Smallholder Farmers' Dis-adoption of Agricultural Technologies: The Case of Conservation Agriculture in Malawi

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The candidate confirms that the work submitted is her own, except where work which has formed part of jointly-authored publications has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given where reference has been made to the work of others.

PhD Publications

Some aspects of this PhD thesis have been jointly published in the following peer-reviewed journal:

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Some of the data in chapter 4 in the thesis is used in the paper, alongside data collected by others (unrelated to the thesis). The candidate also input into the writing process.

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The candidate led the overall process, undertaking data collection, analysis, structuring the article and writing of the paper. Co-authors provided advice around research design and provided editorial input around the structure and writing style.

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Abstract

Dis-adoption of conservation agriculture (CA) remains a perplexing challenge in development efforts aiming to enhance sustainable agricultural production. While international development partners, governments and non-governmental organisations are actively promoting CA across sub-Saharan Africa, increasing evidence shows that farmers practice the technology for a short time, and then often dis-adopt. Due to limited scholarly attention to date, reasons for dis-adoption are not well known. Examining underlying reasons for smallholders' dis-adoption is imperative to improve delivery of CA, achieve sustained adoption, improve agricultural production and ensure enduring impacts of agricultural development interventions more broadly.

This research investigates why smallholders dis-adopt CA in Malawi by examining institutional arrangements of CA promoters, relevant national policies and farmers' experiences and perception of CA. A mixed methods approach was used, involving key informant interviews, policy analysis, household questionnaire surveys, and focus group discussions across two study Districts.

Findings reveal that complex, multi-dimensional and multi-layered drivers across the CA innovation system underlie CA dis-adoption decisions. Shortfalls in institutional arrangements play a critical role in dis-adoption as they promulgate unfavourable experiences and perceptions among farmers during CA implementation. Limited engagement of smallholders in project design and implementation diminishes local ownership and commitment while inadequate resources constrain extension service support. The study shows that smallholder farmers encounter various social, technological and economic challenges, which coupled with unfulfilled expectations, lead to dis-adoption.

Findings suggest that to address CA dis-adoption in Malawi and similar contexts in sub-Saharan Africa, there is a need to: (1) collaboratively design projects to suit local needs, preferences and context; (2) emphasise environmental and climate resilience benefits of CA rather than economic benefits; (3) apply longer-term, flexible, low-cost and inclusive

project management options; and (4) create an enabling policy and institutional environment for sustained CA adoption.

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Chapter 1: Introduction

1.1 Background

A recent report issued by the United Nations Food and Agriculture Organisation shows that 815 million people are currently experiencing hunger globally (FAO, 2017), whilst agriculture is the key economic sector and main source of employment in many countries (Lipper *et al.*, 2014). As increasing agricultural productivity and income is critical for reducing global hunger and poverty, national governments, non-governmental organisations and various other stakeholders continue to develop and disseminate agricultural technologies targeting smallholder farmers. It is paramount that farmers not only adopt new agricultural innovations, but continue utilising them over the long-term, if desired societal, economic and environmental outcomes are to be achieved (Pretty *et al*., 2011; Jayne *et al*., 2018). Farming system studies have established that smallholder farmers often dis-adopt the new agricultural technologies they initially adopted (Andersson and Giller, 2012; Arslan *et al*., 2014; Kiptot, *et al.*, 2007; Moser and Barrett, 2003; Pedzisa *et al*., 2015), despite technologies often being widely considered appropriate by researchers, practitioners and agricultural development agents alike. However, the studies have not delved into why dis-adoption occurs of new practices associated with 'climate-smart agriculture'. While technology adoption literature has concentrated on the concept of adoption, the concept of dis-adoption has received very little scholarly attention and hence little is understood in agricultural development context (Glover *et al*., 2016). This confounding situation drew the attention of the present study focused on the dis-adoption of conservation agriculture practices that have been widely advocated globally.

Rogers (2003) depicts adoption as a process, occurring over a period of time, whereby an innovation or perceived new practice, technique, or technology is accepted, taken up and used by members of a social system. Kiptot *et al*. (2007) defines an adopter as an individual who has managed to continuously use an innovation for at least three years. Dis-adoption, identified as 'discontinuance' by Rogers (2003) sits within the adoption continuum of the

innovation decision process, and is defined as a decision to abandon an agricultural innovation after initially adopting it (Kiptot *et al*., 2007).

