included patterns of reciprocity, forced generosity, communal land and work-sharing. Technical arrangements consisted of seed varieties, planting techniques, and timing. These arrangements helped to even out the inevitable troughs in a family's resources which might otherwise have thrown them below subsistence. In a similar vein, Popkin (1980) observed that many of the norms and procedures of smallholder societies are embedded in considerations of subsistence and survival. The village is not only a ritual and cultural unit but is also an important part of smallholder economic life as a source of rights and resources.

The research also found that *humwe* was used to address labour challenges during basin digging. The practice was also done to collect mulch to cover CA plots and make compost when households modified some CA principles (see section 6.3 for more information). Even though composting for application in basins as advised by promoters was cheap for resource-poor farmers of Ward 30, most farmers reported that it competed with other farming operations for labour and time. Households found that group work helped reduce labour constraints and started making compost in small batches on a rotating basis to address the labour challenges they encounter in creating organic composts. The farmers would come together to cut and collect grass, while those who owned draught power and scotch carts would carry the grass to compost points. The research found that practising *humwe* to address basin digging labour constraints also allowed households to rebuild social networks by encouraging farmers to work together, helping many realise their potential and restoring confidence that they can be accepted as part of the entire community. Practises such as *humwe* are consistent with the concept of innovation adaptation expressed as a reinvention (Rogers, 2003) in the innovation-diffusion theory. Reinvention or adaptation of innovation is an essential process for making the innovation suitable for the local context. This also brings to the fore that farming practice is not isolated from the rest of the society's culture, and it cannot be treated as a purely technical subject. It influences and is influenced by other aspects such as community relationships.

Even though social practices such as *humwe* are one solution farmers come up with to solve labour challenges, the problem still persisted. For example, the shared labour activities (*humwe*) during the digging of basins did not extend to the weeding period; neither did the mulch collection go beyond compost making. One of the main reasons for not extending the shared labour activities was the different demanding tasks that the CA farmers saw requiring attention during this period. This contrasts with winter or off farming season, when farmers do not have many tasks to do and are usually taking a break from farming. However, it is worth pointing out that most farmers found basin digging laborious because they tended to start planting basins in September to October (sometimes even up to November). Zimbabwe Conservation Agriculture Task Force (ZCATF) (2009) reported that this meant squeezing in the basin digging phase into a short space of time before the onset of the rains.

Practising CA and conventional farming simultaneously

When CA was introduced in Ward 30, farmers could choose between CA and conventional farming practices. However, the research found that there was partial adoption of CA as none of the farmers practised the system exclusively. In other words, none of the farmers committed their entire farming land to CA; instead, farmers practised the system on varying proportions of their farming land. Interactive discussion with household farmers revealed that farmers adopted CA while continuing conventional farming on other parts of their farms for crop production. They preferred the lower but more stable yields resulting from the diversification of tillage practises instead of complete conversion to CA tillage systems. This is because households are risk-averse and careful about experimenting with unknown technologies due to resource constraints. Since these are resource-poor farmers, their lives are characterised by uncertainty. That has spurred the development of risk aversion behaviour, hence practising a combination of conventional and CA farming systems.

The risk aversion behaviour is enforced by the soils they farm are often marginal and deteriorating (Lal, 2000), and they face predictable and unpredictable pest and disease problems about which they can do little. The farmers are also exposed to erratic rainfall patterns. However, findings also reveal that each household would disaggregate the technique according to their risk preferences and resources, meaning motivation uptake levels for each component varied (For more on this, see section 6.3.3. on how farmers would modify CA components to suit their local conditions).

The research also found that some farmers, especially those perceived to be rich by the community, did not see any need to adopt CA on the whole farm. For example, one of the relatively resource-rich farmers aged 70, a retired civil servant who has all his children in the diaspora said:

> I do not see any need to totally change from conventional agriculture to CA because I am quite comfortable with my levels of crop production using conventional methods. In fact, I don't have pressure to try new farming technologies because if the way of farming I am used to fails for one reason or the other I have children who will look after me. I am now doing farming as a hobby.[27] (Interview. Sekuru Daramombe, 30 September 2019)

Several farmers doubted whether the principles of CA would work and were not keen on experimenting on the whole farm. Most farmers in Ward 30 live around the poverty line, which means they have no buffer. Trying out a new agricultural principle (CA), with the possibility of failure, was too risky. Farmers listen to promoters of CA, such as project staff and extension workers from the government, but they also listen to their families who expect food provision. The study found that because the farmers are predominantly resource-poor, they think about short-term issues like feeding their families. The CA technology promises to improve soil

[27] Interview with Sekuru Daramombe, Ward 30, Nyanga District, 30 September 2019

structure and fertility in the long run, which takes several years, whereas farmers did not have such a long-term vision, which was a mismatch. They preferred to continue with the lower but more stable yields of conventional farming instead of complete conversion to CA tillage systems. A sentiment from VaMutigwa captures how smallholders organised their agriculture, which also reflects how risk-averse they were when he shared:

> I could not take chances and put all my faith in a farming practice (referring to CA) that is new and could either work or not. I had a section on CA while in the rest of the field I continued with conventional farming practices that I am used to and has proven to work for my household. The best option for me was to adopt CA on a trial basis while continuing with conventional practices that I have known for years.[28] (Interview. VaMutigwa, 05 July 2019)

And even more explicitly Mai Chidzombwe shared:

> No matter how good a new farming practice appears when it's introduced, I will always have another field where I will do conventional farming practise. It has worked for me over the years so I will continue with what I have always been doing and whatever new methods that come I will try them but not discard conventional methods. [29] (Interview. Mai Chidzombwe, 13 July 2019)

An analysis of the quote above, according to Umar (2013), this process of tillage diversification is not unique to the study areas but is common to many poor communities whose lives are characterised by uncertainty. Tillage diversification is important to poor farmers because their lives are characterised by uncertainty, which has spurred the development of risk aversion behaviour among farmers in the ward. Smallholder CA farmers minimise risk by having a combination of tillage and cropping systems. Most farmers practise mixed farming, and cattle are mostly devoted to ploughing large portions of land, defeating the principle of minimum soil disturbance. In addition, it shows that farming households will persist with their farming practices as it is a deeply embedded practice that has been tried and tested over many

[28]Interview with VaMutigwa, Ward 30, Nyanga District, 05 July 2019
[29] Interview with Mai Chidzombwe, Ward 30, Nyanga District, 13 July 2019

generations, even if that means going against the recommendations of CA experts. This finding also tallies with Nyanga (2012), who noted the diversification of tillage systems among CA farmers in Zambia and suggested that rather than seeing CA as an overall superior agricultural system, farmers perceived CA as an additional option, among many, for addressing their food security problems.

While in America and Australia, the CA movement was largely driven by farmers (Ekboir 2003), in SSA, including Zimbabwe, smallholders generally do not have the resources or linkages that enable them to take hold of the reins of development. An analysis of the behaviour of farmers in the study area shows the expected utility and safety-first theory on risk-averse households**.** Smallholders are less able to invest in new equipment and are more risk-averse than large-scale farmers. They consider many factors and are careful about experimenting when adopting a farming system, especially the benefits and risks of something new. Managing uncertainty and identifying opportunity has been especially relevant to smallholder agriculture, where highly vulnerable farmers will likely experience unexpected events with major consequences. Across Africa, highly vulnerable risk-averse farmers will tend to favour precautionary strategies that buffer against climatic extremes over activities that might be more profitable on average (Hansen *et al*., 2009, 2011; Rao *et al*., 2011).

Besides risk aversion, most farmers were reluctant to increase the plot size under CA or adopt CA principles on the whole farm because it meant total abandonment of conventional farming practices, which is unthinkable for most households in the area. Conventional farming, especially tilling the land using a plough, makes sense to farmers in the study area. They will not change this overnight. Farmers make several considerations when selecting agricultural systems at the beginning of any farming season. One of these is the choice of crop. There is a perception among farmers that some crops perform well when the land is tilled and soil is turned over. For example, the total uptake of CA on the whole farm would not encourage the growth of groundnuts, roundnuts (monkey nuts), and tubers such as sweet potatoes that require well-tilled land to thrive well. Conventional farming plots are valued for growing nuts essential for peanut butter and other nutritional values. To add to that, in their study in the Southern Province of Zambia, Baudron *et al.* (2007) observed that most of the cultural practices conflicted with the CA principles. It is clear that farmers are risk-averse and are driven more by food security than anything else. Therefore, once the decision has been made to engage in the production of a crop, the preferred tillage system for that crop will be used. For instance, sweet potato (*Ipomea batatas*) is characteristically grown on ridges and is perceived as unsuitable for growing using the CA system as promoted in the ward. The farmers reported that although this action greatly disturbed the soil, it was necessary for yields. Mai Chiposi explained:

> There are crops that we farm that I cannot grow without tilling the land. Sweet potato needs loose soil for the tube to grow to its maximum size. Once you plant it without tilling the land or making ridges, you will not have a good harvest.[30] (Interview. Mai Chiposi, 08 August 2019)

The farmers' unwillingness to change from conventional practises but experimenting with CA partially resulting in dual farming practises was also evident through discussions when they revealed that after joining the programme the first year, they assigned their most poor and stony fields to the CA project. Some of these fields had never been used for farming either because they are too far from the farm or due to the poor soils and extreme weed pressure. Predictably, the results from practising CA on these plots were not impressive even though they applied all the CA principles. Farmers acknowledged they prioritised their conventional farms because they were afraid that the yields on the CA plot would be disappointing and would not take the risk. In contrast, a few wealthy farmers in the study area who tried CA were willing to take the risk because they had the means to support themselves and their families if they did not get good yields. The finding that poorer farmers are reluctant to risk and adopt CA is confirmed by the literature. Wall (2007) states that adopting a new technology implies knowledge investment in the acquisition of a new complex system which might be too demanding for poor farmers, especially because the results of CA will be seen after some years. Interviewed farmers questioned why they should risk this year's harvest for a technology that will be beneficial in the long term only. Ngwira, Thierfelder & Lambert (2013) found a short-term risk of lower production and therefore lower household consumption under CA. The reason for the lower production has been associated with the learning curves producers face after adoption. This is an unattractive prospect for food-insecure smallholder farmers.

[30] Interview with Mai Chiposi, Ward 30, Nyanga District, 08 August 2019

The research also found that some farm households endeavoured to conform to norms of society (Rogers, 2003) and avoid being labelled *nyope*, and practised no-till only on small portions of their farmland (to be part of the CA project) while the rest was under conventional tillage as reported earlier. As one farmer explained:

> I had two portions of CA and the rest under conventional farming methods. I used both methods because I did not want people to think I am lazy by practising CA only. As with our culture, a proper farmer who is hardworking must till the soil with a plough; therefore, I vindicated myself from negative social connotations attached to digging basins the whole farm.[31] (Interview. Mai VaNgwazi, 16 August 2019)

The quote above demonstrates the role of social expectation on CA adoption, showing the link between social factors and how farming occurs in rural farming set-ups. Because most people like to feel accepted and approved by those around them, they tend to behave following the expectations of those around them. These farmers would only apply one principle to the CA field often in the hope of getting input support. According to the farmers, not taking up at least one principle of CA would mean they would not be considered when other programmes are rolled out, so they thought it was necessary to comply. In addition, these farmers did not want to disappoint promoters and the ward extension officer during field visits and oversight. Some farmers who bought their own inputs for the CA plots were expected to be rewarded by the project staff and felt disenchanted when that did not materialise. This also forced some households to dis-adopt CA even though it would have suited their situation. This finding is similar to Giller *et al*. (2009), who found that most smallholder farmers practise CA for the sake of input support. They cite Haggblade and Tembo (2003), who estimated that 15,000 of the 75,000 farmers that practised CA in 2002/03 in Zambia were spontaneous adopters, while the remaining 60,000 farmers practised CA as a condition for receiving their input.

More experiences, globally and especially in Africa, are found in which adoption of CA was claimed during the active promotion but did not lead to sustained change in agricultural practice.

[31] Interview with VaNgwazi, Ward 30, Nyanga District, 16 August 2019

For example, Derpsch, Lange, Birbaumer & Moriya (2016) reported the dis-adoption of CA in Paraguay due to lack of ownership of the technology. Another case of dis-adoption of soil and water conservation technologies was reported in Ethiopia (Teshome *et al*., 2012). In another case, Baudron, Mwanza, Triomphe, & Bwalya (2007) also reported cases of abandonment of CA by some farmers in the southern province of Zambia after discontinued input support. This means farmers in Ward 30 joined CA in the first year for the sake of input support and later dis-adopted when the NGO working in the area departed, as argued by Sims *et al*. (2005). It is also arguably common in Africa for farmers to anticipate incentives for new technology, as underlined by Derpsch (2005). All these cases of abandonment/dis-adoption of conservation agriculture only prove that lipstick adoption of improved agricultural technologies is a common feature of the majority of poor resource farmers (Mugandani & Mafongoya, 2018).

Wagstaff & Harty (2010) noted that changing the mindset of farmers and forsaking the plough is difficult. This is because new farming practices will be more acceptable to farmers if introduced into existing systems without drastic changes (Oakley & Garfoth, 1985). They further point out that farming practice is not isolated from the rest of society's culture and cannot be treated as a purely technical subject. In addition, Marongwe *et al.* (2012) reported that the practice of having plots under CA and conventional farming plots like in the study area culminates in thin resources such as labour and production inputs being spread around, jeopardising the potential to meet even basic household food needs. Consequently, the expected long-term panacea to the food insecurity in Africa that can be achieved by encouraging farmers to intensify production is difficult to achieve (Gukurume *et al.,* 2010: 41). Farming systems are complex, and change in one aspect may create problems in others. This finding also shows the risk averseness of smallholder farmers as alluded by the expected utility and safety first theory in Chapter Two. According to Ghadim, Pannell & Burton, (2004), risk variables that impact the adoption of innovations would include farmer's perceptions of the riskiness of the innovation; farmer's uncertainty about the innovation; farmer's potential to learn about risk and reduce uncertainty through trialling the innovation; and farmer's attitudes to risk and uncertainty.

CA plot sizes

According to Christian Care (2010), the labour question has reduced most farmers' capacity to increase the plot sizes and reduced time invested in CA. Likewise, labour bottlenecks were a major contributing factor in most households failing to expand their CA plots in the study area. Even though farmers acknowledged good harvest per unit area in their first year of CA adoption than in other tillage methods, the land area allocated to CA of 0.25 ha remained unchanged in the years that CA was being practised.

One of the reasons farmers partially adopted the technology and could not increase the CA land sizes was that they were not comfortable with the risk associated with using expensive inputs but preferred indigenous inputs. In addition, Concern Worldwide, which originally supported CA, had pulled out of the area. Most farmers in the area are resource-poor and have limited capacity to acquire inputs. It appears that investments that could increase productivity (e.g. hybrid seeds, fertilisers) are avoided as they are seen as highly variable and therefore too risky. This is particularly the case if farmers have to pay for these expensive agricultural inputs in advance. One farmer explained:

> I could not increase the CA plot beyond the initial 50 x 50m size due to the price of inputs that was expensive. Imagine when you buy fertiliser, seeds, herbicides and other chemicals and the year ends up being a drought year. I am not comfortable taking such a risk.[32] (Interview. Mukoma Reginald, 07 October 2019)

In agreement, another farmer said:

> The way we do our farming in this ward requires one to be very careful about the risk you take. If you fail to be calculative and go all out with buying all these expensive inputs you will regret it when things do not work out and in most cases, we have seen some farmers in this area who have never recovered from that until this day after they failed to be 'smart'.[33] (Interview. VaMagunha, 16 October 2019)

Understandably, a farmer dependent on their farm to feed her or his family thinks twice before changing anything that could jeopardise the harvest and result in starvation. Convincing these

[32] Interview with mukoma Reginald, Ward 30, Nyanga District, 07 October 2019
[33] Interview with VaMagunha, Ward 30, Nyanga District, 16 October 2019

farmers to adopt new practices or technologies is challenging because their behaviour does not seem driven by the amount of money they need to spend to improve the productivity of their farm or by the attractiveness of anticipated returns. Instead, what they fear most is being locked into a situation that leaves little chance to return to their previous methods.

As reported in Chapter Two, the theory of expected utility and safety first, most farmers are risk-averse, i.e. they would accept a lower monetary value for certain than the expected monetary value of the risky decision alternative (Lambert & Lowenberg-DeBoer 2003; Koundouri *et al.*, 2006). Investigations of perceptions on climate variability and risk among farmers from Kenya show that farmers give greater weight to negative experiences (Rao *et al*., 2011), which is no different from findings in the Western world (Arvai & Kahneman, 2013). The consequence is that highly vulnerable and poorly resourced smallholder farmers consistently miss good opportunities, and the cycle of low-input/low-output becomes difficult to break. This shows that qualitative and non-economic factors are also critical in the adoption of CA. Although most farmers could not afford CA inputs, for others, the partial adoption of CA on a small proportion of land was also an attempt to experiment with the system since the programme was providing free inputs. Discussions with them did not indicate farmers' attempts to adopt the system in a sustained manner. Besides the risk factor associated with investing in expensive inputs, which led farmers not to increase CA plot areas highlighted above, farmers also cited labour constraints as another factor. Because farmers imported large volumes of crop residues which were later modified to grass for soil cover (see section 6.3.2), the availability of these materials became the main factor limiting the area on which they practised CA. Labour challenges associated with basin digging also led to farmers not expanding their CA plots. These planting basins are ideally supposed to be maintained for several seasons, allowing them to accumulate fertility.

Source of inputs for CA plots

Farmers in Ward 30 are increasingly struggling to make a living from agriculture because of low soil fertility and degradation, among other challenges (see Chapter Four on challenges confronting these farmers). In addition, these smallholder farmers have limited or no access to rural financial services, which constrain their ability to acquire productivity-enhancing inputs such as seeds, fertiliser and labour-saving technologies. Therefore, for most farming households, the switch from conventional farming to CA was a costly exercise, especially the purchasing of inputs. Unlike conventional farming, where farmers can be flexible and use traditional inputs, CA promoters encouraged farmers to use scientifically proven inputs such as fertilisers, herbicides, hybrid seeds, etc., in their CA plots.

Due to the limited access to credit to purchase inputs from formal lending institutions like banks, farmers themselves, as social actors, engaged rural enterprises for credit for their CA plots when Concern Worldwide stopped providing free inputs. These rural enterprises emerged as critical actors and vital in organising and guiding CA farming by offering informal loans and sharecropping arrangements to buy CA inputs. These arrangements took place between, on the one hand, farmers who were not able to raise enough money to buy inputs due to resource constraints and, on the other hand, the shop owners in the ward. These arrangements are based on trust, which would fulfil the households' farming and crop production, thereby meeting the actual needs of farmers. Acceptance constitutes a signature to the contract, locally known as *jendiremeni kondirakiti* (gentleman's contract). These contracts are not memorialised or witnessed, nor are they accompanied by any ritual to formalise them. Contracts varied from one household to another and would also vary depending on the farming needs of a household and the bargaining power of the farmer and shop owner. It is also sufficiently flexible as a collaboration model to allow parties to gain and release households from some inherent farming limitations. According to one shop owner VaChitsumba who provided inputs loans to some farmers in Ward 30[34]:

> I trust these farmers because we have known each other for years in this ward, such that I cannot sit back and watch them struggle to buy inputs when we can get into an agreement that can help both parties. Through the relationship we have built over the years, farmers took their CA inputs on credit because we have become very close and trust each other ever since we got resettled in this area. Rather than going through the process of question and answer or even denying a loan, like what happens when they go to the banks, I offered to help them out. (Interview. VaChitsumba, 23 September 2019)

[34]Interview with VaChitsumba, Ward 30, Nyanga District, 23 September 2019

In cases where enterprises did not have inputs as part of their commodities, farmers would get cash loans to buy herbicides, fertilisers, and seeds while also taking cognisance of how much risk they felt they could take, rather than the amount that would maximise production or profit. In my discussion with farmers, I found that farmers did not take enough inputs (seeds and fertiliser) to produce a good harvest in most cases. They would value the smaller risk above the maximum possible return. Moreover, low production means that farmers risk not paying back loans with the harvest due to market and inconsistent price challenges faced in the area. In some rare cases, the shop owner provided all the CA inputs to household farmers while the farmer is involved in everything else, including basin digging and the labour for weeding, spraying and harvest. Farmers who got into agreements or arrangements with shop owners to access loans to buy inputs would pay it back after harvesting using their products or through sharecropping for resale. By doing so, farmers would also secure markets for their farm produce.

It is also not easy to find a definite pattern in crop sharing contracts of shop owners and farmers. Farm produce share varied from one contract to another even when two households took a similar amount in cash loan or inputs from the same shop owner. The difference between a contract and what is expected depends on the individual's bargaining power and risk aversion in the contract. The research found that all the shop owner and farmer contracts were rolling for one season because of the change in prices, especially inputs and changes in needs for each party. These contracts did not help farmers move from subsistence production of low-value staple foods to commercial production of higher-value crops, nor allow them access to the wider economy and raise their income. It is also worth reporting that out of all the discussions I had with shop owners and farmers regarding contracts, I only found one written contract but very basic, and the rest are all verbal. However, these social arrangements and networks between farmers and shop owners brought interdependence: they would share farming risks, e.g. drought, with each other.

For an area where women are mostly involved as agricultural productivity farmers, the research found that access to informal credit loans to farmer-shop owners is gender-biased. Shop owners discriminate against most female-headed households who are unable to access these CA inputs enterprise credit contracts. When a household is female-headed and is a widow or divorced, the shop owners reported that giving CA inputs loans were risky. Some of the reasons given were that CA farming involves doing heavy work, especially digging basins, and the women would struggle to get a good harvest; therefore, they could not meet the contract requirements. Mai Muchirewesi who is a widow from village six who could not get CA inputs loans from shop owners in the area shared:

> I tried to ask for credit loans for produce contract from shop owners in this area but they were reluctant to help me. Most of them told me that I was a loan default high-risk because I might fail to pay back the produce since they don't trust us to do farming activities.[35] (Interview. Mai Muchirewesi, 24 September 2019)

However much enterprise-farmer input loans are helpful in an area like Ward 30 where farmers are predominantly resource-poor, there are also challenges associated with this arrangement. In cases where a household is led by a female and the husband is formally employed in the urban areas, women farmers reported that shop owners prefer to engage with a man because it does not fit with their values and beliefs to enter into a farming contract with a woman whose husband is still alive. After all, men are mostly involved in making decisions such as type of crop, selling, and buying.

Even though these rural enterprise-farmer CA inputs loan arrangements were helpful, most farmers pointed out that sometimes these contracts took away the freedom to make the farming decision as some creditors decided what crop to grow. Sometimes creditors preferred CA farmers to grow a certain crop as payment for their loan, which a farmer lacks enough knowledge or expertise on how to grow it. AGRITEX, the government arm for research and extension, is no longer playing an active role in training new farming techniques, as reported earlier in Chapter Four. The lack of extension and advisory services when farming a new crop resulted in farmers focusing and putting much attention on the new crop while neglecting or even abandoning their CA plots. Most farmers who signed these contracts would do it out of desperation, but just like any other loan agreement, whether formal or informal, it brought its own challenges. When they

[35] Interview with Mai Muchirewesi, Ward 30, Nyanga District, 24 September 2019

failed to pay the agreed produce, some shop owners took livestock (cattle, goats or chicken) or farm implements to make up for the shortfall. The loss of livestock or farm implements will impact a farmer's ability to produce crops and leads to further food insecurity.

6.3 CA components adaptation and modification by households

Recent studies indicate that complex technologies such as CA are not usually adopted but adapted (or locally reinvented) through social processes (Glover *et al.*, 2016, 2019; Ronner *et al.*, 2018). Institutions promoting CA in SSA such as research and development institutes, government extension and NGOs have acknowledged the need to modify the CA principles to local smallholder contexts for over a decade (Erenstein *et al.*, 2012). As argued by Glover *et al.* (2019), the outcomes of the technology adaptation process are determined by the actions and constraints of both technology developers/promoters and farmers (end users). Having laid out how CA was practised and organised by farming households in the discussion above, this section looks at how some CA principles were adapted, modified, and implemented by farming households to suit their local conditions. The acceptance of the CA package was not the same amongst households. Some of the modified principles were digging of basins to plough lines, moving from crop stover to grass as mulch, changes in weeding management, changes in manure application, crop rotation changes and fertiliser application discussed below.

6.3.1 The adaptation of the basin digging principle

In Ward 30, the use of draught animals for farming is widespread and long-established. Farmers who do not own draught power usually hire or borrow animals to prepare the land before planting seeds during the farming season. Furthermore, linked to this, the research found that the drudgery nature of digging basins using hoes and the culture of the plough led farmers to modify and partially adopt the principle of minimum soil disturbance and started using draught power and the plough. Unlike the conventional way of farming, where the plough is used to turn over all the soil, households would make planting rows using the plough without tilling first, a practice not in line with the principle of minimum soil disturbance. Locally this was called '*kudhara maline*', meaning plough line seeding. Farmers used the ox-drawn plough to make row spacing of about 75 cm instead of digging planting basins that are viewed as laborious and time-consuming (see figure 15). Draught animals are trained to follow the previous furrow or planting line, so the distance between the rows will be half the distance between the animals determined by the length of the yoke (crosspiece) between them.

Figure 15: A farmer using an ox-drawn plough in a modified CA practice of minimum soil disturbance

Explaining how the principle of minimum soil disturbance worked one farmer said:

> We saved a lot of time after we stopped digging basins and started using the plough to make lines for planting seeds. In addition, the labour peaks we experienced during weeding periods when we had adopted CA were reduced because we could use cultivators for weeding which was much easier than weeding using a hoe if crops are in basins. [36] (Interview. mukoma Glens, 28 September 2019)

The animal-based systems demanded less labour for the entire farming cycle compared to the manual, animal-based systems. I asked farmers about the tillage history of plough line seeding, and they shared that it is a traditional practice mostly done when farmers do not have time to till over all the soil. Such practises are consistent with the concept of innovation adaptation expressed as a reinvention (Rogers, 2003) in the innovation-diffusion theory. Reinvention or adaptation of innovation is an essential process for making the innovation suitable for the local context. This is because of the time and labour saving effect of the plough, and for these farmers, shifting towards CA and abandoning the plough is less attractive. This finding also reveals how

[36]Interview with mukoma Glens, Ward 30, Nyanga District, 28 September 2019

easily farmers can reverse their decision on adoption once the technology does not fit into their farming system and go back to their previous traditional farming practices because there is little cost involved.

Apart from the culture of the plough drudgery nature of basin digging leading to farmers modifying the minimum soil disturbance principle, farmers also shared that they modified this CA principle due to the rate at which crops wilted during the January dry spell highlighted in Chapter Four. One farmer shared:

> After we closely examined crops under CA plots and those that were under conventional methods we saw that crops that were planted after tilling the soil withstood the dry spell better than those planted in basins without mulch. From our experience in this area, tilled soils capture moisture longer than when you dig basins.[37] (Interview. Mbuya Rudo, 19 November 2019)

In agreement another farmer explained:

> Crops around here have a better chance of surviving the January dry spell if they are on soil that is tilled with a plough than where a hoe is used. At least when you plough, the roots have more freedom to move in the soil than on soil dug by a hoe. That is why you see the difference in the rate at which they wilt.[38] (Interview. VaGudugwa, 23 November 2019)

As I probed more to understand this variance in the perceived ability to withstand wilting, the research found that the competing use of crop stover led to farmers only partially adopting CA principle of basin digging without applying mulch on their CA plots, which contributed to that difference. Even though the experience and explanation by the farmer above are true in their context, one cannot conclude that CA does not work. One can safely argue that farmers' crops were wilting more after they partially adopted the component of basin digging because the crops were lacking mulch. CA proponents argue that for CA to work properly and realise its full potential, farmers must adopt all three components: mulching, minimum soil disturbance and crop rotation. In the case above, the households only partially adopted a modified principle of

[37] Interview with mbuya Rudo, Ward 30, Nyanga District, 19 November 2019
[38] Interview with VaGudugwa, Ward 30, Nyanga District, 23 November 2019

minimum soil disturbance and left the mulch component, which could have helped solve the problem of soil exposed to the sun and wind, leading to the quick evaporation of moisture and wilting of crops. Even though households persevered with the modified minimum soil disturbance principle, input constraints deterred them from increasing their CA plot sizes. This reveals the inability of farmers to fully adopt programmes like CA, especially in an area like Ward 30, because they are poorly resourced, and that is one of the major reasons behind abandoning the CA in the area.

6.3.2 The adaptation of crop stover use for soil cover principle

In line with CA promotion in ward 30, farmers adopted the practice of mulching into their CA plots maize stover and bean plants residues as shown on the demonstration plots. Mulch was added during the dry season and involved collecting, storing, piling and neatly laying (locally called '*kupfurira'* meaning 'thatching') the crop residues side-by-side to facilitate planting when the rains arrived. Farmers reported that they covered their CA plots with a 3 cm depth of mulch cover as recommended by promoters of the project. They reported that the thick mulch layers provided benefits such as smothering weeds and holding moisture during dry spells. However, after they made their first harvest on CA plots, they failed to retain all crop residues in the fields for a more permanent soil cover throughout the year. One farmer reported:

> We could not control external factors such as communal grazing during the dry season as that is the time we are also usually involved in off-farm activities which then hampered crop residue retention. [39] (Interview. Mai Chimukoko, 13 November 2019)

Another farmer explained:

> The crop stover that we had applied decomposed in the first year.[40] (Interview. mukoma Kidza, 14 November 2019)

Since farmers had experienced and seen the advantages of mulching in their first year of adoption, they adapted and implemented this principle to become unorthodox, and a practice to cover the soil in CA plots emerged. They began to use mulch from cut grass as an alternative to

[39] Interview with Mai Chimukoko, Ward 30, Nyanga District, 13 November 2019
[40] Interview with mukoma Kidza, Ward 30, Nyanga District, 14 November 2019

crop residues which were inadequate due to competition. This is because farmers in the area allow communal grazing, and livestock are left to roam around in the fields as they prefer their animals to feed on crop residues, especially maize stover, which is also used as mulch in CA.

The change from using crop residues as soil cover to grass saw most farmers fail to follow the concept of permanent soil covering due to the time spent between harvesting and looking for the grass. In addition, mulch application was supposed to be carried out during the beginning of the dry season, which coincides with other offseason activities such as nutritional gardening activities. Because of their importance, nutritional gardens are accorded more attention compared to grass mulch gathering. Even though most households had modified the mulch cover principle from crop stover to grass, the solution to the challenge of covering the soil all year round was short-lived. Since the grass is supposed to be tall, it also competed with the high demand for thatching. Again, some of the grasslands are accidentally or deliberately burnt in the dry season, thus jeopardising the mulch procurement. This finding is congruent with the findings of Giller *et al.* (2009) and Vanlauwe *et al.* (2014), who pointed out that there is generally low biomass production in smallholder farms, which may not allow farmers to meet the 30% mulch cover as a minimum recommendation for CA.

Even though farmers recognised the value of the component of soil cover, the laborious nature of getting grass mulch away from their farms drove most farmers to abandon the mulch component, or partially provide soil cover on a relatively small portion with the rest of the CA plot remaining uncovered. As pointed out by Grabowski & Kerr (2014) the importing of residues from outside the farm is feasible in small areas and is practised mainly by smallholders in search of family food security, but is rarely feasible in larger areas due to the high labour demands. The challenge of mulch also explains why in 2015, approximately 300,000 farmers used CA in Zimbabwe, but overall hectarage remained low due to the average small size of CA plots (AGRITEX, 2016).

6.3.3 The adaptation of the weeding management practise component

Weeds are a primary challenge in rain-fed cereal systems across SSA (Tittonell & Giller, 2013) because they compete with crops for water, nutrient and solar radiation resources, yet they do not contribute to production but rather reduce crop yield. Promoters of CA argue that as a principle, weeding should commence as soon as the first weeds emerge, and fields should be weed-free throughout the season (ZCATF, 2008).

Unlike conventional tillage systems where farmers plough/cultivate repeatedly to suppress weeds, Ward 30 CA farmers were encouraged to use hand hoeing and hand weeding. In the first year of adoption, weeding started soon after harvesting, before the weeds had set more seeds. Farmers continued to use the hand and hoe weeding method for minimal soil disturbance as encouraged by promoters even when crops had germinated as it was easy to uproot the weeds owing to continuous moist soils made possible by mulch. However, farmers reported that labour peaks were experienced during weeding because CA plots required an average of two to three times more weeding per season compared to once for conventional draft tillage plots. The challenge of weeds in Ward 30 was reported by Nyamangara *et al*. (2013), who pointed out that smallholder farmers in Zimbabwe still struggle with weeds in their fields. The drudgery associated with weeding has not lessened despite generations of techniques, some of which have little or no cost attached in their implementation.

Even though weeding started in winter as encouraged by promoters in the first year of adoption, the practise was abandoned in the second season of adoption by most farmers due to labour challenges. Instead, farmers would opt for post-planting timely weeding (i.e. when the weeds were still small) to prevent the weeds from setting seed on their CA plots, a practice popular with conventional weeding. One farmer argued:

> There is no need to continue weeding off-season because our livestock will graze whatever is growing in the fields during the winter season.[41] (Interview. VaGangara, 25 November 2019)

Other farmers did not keep their fields weed-free when their crops had matured, as encouraged by promoters. On their conventional farms, as the crop matures, farmers tend to leave the weeds in the fields as they believe crop yield will not be compromised at this stage. During that period, farmers prioritise labour over other off-field activities such as building/carpentry, brickmaking/thatching, pottery and basket-making (see figures 16 & 17). Most farming

[41] Interview with VaGangara, Ward 30, Nyanga District, 25 November 2019

households are a place of varied enterprises where farmers have many but relatively small sources of income rather than one or two large sources. This is the case mostly because there is not much surplus when they harvest, and off-farm activities help them spread the farming risk.

Figure 17: People moulding bricks for selling during farming off-season

Figure 16: Finished bricks after moulding

Most farmers reported that in the first year of CA adoption, weed pressure was better on CA fields due to the mulch used as they adopted the complete package. However, in the second year of adoption, weed density increased in most CA fields, and crops competed with weeds already growing at sowing time and those emerging after planting due to several reasons. Firstly, the research found that weed density increased in CA plots when farmers failed to apply mulch due to competing uses of crop residue in the area since biomass helps in weed suppression. In instances where grass mulch was applied as an adaptation and substitute for crop residue, it was not fully applied as recommended, and ultimately it could also not suppress the weeds. Secondly, the density of weeds on CA plots was also due to the non-application of herbicides due to cultural reasons, while some farmers could not afford them. The high frequency of weeding on CA plots reported by farmers in the study area is consistent with Mabasa *et al.* (1999), Twomlow *et al.* (2008), and Nyamangara *et al.* (2013) findings that weed infestations tend to be high under minimum tillage. Thus, farmers who use planting basins need more labour during the season and land preparation.

Most farmers who have farm implements such as cultivators adapted the CA practice of hand and hoe weeding and began to use cultivators to control weeds in their CA plots. As one farmer put it:

> When we modified the way we managed the weeds to address our labour challenges due to strict hand and hoe weeding in CA plots, it lessened the burden on us and the weeds that compete with crops became minimal.[42] (Interview. Sekuru Chikomo, 16 November 2019)

The quote above is consistent with Barberi & Lo Cascio's (2001) study, which found the highest weed seedling density in no-tillage plots compared to chisel and mouldboard ploughing. The same finding was also reported by Moonen & Barberi (2004), who reported a fivefold higher seed bank density in reduced tillage systems compared to till. The research found that farmers weeded their reduced tillage basin plots significantly more frequently than conventional plots. Nevertheless, the reduced tillage basin plots still had more weeds compared to conventional plots.

6.3.4 Adaptation in the application of organic manure component

In order to address the problem of infertile soils, which are dominant in most fields in the ward, manure application per basin was encouraged by CA promoters as a way of adding nutrients to the soil. CA farmers were compelled to apply organic manure soon after digging basins between August and October before the rainy season. This is in contrast to conventional farming practice where there is no specific time to apply manure because it is done all year round. In line with CA promotion in the area, one to two handfuls of manure was mixed with 1- 2 cm of soil per basin resulting in application precision and intensification. The use of the precision application has been estimated that an equivalent of 80 kg per hectare is used compared to 400 kg per hectare recommended in conventional systems (Harford & Breton, 2009). The amount of manure CA farmers applied varied from farmer to farmer because the type of soil determined it. Farms with predominantly sandy soils required more manure while clay soils required less. Covering of the basal dressing and manure with soil was done such that it leaves space to allow the collection of water during the first rains (Oldrieve *et al.*, 2009). Households without livestock would pick cow dung from the fields during the offseason and apply it in their plant basins as a strategy to offset

[42] Interview with Sekuru Chikomo, Ward 30, Nyanga District, 16 November 2019

the cost of fertilisers. Even though manure is readily available for most households, precision basin application of manure and even picking cow dung from the fields was laborious.

To address the challenge of labour, farmers abandoned the component of precision basin application and modified the practice to broadcasting manure on CA plots. Manure was put in small heaps first and then spread out or broadcasted using shovels, hoes or even hands. Contrary to what CA promoters encouraged, manure would then be spread out, and basin digging would follow while mixing manure and soil was abandoned as well. Manure application through broadcasting is the traditional norm done by farmers who own livestock as the area practises a mixed farming system. This challenge was more severe for farmers who had not applied herbicides due to social and cultural beliefs. The increase in weeds also brought disease infestation on crops such as brown leaf spots, and it did not only increase labour but also the costs of implementing CA. This finding is similar to other studies that have acknowledged the increased weed pressure associated with CA. Umar, Aune, Johnsen & Lungu (2011) established that weeding labour requirements tended to be higher on CA plots (in the absence of herbicide use) among smallholder farming households in Southern Zambia.

Besides the labour challenge in precision basin application of manure, farming households also reported that abandonment of precision manure application to a modified version was necessary after they found that crops in manure applied basins would quickly wilt beyond recovery. This was compared to crops grown under conventional practices, which would withstand the *mhare yaJanuary* dry spell. As reported in Chapter Four, Ward 30 farming season is characterised by long dry spells experienced in January since agriculture is under rainfed farming systems. Low moisture content within the soil means that the crops have very little moisture reserves to tap from during prolonged dry spells, leading to increased crop failure incidences. In trying to understand this challenge, the research found that even though most farmers have been applying manure on their farms for many years, they have little knowledge and limited experience in treating manure for cropping purposes. Precision application of manure was from manure that is not fully decomposed or 'matured', leading to crops wilting. Using manure that has been freshly dug may be very high in ammonia or contain so much nitrogen that it will burn the roots and stems of any plant it comes in contact with (https://www.westcoastseeds.com/blogs/garden-wisdom/poop-manure). The above finding shows that farmers did not understand the right quantities of manure that had to be applied, especially in the climatically risky semi-arid regions.

Due to the challenges highlighted above, the modification of the principle of precision manure application in CA basins was pursued. The failure or disregard of farmers to follow this CA component was due to lack of labour involved in transportation, mixing soil and manure, while in some cases, the application of manure which is not fully ‘matured’ meant that the seed-manure contact affected germination rates leading to farmers having a negative perception towards the principle. The lack of flexibility resulted in some smallholder farmers only having small fields under CA or completely abandoning manure application in basins. For other households, the CA technique of manure application in basins encouraged by promoters was a mismatch and proved unpopular, especially for households with large livestock numbers. These farmers reported that traditionally, they apply manure to an area of a field that shows signs of poor fertility, such as the yellowing of leaves in cereal crops.

In contrast, CA promoters made the application of manure on CA fields mandatory. In addition, most households who own cattle and any form of livestock dig manure and transport them to their fields during the offseason. In contrast, during the offseason, it is also the time households are expected to be digging basins for CA. The trade-off between making soil improvements on their farms and adopting a foreign farming innovation was easy for households to decide. Farmers ended up partially adopting the component of application of manure in basins in favour of endogenous practices as they generally revert to familiar patterns if certain expectations are not fulfilled.

6.3.5 Adaptation of crop rotation principle

The CA programmes promoters in the ward encouraged farmers to rotate maize with legumes. They were supposed to set aside two plots under CA, pure maize and pure stand legume. The legume and maize plots were supposed to rotate each year. CA plots were ideally supposed to be maintained for several seasons, allowing the basins to accumulate fertility. Farmers were expected to maintain the same planting stations, which in theory should reduce the labour required in subsequent seasons. However, discussions with farmers revealed that when the CA programme was introduced, promoters only provided maize seeds but could not provide legume seeds. In the first year of CA adoption, most resource-poor farmers who did not have legume seeds required for rotation had to sell or exchange their livestock (chicken and goats) to buy seeds from other farmers. One farmer who is a widow explained:

> I sold some of my livestock to buy beans and groundnut seeds because I did not want to lose the opportunity to receive free maize hybrid seeds, herbicides and fertiliser as it was compulsory for everyone to have one portion with legumes and the other with maize upon adoption.[43] (Interview. Mai Muza, 18 November 2019)

Crop rotation practice became difficult in the study area as most farmers are resource-poor and preferred to grow maize compared to legumes as it is a staple. The research found that strict crop rotation principle recommendations were abandoned in favour of partial and modified adoption due to various reasons. Legume seed shortage was one of them. Most farmers who did not normally farm legumes before CA introduction had poor legume harvests due to a lack of knowledge on how to farm the crop. This meant there was still a lack of legume seeds to plant the following season, and farmers could not bear selling or exchanging their livestock again for another year. Sunflower, another popular main crop grown due to its drought resistance and availability for most farmers in the ward, was unsuitable for CA plot rotation because it does not have the nitrogen-fixing ability. Some farmers also highlighted that they had not been taught how to incorporate legumes in basins as the basin spacing seemed more suitable for cereals, whereas legumes such as beans and groundnuts required smaller spacing and a higher plant population. This posed challenges in rotations due to differences in cereal and legume spacing, and households chose to modify the crop rotation component of CA.

In modifying this principle, most of the farmers in the ward reported that crop rotation was partially adopted where farmers would make a sequential change in the types of crops grown in the CA plots without necessarily following a systematic pattern of cereals being planted after legumes as required under CA. The farmers would continuously plant maize on the CA plot for two to three seasons because they preferred to continue growing maize, the staple on their most fertile soils. The CA plot soils were considered fertile because of the manure, compost, and fertiliser being applied, which ensured good yields leading to better food security. It meant

[43] Interview with Mai Muza, Ward 30, Nyanga District, 18 November 2019

farmers were now practising cereal–cereal rotation on CA plots where they plant maize one year, followed by maize again the following year because legumes should not compete with necessary food crops such as maize.

The argument that legumes should not compete with necessary food crops shows that risk-aversion and food security are at the centre of decision-making for most farming households, as highlighted in the theoretical framework of risk-averse households. The argument is also consistent with the work of Chuma *et al*. (2001), who found that smallholder farmers in Zimbabwe do not practise effective rotations. One reason for ineffective and inconsistent rotations is their decision to allocate more land to grain cereals in an attempt to achieve household food security each year. This is in line with Ahmed *et al.* (1997)'s findings that most smallholder farmers in South-western Zimbabwe allocate most of their cropping area to cereals, namely maize, pearl millet, and sorghum. So, where inputs such as seeds and fertiliser are limited for effective crop rotation, priority is given to staple crops. This hinders the implementation of maize-legume rotation leading to farmers partially adopting and modifying the crop rotation principle as seen in the study area.

Currently, as the farmers are back to their traditional conventional practises, they dedicate large farm areas to maize in anticipation of food shortages, and excess maize always has a market because it is a staple, albeit at lower prices. Besides being a staple, maize is becoming an increasingly important cash crop in the ward and supporting this argument; I found through field observation that the maize crop takes the biggest area under crop production compared to other crops. For example, on average, seven out of the 12 acres per household are for maize, while only two have leguminous crops (sweet beans, cowpeas and groundnuts), and the other three have other crops. Therefore, rotating this with a few other legume crops planted on a much smaller land area is difficult. Rather, farmers prefer inter-cropping by planting maize with cowpeas or beans, protecting the soil from erosion and out-competes weeds for nutrients and sunlight (Steiner, 2011). Farmers also prefer intercropping, reducing weeding labour since the legume leaves provide a canopy and deter weeds from growing due to lack of sunlight. This is in contrast to areas with land constraints, such as Malawi, where farmers prefer intercropping systems to rotations because they believe that the overall yield penalty and loss of area dedicated to maize would be minimal (Rusinamhodzi *et al.*, 2012).

The staple status of maize can also be explained by the pushing of this crop by government extension officers, who have been encouraging the planting of maize since the farmers were resettled in 1980. As reported in the literature, Thierfelder *et al*. (2012)'s findings in Ward 30 are similar to literature from across Zimbabwe that shows that farmers rotate crops even in conventional systems (e.g., in a maize-groundnut rotation), but the rotation frequency and relative space on smallholder farms are small compared to maize (Waddington *et al*., 2007). Farmers also highlighted that they are hesitant to rotate maize with crops of no immediate economic benefit to them, such as soya beans which was also encouraged by CA promoters because farmers prefer rotational crops with "multiple-purpose" uses, as stated by Giller *et al*. (2009). In addition, farmers prefer crops with immediate economic benefits because the ward lacks functional markets for produce. Due to changes and uncertainties in weather patterns resulting in low levels of rainfall, crops for consumption are also becoming a priority, as farming for export using cash crops is too risky. The argument that maize should not be rotated with crops of no immediate economic benefit is related to the risk-aversion of farmers.

6.3.6 Adaptation in the fertiliser application component

Due to the poor nutrient status of many soils in East Southern Africa (ESA), the application of fertilisers (particularly inorganic fertilisers) is essential to ensure good yields for household producers. Nitrogen has been consistently identified as the most limiting nutrient across household production systems in ESA (Stoorvogel & Smaling 1990; Smaling, 1993; Smaling *et al.*, 2012; Bationo *et al.*, 2012; Fischer *et al*., 2014). Nitrogen deficiencies mainly result from inherently poor soils and many years of continuous crop production without nutrient replenishment. Under these conditions, nitrogen fertilisers have been considered an essential input for overcoming poor productivity. On the other hand, mineral fertiliser remains a scarce, expensive and risky resource for most smallholder farmers, with typical prices 3-5 times higher than in Europe due to lack of infrastructure and production facilities (Thierfelder *et al*., 2015a).

When farmers practise conventional methods in the study area, there is very little or no fertiliser applied to crops because it is expensive or unavailable. However, when CA was introduced, the promoters supplied both basal fertiliser (Compound D) and top dressing (AN) because they acknowledge the long term benefits of organic fertilisers in improving soil fertility to increase yields. The farmers reported that one level beer bottle cap of basal fertiliser was applied per planting basin immediately before planting and covered lightly by 1-2 cm of clod-free soil to protect the seed from hygroscopic 'burning' by fertiliser. This is equivalent to 80 kg of compound fertiliser per hectare. Application rates could also be increased in wetter areas and also depended on crop types. Like in the case of organic manure, the amount of fertiliser would also be determined by the soil type. Sandy soils required more, for example, two-level beer bottle caps, while clay soils required less fertilising. Nitrogen fertiliser was applied to crops at the five to six leaf stage soon after the first weeding at a rate of one level beer bottle cap per basin. CA promoters and the area extension officer also advised farmers that they could increase application rates in wetter areas. This is also equivalent to 80 kg of ammonium nitrate fertiliser per hectare. The application was made on moist soils so that the ammonium nitrate would dissolve into the soil. The precision application ensures that the nutrients are available where they are needed.