In sub-Saharan Africa, governments, non-governmental organisations (NGOs) and development partners are actively promoting smallholder farmer-appropriate agricultural technologies. Innovations being promoted include: use of improved livestock breeds, hybrid crop varieties, inorganic fertilisers and other agrochemical inputs; agroforestry; aquaculture; irrigation; soil and water conservation including *in-situ* and *ex-situ* rain water harvesting; integrated watershed and community-based natural resource management; manure application and conservation agriculture (CA) among others (Lipper *et al*. 2014; Stringer *et al*., 2014b). In Malawi, CA is widely promoted mainly to address challenges of persistent food insecurity (Malawi Government, 2015; Chinsinga, 2011), as it is believed to be a viable means of delivering increased productivity and improved resilience of the predominantly poor smallholder farming communities (Mloza-Banda and Nanthambwe, 2010; TLC, 2015b). Despite intensive promotion, problems of dis-adoption persist as smallholder farmers continue to abandon the technologies (Giller *et al*., 2009; Baudron *et al*., 2011; CISANET and Concern Worldwide, 2015). Smallholders' dis-adoption of agricultural innovations and their reverting to traditional unsustainable farming methods perpetuates problems of shrinking water resources, land degradation, poor crop yields, food insecurity and poverty (Liniger *et al*., 2011; FAO, 2010). This situation necessitates research to illuminate why smallholders dis-adopt such technologies; in the case of this research, dis-adoption of CA by smallholder farmers in Malawi.

1.2 Statement of the problem

Although adoption of CA practices has been studied extensively, very little has been done to explore the drivers leading to dis-adoption, especially among smallholder farming communities. Much of the available science-based adoption evidence is generated from developed countries whose recommendations are based on temperate climatic conditions, very large mechanised commercial farms, and advanced economies (Kwayu *et al.*, 2014; Okoye 1998). Such evidence and resultant recommendations are not compatible with the

smallholder farming systems in sub-Saharan Africa, which are characterised by small but complex farming systems, poor economies, tropical climatic conditions, high soil maintenance requirements, (Ngwira *et al*., 2014) highly diverse social-cultural settings (Dorward *et al*., 2007; Giller *et al*., 2011b) and high transaction costs (Thornton *et al*., 2018). While CA is considered as a relevant and appropriate farming system to enhance smallholder food security, strengthen farmers' resilience to climate change effects and foster sustainable agricultural development whilst reducing or removing greenhouse gas emissions (Arslan *et al*., 2015; Knott *et al.*, 2014; FAO, 2015; Africa Congress on Conservation Agriculture, 2014; Hobbs *et al*., 2008), dis-adoption is common (Andersson and D'Souza, 2014; Arslan *et al*., 2014; Bwalya Umar, 2017). Despite this observation, empirical evidence to aid understanding of the phenomenon is missing. As disseminators of new innovations are mostly interested in determining the extent and rate at which innovations spread within a social system (Rogers, 2003), or determine potential impact (Glover *et al*., 2016) and beneficiary-targeting, conceptualisations of adoption decisions have often overlooked dis-adoption of innovations. This situation threatens sustainability of smallholder agricultural interventions in sub-Saharan Africa, and Malawi specifically because the economic performance and livelihoods of the people therein are directly linked to performance of the agricultural sector (Mwase *et al*., 2014).

Despite adoption decisions being a culmination of a wide array of factors (Knowler and Bradshaw, 2007; Gunter *et al*., 2016), researchers have mostly explained adoption by examining a subset of factors, usually household socio-economic and farm attributes (e.g. Thierfelder *et al*., 2016; Amsalu and De Graaf, 2007; Mazvimavi and Twomlow, 2009), from which generalised concepts or theories are developed to predict or explain factors likely to influence adoption outcomes (Gedikoglu, 2010). Econometric (quantitative household) analyses "look at adoption in a static state" (Lalani *et al*., 2017b, p104) and are limited as they shed light on only a small portion of factors influencing farmers' decision making (Ndah *et al*., 2012). Considering that different social, political, cultural and environmental factors produce different experiences (Walters *et al*., 1999; Bunclark, 2010), generalised

claims about determinants of farmers' adoption decisions are likely to be misleading (Knowler and Bradshaw, 2007; Sietz and Van Dijk, 2015).

In their review of adoption research, while attempting to determine universality of variables influencing adoption, Knowler and Bradshaw (2007) argue that quantitative adoption studies fail to effectively offer valuable explanations, nor do they unearth meanings and motivations underpinning the decisions farmers make. Authors often ignore qualitative insights because they are pre-occupied with determining relationships or differences between variables, and with making predictions of adoption outcomes (e.g. Pedzisa, *et al*., 2015). Andersson and D'Souza (2014) and Kiptot *et al.* (2007) also argue that most adoption studies fail to link their results to wider cultural, political and institutional settings which influence perception. An individual's real perception of a particular innovation is a critical determinant of whether he/she continues or discontinues using the innovation (Rogers, 2003). As such, investigating farmers' lived experiences in the use of an innovation and their perceptions would provide more appropriate explanation of why dis-adoption occurs (Wendland and Sills, 2008). Studies that have examined institutional drivers in relation to agricultural technology adoption have mostly focused on issues concerning market access, input and output prices, incentives, access to extension services, credit and infrastructure (see Mazvimavi and Twomlow, 2009; Shiferaw *et al*., 2009). Consequently, other important dimensions in the functioning of an agricultural innovation system have been ignored: national policies and institutional arrangements (Ndah *et al*., 2014). Considering that agricultural activities at the farm-level are either constrained or facilitated by forces beyond the farm, analyses of wider social-cultural, institutional and policy drivers are imperative (Stringer *et al*., 2017). As technology adoption is a result of complex interactions between the people involved, relevant innovations and institutional factors (Long, 2001), dis-adoption could also be more comprehensively understood by interrogating complex interactions between farmers' experiences, particular agricultural technology and the prevailing social, institutional and political environments. Since existing adoption studies are dominated by investigations either funded or sanctioned by interested donors or projects promoting CA, they are usually perceived to be biased (Glover