Use of basal fertiliser in CA plots began to decline in 2009/10 due to unavailability because it was in short supply across the country, and free inputs were not supplied the following year. In cases where the fertiliser was available, it was very expensive and out of the reach of most households. In their bid to cut costs, most farmers modified how they were applying fertiliser in their CA plots. Instead of applying basal and AN fertiliser separately as recommended by promoters, farmers began to mix basal and ammonium fertiliser. The basal and AN fertiliser mixture would be applied to crops at the four to five leaf stage at a rate of one level beer bottle cap per basin. Some farmers reported using basal fertiliser as topdressing, while those who could not afford to buy basal and AN would only use manure or organic compost in basins.

6.4 Investigating claimed benefits of CA

CA is claimed to lead to labour savings, earlier planting, and higher yields (NCATF, 2016). Thus, in addition to investigating how farmers organised CA principles into their farming practice, I investigated whether the claimed benefits of CA also applied in farmers' fields.

6.4.1 Timing and planting method

Household models have shown that late planting can reduce yields and even explain crop failure (Makuvaro *et al*., 2014), while earlier planting could increase the length of the growing season (or crop exposure to rainfall) and improve yields. The recommended ideal period for digging the basins under CA is the post-harvest dry season. Promoters contend that this enables labour constrained households to spread their labour over a longer period (Umar, 2013). It also allows CA farmers to plant with the first good rains of the rainy season in November. Combining basins, precise input application and early planting results in higher yields (Umar, 2013). In line with CA promotion in the study area, most farmers in the study area dug basins soon after harvesting in their first year of CA adoption. Most farmers shared that the excitement of a new programme and the promise of getting inputs from Concern Worldwide made them follow the early requirement in the first year. Despite the purported benefits associated with early planting, findings in the study area were on the contrary.

Most CA households experience from their first year of adoption that the principle of early planting, especially of maize crops, and not practising staggering is not beneficial and ideal in the area. Farming decisions on when to plant are mostly informed by climatic experiences gathered over the years, resulting in a farming method driven by a cropping calendar for planting. It stretches from as early as late October to as late as mid-January in the study area, depending on rainfall patterns and the availability of seeds. Staggering planting dates is a characteristic feature of the planting method for most farmers in the area leading to suboptimal planting times. Most farmers also prefer to spread out planting to spread the risk of crop failure because of the inconsistent weather patterns in the area instead of early planting, as encouraged by CA promoters. One farmer explained:

> We do most of our planting from the second week of November until the second week of January. We aim to plant maize and groundnuts with the first effective rains and then plant

> crops such as beans and sweet potatoes in early January. Given that water stress on crops is a problem in this ward, we have also incorporated the dry planting method, which we do in late October, as a risk management strategy instead of planting with the first effective rains as encouraged by CA promoters.[44] (Interview. VaMakamure, 30 September 2019)

Most farmers also highlighted that the planting method prescribed by the promoters was not beneficial but rather a mismatch with the way they practise farming. Firstly, planting basins which are mostly used for maize, are spaced either 75 x 75 cm or 90 x 60 cm apart, and the recommendation is to plant three seeds per station. After emergence, thinning may then be done to remain with two plants per station, giving a target population of about 37 000 plants per ha. This practice was considered wasteful by farmers, particularly when using the hybrid seed, which is relatively expensive and sometimes not readily available. To reduce the loss, extension officers encouraged farmers to thin out extra plants when the soil is wet and transplant them onto another piece of land (Musasanuri & Pawadyira, 2013). However, farmers cited labour availability as one of the main constraints to transplanting in Ward 30. The purported benefits of early planting and planting methods under CA were not realised because they were a mismatch with the farming practices in the study area. Therefore, this shows how the local farming system and experiences contributed to the tepid reception of the CA programme in Ward 30, even though proponents of CA argue that early planting is the best way of farming in these areas.

6.4.2 Labour savings

CA proponents argue that the benefit of basins is not so much that they save labour but rather that they spread labour out of the peak period at the beginning of the farming season, resulting in a more favourable distribution of farm labour (Umar, 2013). The general argument is that minimum tillage implies reduced labour, energy, and land preparation time demand. Hence, cropping can be done in time and at a lower cost. By starting their land preparation immediately after harvesting, households with labour challenges spread their labour over the dry season and dig a few basins daily. This is important because, by the beginning of the rainy season, which also marks the beginning of the farming season, these households are finished with their land preparation and ready to plant their crops.

[44] Interview with VaMakamure, Ward 30, Nyanga District, 30 September 2019

Most CA households' experiences from their first year of adoption were that an activity like basin digging was labour demanding and hindered other off-farm activities. These households also described collecting and laying residues and sometimes guarding crop residues against livestock as more time consuming and laborious. Basin digging was also delayed and would only commence until the beginning of the first rains of the rainy season when the soil is soft because it was laborious. One farmer shared:

> If you join CA and follow all the requirements to the tee it is not different from a prisoner who is sentenced to a jail term with hard labour. It's sweat, blood and tears because you have to work all year round.[45] (Interview. Mukoma Nyundo, 11 September 2019)

As a result, most farmers either abandoned the technology and returned to their tried and tested traditional planting methods or modified the technology due to labour challenges. Equally important, CA was not flexible enough to allow households to engage in non-farming activities during the dry season in their efforts to diversify their livelihood strategies. Therefore, despite CA proponents' argument that CA requires less labour, findings in the study area were contrary. It was, on average, reported to require significantly more labour than conventional farming practises in the area.

6.4.3 Yield improvement

The research found that most farmers had good yields and higher productivity in their first year of CA adoption. This was achieved because they adopted the complete package as advised by promoters. Household farmers followed all the instructions, such as dry season land preparation using a minimum tillage system (basin planting), use of maize stover as soil cover, and precise fertiliser application. For example, Mbuya Chipendo, an elderly widow, in her first year adopted the complete package on a 50 x 50 m plot. Most of her time was spent on the CA plot and she would ask the ward extension officer questions every time he visited her village in order to make improvements on the plot. That year the rains were also consistent throughout the farming season. Because her CA plot had all the attention and enough inputs, it had better yields than the

[45] Interview with mukoma Nyundo, Ward 30, Nyanga District, 11 September 2019

same area where she did conventional farming methods. She managed to harvest more than twice (twelve) the number of scotch carts on the CA field compared to five on her conventional field. Similarly, my discussion with most farmers in the ward about yields shared that their first year of complete CA package adoption had surplus grains in their storage facilities. They did not have to work in other families' fields for food because they had enough grain for many months until the next harvest. One farmer who usually works *maricho* or *mugwazo* when her she runs out of grain before the next harvest shared:

> For the first time ever, I managed to have enough maize to last me the whole year and did not have to work for people in exchange for grains the first year I adopted the CA complete package.[46] (Interview. Mai Pudege, 20 September 2019)

Another farmer said:

> I was quite happy with the harvest I got from my CA plot. I last saw that kind of harvest during our first years when we arrived in this area when the soil was still rich with nutrients and the rainfall patterns were consistent.[47] (Interview. Mukoma Tauzeni VaNgwazi, 21 September 2019)

The increase in yields from CA realised by farmers in the ward as seen in the quotes above is supported by literature that argues that when practised correctly, grain yield of maize, teff and wheat has been reported to double under CA practises compared to conventional farming in Ghana, Malawi, Tanzania, Ethiopia (Ito *et al*., 2007), Kenya (Rockstrom *et al*., 2009) and Mozambique (Nkala *et al*., 2011; Grabowski, 2011). In Zimbabwe, Mashingaidze and Mudhara (2006) reported that maize crop yield increased by up to 3,5 tons per hectare for farmers practising CA.

In my quest to draw graphs showing increases in yields as reported by farmers, I observed that they did not have proper written records. This was not only during the CA programme, but

[46] Interview with Mai Pudege, Ward 30, Nyanga District, 20 September 2019
[47] Interview with mukoma Tauzeni, Ward 30, Nyanga District, 21 September 2019

farmers do not keep records even when practising conventional farming. What stood out from the discussions was that the yield from their usual farming practices was far less than when they adopted CA. Harford & Breton (2009) reported this trend, and found that communal farmers in Zimbabwe have been producing less than a tonne per hectare on conventional farming. In trying to understand why most farmers in the ward do not keep comprehensive farm records, firstly, the research found that the subsistence nature of farming does not provide an incentive for keeping records. Secondly, the high levels of illiteracy and low numeracy levels among farmers also mean they do not have the skills to utilise the data they collect, which renders recording keeping a futile exercise. This finding contradicts Poggio's (2006) assertion that farm record keeping is often seen as a mundane task by farmers. Mariene (1995) also noted that the main dimensions used by smallholders in deciding whether or not to adopt proper record keeping are its perceived importance and the ease of its practical application in diversified farms. This accounts for the reason why most of the farmers in the ward do not keep comprehensive farm records because they claim that those records are not beneficial to them.

6.5 Chapter summary

Studies that seek to understand the poor uptake of the technology by farmers in SSA often focus on the institutional environment in which CA is promoted. Proposed 'fixes' often include better technical support for farmers and more participatory and inclusive extension approaches. Thus, the relevance of on-farm experiments to farmers' circumstances remains unquestioned. This chapter sought to understand how Ward 30 farmers integrated CA practises on their farms by deliberately focusing on an area where CA was intensively promoted. Overall, the research found that CA principles were rarely practised as intended. Even with several perceived benefits associated with CA adoption and deliberate efforts made to promote and disseminate the CA approach in Ward 30, this technology was abandoned. Even with partial adoption of CA, where farmers adopted principles that fit into their current system, which some have observed as a step towards full adoption, farm households still ended up abandoning the technology. As reported above, there are good reasons for individual farmers not to adopt CA in their specific farm situation. Household farmers also applied both conventional farming practises and CA simultaneously, demonstrating the risk attitudes of the farmers in Ward 30. Drivers of dis-adoption are multidimensional and multilayered, mainly rooted in shortfalls of promoters' project implementation arrangements. Even though promoters package CA as a time and labour-saving concept, many farmers generally reported contrary experiences. For example, the CA limitations of basin digging and mulch collection made it a labour-intensive technology. Farmers cited labour unavailability as one of the major constraints that frustrated them when implementing CA. Many households pointed out that the required labour, especially on basin digging, made the adoption of CA difficult. They reported that labour demand was more than double under reduced tillage than in conventional farming (deep ploughing). Additionally, the unavailability of labour also impacted the farmers' ability to increase the area of CA, leading to households abandoning the farming practice in the study area. High labour demand is among the most important factors that reduce the benefits and limit the adoption of CA by smallholder farmers in SSA (Giller *et al*., 2011; Erenstein *et al*., 2012). The different combinations of CA practise implemented by respondents manifest the lack of universal definition and interpretation of CA and reflect on the heterogeneity of farmers. It also underscores the need to study and know local contexts before looking to implement an innovation such as CA, which is supposed to benefit local farmers.

CHAPTER SEVEN: IMPLEMENTING CONSERVATION AGRICULTURE IN THE WARD

7.1 Introduction

As 2015 was earmarked as the International Year of Soils to highlight the urgent need for better soil management, many promoted CA as a key solution for smallholder farmers. CA was introduced and promoted in Zimbabwe to solve the production problems faced by smallholder farmers (Mazvimavi & Twomlow, 2009; Makwara, 2010). Its focus has been on formulating technological prescriptions relevant for resource-poor farmers, though these prescriptions were largely developed and tested in researcher-managed trials, with only limited consideration of the real-life challenges and priorities that face smallholder farmers (Stoop & Kassam, 2005; Freidrich & Kassam, 2009).

CA's often hyped attractiveness and suitability as a sustainable farming method for the poor is not reflected in patterns and continued use by smallholder farmers (Marenya & Barret, 2007; Mazvimavi & Nyamangara, 2012). Early predictions that CA would transform smallholder agriculture in Zimbabwe have been sharply contradicted by sluggish adoption despite substantial initial support from NGOs (Gukurume *et al*., 2010). Evidence from studies such as Giller *et al.* (2009) and Gowing & Palmer (2008) reveal that most farmers have only adopted a subset of CA practices, and more and more farmers are choosing to discontinue their use. The factors that determine adoption are highly contextual, based on local environmental and socio-cultural conditions at the community level (Halbrendt *et al.*, 2014); however, in terms of farmers' adoption decisions, several characteristics play a role at the individual level.

Having discussed the pattern and adoption decisions by household farmers in Ward 30 in Chapter Six, the purpose of this chapter is to shed light on the socio-cultural practices the CA model missed and incorporated when it was being implemented. I will discuss how this affected households' decisions on adoption, abandonment, and total rejection of the programme by examining farmers' experiences and perceptions of CA implementation. The chapter also explores in detail beliefs, practises, and values that influence smallholder farmers and shows the significance of understanding socio-cultural aspects of communities in the course of applying forms of outside intervention. The first section of this chapter discusses how CA was implemented in the ward, looking at the various promotional methods used and household responses. The last section sheds light on households' responses to CA components and explanations for those responses. Finally, a chapter summary is presented to overview of what the chapter achieved and its contribution to the thesis.

7.2 Socio-cultural aspects of farming missed and incorporated in implementing conservation agriculture

In this section, I will explain CA's historical pathway and its implementation in the ward because it lays the groundwork for understanding if the methodology used impacted the farmers' decision to adopt the technology or not. Therefore, I will initially describe the timeline of CA promotion, i.e. when it was introduced, how it was introduced and who introduced it in the study area. I will also elucidate the method used to execute (key attributes, activities and processes) the technology in order to understand the subsequent impact on the adoption process in the ward.

7.2.1 Approach and methodology used for CA promotion

As the realisation that many smallholders were facing a food security crisis due to the failure of conventional tillage systems, Ward 30 was not left behind in promoting sustainable agricultural systems. According to FAO (2011), conservation agriculture is not an entirely new concept; some farmers have long practised aspects of it, although they have not named it. CA was introduced during the 2008/9 farming season by Concern Worldwide. There are variations of CA promoted in Zimbabwe. In Ward 30, CA involved minimum soil disturbance through digging basins using the hand hoe, continuous soil cover using crop stover, crop rotation of legumes and maize, use of herbicides to control weeds, application of inorganic and during the dry season, each farmer created a 50 x 50 m CA plot. Although herbicides and inorganic fertilisers are not the main principles of CA, they are significant in reducing soil disturbance and improvement, respectively.

The CA programme had the full support of the Zimbabwean government because it involved utilising the skills of government extension officers in the area. The main concept in CA development was to initiate interactive communication of all relevant actors in the innovation system that identified soil degradation as the root problem of productivity decline. The network initially focused on discussions around demonstration plots of CA in each of the target communities, supported in succeeding years by farmer-led experiments around CA-oriented technologies. The implementation of CA at the national level included efforts to raise awareness, especially between the public sector and policymakers, developers of CA equipment, train the technical personnel (researchers, extension agents, NGOs, etc.), mobilise important resources to support CA, and establish strong linkages with the districts across Zimbabwe. The district level, through the DA, involved the coordination of all relevant partners and resources at the district level (e.g. input supplier, market, training facilitator, etc.), communication and information exchange with the national and local level stakeholders, development and implementation of work plans, diagnosis and assessment, as well as monitoring and evaluation. At the local level, the execution of CA technology did not actively involve farmers in designing and implementing the locally tailored CA programme. It was done in a linear, top-down approach ignoring the need for active participation of farmers in iterative technology development through action research to facilitate co-learning and co-innovation (Ekboir, 2003; Hall *et al*., 2003; Wall, 2007). The next section below discusses the methodology used in the ward when the CA programme was being implemented, which included the Master farmer approach, chief and village headmen as entry points, and extension officers as expertise providers.

The methodology used by CA promoters in Ward 30 was a combination of extension officers and a Master farmer system. An extension officer was asked to lead the promotion of CA because of their familiarity and knowledge of the communities gained through years of experience working with rural communities. The extension officer then trained Master farmers in the ward, and in turn, these farmers worked with farmer groups. Master farmers are selected each year by fellow farmers with the help of the extension officer as an acknowledgement of their outstanding crops. The inclusion of Master farmers was important because they play the role of extension workers in training other farmers in CA agronomic practices. Thus, they serve as experiential experts in shaping peoples' norms and values and may play a significant role in legitimising or disapproving changes. The promoters started by working with Master farmers to demonstrate and test the technology. The CA system promoted in the study areas included the following: (a) minimal soil disturbance, (b) permanent ground cover by using previous year's crop residues, and (c) crop rotations. Minimal soil disturbance involved basin digging using hand hoes. Crop residues were applied on the soil surface in the dry season and aimed for at least 30%

soil cover, and maize stover was used. Weeds were controlled using herbicides and light hoe weeding (FAO, 2013).

After training Master farmers, the CA promoters negotiated with the chief to use a section of the field used for Z*unde raMambo* as a demonstration site where Master farmers would conduct the farmer training. All the components of CA were implemented, and all inputs were provided, except labour. *Zunde raMambo* fields in the various villages within Ward 30 were selected due to their proximity to farmers to allow for easy accessibility to the demonstration plots. *Zunde raMambo* fields were a good platform to allow for diversity and inclusion of young, old, men and women, with varying resources and farming experiences.

7.3 Responses to CA methodology and explanations

The section below is a discussion of households' responses to the CA methodology used in the study area. I will be analysing existing farming practices, beliefs and values that were incorporated or missed during implementation and how this influenced households' responses. The methods used were extension workers as providers of expertise strategy, involvement of Master farmers strategy, inputs support strategy and training strategy.

7.3.1 Involvement of the chief and village headmen strategy

Before starting the CA project, Concern Worldwide employees would inform the Chief of the area and Village Headmen before the introduction meeting for all villagers. A village is the smallest administrative unit which is governed by a Village Headman. A group Village Headman oversees a cluster of villages (Government of Zimbabwe, 2015). Their motivation for this approach, as explained by the extension officer VaMahachi:

> Once the chief and Village Headmen buy into the idea and are on the promoter's 'side', the project is guaranteed to succeed because of the value placed on them as opinion leaders by the project staff and ward members.[48] (Interview. VaMahachi, 09 June 2019)

[48] Interview with VaMahachi, Ward 30, Nyanga District, 09 June August 2019

Opinion leaders are specific persons within a community who have a great influence in shaping the opinions of other persons (McEachern & Hanson, 2008). They can play an important role in either preventing or stimulating the spread of innovations as they are regarded as custodians of culture. They often show some form of resistance since they are the conservatives in the society that teach generations about their traditional beliefs.

This research found that the assumption that the involvement of the Chief of the area and Village Headmen will work encountered problems, especially in the early stages of introducing the project. There was much resistance from them to the application of herbicides on CA demonstration fields during training. They were sceptical about the use of herbicides and resisted its adoption in the area due to cultural beliefs. Headman Nyabeze explained:

> Using too much chemicals is a taboo because there are cultural repercussions. Herbicides kill rain birds (such as *dendera*) and insects that fall in the class of rain agents (such as *dzvatsvatsva* – galeodes) which 'angers' spirit mediums. This is why we are not comfortable to use herbicides in this area.[49] (Interview. VaNyabeze, 23 August 2019)

Another headman, VaMachongwe also said:

> Once we use herbicides without proper consultation with our spirit mediums there will be hail storms and hurricanes which will destroy crops, or livestock will contract deadly diseases. Agricultural success must not be achieved at the expense of the ward's culture because it defines us as a community. That is why herbicides are not allowed[50] (Interview. VaMachongwe, 30 August 2019)

In order to overcome the challenge of resistance by the Chief and Village Headmen, the CA promoters provided more one-on-one information and offered more training by experts, which resulted in the adoption of the new technology. When the village headmen were fully armed with information on the advantages of herbicides in CA, they became the torch bearers of the

[49] Interview with Headman Nyabeze, Ward 30, Nyanga District, 23 August 2019
[50] Interview with Headman VaMachongwe, Ward 30, Nyanga District, 30 August 2019

technology in their villages. For example, village Headman *Sabhuku* Nyabeze had a demonstration plot at his homestead and would show people around each time they visited his place. He was proud of his plot, which led to many village members becoming early adopters of the technology. These findings on the use of existing structures in Ward 30 are in tandem with literature by Bulte (2016), who explained that it is better to use already existing structures when targeting communities for development projects. He found that informal power relations are of key importance in rural areas in SSA. These same findings also support Voors *et al.* (n.d.), who found that community projects have a higher success rate if the local chief is involved.

7.3.2 Extension workers as providers of expertise strategy

The methodological approach applied in the promotion and roll-out of CA by Concern Worldwide included training of government agricultural extension staff on the principles of CA. This involved conducting baseline surveys to identify current smallholder farming practices and information gaps concerning cereal production. Identifying and selecting potential farmers, most importantly vulnerable households but with requisite capacity, primarily labour to adopt and adapt the technology, was done in a participatory manner with some joining on a voluntary basis. The introduction of the CA programme in 2008 coincided with a period where there had been a neglect of rural farmers by the government due to various reasons, especially on farming issues. Herald newspaper of 14 March 2019 reported that most districts were being serviced by inexperienced extension workers who lacked the requisite scientific expertise. The use of an extension officer in the ward as one of the main drivers in implementing the model became a challenge due to neglect and underfunding.

The implementation of CA in the ward by government extension officers was a challenge because they still use traditional direct contact methods, which entails visiting the farmer's field or gathering farmers at the ward centre. Due to limited resources, extension officers could not access farmers located further from the ward centre as reported in Chapter 4 on shortage of extension officers and poor extension services. Similarly, farmers located further from the ward centre found it difficult to attend some of the meetings. Many ward farmers needed technical hands-on guidance for CA implementation, but extension support was inadequate, and a sense of frustration prevailed among farmers. Currently, only one extension officer is serving the whole ward with more than 500 households.

Nevertheless, households required much technical support to implement CA. This reflects the extension officer to farmer ratio in Zimbabwe, currently at 1:800 (Pazvakavabwa, 2001). However, this ratio is probably higher than the 1:800 given the massive brain drain that the country has experienced in the preceding years (Nyamupangedengu, 2015).

Farmers' major challenges during CA practices are the failure to access high-quality advisory services and information (Asiabaka, 2001). Likewise, through my discussion with farmers, I gathered a sense of abandonment, frustration and alienation, which prevailed among farmers who expressed that, despite CA being complex, they did not get the necessary technical or advisory support. For example, according to Anderson & Giller (2012), the planting basins for CA are 15cm deep, 15cm wide and 15cm broad. The precision requirements of basin measurements farmers had to follow made CA implementation difficult without technical support especially considering the low literacy levels among many farmers in the ward. The lack of understanding led to some farmers abandoning the technology and reverting to conventional farming practices.

Due to incapacitation, which led to extension workers not visiting all farmers who had adopted CA, extension officers turned their focus to working with and capacitating Master farmers only, who in turn would help other farmers in their area. This approach also presented its own challenges as most farmers who took up the programme assumed that extension officers wanted to only work with Master farmers so that when the donors came to monitor the progress of the programme, it would be viewed as a success. Mbuya Chiposi shared her frustration:

> The extension officer's tendency of working with Master farmers made us think he was not prepared to work with average performing farmers who make mistakes. If he couldn't find time to visit my farm and help me implement CA practice, it meant he found it retrogressive. He wanted to work only with the best so the donors to think the programme

> was a success if they want a progress report.[51] (Interview. Mbuya Chiposi, 06 February 2019)

The quote above shows that the farmers' perception was that CA was meant for households viewed as better farmers, and those trying to learn new farming practices were a burden to the donor programmes. It also shows that farmers were overwhelmed by technological challenges when implementing CA amidst inadequate extension support, leading to frustrations and dissatisfactory CA performance. This also tallies with ACT (2008), which argues that the successful and lasting introduction of CA practices requires change not only on the side of farmers but also on stakeholders in the agriculture sector, notably agriculture administration, extension services, education and training institutions as well as farm service providers.