et al., 2016) or as mere 'prove success' studies (Andersson and D'Souza, 2014). Therefore, this thesis not only broadens the approach in technology adoption studies (integrating analyses of national policies, institutional arrangements of promoters, and farmers' experiences), but also contributes relevant independent insights in understanding CA dis-adoption decisions in Malawi.

1.3 Rationale of the study

It has been over two decades since components of CA were first disseminated to smallholder farmers in Malawi; yet adoption levels remain modest (Mloza-Banda and Nanthambwe, 2010), despite NGOs, government and other stakeholders actively engaged in its promotion. While CA is promoted on the basis of its ability to address challenges of deteriorating soil fertility, moisture stress, and poor agricultural production, which are prevalent in Malawi, less than 2% of the total number of small-scale farm families practice some form of CA (Kaluzi *et al*., 2017). Despite an abundance of adoption literature around the world, albeit predominantly from developed countries, published empirical research on dis-adoption is scarce globally, and practically non-existent for Malawi. Understanding dis-adoption is important because its continued occurrence undermines agricultural interventions aimed at enhancing resilience and sustainability of smallholder farming systems, more so taking into account current changes in climate and their impact on vulnerable rural farming communities in sub-Saharan Africa. From the perspective of national governments, CA promoters and international development agencies, CA dis-adoption implies a waste of resources used in promoting and disseminating the technology to smallholders. Hence, it is necessary to improve knowledge and understanding of dis-adoption of such apparently suitable agricultural innovations. Knowledge and lessons derived from this study will inform various stakeholders (e.g. agricultural researchers, trainers, academia, CA practitioners including funding agencies, advisory bodies and land managers) in the design and implementation of current and future CA interventions, and other agricultural development programmes/projects in similar contexts. Findings of this study are relevant for a wide array of stakeholders in the CA innovation system, and more

importantly, the evidence could be used to inform policy processes aimed at improving rural livelihoods in Malawi and the wider sub-Saharan African region.

1.4 Aim of the study

The aim of this study is to identify and analyse underlying drivers of CA dis-adoption among smallholder farmers in Malawi with a view to providing insights into organisational structures, processes and delivery mechanisms that can improve and sustain CA adoption. Specific objectives are:

1. To analyse the role of promoters' institutional arrangements in smallholder farmers' dis-adoption of CA in Lilongwe and Dowa districts, Malawi.

2. To explore how and why smallholder farmers in Malawi experience and perceive CA, and the implications of these experiences and perceptions for CA dis-adoption.

3. To examine the role of national policies in CA implementation, and their implications in smallholders' dis-adoption in Malawi.

4. To develop a framework conceptualising pathways to CA dis-adoption among smallholders in Malawi.

Figure 1.1 illustrates the approach that guided the study and how the objectives were addressed.