Knowledge contestations between CA promoters and the extension officer during rare field visits and demonstrations led to dilemmas and controversies, which frustrated farmers. In rare cases where the extension officers would visit non-Master farmers, households were left confused by the information they were given, especially on mulching, as it was different from what CA programme representatives encouraged during demonstrations. For example, extension officers encouraged households to use off-site materials such as decomposing tree leaves or grass since maize stalks provided livestock feed during winter, whereas programme representatives advised households to keep crop residues for mulching. Sekuru Chiga who had initially adopted CA but later abandoned it when he felt overwhelmed by the contradictions shared:

> It's hard enough to find residues for mulching in the field but more disappointing when the extension officer comes and tells us to do something different from what the promoters of the programme said. I did not know whether to follow advice from the extension officer of using grass or use crop residues as mulch, as advised by the programme representatives and I was left frustrated.[52] (Interview. Sekuru Chiga, 12 February 2019)

[51] Interview with Mbuya Chiposi, Ward 30, Nyanga District, 06 February 2019
[52] Interview with Sekuru Chiga, Ward 30, Nyanga District, 12 February 2019

Findings show how households perceived CA to be knowledge-intensive and required frequent reinforcement of appropriate skills to implement it correctly. In addition, households lacked the requisite technical know-how to implement various CA practises independently and effectively. Rogers (2003), in his diffusion of innovation theory, argues that if innovation is perceived to be complex, the amount of how-to knowledge for its continued adoption is much greater than less complex technologies, and if insufficient knowledge is obtained, the likely result is abandonment.

7.3.3 Involvement of Master farmers strategy

The CA model implementation in Ward 30 had a Master farmer approach to spread the technology. Establishing farmer clusters in every village to facilitate Master farmer-to-farmer extension was key. This approach allowed for greater adoption of CA since it allowed for cross-learning and close monitoring of the cluster farmers by the lead farmers. Training of Master farmers in every village was conducted to train other farmers and provide technical backstopping. The initial focus was on resource-constrained farmers. Later, deliberate efforts were made to select successful and popular farmers who also doubled as community opinion leaders to facilitate buy-in and voluntary adoption of CA practises by other farmers within the community. This led to a constant increase in the number of farmers adopting CA.

The research found that most Master farmers have an adequate level of literacy. They can read, write, lead a group and are well-known, and they had direct contact with the NGO staff to ask any project related questions. They encourage other farmers in the village to practise sustainable agriculture because farmers generally learn from each other and often make good extension workers. According to VaMahachi, the ward extension officer:

> Master farmers of this ward are role models in new programmes and even during CA, the adoption process was easy and quicker because of them unlike bringing outsiders because fellow farmers get motivated that if one of them can be successful in new farming practises, they can do it as well, and adoption snowballs to the others as well.[53] (Interview. VaMahachi, 09 June 2019)

[53] Interview with VaMahachi, Ward 30, Nyanga District, 09 June August 2019

This impact of Master farmers on adoption is also highlighted by the case of mai Kureva, who did not adopt CA the first year it was introduced because she was not sure and did not trust the technology. However, she tried CA a year after it was introduced when she saw that vaNyaundi, a popular Master farmer, had managed to get three tonnes of maize on his 50 x 50 m demonstration plot. When she tried CA farming on an acre she usually plants maize on, because she applies manure every year on that piece of land, she got 30 scotch carts which was an improvement from her usual 20.

The quote above from the ward extension officer and case is in tandem with the work of the Zimbabwe Conservation Agriculture Task Force (2009), which stated that farmers tend to believe and trust each other's experiences more than messages brought by outsiders. This also shows that using Master farmers in implementing the CA model was a hit and a stroke of genius from the project staff as this contributed to early adoption. This strategy resonated with cultural practises of farming, where many households look up to Master farmers in the ward. Master farmers serve as experiential experts in shaping other farmers' norms and farming practices and play a role in legitimising or disapproving certain changes. They also share the knowledge with friends or relatives.

The assumption that Master farmers will automatically diffuse knowledge was proven correct in Ward 30. This is an indication that the farmers who were enthusiastic about CA tried out the principles for themselves. This type of learning is called environmental learning, in which people experiment with new technologies and base their adoption choice on empirical feedback. According to the agricultural extension officer, Master farmers had convinced most early adopters of CA because of the information and persuasion they got from the Master farmers. Opinion leaders (such as the Master farmers) tend to convince others within their social networks to adopt certain opinions and behaviours by upholding social norms (Keller & Berry, 2003).

These findings are also in line with the assertion of Cialdini & Goldstein (2004), who claimed that when people are unsure of what to do, they look toward others for guidance on how to act.

Opinion leaders had the social power to influence early adopters in the ward. They also successfully persuaded some of the difficult-to-convince farmers in their social groups, such as late adopters or laggards who did not adopt in the early years. However, it is worth pointing out that most Master farmers did not expand their CA area beyond their trial demonstrations. This finding is similar to Brown *et al.* (2020), who reported that lead farmers did not understand expanding beyond the trial. The farmer stories present that decision-making can result from information flow interacting with personal (sometimes accidental) experimentation. As argued by Rogers (2003), one of the great attributes of the approach used by promoters in the area was higher observability through Master farmers. Farmers were able to observe the results of CA innovation, and it led to adoption because if an innovation increases yields visibly (or decreases costs visibly, such as by saving labour), then there is a high possibility that it will be adopted.

7.3.4 Inputs support strategy

The provision of free inputs was another strategy used to promote CA by Concern Worldwide in the ward. Proponents have suggested input provision as a measure for overcoming barriers to implementing CA in Zimbabwe (Gondo, 2008). These inputs included compound D and top-dressing ammonium nitrate fertilisers, herbicides, hybrid seeds and sprayers. According to the ward extension officer, free inputs were only meant as a kick-starter in the first year for every farmer who was interested in joining the programme, while in the second year, vulnerable households were supported with packages of subsidised seed and fertiliser, known as "vouchers". The input support for farmers motivated them to adopt the technology. Mbuya Rwodzi, who adopted CA because of the free inputs shared:

> The moment I heard about free inputs I did not think twice about joining. I definitely wanted to be part of the programme because I cannot afford to buy them in the shops since the price is very high. Opportunities like these are far and few so I had to take advantage.[54] (Interview. Mbuya Rwodzi, 13 April 2019)

And even more explicitly mai Chuchu said:

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[54] Interview with Mbuya Rwodzi, Ward 30, Nyanga District, 13 April 2019

Every time there are programmes that provide free inputs either from the government or NGOs we join because most of us cannot afford to buy them. That is the norm for us here.[55] (Interview. Mai Chuchu, 16 April 2019)

The statement from the farmer above is confirmed by literature that free inputs were an incentive to join CA projects. According to Andersson & D'Souza (2014), incentives in the form of input packages, credit or subsidies have become a significant feature of CA promotion projects in countries like Malawi. Input support does not only influence CA uptake but also the sustainability of such uptake. Marongwe, Kwazira, Jenrich, Thierfelder, Kassam and Friedrich (2011) agree that CA promotion often involves supplying input packages (fertiliser and seed) to farmers, mainly due to the inaccessibility of inputs by smallholder farmers.

It has been argued that farmers who join for the sake of input support are likely to quit if the NGO working in the area departs (Sims *et al.*, 2005). It is also arguably common in Africa for farmers to anticipate incentives for new technology, as underlined by Derpsch (2005). This argument is similar to Ward 30 findings in that even though the adoption of CA in the first year was high among farmers, the study found that most farmers who did not receive free inputs the following season did not take up CA and reverted to using indigenous seeds and conventional farming practises.

However, although a large number stopped practising CA, some farmers continued even without receiving free inputs. In discussions with this group on why they continued, I found that they felt that if they do not take up CA, they were not going to be considered for other programmes that would be rolled out, so they felt it was necessary to comply. Within the same group, some farmers' responses painted a picture of CA adoption as doing the promoters a favour since they did not want to disappoint project promoters and the ward extension officer. For example, some farmers who bought their own inputs when free inputs were not given in the second year expected to be reimbursed for the inputs costs incurred by the project staff members and felt disenchanted when that did not materialise. As one farmer VaChidza explained:

[55] Interview with Mai Chuchu, Ward 30, Nyanga District, 16 April 2019

After Concern stopped providing inputs for the CA programme we bought all the inputs required for CA as we did not want to be sidelined next time other programmes came and we also thought the promoters would refund us. It was only fair for them to consider that because we had joined their programme and helped them to put it on the map. Are they not going to report the programme as successful to their superiors and therefore meet their performance indicators?[56] (Interview. VaChidza, 12 April 2019)

As the programme ran into its third year, there was limited oversight and field visits by promoters and the ward extension officer, and there was abandonment even among Master farmers. This also forced some households to dis-adopt even though it would have suited their situation. This shows the power of social capital where some farmers would rather follow established farmers than act on their own. Besides social capital playing a huge role in abandonment among farmers, the study also found that CA promoters focused on high-cost inputs in promoting CA. Many farmers could not sustain CA implementation after the withdrawal of subsidised input support or project expiry. The lesson here is that such programmes need to plan for subsiding inputs throughout the implementation timeline to see the real impact and results of their programmes.

Even though it is eight years since abandonment, indications from farmers are that they are willing to try CA again if they get free inputs from NGOs or the government. This finding is similar to Giller *et al*. (2009), who found that most smallholder farmers practise CA for the sake of input support. They cite Haggblade and Tembo (2003), who estimated that 15,000 of the 75,000 farmers that practised CA in 2002/03 in Zambia were spontaneous adopters, while the remaining 60,000 farmers practised CA as a condition for receiving their input. More experiences are found in which adoption of CA was claimed during the active promotion but did not lead to sustained change in agricultural practise.

[56] Interview with VaChidza, Ward 30, Nyanga District, 12 April 2019

7.3.5 Training strategy

Access to information is critical for the adoption of new technologies (Jack, 2011). This is true for CA, which is regarded as knowledge-intensive and a diverse technology (Hamdy *et al.*, 2016). Provision of training to Master farmers of the area who would go on to train household farmers in their village was also another methodology that was used as a way of information sharing. The Master farmer-household farmer training strategy was a success in the study area because this training was the most important source of information on CA practices. These results consist of innovation diffusion theory (Rogers, 2003) which postulates that information access is central in the process of innovation adoption. Qualitative analysis indicated that good rapport was an important factor influencing CA adoption. Farmers reported that having a good trainer in the form of Master farmers was important for adopting CA. In addition, the frequent visits to demonstration centres for training influenced the knowledge pathway to CA adoption.

This is not surprising given that Mazvimavi *et al.* (2011) found that demonstration centres enable impulsive adoption by observing conservation agriculture benefits through learning from others. Farmers often expressed this view in statements such as "when you have a good leader (Master farmers), most people attend the training and do what they are taught." Probing what characterised a good leader revealed attributes such as explaining the contents of CA training materials in an easily understandable way, answering questions from farmers, having successful demonstrations, being approachable and showing concern and respect towards farmers. Although these attributes are subjective, the findings show that effective communication and good rapport between the Master farmers and farmers were important in enhancing the uptake of CA. Van clay (2011) points out that good rapport and providing farmers with practical, useful answers that assist them in their day-to-day operations is important in enhancing the adoption of innovations. Adoption of CA is also influenced by an interaction of farmers' worldviews (previous farming experience, knowledge and objectives) and current efforts of CA promotion. This finding is in tandem with a study by Simtowe *et al.* (2011), who explored the determinants of knowledge on adopting improved varieties of pigeon pea in Tanzania. Their results indicate that access to information related variables such as distance to extension officer, visits to demonstration centres, frequency of contact with extension workers, participation in participatory variety selection, distance to the major market, distance to the nearest agricultural extension officer, and attendance to agricultural shows significantly influence the knowledge aspect.

7.4 Households' responses to CA components and explanations

In this section, I discuss in detail how households' missed some and incorporated other existing beliefs, farming practices, and values that influenced their response (adoption, partial adoption, abandonment and total rejection) to CA elements promoted. In the first section, I discuss the responses and explanations on CA adoption followed by partial adoption and move to abandonment and finally, reasons for total rejection.

7.4.1 Farming households' reasons for CA adoption

The research found that the main motivation of farmers of Ward 30's to adopt CA was not divergent from the primary promotional message, which focused on soil moisture retention through the mulch component and soil erosion control attributes of CA. These were key ecological factors for farmers to start CA. Social norms, peer pressure, and agricultural associations are also factors that influenced adoption and are discussed below.

Moisture retention of mulch component

The effect of mulching with crop residues on reducing water runoff and increasing infiltration is well known (e.g. Mannering and Meyer, 1963 and Thierfelder and Wall, 2009 for CA in Southern Africa). Most farmers in the ward acknowledged that the inconsistent rainfall patterns experienced in the area motivated them to adopt the component of soil cover. Like most areas in the country, when the area receives rain, they are mostly short and heavy and end up as runoff. Therefore, farmers were motivated to adopt the CA component of mulch application to help retain water in the soil for a long time so that crops do not experience moisture shortages. These farmers are aware of the difficult situations concerning the unreliable rainfalls and made the linkage between rainfall, soil moisture and evaporation. Since the turn of the millennium, the rains have become short and insufficient for crops to reach maturity, so ways that help to retain moisture in the soil are always welcome.

The ability of mulch in preventing total crop failure through moisture retention under dry spell conditions as those faced by the community in January (*mhare yaJanuary*), which is a huge challenge highlighted in Chapter 4, was appealing because farmers in the ward only depend on rains and cannot irrigate their fields in the dry land. The importance of mulch was highlighted by Mai Chikore when she explained:

> When I compared a part of my farm where I applied mulch for CA with the part where I planted maize using conventional methods, after two weeks of sun, there was more moisture in the mulched area than in the part where I followed conventional farming methods. This is what made me fall in love with the mulching component and the reason why I tried CA.[57] (Interview. Mai Chikore, 10 September 2019)

This understanding of the differences between CA mulching and conventional farming techniques brings out farmers' own experiences after comparing the two farming practices. This kind of learning is called experiential learning. The advantages stated by the farmer and the explanation of why they were content with the component of soil cover show that most farmers had a founded knowledge about the technology they were applying. They knew that the mulch layer reduces evaporation because the sun cannot penetrate the mulch layer and, at the same time, enhances soil fertility.

Besides mulch material helping to reduce evaporation and improve water infiltration into the soil by slowing runoff, the condition and type of soils in the ward, as explained in Chapter 3, also motivated farmers to adopt the mulching component. Most farmers in Ward 30 recognise soil erosion to be a problem since their farms have highly erodible soils and very limited natural barriers for protection with a net effect on the workability of their soils. The categories ‘cracks when dry’, ‘sticky, difficult to work on when wet’ and ‘hard to work on’ all describe these soils, which at some stage cause problems to work them. Some farmers also described their soils as soft and loose, and these soils are very vulnerable to soil erosion, especially during the short and heavy rains received in the ward. When CA was introduced, and the promoters explained that retention of crop residues as surface mulch is an effective method to manage soil erosion on their

[57] Interview with Mai Chikore, Ward 30, Nyanga District, 10 September 2019

fields, farmers were motivated to adopt CA. Farmers also expected that mulching would improve the condition of soil structure which forms a hardpan, and sometimes they hire a tractor to break the hardpan. The reasons and responses pointed out by farmers as to why they found CA appealing to them are in tandem with other studies that have reported positive and significant correlations between high soil erosion and the probability of adoption of CA (Uri, 1997; Soule *et al.*, 2000; Pautsch *et al.*, 2001). Other studies also support the finding that soil condition is among the most important factors influencing smallholder decisions to take up technologies (Arellanes & Lee, 2003; Chiputwa, Langyintuo, & Wall, 2011; Muzari *et al.*, 2012; Wubeneh & Sanders, 2006).

Lack of farming equipment

Smallholder farmers lack agricultural assets, continue using hand hoes, have limited access to new information, and lack institutions supporting smallholder agriculture (Gowing & Palmer, 2008; Nkala *et al*., 2011). Similarly, farming in Ward 30 is done through conventional practices whether a farmer owns farm implements or is resource-poor. During the farming season, farmers who do not own draught power hire or borrow animals for preparing land before sowing and sometimes would be forced to use hoes for basin digging if they cannot afford to hire draught power. Naturally, the animals' owners select the optimum time for their land work which means, of course, that the hirers must wait, often until the rains are well established. By this time, planting will be late, with knock-on effects that may be disastrous to yields. In addition, these households are in the least favourable economic situation, do not produce enough maize to sustain their households and often struggle to meet their basic needs. Hand hoe households tend to be older farmers with few assets and fewer family members. They often have the least number of options for both bartering and hiring oxen.

Basin digging as farming practice encouraged by CA promoters was most appealing and motivated most of the resource-poor farmers in the area. Because these resource-poor farmers use hoes when planting, the introduction of the CA minimum tillage system came as a validation to a farming practice that is looked down on in the ward (For more information on this, see the section 6.4.4 on basin digging as a symbol of poverty). Through demonstration and training by project staff, resource-poor farmers realised that they did not have to rely on other households for draught power to realise good yields in their fields as the following case illustrates: Mai Chenai is a widow who sold all her cattle to take her children to school and every year when the rainy season came, she had to look for task-contracted labour (*maricho*) from households with draught power. She would do *maricho*, and after completing a certain task, such as helping with planting seeds or weeding, the farmer would plough a portion of her farm. Almost all the years she did *maricho* in exchange for ploughing, her field would be planted late, and ultimately the yields were poor. However, when CA was introduced and she tried it, most of her crops were planted on time, and she was very happy with her yields.

The research also found that when CA was introduced, it was not only appealing to resource-poor farmers, but it was also popular for some farmers who own draught power as they were trying to find a solution for their weak draught power. Draught animals are in their weakest condition at the end of the dry season, and farmers have always been looking for ideas that take the burden away from their cattle. As one young farmer put it:

> If you see us ploughing after the first rains you will feel sorry for us but more especially our oxen. Our beasts are at their weakest and even if you want to plough as much as you can it is just not possible because of the condition they are in. This is why we found the CA programme so appealing because it took the burden away from our draught power.[58] (Interview. Mukoma Tapera, 19 August 2019)

They also miss much valuable time when the rains come because they have to wait until their oxen are strong enough to pull the plough. Therefore, when CA was introduced, these farmers decided to adopt this technology because they thought it would solve late planting.

Social norms and peer pressure

Social norms and peer pressure greatly impact agricultural producers' perceptions and attitudes and play key roles in adoption processes (Prokopy *et al*., 2008). Many farmers in the ward decided to join the CA programme when it was introduced due to peer pressure and expected social norms from fellow farmers in the village. Most farmers in the study area tried the CA

[58] Interview with mukoma Tapera, Ward 30, Nyanga District, 19 August 2019

model because they did not want to disappoint their peers by not taking part. Discussions with farmers revealed that doing something fundamentally different from the others in the ward means that one runs the risk of being excluded from the group and becoming an "outcast". Exclusion happens in many forms; for example, fellow village members will not come to an "outcast" field to help provide labour during *humwe* or even when you hire them. Sometimes even if cattle stray into your field, they will not drive them out, among other things.

Some of the farmers explicitly mentioned that only very strong and individually minded characters would take that step, leading to group isolation and sometimes even mocking. Even if those individuals have visible success, the aversion created in the group and the peer pressure can result in other farmers not following. For example, in the 2013/14 season, VaChikwenjere, contrary to the usual crops households plant in the village, planted paprika under contract farming on his farm as a cash crop. The crop was a huge success, and he harvested 6 tonnes which were taken from his farm by the supplier. He did not have to struggle with transportation or issues of the market. However, in the second year, the contractor required him to get his own transport to deliver his produce after harvesting. He spoke with other farmers to join paprika farming so that it would be easy to share transport costs and other farming or logistical challenges, but households in his village did not take up the offer. Farmers in his village did not join contract farming because they wanted to make an example out of him. After all, he had decided to do his 'own thing' and not consult fellow community members. Even though growing paprika was profitable, VaChikwenjere did not grow the crop in the 2014/15 season because all his profits would have gone to cover transport costs. Besides the exorbitant transport costs involved, the pressure on VaChikwenjere contributed to him deciding against growing paprika. This case is aptly captured by Goreham *et al.* (1992), who explain that farmers who choose alternative practices lose prestige as they can no longer be judged according to locally accepted norms of good farming.

The research findings are in tandem with the work of Friedrich & Kassam (2009), who argue that CA adoption is seldom strictly a function of individual profit maximisation alone but can also reflect non-individual or societal interests. More specifically, Lynne (1995) argues that farmer decision making usually reflects a compromise between private economic utility and collective utility. Producers often identify this latter interest as 'the right thing to do', at least in those places where stewardship is part of the cultural norm. The findings of this study are also similar to Wollni & Andersson (2014), who, after studying the spatial patterns of organic agriculture adoption in Honduras, found that neighbourhood effects exist such that farmers are more likely to convert to organic farming if their neighbours are also adopters. Turinawe *et al*. (2015) also found that using soil and water conservation technologies in neighbours' parcels increases the probability of adoption by 45% if everything else is fixed. More importantly, peer pressure on CA adoption shows the link between social factors and how farming occurs in rural farming setups. Because most people like to feel acceptance and approval from those around them, they tend to behave as per the expectations of those around them.

Agricultural association membership

Farmer organisations are critical inefficient agriculture systems. They assist in knowledge transfers on best practices for farming. 'Membership of a farmer organisation helps farmers learn new ideas and techniques for ecologically sound farming and for conserving an area's natural resources' (Mupetesi *et al.*, 2012). In addition, belonging to a social group enhances social capital allowing trust, ideas and information exchange (Mignouna *et al*., 2011). The ANT describes that farmers are not independent actors, but their activities are formed by their heterogeneous networks.

Likewise, farming in the study area is not only organised in informal groups, as highlighted in Chapter 5, but it is organised in formalised groups where farmers' decisions are influenced by the networks in which they operate. The research found that some farmers are members of associations such as the Nyajezi Farmers Growers Association (NFGA). While this association does not directly support or advocate the adoption of CA, it served as a means by which farmers were able to share information about ideas and experiences on the CA model in the study area.

As Uaiene *et al*. (2009) observe, social network effects are important for individual decisions, and in the particular context of agricultural innovations, farmers share information and learn from each other. Farmer groups in the ward acted as platforms for interaction where farmers would influence each other through socialisation processes since they have developed similar norms and preferences, including attitudes and practises concerning farm management over time.

Farmers would be involved in the informal sharing of knowledge and experiences on CA with other farmers with similar objectives and interests. VaChiro, who is a member of NFGA, shared how the association influenced him to adopt the technology when he said:

> I decided to adopt the CA model because I would share information and farming experiences with members who belong to the Nyajezi Farmers' Growers Association and they encouraged me. We have walked this farming journey for more than 20 years together and I trust their ideas and judgement in farming related issues.[59] (Interview. VaChiro, 13 September 2019)

Another farmer who is part of NFGA also shared:

> What we have seen around this place, if a new farming model like CA is introduced, the best way to be successful is to work as a group and that is why it was easy to adopt CA for us. We believe in the adage '*kana uchida kufamba nekukurumidza enda wega asi kana uchida kuenda kure zvakanyanya famba nevamwe*. (If you want to go fast, go alone. If you want to go far, go together.)[60] (Interview. Mukoma Dzandi, 13 September 2019)

Furthermore, the readily available support and information led many farmers who belonged to the NFGA to be early adopters of the CA model. In contrast, farmers who were not members of any association were late adopters of the model, further underscoring the importance of groups and the flow of information among farmers. This finding was corroborated by ward extension officer VaMahachi who explained:

> What we saw was that farmers in Nyajezi Farmers Growers Association adopted the CA model quicker than other farmers who do not belong to the group. Even when households who adopted the CA model were recording yield improvement, the uptake of CA was slow for farmers who were not members of the Nyajezi Farmers Growers Association.[61] (Interview. VaMahachi, 13 October 2019)

[59] Interview with VaChiro, Ward 30, Nyanga District, 13 September 2019
[60] Interview with Mukoma Dzandi, Ward 30, Nyanga District, 13 September 2019
[61] Interview with VaMahachi, Ward 30, Nyanga District, 13 October 2019

One can argue that the reluctance in the uptake by farmers who did not belong to NFGA could be due to high levels of social capital in other associations to which households belong. In such a set-up, farmers tend to believe trusted peers outside their farming compatriots when discussing innovations, making it difficult to adopt agriculture programmes even if it benefits them. Findings herein also show the role and importance of social capital in adoption. Husen et al. (2017) acknowledged that membership of a group greatly increased the likelihood of member farmers adopting an agricultural technology compared with those who were not members of any group. Farmer groups, at whatever level, are important in that they may reduce transaction costs and reduce the informational asymmetry gaps that exist in agricultural-related supply chains through the effective associations, dissemination of information and networking in the groups (see Mittal & Tripathi, 2009).

Membership in community groups is one of the reported variables associated with reducing the risk and uncertainty of agroforestry technologies (Mercer & Pattanayak, 2003). Apart from these farming associations being used as platforms to share knowledge, ideas and experiences, farmers also used them to reduce risk and uncertainty on the CA programme in the ward. Farmers also reported that membership in an association enabled more support and delivery of information on CA that is not achieved using the linear model of technology development (research-extension-farmer linkages). Farmers got more support and information during the CA programme from fellow association members than from the extension officer or representatives of Concern Worldwide.

The findings on the role of farming associations in Ward 30 on CA adoption tally with other studies that have also shown the positive and significant relationship between adoption of CA and membership in farmer organisations (Curtis & De Lacy, 1996; Sobel, Curtis, & Lockie, 2001; Sidibé, 2005; Knowler & Bradshaw, 2007). Studying the effect of a community-based organisation in adopting corm-paired banana technology in Uganda, Katungi & Akankwasa (2010) found that farmers who participated more in community-based organisations were likely to engage in social learning about the technology raising the likelihood of adopting the technologies. This is in tandem with social learning theories that postulate that people learn by observing the behaviour of others (Bandura, 1977).

7.4.2 Farming households' reasons for CA partial adoption

The farmers who adopted CA technologies tended to do it partially, either practising some components or adopting CA and doing it inconsistently. In Ward 30, free-riding was a factor that led to some farmers partially adopting the technology. Below is a discussion of how that happened.

Free-riding

Although many researchers have reported a positive influence of social groups on technology adoption, social groups may also negatively impact technology adoption, especially where free-riding behaviour exists. Foster & Rosenzweig (1995), when studying the adoption of Green Revolution technologies in India, found that learning externalities within social networks increased the profitability of adoption, but also farmers appeared to be free-riding on their neighbour’s costly experimentation with the new technology. Discussions with farmers revealed that free-riding was evident in the implementation of the model in Ward 30. For example, due to his plough culture in which Sekuru Chirenje defines farming as tilling the land, he partially adopted the technology. Instead of digging basins as required by CA promoters, he tilled his land, and applied mulch but did not dig basins as this was too time consuming and laborious for his household. He did not want to take the risk and fully implement all the components of the CA model the in the first year because he wanted to learn from fellow farmers’ mistakes who had fully adopted CA even though he had received free inputs.

In another case, Mbuya Chisharu also did not fully implement all the components on her CA plot because she did not trust the promoters. This was as a result of her previous experience with Operation *maguta* - an agriculture programme introduced by the government in the ward a few years back. Under the programme, farmers were told that inputs were free when they were being distributed to them. However, towards harvesting, communication was made that it was a loan and all the farmers who were given inputs were not supposed to sell their produce anywhere except to the GMB and the money for inputs would be deducted. Many farmers in the area ended up owing the government through GMB since the harvest that year was poor due to drought and some had to sell their livestock to pay their outstanding arrears. When CA promoters were giving free inputs, Mbuya Chisharu was reluctant to get all the inputs because of her experience with Operation *maguta* and ended up taking seeds only and leaving fertilisers and herbicides out. She partially adopted CA on her plot as she only dug basins and applied mulch but did not apply fertiliser and herbicides as recommended by the promoters because she did not want to find herself in a similar predicament of paying back a lot of money for inputs after harvest in the event of CA promoters asking for their money back.

Bandiera & Rasul (2002), as cited by Hogset (2005), suggests that learning externalities generate opposite effects, such that the more other people engage in experimentation with new technology, the more beneficial it is to join in, but also the more beneficial it is to free-ride on the experimentation of others. As a result of these contradictory effects, Bandiera & Rasul (2002) propose an inverted U-shaped individual adoption curve, implying that network effects are positive at low adoption rates but negative at high rates of adoption.

Some have observed partial adoption of CA as a step towards complete adoption in some cases (Ndah *et al.*, 2018), but it never led to complete adoption of the model in this study area. In the case of Sekuru Chirenje, a discussion with him revealed that after he had attempted CA in the first year, he did not follow that up with complete adoption the year that followed. The challenges of crop stover in the area and the lack of labour, especially to dig basins led him to abandon CA. One can also argue that the partial adoption/free-riding that was done indicates risk aversion normally seen in smallholder farmers because he was not sure if the technology was going to be a success or not; therefore, he took a cautious approach.

7.4.3 Farming households' reasons for abandonment

The sustained adoption of CA by households in the ward was disappointing. CA adoption is seldom strictly a function of individual profit maximisation alone but also reflects non-individual or societal interests. More specifically, Lynne (1995) argues that farmer decision making usually reflects a compromise between private economic utility and collective utility. Abandonment of CA by farmers was mostly a result of socio-cultural considerations such as the use of crop residue for livestock feed, the challenge of communal grazing rights, family obligations, and mulch as a deterrent to crop germination. These challenges are discussed in detail below.

Crop residue as livestock feed

Many farmers in Southern Africa collect crop residues and use them as stock feed, especially in mixed farming systems where livestock is a major source of household income (ICRISAT, 2006). At the same time, proponents of CA advocate for the soil cover in the area where crops will be grown with crop stover as mulch for moisture retention. After the first year of adoption of CA and applying crop stover on their CA plots, the principle became less appealing for most households who own livestock and whose high social status is earned by cattle ownership, and they abandoned CA. Most of the farmers in Ward 30 have integrated crops and livestock farming systems, resulting in competition for crop residues. They are left to choose between leaving crop stover in the fields for their cattle to feed during the winter season or using it as mulch. They contribute to the food security of the household, provide for system diversification, generate cash, spread risk, recycle nutrients, and provide draught power and transportation (De Haan *et al*., 1997).

CA promoters missed the socio-cultural value of crop residue as cardinal and on high demand for animal feed during the dry winter season for farmers whose high social status in the ward results from livestock ownership. Besides the high status, livestock is also a source of livelihood and plays a crucial role in contributing to food security. Their value acts as social currency, thereby adding to capital and managing risk (Herrero *et al*., 2010). They also represent liquid assets or 'fluid capital' that can be realised at any time, reducing the risk for these households, which is integral to their farming, adding stability to the farming system. Rural life also requires people to rear livestock because they come in handy in times of a poor rain season that affects crop production. They also rely on livestock for some social transactions such as lobola, payment of school fees, etc.

The importance and value of crop residue for households who own livestock are indicated by collecting stuffed maize stover on wooden structures known as '*dara remashanga*' for controlled feeding during the long dry winter season (see figure 18). This practice is common for farmers with cattle. Every year after harvesting, they ensure maize stalks and any crop residue is stored on these structures without fail. These become important feed for livestock in the long winter dry season. The importance of crop residue was similarly reported by numerous studies (Mueller *et al*., 2001; Thierfelder *et al*., 2011; Giller *et al*., 2011) who reported that residue for livestock feed is likely to remain integral to smallholder farming into the future.

Figure 18: A wooden structure locally known as *'dara remashanga'* with maize stover kept for feeding livestock during the dry season

Interestingly, most farmers with livestock consider crop stover important and will not consider using them for anything other than cattle feed, as shown by the following comment by Mai Benyu who shared:

> I could not continue with CA because we use crop residue as feed for our cattle. I would rather try other ways of mulching but not use maize stover because that is what our livestock feed on during the long dry winter season. If I don't leave my cattle to feed on crop stover then it means they will die due to starvation during winter. I cannot imagine not having cattle and risk being a laughingstock of the community and for that reason I abandoned CA.[62] (Interview. Mai Benyu, 22 September 2019)

The quote above highlights the point that farmers prioritised feeding their livestock with crop residues before mulching their plots. For a household facing the challenge of food security threat,

[62] Interview with Mai Benyu, Ward 30, Nyanga District, 22 September 2019

between providing crop stover for their livestock and a CA programme promising gains in the future, the choice is determined by the immediate need to survive. Several studies and reports have pointed to these problems of crop residue retention and the trade-offs between different uses in crop-livestock farming systems in Southern Africa (Wall, 2007; Chivenge *et al*., 2007; Giller *et al*., 2011; Hove, 2011; Umar, 2012; Hove, 2011; Rusinamhodzi *et al*., 2013). Furthermore, the importance of crop residue has further increased due to the effects of climate change in the ward. The weather characterised by erratic rains with severe dry spells has resulted in high pressure on the crop residues for livestock in households practising mixed crop-livestock farming. Since biomass production in many parts of Southern Africa is relatively low, cattle keepers rely on crop residues to feed their livestock during the long dry seasons, implying substantial opportunity costs to their use as mulch (Valbuena *et al*., 2012).

The study also found that overemphasis on using maize stover as the main mulching material of the model by extension officers in the ward intensified competition between CA and other household functions utilising the same maize stover. Households prioritised the more instantly rewarding non-CA use, and using maize stalks for mulch is not a priority for farmers whose social prestige is built on livestock ownership which led to the abandonment of CA. In arguing for crop residue retention on CA fields in the ward, the study found that it is insufficient to provide mulch for CA which is used for free grazing by livestock. As argued by Rogers (2003), innovation ought to be compatible and consistent with the existing values and needs of potential adopters to have high chance of being adopted. Even though the benefits of CA are most directly attributed to the mulch of crop residues retained in the field, due to the integral role of crop residues as livestock feed in the ward, it became a misfit in the implementation of CA. Most importantly, this shows that socio-cultural considerations are at the heart of farming decisions among smallholder farmers and can act as an obstacle to the adoption of CA technology, as seen by the abandonment of the programme in Ward 30.

Communal grazing rights challenge

Soil cover through the use of mulch from crop stover - a principle recommended under CA for moisture retention - was a misfit for all households due to social expectations of communal stubble grazing. This practice is a norm in this rain-fed smallholder mixed farming system found in the ward. After the harvest period is over, grazing livestock is free to roam in the fields and individual farmers cannot protect residues from this grazing. All the households who adopted CA in the ward implemented soil cover through mulching in the first year the project was introduced but faced challenges from established farming practices.

Promoters of CA in the ward required the field under CA not to be disturbed for farmers to realise maximum benefits of the technology. Giller, Witter, Corbeels & Tittonell (2009) describe that land-use rights can be an obstacle to mulching for farmers. The free-range grazing system relies on communal use of the land and traditional grazing patterns. They state: "Individual farmers cannot restrict grazing even on their own land without challenging the traditional rights of others in the community". Twomlow (2008: 21) also argues that 'in systems where farmers are used to grazing cattle on other people's fields in winter, suddenly stopping it (for purposes of CA) would be socially unacceptable'. This is the case in the study area, where the social expectation of using fields for communal grazing of livestock during the winter meant that households who had mulched using maize stover were forced to do the process every season (see figure 19). Many farmers who were early adopters of CA in the area had to abandon the programme because they did not have time, physical energy or even resources to prepare an area specifically for CA every planting season. Explaining the dilemma of adopting CA and grazing rights in the ward Mai Chitsunge explained:

> Everyone is expected to leave and open their field for livestock to feed on the crop stover during winter in this ward. It is the norm, so one cannot be seen making their field an exception. Anyone who goes against these norms is viewed as a rebel and becomes an outcast and because we would rather live harmoniously, it made sense to abandon CA.[63] (Interview. Mai Chitsunge, 17 September 2019)

In agreement Sekuru Rudhaka said:

> You cannot close your field during the off season, but expect your livestock to be feeding on other people's fields. Once you close off your field during off-season then we won't allow your livestock to go onto our fields as well. It's fair that way or the best option would

[63] Interview with Mai Chitsunge, Ward 30, Nyanga District, 17 September 2019

be to abandon CA which most people ended up doing anyway.[64] (Interview. Sekuru Rudhaka, 18 September 2019)

These norms are deeply ingrained in people's attitudes and beliefs. They not only determine how other people think an individual should behave; they determine what behaviour the individual feels is correct.

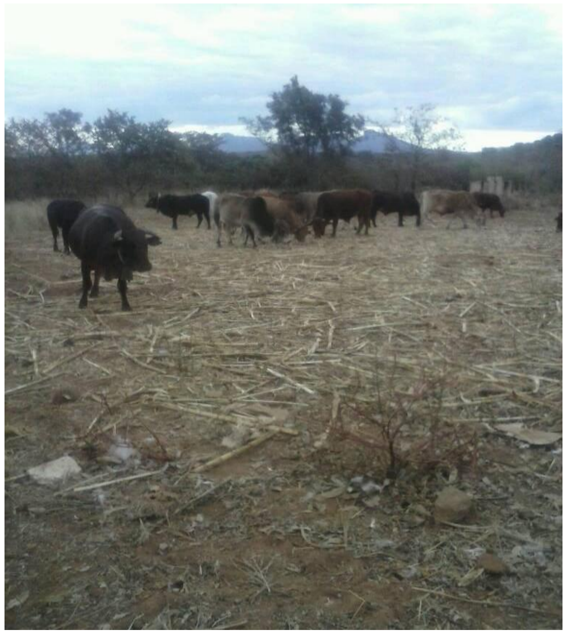

Figure 19: Cattle feeding on maize stalks left for in-situ grazing during the winter season

In addressing the challenge of communal grazing rights, Erenstein *et al*. (2008) argue that community participation is thus a requirement. They postulate that it is important for the whole community to realise the benefits of CA and act cohesively to reverse the long-term deleterious effects of soil organic matter decline. They cite two cases that demonstrate how this issue may be resolved. The first case is near the town of Karatu in northern Tanzania, where a farmer who collaborated with CIMMYT started managing CA systems under the auspices of a project funded by the German government. From his experiences, he managed to convince his neighbours of the benefits of CA and persuaded them to adopt the system. The farmer convinced them that as soil cover and residues were so important they should, as a community, restrict the free grazing of their animals. This has led to a "residue friendly" community where farmers realise that leaving

[64] Interview with Sekuru Rudhaka, Ward 30, Nyanga District, 18 September 2019

their residues on the soil surface is more beneficial than passing them through an animal. Making a case like the one cited in Karatu in a community like our study area will be a misfit because firstly, farmers, either rich or poor, often hold financial capital in livestock and will not sacrifice their generational wealth for the CA programme. This was aptly put across by Sekuru Chipanga, who shared:

> The decision I made was to abandon CA as I could not afford to lose my cattle due to starvation in winter because of the CA programme. These cattle are like a bank and I shall leave them for my children as well as they are hope to a decent life around here.[65] (Interview. Sekuru Chipanga, 12 August 2019)

Farmers are also unwilling to risk their investments on something they are promised in the future but are not guaranteed, whereas livestock reduces the risk involved in farming. Most of these farmers live around the poverty line, which means they have no buffer. Trying out a new agricultural principle, with the possibility of failure, is too risky.

A second case is the Shamva District of Zimbabwe, where a local policy-maker has observed the benefits of residue retention in the CA demonstration/validation plots and has re-enacted local regulations that permit farmers to deny access to their fields to grazing animals. The enactment of regulations in Ward 30 will be a misfit because households who rejected CA because of their social status will suppress the voice of the resource-poor households. Those with high status have the power to influence decisions in the ward, and any law that is not beneficial to them will not be passed. These problems can be real impediments to the adoption of CA and conflicts arising, for example, from communal grazing rights cannot be solved by orders or directives. Also, social relations do play a role. Many cases of livestock encroachment were never reported because the livestock belonged to a friend or relative, and people do not want to disturb social relations. Studies such as Johansen *et al*. (2011) have suggested strategies such as fencing fields or reinforcement of local by-laws on cattle roaming as a way of overcoming limitations of competing use of crop residues. Even physical protective structures such as fences might not be

[65] Interview with Sekuru Chipanga, Ward 30, Nyanga District, 12 August 2019

the optimal solution in the ward because they work against the traditional social values of households.

Given that agricultural development programs should consider indigenous farming systems, it is imperative to consider how the CA program maintained or hampered the indigenous farming system. The case of Ward 30 CA adopters demonstrates the potential of CA but this was threatened by the fact that socially, culturally and customarily, households respect communal grazing rights. As a result, the Ward 30 case supports the long-held view that indigenous land rights systems hamper adoption in SSA (Chinseu *et al.*, 2018). As a result, the CA innovation is not compatible and consistent with some existing values and needs of potential adopters, as Rogers (2003) argued, and farmers abandoned the technology. The communal grazing rights systems contributed to the low adoption and subsequent abandonment of the CA in the study area and farmers' abilities to put sizeable tracts of land under CA technology. Controlling livestock and protecting fields against roaming animals lead to an increase in labour and a negative association with CA. These results suggest that crop residue retention may not be the best way of crop residue management from a broad livelihood perspective for farmers. Therefore, for CA programs, especially the CA component of the use of maize stover as mulch, to be effective, it should be implemented so that it does not interfere with indigenous communal grazing rights systems for the technology to be adopted. Crucially, the role of grazing rights on CA abandonment shows how social expectations determine the success of agricultural development programmes in rural farming setups like Ward 30. Because most households like to feel acceptance and approval from those in the community they abandoned the technology, which elucidates the apathetic adoption of CA inward 30.

Family obligations

Likewise, the family set-up in many households in Ward 30 has been affected by rural-urban migration; where many men are in urban areas working formal jobs while their wives and children stay in rural areas looking after farming, livestock and the homestead. There has been a major push for men to source financial resources elsewhere to complement and diversify the farm economy since farming has become risky due to climate change. Also, in most cases, the income generated through farming is too limited to support the household economy.

The CA promoters recommended the digging of basins in the post-harvest dry season as ideal. They contend that this timing enables labour-constrained households to spread their labour over a longer period and allows them to plant with the first rains in November when the rainy season starts. However, discussions with households revealed that preparing basins during the farming off-season as recommended became a misfit because it interfered with important social & family obligations. During the farming offseason, it is the only time they take a break to rest from farming and visit their husbands or relatives in the urban areas. Visiting urban areas during the off-season is important because many households value family as an important institution. Farmers had a choice between sacrificing time with their family during the off-season and digging basins, and many decided to abandon CA because implementation could not work for them as illustrated by the following case.

During the 2008 hyperinflation period when most people could not afford a decent meal in rural areas, VaJemu left his family and decided to look for greener pastures in South Africa. He did not have money to acquire a passport which required about US$150 and he resorted to becoming a border jumper. Since he left Zimbabwe, he has never gone back home, but still supports his wife and family who look after their homestead. Since he does not have formal employment he has managed to pay only for his wife and youngest daughter's passports and they visit him every year after harvesting. He cannot visit his other relatives back home due to lack of proper documentation and is forced to stay in South Africa indefinitely. When CA was introduced his wife Mai Jemu dug her basins in May before she had left to visit her husband. When she came back in November before the first rains, she found that all the basins she had dug were covered with soil again because of livestock that was roaming in her field while she was away. Due to the drudgery and hard work of basin digging, Mai Jemu could not think of starting to prepare basins again and decided to abandon CA.

Mai Keche, who also initially adopted CA but had a husband working in the urban area, shared:

> I abandoned CA because it's not possible to be going back to the farm digging basins during off season when it's time to visit my husband in the city. Besides that, I also use the

time to visit relatives and take a break from farming.[66] (Interview. Mai Keche, 01 April 2019)

Farmers who were present during the offseason and would not be travelling reported that digging basins after harvest was still a challenge. These households will be preoccupied with traditional ceremonies during the same period, such as traditional weddings, appeasement ceremonies, and time to rest as well. These findings show that digging basins post-harvest was difficult to implement because farmers use the time to engage in different non-farming activities such as social and cultural activities. The lack of flexibility from CA promoters who insisted on basins being dug after harvest resulted in some farmers abandoning the programme. The challenge of dry season land preparation has been reported in other studies carried out in Zambia. Umar, Aune, Johnsen and Lungu (2011) found that most households prefer to engage in non-farming activities during the dry season in their efforts to diversify their livelihood strategies.

While the need to fulfil family obligations was a major reason for abandoning CA, the research also found that it was easy for these households to discontinue CA because of the remittances they get from family members working in urban areas. These households also have the financial means to buy maize or any crop if they do not have a good harvest. The money received by migrant households is primarily used for daily consumption and, among other things, for food purchases. These remittances cushion them from risks associated with agriculture risk, and the motivation to implement the CA model was lacking. The remittances contribute to ensuring the food security of these households and can be regarded as a safety net for some households in the ward. It is also worth noting that CA could not offer a comparative advantage over remittances for these households, as pointed out by Rogers (2003) in his diffusion of innovation theory. This became a serious barrier to change as farmers saw little advantage in improving their position because there was little personal benefit from the technology. Significantly, the social structure set up of families in a rural area like Ward 30 is one of the reasons why the CA response was indifferent, showing the link between social-cultural factors and technology adoption.

[66] Interview with Mai Keche, Ward 30, Nyanga District, 01 April 2019

Herbicides as a threat to indigenous/traditional leafy vegetables

Traditional leafy vegetables play an important function in society and promote social cohesion and order (Owuor & Olaimer-Anyara, 2007). Most Ward 30 farmers shared that these identified, edible, indigenous plants have a social meaning and cultural value because they are prepared during ceremonial occasions held in the villages, as well as being an essential native, food source. For example, the locals believe that community members need to provide only locally produced food for a successful rainmaking ceremony. Once ingredients from outside are served, then the ancestors or spirit medium will not intervene in the ceremony.

Herbicides had been promoted with CA to help control weeds (Bouwman *et al.,* 2020). However, herbicides became a misfit when farmers realised that traditional leafy vegetables were destroyed in the process, and this led to the abandonment of the technology. Many of these so-called weeds are actually indigenous, edible vegetables that are highly cherished within the local communities. As part of their traditional dishes, farmers in the ward deliberately leave these indigenous leafy plants in their fields with their crops (see figures 20 & 21). However, when they used non-selective herbicides such as the atrazine provided by promoters, many of these valued plants were destroyed. Therefore, the use of herbicides that destroy valuable wild vegetables like *cleome gynandra* was undesirable.

Traditional leafy vegetables are essential, especially when agriculture is facing climate change challenges. Most of these vegetables can withstand harsh climatic conditions and be harvested when there is total crop failure. Besides providing food and their socio-cultural meaning at a community level, traditional leafy vegetables contribute towards income generation and employment creation for households. Women and widows sell these vegetables to enhance their livelihoods, and the money is used for household needs (medical, school fees, etc.). As one elderly widow put it:

> Eating traditional leafy vegetables is something that we learnt from our forefathers. I rarely visit the hospital even when I am sick with a disease such as malaria. It is because the *soldiers* (immune system) in my body are strong because of these plants I eat. I am convinced that one of the reasons why you people of today are always hospital guests is

> because you don't like these traditional leafy vegetables because you think it's backward. We decided to abandon CA because we saw that once we apply herbicides then we would not have traditional leafy vegetables the entire farming season.[67] (Interview. Sekuru Kadzirange, 12 June 2019)

In agreement on the importance of traditional leafy vegetables, Mbuya Chitepo who is one of the elders in Village 5 said:

> Even in a bad year when you experience drought, our hope is usually on traditional leafy vegetables. I vividly remember in 1992 when there was a drought never seen in this area, I sold traditional leafy vegetables and I managed to keep my kids in school that year. I could not imagine sacrificing traditional leafy vegetables for CA. The choice between the two was very simple. I had to abandon CA because herbicides were cleaning up all our food culture and other forms of livelihood for my household[68] (Interview. Mbuya Chitepo, 12 June 2019)

The last quote is in line with the assertions of Hirschmann & Vaughan (1983), who claim that selling traditional leafy vegetables produce is the easiest and sometimes the only way in which women can raise cash in rural communities.

Although traditional leafy vegetables play a huge role in most farmers' cultural and social diet in the ward, the study found out that if these indigenous plants are not managed properly, they affect the growth of crops. Field observations revealed that most of these plants grow haphazardly and start to compete with crops for moisture, sunlight and other plant nutrients. This finding agrees with the work of Mwania *et al*. (1989) that some farmers delay weeding deliberately to allow these vegetables to germinate, thus encouraging heavy growth of other weeds, which is undesirable.