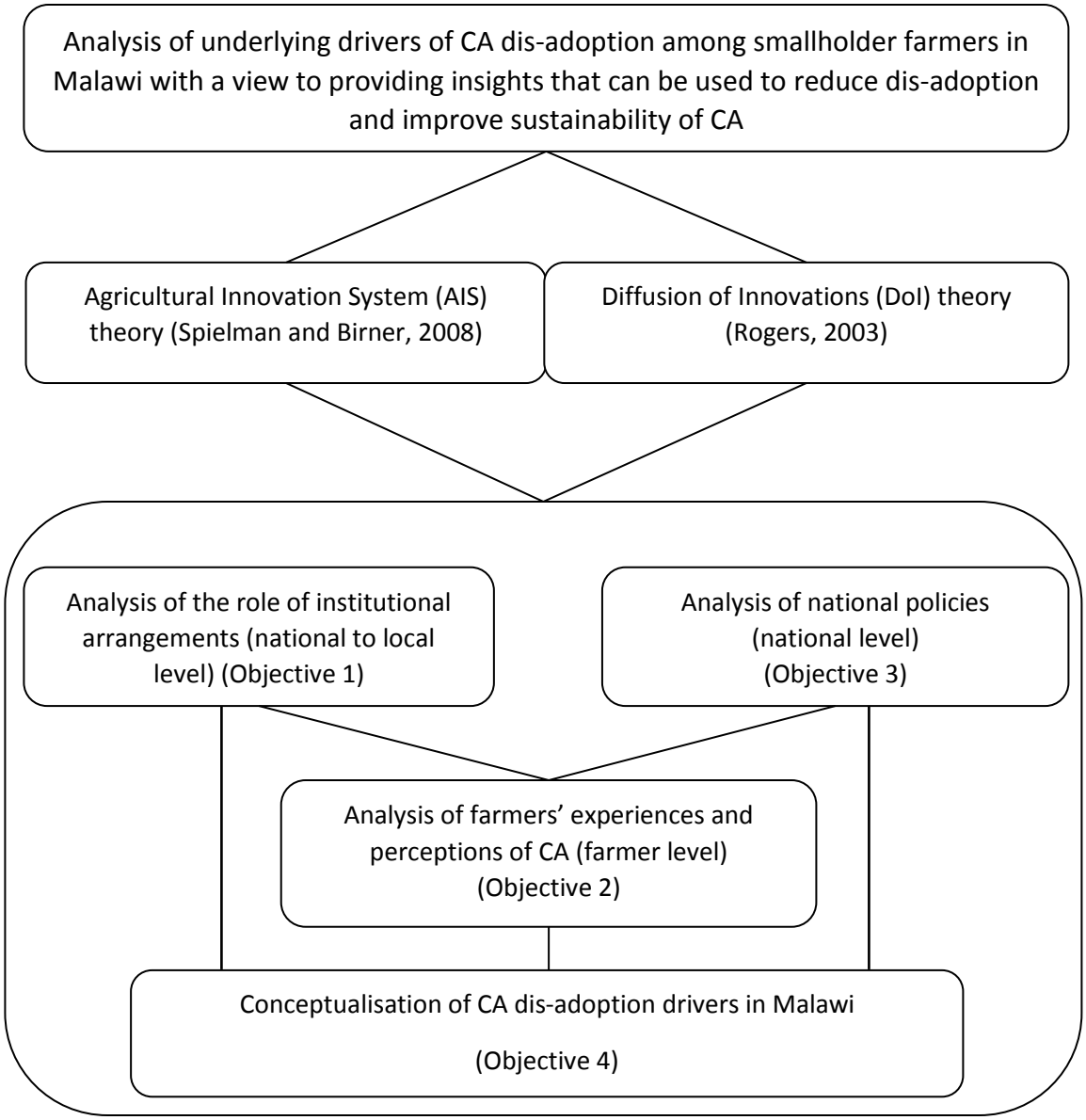


Figure 1.1: Conceptualisation of the study approach

1.5 Thesis structure

This thesis is divided into eight chapters. Chapter 1 has presented a broad introduction to the research by stating the problem that this project aims to address. Chapter 2 presents a review of literature relevant to the study, and provides perspectives on how it fits within the existing agricultural technology adoption literature, including theoretical perspectives. Chapter 3 presents a detailed research design and methodology, indicating the methods and data used to address the research objectives, stating their philosophical basis. Chapters 4, 5 and 6 present findings. Findings on the role of institutional arrangements on smallholders' dis-adoption are presented in Chapter 4. The chapter first identifies relevant stakeholders, their roles and how they interact within Malawi's CA innovation system. It also analyses organisational capacity of CA promoters, how they package and disseminate CA to smallholders and their implications for continued utilisation of CA practices. Chapter 5 presents findings on how smallholder farmers experience and perceive CA and seeks explanations for their perceptions. This involved analysing CA practices implemented, farmers' motivations to practise CA, perceived benefits and challenges they encounter during implementation and how they relate to dis-adoption. Chapter 6 presents findings on how national policies are linked to smallholders' dis-adoption of CA. Chapter 7 synthesises the research findings presented in Chapters 4-6 to produce an integrated and concise conceptualisation of pathways to CA dis-adoption. The thesis concludes in Chapter 8, where the study's contributions are highlighted and key lessons and recommendations for policy and practice are drawn. The recommendations are not only applicable to Malawi, but also to similar contexts in sub-Saharan Africa and other developing countries.

Chapter 2: Literature review

2.1 Introduction

This chapter reviews relevant literature in the context of this research. In so doing, it provides a perspective of how the study relates to existing literature. The chapter begins by explaining the concept of dis-adoption before discussing dis-adoption of agricultural innovations. It then engages with the literature to illustrate CA concepts and practices in sub-Saharan Africa, before outlining the context of smallholder agriculture in Malawi. The final section discusses theoretical frameworks underpinning the study.

2.2 The concept of dis-adoption

Dis-adoption, also known as discontinuance (Rogers, 2003), is an individual's decision to reject a technology after having adopted it previously. Rogers identifies two types of dis-adoption/discontinuance: replacement discontinuance; and disenchantment discontinuance. Replacement discontinuance occurs when an individual decides to abandon an innovation and swaps it with another innovation, while disenchantment discontinuance is when an individual rejects a technology because of being dissatisfied with its performance (Oladele, 2005). Although the concept of dis-adoption is largely neglected in adoption research, the level of discontinuance/dis-adoption of an innovation is as significant as the level of its adoption when determining the degree of adoption at any given time (Rogers, 2003). Therefore, it is important for researchers, technology practitioners or change agents to have greater understanding of the concept of dis-adoption and why it occurs.