[67] Interview with Sekuru Kadzirange, Ward 30, Nyanga District, 15 May 2019
[68] Interview with Mbuya Chitepo, Ward 30, Nyanga District, 12 June 2019

Figure 21: Maize with tolerated with Cleone gynandra (*nyevhe*)

Figure 20: Maize with tolerated weeds locally known as *muferefere*

The study also found that farmers prefer to have their labour during weeding reduced while meeting food security needs for their families without disturbing their traditional leafy vegetables or aggravating food insecurity problems. However, meeting such goals simultaneously in CA fields seemed impossible for most of them, especially with the application of herbicides. That challenge is consistent with Nyanga *et al*.'s (2012) literature, which argues that increased labour reduction through herbicide use implies an immediate increased risk of being food insecure during the peak hunger period. Normally, most farmers are food insecure between December and March because they do not produce enough food to last until the next harvest. In such instances, most farmers opted not to use herbicides, which contributed to the dis-adoption of CA. The observed behaviour of these CA households agrees with the utility maximisation theories in that farmers are more interested not in profit maximisation but in maximising their utility, and in this, it was through assurance of home consumption. More essentially, this exposes how social-cultural factors considerations are at the centre of household farmers' decisions and unconvincing CA reception. Inherently farmers believe that their way of life is the best, and this attitude results in a reluctance to try something new.

7.4.4 Farming households' reasons for CA outright rejection

When the CA programme was being introduced, some farmers rejected it out of hand due to prevailing socio-cultural reasons. The research found that social status preservation, basin digging as a symbol of poverty, the plough as a tradition and identity of farmers, and patriarchy and gender issues contributed to outright rejection, as discussed below.

Social status preservation

It is an African cultural belief that a 'real' man should have cattle and use them for farming (Gombiro, 2012). CA model implementation missed the role, values and cultural significance livestock, especially cattle, have in farming amongst households in Ward 30. Farming that does not involve the use of livestock means that traditional practice habits are undermined. Livestock informs how farming and crop production is done and organised for many farmers and goes beyond direct food production to include multipurpose uses such as hide, fibre, manure, and capital accumulation. Furthermore, livestock is closely linked to these farmers' social and cultural lives, for whom animal ownership ensures varying degrees of sustainable farming and economic stability. Social prestige brought by livestock ownership influenced total rejection as households whose social status is built by cattle ownership were reluctant to implement the CA model of basin digging because of their social status.

Farmers with large herds of cattle are considered rich in the ward and prefer using cattle in all their farming activities. In addition, owning livestock, especially cattle and using them for farming is important for social reasons as it is viewed as a sign of wealth and gives one an elevated status in the community. In contrast, the CA model implemented by promoters compelled farmers not to use cattle at any stage of farming but dig basins to plant crops. In response, farmers with large herds of cattle totally rejected the CA programme when it was introduced, to preserve their high social status. They felt like they were being considered poor. For them, farming practice of using hand hoes to dig basins must target the 'poor' who do not have access to cattle for draught power.

Household testimonies suggest that the culture and value placed on cattle in the ward have gradually shaped the ward's views and prejudice that any farmer not using cattle for tilling the land is from a poor social class. Apart from this, households without draught power are often viewed as disorganised. Mai Chimbo, a widow who uses the hand hoe to dig basins, shared:

> A proper farmer like me cannot be seen being asked to be grouped with some poor unknowns of this community in a CA programme. It shows the promoters do not respect people like us. If they did, they could have come up with a different programme for us that is different from CA. To make it worse, the people who joined CA cannot even produce food that is enough for their consumption and most of the time, we employ them to help us in exchange for food. We see them as lazy people who are failing to put their household affairs in order. It is therefore not fair to be seen using the hoe to dig basins for CA just like what the poor and lazy people do. I could not picture myself doing that and I rejected the CA programme outright.[69] (Interview. Mai Chimbo, 05 March 2019)

Mai Ganda who is a widow for the past twenty years and sold all her cattle to help raise her kids after the death of her husband was even more explicit when she said:

> Each time the rains start I feel condemned again because I am forced to go around the village grovelling before people who own draught power. People do not even see me as a normal person and I don't blame them because I am as poor as a church mouse. If I had my own cattle people would not be looking down on me in this village. Most people who are rich rejected the CA programme because they did not want the shame associated with joining a programme with people like us who are looked down upon in this village.[70] (Interview. Mai Ganda, 11 April 2019)

Evidence from the above quotes shows the ward farming culture and meaning attached to lack of cattle ownership; a misfit, especially for farmers viewed as rich. These farmers decided against CA uptake to show power and status to people in the area because not using cattle when farming meant adopting a farming practice meant for the 'poor'. These findings also reveal a correlation between asset ownership or a higher social position and non-adoption. This is supported by

[69] Interview with Mai Chimbo, Ward 30, Nyanga District, 05 March 2019

[70] Interview with Mai Ganda, Ward 30, Nyanga District, 11 April 2019

studies in Zambia that found cattle ownership as negatively related to CA component uptake (Nyanga, 2012; Arslan, 2013).

Although there is a correlation between cattle ownership and CA outright rejection in Ward 30, some studies have different findings. For example, Chiputwa *et al*. (2011: 14) found 'a significant positive relationship between cattle ownership and adoption and use of zero-tillage' in northern Zimbabwe. They postulate that assuming cattle ownership should be taken as an indicator of wealth, therefore 'farmers with cattle might be able to raise the initial investment capital required…' or that 'the bigger the herd, the more the labour and capital requirements for management purposes and hence the need to explore labour-saving technologies (e.g. zero-tillage)'. However, the observed behaviour of Ward 30 households shows that CA was not compatible with the values of these households. The technology was not going to help improve their social status, and they totally rejected the programme.

Basin digging as a symbol of poverty

Promoters of CA in Ward 30 missed the preconceived mindset farmers had about basin digging when the CA programme was being implemented, leading to outright rejection for some households. Before CA was introduced in the ward in 2006, farmers who did not have or could not afford to hire draught power dug basins to plant crops, though reluctantly. As discussed in the section above, this farming practice is viewed as an act of desperation and demeaned by households, especially those with large herds of cattle. Basin digging with hoes in the ward has negative social connotations and the practice is associated with poverty. A quick comparison of households who use hoes for planting and those who own the plough shows that people who use hoes are very poor and struggle to make ends meet. Farmers who own ploughs can work fast and on large pieces of land. This allows them to plant their crops on time and also do crop diversification, unlike farmers who use the hoe. These produce very little and sometimes not even enough for their own families whereas those with the plough have a surplus to sell and get income.

The research found that the life of extreme poverty experienced and lived by people who use hoes on their farms has influenced many people to look at the hoe as a symbol of poverty and also believe that using a hoe alone does not make for successful farming. This was corroborated by life history discussions with households that rely on ploughs to prepare their fields revealing that even though difficult, their children have always finished education and work formal jobs or run businesses because their parents could afford to pay for their fees. In contrast, households that traditionally practise hoe tilling today are still very poor because they cannot afford to pay fees for them so that they can get proper education. The difference is that farmers who own ploughs can farm large pieces of land and also on time when the first rains come. One farmer who rejected CA outright because of the social meaning attached to the use of the hoe for tilling and the correlation with achievements explained:

> I did not join CA because it did not make sense to use the hoe which was used by our forefathers. We have since passed that stage especially when you look at how the plough has made farming easy for us. In this ward, if you want people not to take you seriously, then you should go ahead and use the hoe for tilling. In fact, as your homework, while you are around, I would like you to go around and look at households that use hoes *vis a vis* those who use the plough. I will tell you in no uncertain terms that for us who have used the plough, we have achieved more. For example, I have taken all my children to school, I have built myself this four-bedroom house, I managed to buy myself a car even though it broke down, and I have bought livestock among many other things. The people who have been using hoes can only dream of these things and will never achieve this in their lifetime. So in all this, there is no way I could have gone to join a programme like CA and dug basins as farming practice when I have seen and have evidence of how farmers around here live because of using a hoe to till the land.[71] (Interview. Sekuru Mudere, 19 June 2019)

As I moved into the ward during the research after my interview with Sekuru Mudere, I also became curious and observant of the economic situation of farmers who use the hoe for tilling and indeed most of them are very poor. This is illustrated by the following case:

VaMakwiramiti household does not have cattle or a plough for tilling and their farm. As a family, they use hoes to dig basins to plant their crops. Every farming season they do not yield

[71] Interview with Sekuru Mudere, Ward 30, Nyanga District, 19 June 2019

much from their crops and have little money and no food to eat. As a result, their children do not go to school because they cannot afford to pay fees most of the time. Unlike some people in the village, who are either supported by their adult children and/or own cattle, this family does not own any valuable assets. Most of the time, the family survives by cutting firewood to sell. As I walked around the VaMakwiramiti homestead, the signs of poverty and lack of progress were everywhere to see. There is no latrine for sanitation and hygiene, a single dilapidated hut which they use for cooking as well as sleeping for their children and another 1 bedroom structure, and a chicken run that is old and also dilapidated. They have never managed to acquire any assets for all the years they have been farming. Most people in the village use VaMakwiramiti as an example of how not to farm.

The study also found that the concept of basin digging was a social misfit as it was also dubbed '*dhiga ufe'*, a derogatory vernacular term that can be loosely translated to 'death by digging'. This led to farmers, particularly those who could afford to use cattle, rejecting CA outright because they deemed the concept of basin digging not aligned with their way and understanding of farming. Such sentiments suggest that CA promoters failed to customise the model of basin digging and the attached social views to minimise unintended consequences and conflicts with cultural norms.

Discussions with farmers who are classified as poor because they practise basin digging confirmed the pressure they experienced to 'do the right thing' in the ward. Basin digging conflicts with an important cultural symbol for hard work, as ploughing is generally believed to symbolise a hard worker, an attribute that generates respect from people in the ward. In fact, in their quest to 'do the right thing', the research found that 'poor farmers' in seasons where they can afford to hire draught power, abandon basin digging and till their land. Tilling land instead of basin digging gives them a sense of belonging and achievement in practising farming according to the ward standards. VaMutenje shared:

> We feel a sense of achievement in seasons that we afford to hire draught power and don't dig basins because that is what every farmer is expected to do in this ward.[72] (Interview. VaMutenje, 11 May 2019)

The statement above highlights that farming in the ward is not only done at the individual or household level but farmers' decisions are also influenced by the collective meaning attached to farming in their community. The observed behaviour of these households is an indication that they viewed CA technology as not offering a comparative advantage over conventional practices, and also, it was incompatible (Rogers, 2003) with how farming is supposed to be done in the ward. As such, CA's total rejection lies outside the individual but rather in relationships among individuals or between individuals and society at large. Crucially, farming practice is not isolated from the rest of society's social meanings, and it cannot be treated as operating in a vacuum. The consideration of these dimensions determines if farmers are going to adopt a technology or not.

The plough as tradition and identity of farmers

The plough is an indispensable implement within farming communities and Ward 30 is no exception. Indeed, very few farmers do not own a plough; it has become a status symbol of farming. It is an affordable, sustainable technology; one that, given the ever-increasing cost of tractors, spare parts and diesel, is becoming more and more attractive. A farmer using draught animals with the plough can carry out all farming activities as effectively as with a tractor. It may take longer, but he can still do all the activities in time, and take advantage of the window of opportunity for planting at a cost that matches his/her pocket.

In discussing the importance and meaning of the plough for many smallholder farmers, Giller *et al*. (2009) argue that 'the plough has become a symbol of agriculture such that many people involved including, farmers, extension agents, researchers, university professors and politicians find it difficult to believe that agriculture can be possible without tillage'. Furthermore, Anderson & D'Souza (2013) acknowledge the impact of using the plough as a tradition among smallholder farmers.

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[72] Interview with VaMutenje, Ward 30, Nyanga District, 11 May 2019

Similarly, the findings of this study are in tandem with the work of the authors above as household farmers in Ward 30 persist in ploughing as it is a deeply embedded practice, which has been used over many generations. The plough use is also considered what *wasu*[73] should 'do', which is the tribal identity and tradition of the households in the ward. It is conceptualised as including the use of oxen and mouldboard ploughing for tillage. The influence of the plough and *wasu* tradition of farming led to outright rejection of CA implementation among households in the ward. Households are always hesitant to try other forms of farming that exclude using the plough because they have always known one way of farming, as illustrated by the cases below:

Sekuru Chiga is 72 years old and has been using the plough for the past 50 years. He views the plough as part of *wasu* identity. He bought his first plough using a loan from the Post Office Savings Bank in 1969 and managed to take all his children to school through farming using the plough. He cannot plant crops without ploughing the field because he sees the plough as an implement that defines how he farms. He pointed out that once he does not use the plough, then he will not be a proper *wasu*.

In another case of how the use of the plough is only viewed as the only way, farming should be defined was a case that happened in Village three. In the third year of CA adoption, Mai Hondo who does not own draught power dug basins with the help of her *humwe* partners on two acres. She also sacrificed the little resources that she had and hired other people in the village for *maricho* and *mugwazo* and dug basins on three more acres to make a total of five acres dedicated for CA. She followed all the principles of the technology as advised by the promoters and planted with the first effective rain. In the same village, VaMugoni, also had five acres which had maize that was planted under conventional practice and it was equally good because he had applied enough fertiliser, manure, and herbicides and done timely weeding. As is the norm in Ward 30, farmers visit several households looking at crops to vote on a farm with outstanding crops so that a field day is held in honour of their outstanding work. This is really a big deal for farmers in the ward and the function is also something people look forward to as it also builds one's social status. After farmers had visited all the outstanding fields, the competition was only

[73] Wasu is a word from the Manyika dialect of Shona which means roughly 'bosom friend'.

between Mai Hondo and VaMugoni in the Ward but after deliberation people could not agree on who had the best crop between the two. One old farmer who is well respected and known to have wisdom stood up and said: 'For all my life and how you know how farming is supposed to be done, using a plough must be at the heart of farming. As far as I am concerned and in our *wasu* tradition there is only one person who did proper farming and it is VaMugoni because he used the plough'. As he sat down, everyone in attendance smiled, and clapped while nodding their heads in agreement and that is how the impasse was solved and how Mai Hondo lost to VaMugoni in the competition of Master farmer that year.

For most farmers, growing crops without using the plough conflicted with conventional farming practices inherent in farmers in the ward. They wait until the first rains of the season have softened the soil before they can prepare or plough their land for sowing. The study found that not even the late onset of rainfall or increased risks involved in late planting is enough to change households from the culture of ploughing. For example, while I was in the field, I could see farmers still ploughing as late as the end of January even though most of the crops planted that late in the season will not have enough time to reach maturity. The observed behaviour of these households is an indication that they viewed CA technology as not offering a comparative advantage over conventional practices, and also, it was incompatible (Rogers, 2003) with how farming is supposed to be done in the ward. The findings of this study are consistent with Derpsch in García-Torres *et al*. (2003), whose work asserted that to forsake the plough is very difficult for farmers, and this change of mindset is probably the greatest challenge for CA adoption. CA came with changes to the farming culture of most households, and if changes in one aspect of culture are introduced, these are likely to have an unacceptable effect on other aspects, which led to CA abandonment. This illustrates the role culture plays in CA adoption in smallholder farms like Ward 30, which explains the enthusiastic reception of CA in the area.

Patriarchy and gender issues

Gender issues in agricultural technology adoption have been investigated for a long time, and most studies have reported mixed evidence regarding the different roles men and women play in technology adoption (Bonabana-Wabbi, 2002). In analysing the impact of patriarchy on CA model implementation, the study found that gender affected farming in Ward 30 because men hold the power-making decisions and women's role is to support them. This impacted CA model implementation as some women farmers could not go against their husband's directive not to take up CA even though they were keen to try the CA innovations. Adoption or non-adoption of farming technologies is also up to the man, and in cases where women would want to try new farming techniques, men have overruled them as the decision-makers. Such cases were more prevalent in a household set-up where the husband is formally employed and stays in the urban areas, and they give orders for the wives not to join the CA programme. This led to some homes rejecting the CA programme as the women could not go against their husband's decisions as dictated by culture.

Most married women's beliefs, cultural attitudes, and social norms dictate that they must be submissive to their husbands. This is confirmed by literature that women may have little decision-making authority in farming due to patriarchal cultural beliefs (Ani, 2002). In some instances, women pointed out that their husbands decide where and the kind of crops that must be planted for every season. For example, while in the field, I observed how one woman would run every decision past her husband, who is formally employed in the urban area, through the phone. This confirmed the dominant patriarchal situation in the ward and how men also decide how, where, and when to allocate limited resources.

Some women who did not adopt CA reported that one of the challenges was that they would not be allowed by their husbands to attend training that was being conducted on demonstration plots. The women did not want to risk their marriages by going against their husbands and thus being viewed as disrespectful. For one to understand what is at the core of these challenges of why women could not implement the CA model is the system of patriarchy that relegates women to perpetual servitude. As one woman puts it:

> I did not adopt CA because my husband did not want me to be attending the demonstrations when it was introduced. My culture does not allow me to go against what the head of the house says. In addition, farming decisions are done by my husband and I am there to support that. Once I try to bring my own ideas on how things must be run in

> this family it usually ends up bringing confusion.[74] (Interview. Mai Rugare, 11 September 2019)

Not all women agree with patriarchy. As one put it:

> As women, we put a lot of effort to keep families afloat and our husbands must also respect us. For example, I spend the whole day here working in the field while my husband moves from one homestead to another drinking opaque beer and he demands I listen to everything he says. To be honest that doesn't work. I sometimes feel I should be the one wearing the trousers and he must be wearing a skirt.[75] (Interview. Mai Chauke, 22 September 2019)

According to Bonthuys & Albertyn (2007), the concept of patriarchy was first used by social scientists to describe a system of government where men held political power, as well as in their capacity as heads of households. Patriarchy, therefore, is a social system whereby men dominate in all spheres of life. Even though agriculture carries a female face representation and women play a central role in agriculture in Ward 30, they do not have the power to make decisions regarding ownership and management of land. Women do not have rights to the land that they work on every day. These unequal and unjust land ownership patterns have led to the disempowerment of women in CA adoption, adding to the outright rejection and, in the process, showing the connection of socio-cultural factors in the lacklustre adoption of CA in the study area.

The findings on the lack of decision making power of women in many households in Ward 30 are similar to a study by Tesfaye *et al.* (2001), Mesfin (2005), Omonona *et al*. (2006), and Mignouna *et al*. (2011), who found that gender affects technology adoption since the head of the household is the primary decision-maker and men have more access to and control over vital production resources than women due to socio-cultural values and norms.

[74] Interview with Mai Rugare, Ward 30, Nyanga District, 11 September 2019
[75] Interview with Mai Chauke, Ward 30, Nyanga District, 22 September 2019

Area of cultivation under CA

The emphasis on yields by CA proponents is based on the assumption that as more crops are produced per unit of land, there will be a greater surplus to be sold, thereby alleviating poverty and ensuring food security. Development experts believe that food security for farmers under subsistence farming conditions can only be achieved by increased yields per unit of land and labour (see Tchale *et al.*, 2005). As a result, a great deal of research on agriculture in Africa is organised to assume that intensification can take smallholder farmers out of poverty. The emphasis in programming often focuses on technologies that increase farm productivity and management practices that go along with them. When CA was promoted in the ward, farmers were compelled to start on a surface area of 50 x 50 m, and the inputs they received would only cover that. The research found that the cultivation area encouraged by promoters was a misfit and lent to total rejection of the technology. Communal communities have always regarded the extension of agricultural land as the sole option for increasing productivity.

Discussion with farmers and some key informants found that some households totally rejected CA due to social prestige. Farmers explained that most households' prestige in Ward 30 often increased with the increase in the number of hectares they could plant and later their crop production. It is a socially important practice to farm a large area. The research also found that this was mostly associated with households viewed as wealthy and who own equipment for farming, such as ploughs, cultivators, harrows, and ridgers. Although most farmers acknowledged that harvest per unit area was higher in CA basins than in other tillage methods, prestige was more important to some households than the productivity benefits of CA. This shows that qualitative and non-economic factors are also critical in the adoption of CA. In this regard, some farmers can decide and act as postulated by the human agency theoretical perspective (Giddens, 1984; Long, 1992) for non-economic reasons (such as prestige).

When farmers arrived under the government programme of resettlement after 1980, twelve acres were allocated per household. Most households have continued working on their allocation, while some households now find it difficult to plough all the acres and leave some of the land unutilised due to lack of resources and labour constraints. However, village 10 is known as *kuminda mirefu,* which means vast tracts of tilled land. Most of the household farmers in this village now farm more than doubled the 12 acres they were allocated when they arrived in the area. People in this area believe that an accomplished farmer is seen by how big the area they till for cropping. In some seasons, when inputs are not enough, most of these farmers use ordinary seeds from the previous harvest that are not hybrid to ensure all their fields have crops planted. Even though most of the time, the harvest output from the areas with sub-standard inputs is not worth time plus labour efforts, it is more prestigious to till crops under a large area. Therefore, the CA idea, which said that farmers were supposed to focus on an area of 50 x 50 m only for farming, was unthinkable for these household farmers. They could not fathom the idea of working and focusing on a tiny piece of land and leaving the rest of their field idle. Farmers explained that a man's prestige often increased with an increase in the number of hectares he could plant and later his crop production. The reason is that people in this village generally endeavour to conform to the norms of society (Rogers, 2003) and try to avoid being labelled *nyope* (lazy). For them, there is honour and respect that one is accorded by fellow farmers when one farms many acres, which is not given to farmers who focus their agriculture on small land no matter how successful it might be.

Most farmers in village 10 totally rejected CA because it did not fit how farming must be done according to the households' understanding or definition of farming. The reluctance to increase the area under CA seems to confirm the conclusion by Baudron *et al.* (2012: 1) that ''small scale farmers in Southern Africa are predisposed towards extensification rather than intensification and that a widespread adoption of CA in the region seems to be unlikely.'' This is because farming households in the area understand food security as holistic rather than reductionist. Increased yields are only one part of a story that includes social norms and conformity, among other things. The reluctance behaviour among farmers is also an indication of the incompatibility of CA with the existing values and needs of potential adopters, as argued by Rogers (2003) in his theory of diffusion of innovation. Equally, the incompatibility of CA due to households' quest to conform to the norm of extensification as opposed to intensification also explains the uninspiring adoption of CA in the study area.

7.5 Chapter summary

This chapter investigated beliefs, practices, and values that influenced the integration and exclusion of CA principles by small farm households in Nyanga District, Ward 30 in Zimbabwe. The chapter was necessary because the adoption of the CA programme was lacklustre, and eventually, there was a disadoption of the programme even though agricultural yields have remained low. This chapter, using ethnography data from the ward, contextualised a range of theoretical discourses in intervention and development (Escobar, 2011) in addition to the significance of agriculture to economic development (Johnston & Mellor, 1961; Hazell & Diao, 2005; Hayami & Ruttan, 1971) at the wider level. The chapter highlights the importance of considering households' specific socio-cultural and contextual aspects in policy formulation, planning, and implementation of development intervention. This is key because field observations, life history, interviews and discussions show that smallholder agriculture is characterised by a complex interaction between natural, cultural, and social environments in which farming practises are highly interwoven with farmers' social life; kin relations, local knowledge, values and resource sharing. This chapter also brought attention to decision-making by household farmers, not only focusing on the individual characteristics of farmers but considering the community to which they belong and the social relations in which they participate. It was important, therefore, that the social element beyond rational decision-making in the ward be explored. This is not to say that farming practices are necessarily seen as either rational or irrational. However, it does imply that there may be more than one kind of rationality based on different sets of social prescriptions or habits. This shows that farmers' adoption of new technology is very much influenced by a complex combination of environmental and socio-cultural factors.