2.3 Dis-adoption of agricultural innovations

Although some literature exists on dis-adoption of agricultural technologies, current knowledge and perspectives on the phenomenon are limited; largely due to most studies focusing on household and farm level determinants of (dis)adoption decisions. Neill and

Lee (2001) argue that dis-adoption is a highly complex process while Doss (2006) further contends that most (dis)adoption studies have yielded information that is less useful for policy makers partly due to their narrow focus on methodological issues, aimed at demonstrating the significance of particular factors in (dis)adoption decisions. Various studies show that dis-adoption of agricultural innovations has been a concern in global agricultural development for many years. For instance, Neill and Lee (2001) investigated dis-adoption of maize rotation with cover crops as a soil conservation and sustainable agriculture technique for smallholder farmers in Honduras, reporting agronomic and farm management parameters as significant determinants of dis-adoption. In the United States, Alexander *et al*. (2002) found that some corn farmers in Ohio dis-adopted genetically modified corn due to controversies around health and safety of genetically engineered crops on humans. Similarly, Rogers (2003) describes how some farmers in Iowa dis-adopted the use of green revolution technologies comprising agricultural chemicals such as pesticides and inorganic fertilisers in favour of less productive organic farming techniques amidst health concerns of chemicals to the wellbeing of humans and animals. Contrary to assumptions of his own theory, Rogers found that the dis-adopted farmers had household-farm characteristics similar to those who continued with the use of agrochemicals in their farms. This illustrates that sole use of personal/socio-economic attributes in dis-adoption studies may fall short in explaining individuals' dis-adoption decisions.

In sub-Saharan Africa, studies on dis-adoption of agricultural technologies have mainly focussed on improved crop varieties, crop and livestock management systems; very little research has been done on the dis-adoption of land-enhancing conservation technologies and even fewer studies have assessed CA dis-adoption (Pedzisa, 2016). For example, Abebe *et al*. (2013) attributed smallholders' dis-adoption of a new improved potato variety in Ethiopia to its poor taste and challenging crop management system. Oladele (2005), Olalekan and Simeon (2015) and Tura *et al*. (2010) conducted studies to examine smallholders' dis-adoption of improved maize and okra varieties in Nigeria and Ethiopia. Despite potentially high yields associated with the hybrids, smallholder farmers still dis-adopted the new cultivars and went back to planting local varieties. Similarly, Moser and

Barrett (2003) observed dis-adoption of improved low-input and high yielding rice production system among the rural poor in Madagascar, who reverted to their traditional rice varieties. Since these authors did not capture perspectives of farmers and other relevant stakeholders in the innovation system, the above studies provide only limited knowledge on farmers' underlying reasons for dis-adopting the technologies. Multi-level analyses as presented in this thesis are therefore paramount to broaden understanding of dis-adoption.

From their study, Kiptot *et al*. (2007) demonstrated that technology attributes (i.e. planting trees with non-edible products and delayed benefits) were largely responsible for dis-adoption of agroforestry trees which were promoted for purposes of enhancing soil fertility in Kenya. Pedzisa *et al*. (2015) analysed determinants of smallholders' CA dis-adoption in Zimbabwe; mainly focusing on farmers' implementation of planting basins, yet CA in Zimbabwe entails using various combinations of practices (see Edwards *et al*., 2014; Andersson and D'Souza, 2014) which might have implications for the dis-adoption decision. Although Wendland and Sills (2008) observed that experience has significant influence on farmers' dis-adoption decisions, based on their study of dis-adoption of soy bean in Togo and Benin, they mainly considered experience in terms of length of time of growing the crop as proxy for knowledge, and failed to engage farmers' actual experiences of implementing the technology. In general, existing dis-adoption studies focus on analysis of household-farm attributes and link them to dis-adoption decisions, with perspectives on issues underlying farmers' dis-adoption decisions in sub-Saharan Africa remaining limited.

Despite global improvements in agricultural innovations over the decades, per capita food production in sub-Saharan Africa has declined (Olarinde *et al*., 2011). The situation is worsened by occurrence of variable adverse conditions including poor soil fertility, water shortages, growing population (McCarthy *et al*., 2018) leading to shrinking per capita land sizes, and climate change impacts coupled with the widespread use of unsustainable agricultural methods (Pretty *et al.*, 2011). While dissemination of various new agricultural technologies has traditionally driven the development agenda in the sub-Saharan region (Teklewold *et al*., 2012), dis-adoption continues to frustrate progress. Consequently,

smallholder agriculture in sub-Saharan Africa is characterised by a vicious cycle of land degradation, low agricultural productivity, food insecurity, malnutrition and poverty (Pretty *et al.*, 2011).

Current limited scope and lack of consensus in the dis-adoption literature, in view of persistent incidents of smallholder farmers dis-adopting agricultural technologies, underscores the need for broadening investigations to understand underlying drivers of dis-adoption. Studying dis-adoption may illuminate unappealing features that limit continued utilisation of the agricultural technology. Identifying and correcting such features may lead to more sustained adoption (Morrison and Greig, 2013). Generating relevant knowledge is necessary to inform policy decisions aimed at improving livelihoods of smallholders in developing country agriculture. Since questions linger on how and why CA dis-adoption occurs (Pedzisa *et al*., 2015), the present study is timely and relevant in addressing this knowledge gap; more so because it explores farmers' experiences of implementing CA in a wider context encompassing existing policy, institutional and cultural environments.

2.4 CA concepts and practices in SSA

FAO (2015) defines CA as a sustainable farming system based on three fundamental pillars: minimum soil disturbance, maintaining permanent soil cover and crop association (Figure 2.1). However, a CA definition is yet to be universally agreed (Whitfield *et al.*, 2014 and 2015) hence it is subject to diverse interpretation resulting in disparate practices being promoted across sub-Saharan Africa (e.g. Andersson and D'Souza, 2014; TLC, 2015; Bwalya Umar, 2017). CA is mainly promoted to enhance agricultural productivity or yields, reduce labour, save time, build resilience to smallholder production systems and to combat climate change impacts (Knott *et al.*, 2014; Thierfelder *et al*., 2013a, 2016). Performance of CA remains contentious as its assessment methodologies emphasise on number of adopters, often incentivised by farm input provision (Baudron *et al*., 2011; Giller *et al*, 2015; Pittelkow *et al*., 2015; Kaluzi *et al*., 2017). Thus, this questions levels of adoption and raises sustainability issues if such incentives are withdrawn or once the project expires (Kamoto

et al., 2013; Baudron *et al*., 2007). Despite that duration and area under CA are crucial to monitoring progress, such pertinent issues are generally neglected in CA reports (Andersson and D'Souza, 2014). According to FAO (2010), it is advisable for farmers to observe all the three CA principles simultaneously, in addition to other good agronomic practices, in order to obtain optimal results. However, performance of CA under smallholder farming conditions is often poor as farmers seldom practise the three fundamental principles simultaneously (Giller *et al.*, 2009, 2011), with some promoters reducing CA to sole implementation of mulching or no-till (Kaluzi *et al*., 2017).

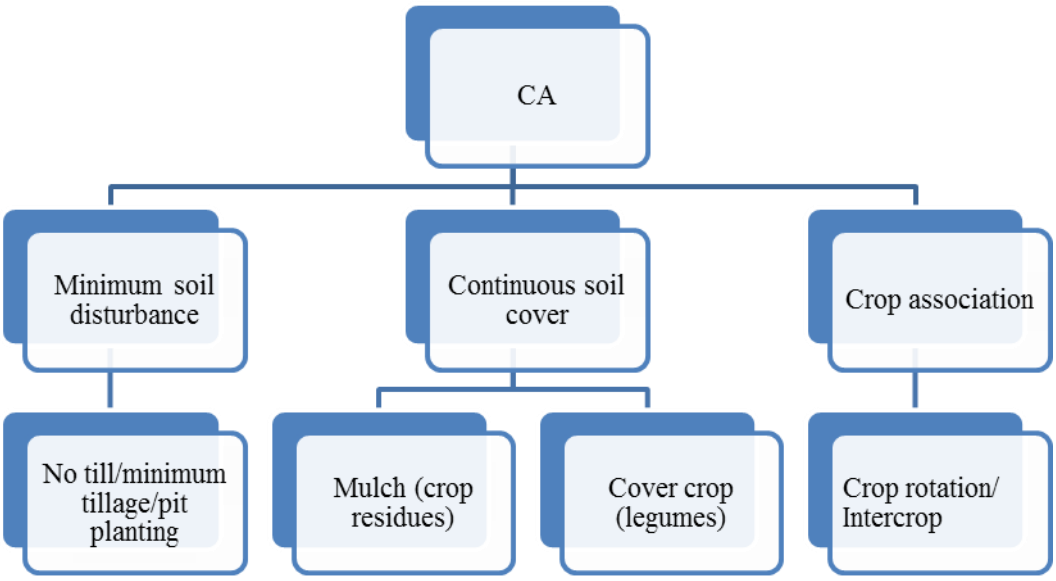


Figure 2:1 Schematic presentation of CA, adapted from Mloza-Banda and Nanthambwe (2010).

Minimum soil disturbance

Minimum soil disturbance entails eliminating tillage practices, reducing mechanical ploughing, or minimising digging of the soil (FAO, 2015). Nonetheless it is argued that tillage avails many benefits, which include increased soil fertility through nutrient mineralisation; loosening the soil allowing easy and fast crop emergence; soil aeration; control of weeds, pests and diseases; improved water infiltration and more equal distribution of nutrients within the soil profile (Kirkegaard *et al*., 2014; Hobbs *et al*., 2008; Baudron *et al*., 2007).