CHAPTER EIGHT: DISCUSSION, CONCLUSION AND POLICY IMPLICATIONS

8.1 Introduction

This chapter gives a detailed presentation of the summary of findings, brief discussion, conclusions and implications for policymaking as deduced from the empirical findings. This thesis is written in response to the often under emphasised role social and cultural factors play in smallholder farmers' decision-making on agricultural innovations, especially in CA studies. In the context of agricultural livelihoods in Nyanga District, Ward 30, and emphasising places, experiences, meanings and knowledge (Chapters 2 and 3), the goal of the thesis is to provide a space for local voices on socio-cultural practises, which is largely absent from the discourse of sustainable agricultural practises, especially CA. The goal was achieved by answering four research questions:

1. What are the specific challenges confronting rural small farm households that led to the introduction of the CA model in Nyanga District, Ward 30?
2. What are the emergent socio-cultural factors guiding small farm households' agricultural practises and performance in Nyanga District, Ward 30? How are these factors incorporated into small farm households' agricultural practises?
3. What aspects of these cultural practices did the CA farming model incorporate before it was implemented in Nyanga District, Ward 30? What aspects of these farming practices were completely missed in the implementation of the model? How did these issues affect households' decisions on adoption or non-adoption?
4. How do farm households that have adopted the CA packages organise their agriculture and make farming decisions?

To answer research questions one to four, I spent over a year in the field, from September 2018-December 2019, in Nyanga District, Ward 30. To achieve this, empirical data collection for this study has been derived mostly using various methods. Upon arrival, I used non-participation observation in the community. After familiarising myself with the community surroundings and the farmers, I then started to participate in various activities in the community and farm households. In between participation in various farming activities, I would also conduct my expert/elite interviews and conduct life history sessions with relevant people in the study area. From using this research methodology and methods there are insights that came up as reflected in the subsequent research. Descriptive, explanatory and exploratory work on complex issues such as culture, seed systems and criteria, the plough as a tradition and identity of farmers work best through non observations and observations, expert interviews that enable respondents to show-and-tell. The use of ethnography facilitated understanding of new areas of study and encouraged discussions about sensitive issues like cultural beliefs and taboos. Unclear or poorly understood answers were also addressed immediately. All in all, data was analysed through thematic analysis and a combination of methods has assisted in the triangulation of results, hence contributing to 1) obtaining reliable results and 2) successful realisation of the entire PhD project.

Findings from Chapter Four show that agricultural productivity in Ward 30 has been unsatisfactory due to challenges farmers encounter such as biophysical, human, social, political and institutional. Despite the challenges facing agriculture in the ward, local initiatives tailored to address these challenges are emerging, such as applying manure from livestock to improve soil fertility and carrying out rain-making ceremonies as a response strategy to changing weather patterns, among other adaptation strategies. The previous chapter fed into Chapter Five, which looked at the conventional and emerging socio-cultural factors guiding farming in the study area. Findings show that the farming system encompasses spiritual relationships, relationships with the natural environment and the use of natural resources, and relationships between people, and it is reflected in language, social organisations, values, institutions, and laws. Having laid out the platform on what guides farming in Ward 30 in Chapter Five, my next chapter (Chapter Six) looked at the socio-cultural aspects that were incorporated and missed when CA was implemented in the study area. Findings show that farming in the area is highly traditional, and socio-cultural factors drive decision making in most cases. Some of the factors that made CA a misfit in Ward 30 and contributed to its abandonment and outright rejection included social prestige, community laws and traditions, among other issues. Chapter Seven findings show that households that adopted CA did not find it easy, and most of them partially adopted or tried to modify the technology to address the challenges and suit their local ways of farming. Some of the challenges were a shortage of labour to dig basins, weeding and lack of mulch for soil cover.

Despite the challenges, initiatives tailored to address those challenges were used, such as resource pooling to address labour challenges but were not sustainable as people had social obligations which clashed with such arrangements leading to CA abandonment.

This chapter gives a detailed presentation of the summary of findings and a discussion of those findings. The thesis examined the role socio-cultural dynamics play in the slow or outright rejection of sustainable agricultural technologies focusing on CA in Nyanga District, Ward 30. This thesis used information from desk review, key informant interviews, non-participant and participant observations and life history to collect data in Ward 30, Nyanga District, Zimbabwe. Unlike other CA adoption studies, this study was unique. It used an ethnographic method that managed to generate rich, in-depth data regarding social dynamics and their interactions with farming in rural areas. In addition, this qualitative assessment of farmers' perspectives on CA provides depth and detail from the farmers' perspectives which are often lacking in quantitative studies and can inform CA research about constraints to adoption from a socio-cultural perspective. This chapter aims to tease out major themes that emerged from the study to address the research questions posed in section 1.4 of Chapter 1. These themes will be used to conclude the thesis, and out of the conclusions, policy implications will be extensively identified and discussed. Therefore, this chapter is organised as follows: It starts with the discussion of the findings from the study, followed by the conclusive remarks from the whole study. After this, the policy implications follow, and finally, the suggestions for further research are documented.

8.2 Discussion

Diverse stories of farming households in Ward 30 hold themes that contribute to a more nuanced understanding of adoption and innovation dynamics, which are often overlooked in linear innovation diffusion discourse. The following section highlights and discusses three lenses that can contribute to our understanding of farmer behaviour when making decisions. The observed behaviour of the farming households agrees with the utility maximisation theories in that households are more interested not in profit maximisation but in maximising their utility, be it through assurance of home consumption, avoidance of drudgery, crop and tillage diversification and engagement in non-farm activities. Below is a discussion of social-cultural factors, risk aversion and farming experience as conceptual issues that emerged in the study area.

8.2.1 Risk aversion by smallholder households

In a community set-up like ward 30, particularly for resource-poor farmers, a risk-averse approach to new technologies and investments may predominate (Iyer, Bozzola, Hirsch, Meraner & Finger, 2020; Ngoma, Mason, Samboko & Hangoma, 2018b). In response to the pervasive risks and uncertainty, practises and norms aimed at minimising risk and the adverse effects of calamitous events have been developed and are consciously maintained. These include strong local institutions for reciprocity, labour pooling and communal grazing for livestock during the post-harvest season, among others. Added to these are livelihood diversification strategies. Most smallholders have a diverse portfolio of activities that different household members engage in at different times of the year.

There is an implicit assumption by CA promoters and experts that once smallholders are shown the economic and agronomic advantages of CA, their profit-maximising mindset would automatically lead them to adopt it. Rather, they first consider the security of household consumption when farming before any other considerations and their responses are contingent upon 'safety first'. This suggests that most farmers in this study are risk-averse regarding the 'introduction of new practices'. Indeed, adopting CA was identified as a risk in its own right and continuing with CF practises on the other farm plots was a risk management strategy.

The findings also reveal how past experiences with technologies and interventions can contribute to an aversion to risk. This is evident in the piecemeal adoption, in this case, partial adoption, abandonment or small area allocation experimentation with CA practises in the study area. Risk-averse behaviour to keep options open also guides farmers' decision-making. The risk was spread by practising both the conventional and CA systems in case of prolonged January dry spells and the perceived CA practises, of which the main focus is residue retention, in case of droughts (Brown *et al.*, 2017). Additionally, as opposed to outright CA adoption, continuing with conventional methods was seen as leaving options open if resources to buy CA inputs such as seeds and fertilisers are limited. In that case, farmers can use selected indigenous seeds in conventional methods. For smallholder communities with farming systems that depend on rainfall as the only source of moisture for crop growth, seasonal rainfall unpredictability is unavoidably seen in both highly variable crop production levels and in the risk-averse livelihood and coping strategies that have emerged over time. Other risk aversion strategies manifest through households' focus on producing for their own consumption, diversification of crops and tillage systems and livelihood strategies. The observed behaviour of the studied CA households agrees with risk-averse households' theories in that households are more interested in farming practices designed to increase family food security rather than to maximise profits.

Farmers in Ward 30 see themselves as susceptible to various sources of risk, most notably climate change challenges such as drought and long dry spells, as we have seen in Chapter Four section 4.3.1.1. However, most farmers did not regard themselves as risk-takers with the introduction of a new practice like CA. According to Callo-Concha (2018), climate change coping measures are primarily selected by farmers based on their short-term benefits and only when they are compatible with local ecological, social, institutional, and customary settings. This also suggests farmers have a good sense of their relative risk, and any perceived risk-taking (concerning the introduction of new practises) is opposed to something they are familiar with, such as dry soil planting as an ex-ante drought risk adaptation strategy to help ensure food security (Westengen and Brysting, 2014). Under such conditions, the risk of income shortfall is reduced by growing maize crops on several fields and reduced even more when different crops are cultivated. Examples include the spatial diversification of farms, diversification of agricultural enterprises and diversification from farm to non-farm activities. One can also argue that these practices are more complex and may not (as yet) be mainstream or widely accepted, or that farmers who have implemented conservation practices may be more confident in their ability to manage drought.

The research findings also provide indications that farmers' values and motivations influence their risk assessment. Namely, there was a connection between the implementation of CA and lifestyle motivations and the view that these conservation practices assisted in managing risk. Economically and socially motivated farmers (indicated as ownership of many livestock, implements and remittances) specifically did not regard CA as a worthwhile element of their risk management strategy—they might attribute a higher option value to delayed adoption (Marra *et al.*, 2003). If the expected return is small or negative, risk aversion reinforces the obvious choice of non-adoption. Intrinsic motivation to adopt conservation practices will modify the choice in many instances. However, it would appear that farm households who are predominantly motivated by social and economic/financial goals are looking for external motivators to achieve the necessary certainty equivalents to implement CA. As recognised by the expected utility and safety first theory, the practice of CA in ward 30 did not seem to be based on profit maximisation, but rather several considerations were made.

The phenomenon of partial adoption of CA, where smallholders adopt two or a single CA principle, was another risk management strategy. The major challenge associated with the need for integration of multiple practises, as suggested by the CA paradigm and supported by recent literature, is that it necessitates a major transformation of the established farming practices, which is not always a realistic requirement for smallholder farmers (Giller *et al.,* 2009). Such changes embody uncertainties, which in the absence of production surpluses or safety nets increase the risk for farmers' livelihoods in the short term. Therefore, such partial adoption should be regarded as a way to manage risk and adaptation of CA to local conditions, needs and challenges.

Time had a negative and significant impact, indicating that farmers would adopt fewer techniques in subsequent years from the time the technology was introduced. This suggests that the nature of abandonment is stepwise. A risk-averse farmer would use more techniques as he/she gains confidence in the technology; however, in this study, farmers would evaluate CA components each season and subsequently abandon the intensity of use. However, the sequence of components of dis-adoption would vary from farmer to farmer, depending on the constraints and what could be considered an easy practice. This also indicates that if partial adoption had led to sufficient good results, farmers would continue with certain CA components and partial adoption would magnify over time. As recognised in diffusion theory (Rogers, 2003), sustained engagement with an innovation depends on whether or not there is a relative advantage of the new practice over the current practice. The challenges and constraints farmers continued to face meant that they could not overcome the barriers and had to abandon the technology in Ward 30.

8.2.2 Socio-cultural factors

Farm-level knowledge and decision-making are socially constructed and recognised in emergent science and technology literature (Glover *et al.,* 2016; Whitfield, 2015). In the case of CA in Ward 30, we have seen how social dynamics shape farmers' perceptions and experiences of innovation, including decisions about whether and at what points to engage with or disengage from a process of trialling new practices. Sentiments commonly expressed by households revealed that CA promoters failed to genuinely engage farmers in the technology transfer process, resulting in mismatched priorities between CA promoters and the social and cultural beliefs in the ward. For example, minimum soil disturbance was introduced in an area where the plough is strongly attached to the *manyika* cultural values. People generally make every effort to conform to cultural norms in their community, and the continuity of CA principles against their culture becomes uncertain once the project expires. This suggests that failure to fully and continuously engage farmers in their culture, when it is the backbone of how agriculture is done locally, undermines learning from indigenous knowledge and experiences. Therefore, CA promoters in the area missed an essential step in localising and modifying CA leading to conflict with cultural farming values and preferences, thus weakening local commitment and ownership of the CA project.

The study's findings revealed a series of steps and stages set out by CA promoters for farmers to follow if they were to achieve maximum production and economic growth with CA technology. Promotion of external farming programmes such as CA in Ward 30 by promoters has largely focussed on economic growth. For example, in this study, it is manifested by promoters promoting crop rotation, almost as if development is only synonymous with increased incomes. The project promoters largely ignored social and cultural factors that farmers value as part of development. The improvement of farmers' quality of life, measured in the form of free/rest time and self-sufficiency in all dietary needs, was largely ignored, emphasising cash generation. Beckford (2002), Beckford *et al.* (2007) and Beckford and Barker (2007) have all argued that farmers see progress in more than just economic terms, and, in particular, they prioritise the achievement of food security at the household level. Social and cultural values are included in farmers' efforts to achieve economic progress. It is clear from this study that farmers need more meaningful options from which to choose, rather than being given prescribed actions for development. For farmers, cash income is not sufficient as a measure of progress or development. This study has shown that farmers value their way of life, as seen in Chapter Five, where they observe *chisi* or *mahakurimwi,* although some literature portrays them as struggling to make a living. Portraying farmers as struggling to survive can be not only inappropriate but also unhelpful.

A World Bank study (2004) found that farmers cannot make incremental gains on their 'experiments' largely due to a lack of record-keeping and thus sometimes fail to progress. However, the study established that such an approach of emphasising increased production for the market to generate income had led a programme like CA to be a misfit. Farmers' priorities are first to produce sufficient for consumption and only then to sell the surplus to generate income. The emphasis by CA promoters on market-oriented production might be appropriate for expert-led economic growth, but for farmers not prioritising this, it is less relevant. This is exemplified in Chapter Six, where findings revealed that farmers do not keep farming records. This implies that farmers' valuation of resources, such as food, is based on intrinsic values embedded in food. The observed behaviour of the households agrees with the utility maximisation theories in that households are more interested in maximising their utility rather than profit maximisation. Escobar (1998) alludes to this point indirectly when he argued that the peasants' economy is geared towards satisfying the needs defined qualitatively, while Western technology and science are based on exchange value with its drive towards accumulation and profit. This gap must be recognised and addressed before aid implementation if meaningful development is to be achieved in local communities.

In addition, smallholder farmers inherently make decisions based on short-term projections, as crop yields compromise their livelihood and the absence of alternative income severely limits food security. According to Giller *et al.* (2009), short-term variability, including positive, negative and neutral effects, in the field response to the introduction of CA can reduce the overall attractiveness to farmers of adopting such practices. Furthermore, farmer beliefs may lean more heavily on personal experience and values and traditional knowledge of farmers with comparable short term objectives (Thrupp, 1989). In comparison, CA promoters draw from multiple sources of information, creating a broader understanding of the agricultural system, including longer temporal expectations of land dynamics, and can view CA within the smallholder farming system objectively, seeking long term conservation impacts without the immediate pressures of crop yield gains (Halbrendt, 2014). As such, the disparity in viewpoints regarding timeframes may account for the basis of predicting the outcomes introduced by CA practices; farmers set up decisions on instant and positive results, while promoters maintain a broader perspective of change over time. Therefore**,** decisions on whether to adopt CA, and how many of the prescribed practices to adopt or over what area, are made in light of the impact on the whole range of other livelihood strategies engaged in by the household, and also in light of local norms, culture, and practises. No profit motives enter into the growing of crops.

The findings also revealed that most farmers were unanimously positive and agreed on the benefit of yield improvement under CA but still abandoned the innovation even after seeing these agronomic and economic benefits. This suggests that dis-adoption is not primarily a factor of perceived benefit. Instead, factors or considerations other than or in addition to profit maximisation might be at play, such as the feasibility of CA implementation within local socio-cultural systems. Decision-making amongst farming households in a rural setup does not only include technical or economic dimensions, as social acceptability is also important. Community members' perceptions and opinions make implementing new agricultural practices unlikely because of how farming is defined. For example, as we have seen in Chapter Seven, section 7.4.4 practising farming on 50 x 50 m of land was not feasible in terms of social dynamics because it lacked social approval. Some farming households were intimidated or feared being mocked for being' lazy'. This wording came up frequently in farmer discussions concerning CA plot area and how farming is practised in the ward, showing that failure to till on a big piece of land is associated with 'laziness', whereas being' hard-working' is dependent on the farmer’s ability to be food secure. The adoption process of CA is not restricted to a household’s choice to adopt or not, as Rogers (1995) explained in his five stages of the adoption process, neither will it simply spread in communities through the social process of diffusion.

Even though Stone (2007) adds to how individuals learn (environmentally and socially), it does not clarify whether CA is beneficial for smallholder farmers in Ward 30. Other factors and processes play a role in the process of adoption, and the question of whether CA can fit in the networks of farmers, such as socio-culture practises, farming systems and risk-aversion, should be considered. The ANT theory gives a much broader perspective on this. The ANT model of Latour (1999) argues that local and social interaction produce networks in which farmers operate. The ANT model correlates with Sigaut (1994) who postulates that technology is a 'science of human activities' in which activities are entrenched in people's networks. It explains how local, and social discussions affect a network and how networks of scientists, farmers, and experts interact and spread a technology. Rural farmers are not independent actors; they are not as free to decide as Rogers (1995), and Stone (2007) assumed. Rural farmers make decisions and choices in the context of the community they operate; their social, environmental, cognitive, cultural, economic, geographic and political structures affect the decisions of farmers (Gray and Gibson, 2013). Their context and surroundings shape rural farmers; they are part of heterogeneous networks and make decisions influenced by opinion leaders, the prices of inputs, the need to conform to the group, and the rules of their community. Farmers also have a strong sense of belonging to the community, which hinders the adoption of new systems because people do not want to do something different from the rest. Latour (1999: 16) postulates that the focal point of analysis in adoption processes in any technology should be "notions such as norms, values, culture, structure and social context".

Social acceptability is also associated with community group dynamics and the connected flow of information. The theory of adoption and diffusion by Rogers (1995) focuses on the social factors in the adoption process of technology. Rogers explains that technology spreads because farmers talk to each other and look at their compatriots before adopting an innovation. The data from interviews showed that farmers easily shared information on the content of CA in farming associations and their villages, as shown in Chapter Seven section 7.4.1, which tallies with the theory of Rogers. CA promotion in ward 30 used the adoption and diffusion theory to spread the technology. It has been found that this strategy was effective because farmers easily shared information and skills gained during agricultural training and group associations. The involvement of an opinion leader, such as Master farmers, was of key importance in the spread and acceptance of conservation agriculture. The specific problem is that while the theory of change of demonstration trials and farmer to farmer distribution assumes homophily (i.e., people in the community are equal) (Rogers, 2003), the group dynamics create heterophily, which makes the diffusion of innovation not as effective.

Lessons in many countries have shown that CA's rapid adoption and spread call for a change in behaviour and commitment of all concerned stakeholders (Derpsch, 2009a and b). For the farmers, a mechanism to experiment, learn and adapt is a prerequisite. Adopting technologies such as CA requires significant changes in practices and mindset because it contradicts much of conventional farming knowledge and farming traditions, as seen in Chapter Seven section 7.4.4 on the plough as the tradition and identity of the farmer. This is mostly because of the long tradition of farming using conventional methods, which has become part of what constitutes good farming practices. Not all CA practices fall within the domain of good agronomic practices from some farmers' perspectives. Many household farmers are accustomed to the plough as an essential part of their farming and find it difficult to overcome the idea that ploughing is not required for successful planting. Even though these farmers are experiencing challenges related to farming, such as droughts and long dry spells, as indicated in Chapter Four, it is particularly difficult to convince these farmers to adopt CA if they do not experience strong economic or environmental pressures to change. Conventional farming practices are also tightly woven into local culture and rituals, making such practices even more entrenched. Another plausible explanation is that farmers in Ward 30 have invested heavily in conventional tillage equipment such as ox-drawn ploughs, harrows, ridgers, and cultivators such that shifting to CA means discarding the costly equipment. Transformation of local farming systems to sustainable agricultural practices requires one to fully understand the immense and longer-term economic, social and environmental benefits the CA system paradigm offers to households and society. Reversing the belief that maize production is not possible without soil tillage is very difficult if cultural sensitivity and tradition are not taken into account (Bunderson *et al.,* 2011) in Ward 30.

8.2.3 Household`s farming experiences

The study's findings revealed that the dis-adoption of CA technology occurred due to unfavourable experiences and perceptions of smallholder farmers as they practised the technology. These experiences were both at an individual and community level, and partial adoption or abandonment decision-making was the only rational action. In Ward 30, input constraints contributed immensely towards discouraging the adoption and implementation of CA farmers. This is not surprising because, in most parts of SSA, smallholder farmers largely access their inputs through informal channels such as on-farm seed saving, farmer-to-farmer exchange and unregulated sales (Baiphethi and Jacobs, 2009), as discussed in Chapter Five section 5.4.1. Without a doubt, the purpose of introducing CA in Zimbabwean rural communities, including Ward 30, could not be realised due to unreliable and inflated cost of inputs and unstable market conditions that were prevailing (Marongwe *et al.*, 2012).

Labour constraints also prevented household farmers from increasing their CA plot sizes and following all the concepts of CA. From the findings, farmers are used to conventional farming, which requires less labour because they leverage farm implements such as ox-drawn ploughs to cultivate their fields. Besides, CA was misconstrued by many household farmers to be a technology of the poor due to its inclination towards manual labour with the concept euphemistically labelled "*dhiga ufe*" (meaning dig and die) by the local villagers as seen in section *6.4.4.2.,* Chapter Six instead of the "*dhiga udye*" (dig and eat/survive) label of the program's advocates. This was in line with the inequality in the farmers' outputs compared to the labour and time, among other investments they put in it (Gukurume *et al*., 2010).

Shared labour activities are prevalent in most parts of the country (Wagstaff and Harty, 2010), but farmers in Ward 30 did not practise these during weeding. A combination of demanding activities, especially tending livestock and off-farm activities prevented sharing labour activities during weeding. The shortage of labour compelled CA adopters to resort to ploughing and basin preparation just before the rainy season, thus further dampening the effectiveness of the CA concept. Undoubtedly, CA's initial high labour demands meant that most CA adopters and followers were unable to implement the full CA package and thus could not reap the full benefits as is expected by the strategy. Furthermore, the absence of fencing allowed animals to feed on the much-needed crop residues that are supposed to be used for mulching. It also worsened the labour constraints in the sense that there was a need to reconstruct the basins and plants before the first rains yearly because the basins were destroyed by livestock. Consequently, CA's identified labour intensiveness during the first year only and reduced labour requirements in the subsequent years due to using the same planting pits and ripper furrows (Wagstaff and Harty, 2010: 69) become useless in the absence of fencing. To this end, the envisaged benefits that accrue due to mulching were not attained where the plots were not fenced because CA farmers did not afford the fence, and the NGOs did not provide them with any resources towards that.

As implemented in Ward 30, all three principles of CA are seldom applied together as a full package. If at all, farmers tended to partially adopt or modify CA components, such as doing minimum tillage using the plough and grass for soil cover instead of crop stover. Crop rotation was rarely taken up. Importantly, the CA plots did not change in size from the 50 x 50 m area initially introduced as a CA trial method as households were either unwilling or unable despite the yield increase. I argue that the technology was adopted as a safety-first food security strategy, not for profit maximisation. Moreover, in line with Chayanov's (1924) assertions, I further argue that the CA households did not push the practice beyond the point where the drudgery of the extra work outweighed the possible increase in output. This is not surprising as smallholder farmers are less able to invest in new equipment, are more risk-averse than large farmers as recognised by risk-averse households theory, generally have weak links to new information systems outside the community, and usually manage more complex crop-livestock systems (Wall, 2007).