Debate is on-going regarding use of the terms minimum tillage, conservation tillage, reduced tillage, and zero tillage or no-till interchangeably (Lalani *et al*., 2016), as these terms carry different connotations even though they are all associated with the minimum soil disturbance principle. In addition, out of the three principles (also referred to as pillars of CA), the principle of minimum soil disturbance, specifically no-till practice dominates CA discussions globally, such that other quarters regard CA and no-till to be synonymous (Pedzisa, 2016). However, some authors have argued that practising minimum tillage or no-till exclusively leaves the soil more susceptible to compaction and erosion (Erenstein, 2002) and reduces yields (Pittelkow *et al*., 2015). To meet the minimum soil disturbance requirement, CA farmers are required to plant seeds either on flat land which remains untilled or on old ridges by using specialised planting equipment. Sims and Kienzle (2015) recommend the use of no-till soil rippers and jab planters capable of cutting through surface mulch to precisely place seeds in appropriate planting stations.

Planting basins, which constitute simple pits typically dug using a hand hoe, are promoted as a form of minimum tillage mainly to capture and conserve rainwater under conditions of short rainy season and frequent dry spells and droughts (Twomlow *et al.*, 2008). It is argued that planting basins offer further benefits in allowing for precision application of manure and inorganic fertiliser, concentrating nutrients and moisture in the basin, and improving their accessibility to crops when needed (Lahmah *et al*., 2012). While planting basins and no-till are common practices under the principle of minimum soil disturbance, annual tillage practice is customary in most of sub-Saharan Africa (Dalton *et al*., 2014). It is unclear how the entrenched ‘mindset of the plough’ prevalent in the African region (Andersson and D'Souza, 2014) affects farmers’ dis-adoption decisions, considering that minimum tillage principle of CA may seem odd, not only to rural communities in the region, but also to some researchers and change agents (Fanelli and Dumba, 2006).

Continuous soil cover

Continuous soil cover involves either laying crop residues on the soil surface, rather than incorporating the residues in the soil as is common in conventional tillage practice; or use of live mulch comprising cover crops. Erenstein (2002) reported that maintaining

continuous soil cover provides many benefits for crop growth, including that: the layer of mulch protects the soil from direct impact of raindrops and wind, thereby reducing soil erosion; moisture holding capacity is improved due to reduced evaporation since the soil is protected against heat; mulch becomes habitat for various organisms which feed on the organic residues to produce organic matter which enhances soil health after decomposition, and that thriving soil fauna burrow holes which improves soil aeration. Other sources have claimed that soil cover can also be used as a weed control measure in CA systems, and that when the cover crop comprises legumes, it facilitates biological nitrogen fixation which improves soil health (Khan *et al*., 2011). Despite many benefits associated with maintaining continuous soil cover, Baudron *et al*. (2011) warn that there is potential competition for crop residues amongst various uses within the smallholder's farm household. While the requirement for CA is to continuously provide at least 30% soil cover (Lalani *et al*., 2016), with a recommended mulching amount of 3 tonnes of crop residues per hectare (NCATF, 2016; Corbeels *et al*., 2014), it is not fully understood how mulching requirements affect CA implementation for smallholders; including if and how mulching plays a role in CA dis-adoption, taking into account heterogeneity of smallholder farming systems in Africa (Jayne *et al*., 2018; Giller *et al*., 2011b).

Crop associations

Crop associations involve planting more than one type of crop on the same piece of land either simultaneously, as a relay crop, or in rotations with the aim of maximising synergies between different crops in order to enhance productivity (Liniger *et al*., 2011). For instance, crop rotation may involve alternating deep-rooted crops with shallow rooted crops, while in simultaneous intercropping, legumes and cereals can be mixed to facilitate nutrient recycling. According to Liniger *et al*. (2011) benefits of crop associations include: enhanced crop diversification among smallholders which brings about resilience and improved nutrition; weed, pest, and disease control; soil health improvement; improved labour efficiency; and improved availability of mulch or livestock feed derived from fast growing legume trees. Notwithstanding the benefits of crop associations, use of crop

rotation among Malawi's smallholder farmers is increasingly becoming less practical in view of small per capita land sizes of 0.33 hectare (Malawi Government, 2008). Furthermore, Kirkegaard *et al*. (2014) argue that smallholders' rotations of legume and cereals may not be viable due to lack of markets for the legume produce. This has potential to undermine implementation of the crop association pillar of CA.