Several factors can explain the difference between findings for Ward 30 and the presumed labour-saving potential of CA found in experimental studies and the literature for other regions. Firstly, the labour-saving potential of CA is usually attributed to, and sometimes restricted to, the implementation of minimum tillage. In Ward 30, minimum tillage was correctly done as prescribed by promoters in the first year. Changing from tillage-based systems to minimum tillage involves long-term investments to restore soil quality and investment in direct-seeding equipment, which can be difficult for smallholder farmers. However, even when the CA full package was implemented in the first year of adoption, the CA practice did not show lower labour demand for most households. This leads to a second potential explanation: as CA involves a change in the use of various inputs, it may be the case that CA adoption was not being accompanied by these complementary practices in an optimal way (notably chemical inputs, skills and machinery), leading to higher labour demand. A third possible explanation relates to the time it takes for CA benefits to accrue. It could be the case that farmers had not yet been acclimatised to the new practice and were yet to capitalise on the labour-saving potential of CA, particularly given that CA adoption requires a transition period for soil quality to recover. CA requires intensive knowledge to understand its specific practices, as well as understand and implement complementary inputs in an optimal manner (Wall, 2007). These explanations are consistent with the fact that we observe lower yields under most CA practices, leading to the hypothesis that CA is not currently being adopted in ways that will ultimately benefit farmers. This, in turn, explains why the CA practice was dis-adopted in the ward.

In summary, smallholder farmers' decisions in Ward 30 are shaped mostly by the environment they find themselves in, which is characterised by uncertainty related to the biophysical environment and markets at times. They deal with the uncertainty and ultimately do not aim at profit maximisation but contingent utility maximisation. Their farming practice prioritises their own consumption before other considerations, such as deciding whether and what to grow for sale.

8.3 Theoretical and empirical reflections

Smallholder farmers in Ward 30 live in an inconducive biophysical environment, human, social, political and institutional challenges. They deal with the uncertainty both as consumers and producers. Their aim is not profit maximisation but contingent utility maximisation. Before anything, their practice of farming prioritises own consumption before other considerations such as deciding whether and what to grow for sale. In most cases, the quantity and kind of foods to be produced for own consumption is informed by the size of the households. In response to the persistent risks and uncertainty, practices and norms aimed at minimising risk and the undesirable effects of disastrous events have been developed and are continuously maintained. These include strong local institutions such as *Zunde raMambo*, labour pooling practices such *humwe* and communal grazing for livestock during the post-harvest season, among others. In addition to this are livelihood diversification strategies. Most smallholders have a diverse portfolio of activities that are engaged in by different household members at different times of the year. Decisions on whether to adopt CA, and how many of the prescribed practices to adopt and over what area, are made in light of the impact on the whole range of other livelihood strategies engaged in by the household, and also in light of local norms and practices.

The adoption and diffusion model of Rogers (2003) focuses on the social factors in the adoption process of an innovation. Rogers describes that innovations spread because farmers talk to each other and farmers look at others before adopting a new technology. The data from observations and interviews show that household farmers decision making is not linear neither does it follow certain steps, which conflicts with the theory of Rogers. The adoption and diffusion theory has been useful though, to be able to observe how CA project was promoted, and how processes of adoption and diffusion are shaped in practice.

8.4 Conclusion

Increasing agricultural productivity to meet the growing food demands of the ever-increasing population, especially in rain-fed farm systems, is perhaps one of the most pressing contemporary development challenges in SSA. Development practitioners and governments have been actively promoting CA technology over the last two decades as a potential solution to the food insecurity challenge in the region. This study examined the role of socio-cultural factors in farming, particularly how farmers use and incorporate it within their everyday practises and wider agricultural programme uptake. It has demonstrated that the reality of the adoption and diffusion of agricultural innovations in rural communities is a much more complex issue, but at the same time, it has improved the knowledge and understanding of contextual factors influencing the adoption and diffusion of CA in Africa, and especially Zimbabwe. Nevertheless, socio-cultural considerations play a major role in farmers' decision-making processes and are still widely the reason for agricultural management practices in Ward 30, despite the promotion and dissemination of 'modern' farming practices after the country attained independence in 1980. This indicates that socio-cultural factors have a robust and effective way of transferring from one generation to the next. One of the major ways to transfer these practices between generations is through the use of social capital, e.g., reciprocal labour (*humwe*). Another important role of socio-cultural considerations in agricultural production is to ensure the 'survival' of the communities through the careful and sustainable utilisation of resources at their disposal. The ability of individual farmers and communities to manage resources sustainably through observing socio-cultural dimensions to produce their own food is very important. Farmers' livelihoods are dependent on these resources, and, in addition, these resources must be available to the next generation in a state they can provide for their livelihoods. For example, Dei

(1993) observed that indigenous knowledge ensures sustainable use of resources and encouraged experts to learn from local practises, particularly those that were environmentally friendly in resource utilisation.

Numerous challenges bedevilled the successful implementation of CA for the attainment of food security in Ward 30. My findings reveal that drivers of CA phenomenon of outright rejection, partial adoption and dis-adoption in the study area were complex, multidimensional and multilayered straddling social, cultural, and farming households' experiences with CA and risk aversion. There was a discrepancy between CA benefits as highlighted by promoters and farmers' real experiences of implementing it. Based on my findings, the introduction of unfamiliar concepts and dynamics of CA, such as basin digging or using crop residues for mulching, was inconsistent with existing community socio-cultural beliefs.

It is evident that CA in Nyanga District, Ward 30, was not successful in ensuring sustainable agricultural productivity and food security. In other words, the significance of the intensification of sustainable agriculture and its resource-conserving technologies and farm centred participatory approaches (Pretty *et al*., n.d: 2) were not achieved as envisaged by CA promoters. While reasons for the failure of CA radiate from multiple domains and levels of the innovation system, reasons for outright rejection, abandonment and partial adoption are manifested largely in socio-cultural factors among farming households in Ward 30. Immediate triggers of outright rejection of the technology were social status preservation, basin digging as a symbol of poverty, the plough as an identity of households and the initial area under CA, while those for abandonment included community grazing rights challenge, family obligations and the threat of herbicides on traditional leafy vegetables.

It is, therefore, not surprising that agricultural development programmes such as CA have largely failed to transform small-scale African agriculture because they have relied on replacing or overlooking socio-cultural factors with Western (modern) technologies. A better approach would be to study and implement ways to incorporate local socio-cultural practices and expertise before looking to implement externally devised innovations. This has left development experts lagging behind farmers who use these indigenous ways of farming. In some ways, agricultural development promoters also lag behind farmers' expectations and realities in developing programmes that need to consider farmers' nature of knowledge production and acquisition, particularly when they either only rely on their own knowledge or exclude farmers in some stages of development. Chambers (1983) also noted that the outcome of the exclusion of farmers' inputs by experts was that development programmes initiated were inappropriate and irrelevant. The study has shown that it is important for farmers' values, culture, and local farming expertise to be considered because it 'almost guarantees' the success of programmes initiated by external experts. This finding is consistent with observations made by Harrison (2001), who also noted that the success of expert-initiated development programmes is guaranteed to succeed if there is the incorporation of inputs from farmers.

Findings in this thesis suggest that the reason for the lack of CA adoption lies with the technology itself. In line with Giller *et al.* (2015), I call for a paradigm shift in the responses to the poor performance of CA in Ward 30. Going beyond attempts to improve CA promotional practices and fitting CA principles to farmers' realities, agricultural research and intervention could perhaps better strive to understand what farmers are doing and aim to help them do it better. A simpler conclusion could be that under present circumstances, CA is inappropriate for the vast majority of resource-constrained smallholder farmers and farming systems in Ward 30. Giller *et al*. (2009) aptly summed it up when they said, "We do not doubt that CA is one approach that can offer substantial benefits for certain (types of) farmers in certain locations at certain times. Identification of the situations when CA can offer major benefits is a challenge that demands active research."

8.5 Key policy implications and prescriptions

With the help of development partners, the government of Zimbabwe is socially and economically justified to support the adoption of CA among smallholder farmers as one of the sustainable technologies that can increase productivity and production. NGOs as development partners play a major role through advocacy and strategic lobbying for external funding for the technology. Even though the lack of any clear unanimously significant factors affecting CA uptake, particularly the sometimes conflicting results observed across analyses, makes the government's task of developing policies to promote the uptake of CA particularly challenging, the study still suggests policy ideas based on the findings. A huge step towards successfully adopting this technology would be to study, acknowledge and incorporate local farming knowledge and expertise, with concomitant knowledge and incorporation of local socio-cultural norms and values, before promoting CA.

Firstly, the findings of this study support the view of Stonehouse (1996) and others who advocate for a 'targeted policy approach' to promoting CA, whereby development experts should explicitly consider the interactions among technology and socio-cultural variations in both individual and societal contexts. Additionally, they must recognise the absorptive capacity and related community and individual context-based variables when considering the transfer of technology. The processes of adoption and diffusion of technological innovation are by no means linear, and there is evidence that potential adopter enthusiasm would dampen considerably if the parties in key brokerage roles are threatened (Kimberly, 1981).

Policymakers should place greater emphasis on interdisciplinary frameworks. Future agricultural development programmes strategies on the effectiveness of various types of technology transfers should not be based on economic factors only. Rural farming households have many concerns besides economic growth and development. Technologies that do not match the needs of their social and cultural contexts are likely to be greeted with more vague rhetoric. It would be more effective if significant advances in the field of cross-cultural studies of management were incorporated into future theories and research on technology transfers. Both developed countries and developing countries would benefit from such an interdisciplinary orientation. Another policy implication derived was the continued use of demonstration and effective technical backstopping support that might be useful when designing CA promotional programmes, and continued advisory services may support continued CA practice.

8.6 Areas for future research

This thesis was by no means exhaustive and had limitations such as methodology, time and data constraints. In the absence of these constraints, the value of the research could be enhanced by allowing a more comprehensive analysis as suggested below:

Given the urgency of adopting intensive and sustainable forms of agriculture around the world and the fact that sustainable forms of agriculture, like CA, change the organisation of work in rural economies, more research is required to understand the specific ways in which CA can achieve such outcomes. This includes addressing the difference in skills and technology requirements between conventional agriculture and CA. CA is skills-intensive and requires specific technology. Research can inform policy in the effective investment in human capital development and other outreach services. More research is also required to understand the characteristics and institutional mechanisms that need to be in place for these benefits to accrue or to maximise CA benefits. This includes research that explores effective and fair access to markets (e.g. addressing information asymmetries and power imbalances between farmers and downstream actors, or exploring forms of organisation that promote vertical integration as is the case of cooperatives). This research can then inform development programs that promote the adoption and implementation of CA. As CA involves a transition period, these development programs could be accompanied by income support measures and should be accompanied by access to machinery, skills development and the safe and proper management of chemical inputs.

The aggregate impacts of CA adoption should be explored as well. If CA requires more labour and eventually produces higher yields, it can enhance food and income security among smallholder and family farms. As households dedicate more of their time to the farm, however, they have fewer opportunities to pursue off-farm income activities, placing them at higher risk for income volatility in situations of drought or price fluctuations. Importantly, in increasing farm labour intensity, these practices can increase child labour and, in certain cases, increase labour for women, reducing progress in other key dimensions of sustainable development. The promotion and implementation of CA should be complemented with policies and programs that advance decent work in rural economies.

There is a clear need to weigh the positive contributions of socio-cultural factors against their negative ones, for many in Africa; socio-cultural farming decisions have not necessarily transformed their lives. Therefore, an important task for future research is to ensure that socio-cultural factors are fully valued in sustainable agricultural practises and that we carefully describe and evaluate such dimensions of farming so that it contributes fully to development without the need for farmers to have to keep "reinventing the wheel". The manner we might go about this is a motivation for future research, especially if geographical variations are explored on barriers to the adoption of CA by disaggregating data for each site.

APPENDICES

Appendix 1: Key informant interview guide

Government representative questionnaire guideline

a) Rural small farm households challenges

1. What challenges are small farm households faced with that led to the introduction of CA?
2. In your view, are local socio-cultural ways of farming able to withstand the challenges that have led to introduction of CA or donor intervention?
3. What challenges do you think are responsible for the current level of uptake in CA?

b) Socio-cultural factors guiding small farm households

1. What are the socio-cultural practices that are applied in farming by the households?
2. What rituals or practices do households observe in their own farming? Please describe the rituals that they perform and explain their purpose and how they affect their farming outcomes.
3. How would you describe the significance and role of socio-cultural farming practices in small household farming in the ward?
4. What factors do you think are responsible for the current level of uptake in CA?

c) Integration and exclusion of cultural farming practices in the CA model

1. In what ways have households innovated or changed or excluded aspects of the CA model practices differently in the agricultural field?
2. What are the major challenges for you in the implementation of conservation agriculture measures effectively?
3. Are there any external (political, economic), or other pressures that act to prevent or discourage the application of CA in the Ward? If such pressures exist, what is their source or motivation?

d) Tension between scientific knowledge and local farming practices

1. Do you perceive any area of conflict between local farming practices and methods of farming recommended by NGOs or government in the ward? Can you give examples of areas of conflict?
2. When a decision has to be made involving an innovation or a change in local farming practices, on what basis is the decision made?
3. What is the proper relationship and role of farming technology in relation to local farming practices in the ward?

Appendix 2: Spirit medium/village head interview guideline

a) Rural small farm households challenges

1. What challenges are small farm households faced with that led to the introduction of CA?
2. What challenges do you think are responsible for the current level of uptake in CA?
3. Are there any historical farming challenges that have been addressed by agricultural development programmes such as CA?

b) Socio-cultural factors guiding small farm households

1. What rituals or practices that you regard as traditional do you observe when farming?
2. Please describe history of local farming practices of the ward. Are there any modifications or changes applied to improve these traditional practices?
3. How important is your knowledge of farming and that of other household farmers as compared to advice from technical staff?

c) Integration and exclusion of cultural farming practices in the CA model

1. In what ways have households innovated/changed or excluded aspects of the CA model practices in the agricultural field?
2. What are the major challenges households are faced with in the implementation of conservation agriculture measures effectively?
3. Are there any cultural aspects or historical beliefs of farming in the ward that clash with the way how CA model is practiced?

d) Tension between scientific knowledge and local farming practices

1. In what conditions can technology or practices introduced & applied from an external source to become part of the body of socio-cultural farming practices in Ward 30?
2. Do you perceive any area of conflict between local farming practices and methods of farming recommended by NGOs or government? Can you give examples of areas of conflict?
3. Has agricultural development programmes been developed with farmer household input?

Appendix 3: Permission letter

Department of Archaeology & Anthropology

01 February 019

Letter of Informed Consent

Attention: Councillor

I am Brian Mandipaza born in Nyajezi resettlement scheme area. I attended my primary at Tendanai from Grade 1-5 and later transferred to Mount Mellery to do my grade 6-7. I enrolled for my secondary education at Emmanuel High School. I am currently registered with University of Pretoria for my PhD in the Department of Archaeology and Anthropology studying Development Studies. To fulfil the requirements of my doctorate programme at the University of Pretoria, I am required to conduct research on any societal related topic.

The title of my research is 'Socio-Cultural Dimensions of Farming, Small Farm Households and Conservation Agriculture in Ward 30'. I chose to conduct my research in Ward 30 since I grew up here, speak the same language and am familiar with the set-up of this community.

The primary aim of the study is investigating, examining and analysing how local cultural farming practices (experiences, local practices and values) have contributed to the passive reception of the conservation agriculture technology in Ward 30. To achieve the purpose of the study, the following specific objectives have been outlined.

- To identify the specific challenges confronting rural small farm households that led to the introduction of the conservation agriculture model in Nyanga District Ward 30.
- To establish the local socio-cultural factors (farmers' prior experiences, farming practices, knowledge systems and values) that guide rural small farm households' and how they are incorporated into farming practices in Nyanga District Ward 30.
- To identify and analyse aspects of cultural practices that were incorporated and missed in the implementation of the conservation agriculture model and how these affected adoption or non-adoption in Nyanga District Ward 30.

- To investigate how farm households that have adopted the conservation agriculture packages organise their agriculture and take farming decisions.

The data will be collected by the researcher who shall spend at least a week staying in a household participating and observing their farming activities such as land preparation, ploughing etc to gain insight of certain aspects of household's history and farming activities. With regard to these households, I will divide my sample into three categories: the first consists of those households that have partially adopted the technology (about 5 households); the second will be those households that had adopted the technology, but had since abandoned it (about 5); and the last will consist of households that rejected the technology outright (5 households). Conversations with households will be held with a range of household members including the heads of households and other members involved in farming activities.

Therefore, the letter is written to request permission from the councillor to allow me to conduct the research with Ward 30 members.

Yours sincerely

Brian

Appendix 4: Shona verbal consent version

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Department of Archaeology & Anthropology

01 Kukadzi 2019

Tsamba yekukumbira mvumo

Vadiwa murimi

Tinokukumbirai kana muchikwanisa imi nemusha wenyu kuti mushande naBrian Mandipaza ari kuita zvidzidzo zvake zvekuda kuita chiremba wezvefundo pauniversity yePretoria. Musoro wezvaari kufunda unoti kuongorora tsika nemagariro anoshandiswa pakurima nemisha yevanhu nezvakwakakonzera mukugamuchirwa kwekurima kwetsa kwetsa mudunhu renyu. Izvi zviri kundibatsira kuti ndinzwisise kuti kurima kunoita vanhu mumisha yavo kwakakonzera kuramba kwetsa kwetsa akaunzwa nemadonor nehurumende here.

Mukuedza kunzwisisa zvinoitika ndichange ndichishanya nekugara pamusha penyu, ndichibatsira pamunenge muchirima nekuona tichikurukura kuti munenge muchizvifambisa sei. Hurukuro dzedu hadzisi kuzokumisai kubata basa renyu sezvo tinenge tichidziita tichitoshanda. Hapana njodzi kana tsaona inokuwirai imi nemusha wenyu nekuda kwekunge ndiri kutsvaga humbowo uhu. Makasununguka kusapindura mibvunzo yamusingade kubvunzwa kana isingakufadzei. Kana mukanzwa kubatikana nezvinenge zviri kuitika makasunungukazve kurega zvachose kuva muchishanda neni

Pfungwa nemuono wenyu zvichashandiswa pakubatanidzwa gwaro rechidzidzo ichi asi zita renyu kana remusha wenyu harizofi rakashandiswa kukutsvagai pane zvamunenge matipa. Zvichakadaro, tichatoshandisa rimwewo zita kuti ritsividze renyu kuitira musazivikanwe.

Zvese zvamuchatiudza zvinobva kwamuri kana mumhuri yenyu tichazvibata nenzira yekuti zvisave neumwe anozvishandisa asinei nechekuita nechidzidzo ichi. Hamumanikidzwekuti munge muchishanda neni uye hapana mari yamuchapihwa mushure mekunge mabvuma kuti tishande tese. Inongova nzira yangu yekuda kudzidza yandiri kuti mundibatsirewo nekuda kunzwisisa hurimi hwenyu Dzimweni dzenguva ndichange ndiine camera inotora mifananidzo yazvamunenge muchiita yandichazoshandisawo zvakare pakunge ndava kunyora gwaro rangu mushure mekunge ndaona zvese zvamunenge muchiita pamusha wenyu. Zvese zvamuchataura hatisi kuzozviisa pamushina unotora mazwi enyu asi kuti tichange tichingotaura zvedu

Chifundo ichi chinongovapo kuti ndidzidze chete hapana chimwe chinhu uye zvese zvandichawana kubva kwamuri ndichazvishandisa kuzonge ndiri kuenda kumisangano yezvedzidzo uye kunyora magwaro tichitsananguro hurimi hwamunoita. Ndichinge ndapedza ndichapedza kushanda nemi uye kuita fundo iyi zvese ndichazvipa kuchikoro changu yunivesiti yePretoria kwazvichachengetwa pakabata asi mushure memakore gumi nemashanu zvichabva zvazoraswa asi pakava neanoda chekuita nezvandakatora kubva mamuri makore gumi nemashanu asati asvika anenge akasunungua kuzvishandisa.

Kana muchinge manzwisisa uye mabvumirana nekuti muchandibatsira mukuti nditevedze fundo yangu pamusha wenyu makasununguka kubvunza.

Ini..ndapa mufundi uyu mvumo yekuti ndinge ndichishanda naye pafundo yake sekutsanangura kwaaita.

Sign-------------------------------------Musi wa

Mufakazi------------------------------Musi wa

Mufundi-------------------------------Musi wa

Appendix 5: Household Interview Guideline

a) Rural small farm households challenges
1. Changes that have taken place in rural farming since you settled in this community.
2. The causes to these changes.
3. Effect of these changes on agriculture practices, performance, role in livelihoods.
4. Responses to these changes overtime.
5. The changes and government and donor agricultural interventions.
6. Effect/impact of the changes on social practices of farming.
7. The changes in agriculture and the implementation of CA.
8. Social practices of agriculture and the reception of CA.

b) Socio-cultural factors guiding small farm households
1. Social structure
2. Values, norms and rituals shaping and guiding household farming practice.
3. Implications of values, norms and rituals on household farming practice.
4. Social and cultural change in household farming practices
5. Social and cultural barriers in household farming practice

c) Integration and exclusion of CA model aspects with cultural farming practices
1. CA model packaging and approach by households
2. Household adoption constraints in the implementation of CA model
3. Impact of these on agricultural practices

d) Tension between scientific knowledge and local farming practices
1. Conflict between local farming practices and scientific methods
2. Relevance of local farming practices
3. Dynamism and positioning of local farming practices
4. Agricultural approaches adopted by NGOs
5. Local approach to agricultural development
6. Limitations of scientific and local farming practices

Appendix 6: Households Observation Guideline

a) Rural small farm households challenges

1. Changes that are taking place in household farms.
2. The causes to these changes.
3. Effect of these changes on agriculture practices and performance.
4. Responses by farming households to these changes.
5. Effect/impact of the changes on social practices of farming.

b) Socio-cultural factors guiding small farm households

1. Social structure
2. Values, norms and rituals shaping and guiding household farming practice.
3. Implications of values, norms and rituals on household farming practice.
4. Social and cultural barriers in household farming practice

c) Integration and exclusion of CA model aspects with cultural farming practices

1. CA model packaging and approach by households
2. Household adoption constraints in the implementation of CA model
3. Impact of these on agricultural practices

d) Tension between scientific knowledge and local farming practices

1. Conflict between local farming practices and scientific methods
2. Relevance of local farming practices
3. Dynamism and positioning of local farming practices
4. Limitations of scientific and local farming practices

Appendix 7: Household informed consent form

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Department of Archaeology & Anthropology

01 February 2019

Letter of Informed Consent

Dear participant,
You are being asked to avail yourself and your household as part of a doctoral study by Mr Brian Mandipaza, a student at the University of Pretoria. The study is on **Socio-Cultural Dimensions of Farming, Small Farm Households and Conservation Agriculture in Nyanga District Ward 30.** The study will assist me in understanding the impact local farming practices had on the adoption or non-adoption of conservation agriculture that was introduced by NGOs and the government.

- To collect data I shall spend at extended period visiting your household, participating in agriculture tasks, observing how you do your agriculture and engaging in regular discussions. The interaction process and discussions will not in any way interfere with your daily routine as they will take place within your schedules.
- There will be no danger or harm to you or to your household. You are free not to answer any questions that may make you feel uncomfortable. If you experience discomfort during the study, you are free to withdraw your participation.
- Your opinions and views will form part of the consolidated results, but your name or that of your household will not be linked directly to any information provided. You and your household will be identified through pseudonyms.

- The information gained from you and your household will be treated with confidentiality and will not be shared with people outside this project. I will ensure that the information is stored safely where access by a third party is difficult.
- Your participation is voluntary. You will not receive any payment either in the form of money or gifts for your participation. Your contributions will assist in understanding the relationship between society and farming and has the potential to inform better policy interventions by government and NGOs.
- There will be no photographs of the farms will be taken and included in the research.
- The study is entirely for academic purposes and the data collected will be used to develop a thesis for the University of Pretoria. The information may also be presented in international conferences or published as a scientific paper.
- After I have completed the study, I will submit all information to the University of Pretoria where it will be safely kept for 15 years, after which it will be destroyed. If the data is used during this period, it will only be for research purposes.

If you understand and agree to participate in the study, please fill your information below and feel free to ask me any questions.

I……………………………………………hereby voluntarily grant my permission for participation in the research as explained by………………………………………………….
The nature, objective, possible safety and health implications have been explained to me and I understand them.

I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication and for future research.
Upon signature of this form, I will be provided with a copy
Signed______________________________ Date______________________

Witness_____________________________ Date______________________

Researcher__________________________ Date_____________________

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