2.5 Common CA configurations in southern Africa

As national, regional and global stakeholders interpret CA principles differently (Whitfield *et al*., 2015), different practices are promoted under the banner of CA, which brings confusion. For instance, in Zimbabwe, apart from the three fundamental practices (i.e. no-till, mulching and intercropping or rotations), CA includes planting basins (15 cm deep and 15 cm long), timely planting, regular weeding, manure and precise inorganic fertiliser application, integrated pest management, and conservation of soil and water (Twomlow *et al.*, 2008; Andersson and D'Souza, 2014). In Zambia, Bwalya Umar (2017) report CA to include soil ripping, lime and inorganic fertiliser application, continuous weeding, larger (20 cm by 30 cm) planting basins, and agroforestry, especially with fruit trees and *Jatropha curcas,* grown for biofuel and live fences designed to protect crop residues from roaming livestock. In Malawi, the different practices promoted under CA include: mulching; no-till; planting basins (standard dimensions of 30 cm x 15 cm x 20 cm); *in-situ* and *ex-situ* rainwater harvesting structures; vetiver grass hedgerows; stone terraces; gully reclamation; agroforestry trees, notably *Tephrosia vogelii*, *Gliricidia sepium* and *Cajanus cajan* for soil fertility enhancement; and use of dibble sticks, planting blades, soil rippers, manure, hybrid seeds, inorganic fertilisers and herbicides (Mloza-Banda and Nanthambwe, 2010; NCATF, 2016). Actual practices implemented on the ground reflect the promoter's core agenda, area of focus and/or underlying interests. This is a manifestation of the lack of consensus on the definition and interpretation of CA.

While numerous studies have reported CA success in some areas (Thierfelder *et al.*, 2016; Wall *et al*., 2013; Ngwira *et al*., 2012; Steward *et al*., 2018), others have reported contrary

views (Giller *et al*., 2009; Bwalya Umar, 2017; Grabowski and Kerr, 2014), attributing poor performance of CA to the promotion of locally inappropriate practices (Whitfield *et al.*, 2015). CA is considered to be knowledge intensive (Kassam *et al*., 2009) since its performance hinges on interaction of a myriad of factors such as the management system, biophysical dynamics (Mloza-Banda and Nanthambwe, 2010) and institutional aspects (Ndah *et al.*, 2014; McCarthy *et al*., 2018). However, interaction of existing CA designs, particularly those incorporating numerous add-ons, and farmers' capabilities and their adoption decisions is yet to be adequately understood. This is particularly relevant taking into account that smallholder farmers in developing-country agriculture are commonly associated with widespread poverty (World Bank, 2012; Food Security Information Network, 2017).

2.6 Context of smallholder agriculture in Malawi

In Malawi, smallholder farmers are described as households deriving their livelihoods mostly, though not exclusively, from agriculture: they largely use family labour in agricultural production; are partially involved in input and output markets; and are producers and consumers of agricultural goods and services (Ngwira, 2013). According to the 2010-11 Integrated Household Survey, 85% of the population in Malawi live in rural areas, of which 94% derive their livelihoods from farming (NSO, 2012). More than 80% of the total work force is employed in the agriculture sector alone (*Ibid*). Smallholder farmers in Malawi own small land holdings averaging 0.5-2.2 hectares per farm family and heavily depend on rain-fed agriculture (Malawi Government, 2013, 2016a). The main farm implement of smallholders remains the traditional hand-hoe; hence, agriculture is heavily reliant on manual labour. Every growing season, the main agricultural practices consist of clearing land mostly by burning crop residues, making ridges and monocropping of maize, the main staple food, with relatively low application of inorganic fertilisers. Smallholders' role in the country's social and economic development cannot be over-emphasised as they produce 80% of the country's food annually and account for 65% of agriculture's contribution to GDP (Chinsinga *et al.*, 2012). Despite that 97% of smallholder farmers

produce maize, 60% are net buyers of the staple food (Feed the Future, 2011). This renders the smallholders vulnerable to hunger annually.

2.6.1 Historical perspectives of smallholder agriculture in Malawi

Current dynamics of smallholder farming in Malawi are better understood when put into perspective of the country's agricultural history. Smallholder agriculture in Malawi has traditionally been associated with low-input and low-productivity subsistence farming (Ngwira *et al*., 2013). The agriculture sector is largely classified into two categories: the estate sub-sector, predominantly under private land tenure and producing high value cash crops mainly for export; and smallholder sub-sector, traditionally under customary land tenure and mainly producing food crops for home and local consumption. According to Malawi Government (2010), the estate sub-sector was regarded as 'Malawi's engine of economic growth' from the colonial era until the 1970s due to high quality cash crop exports of tobacco, tea, sugar, and coffee; therefore, estate farming received many concessions. During this time, the main role of smallholder farmers was to produce enough food for the nation while supplying cheap labour to commercial estates (Ngwira, 2013). Although smallholder farmers were not permitted to grow export cash crops during that period, the government provided them with different forms of agricultural support including credit schemes administered through farmer clubs, readily available rural input and produce markets through Agricultural Development and Marketing Corporation (ADMARC) and relatively strong extension service and rural training centres. However, the advent of the World Bank's Structural Adjustment Programme (SAP) (late 1980s to 90s) led to the implementation of policies such as privatisation and market liberalisation with disastrous consequences. For instance, the Malawi Government massively reduced its budget allocation to the Ministry of Agriculture from 32% in the 1970s to 6% by early 2000 (Phiri, *et al*., 2012); this resulted in the withdrawal of crucial government services to the agriculture sector, with dire impacts on smallholder farming communities. The reduced budget allocation stifled the extension delivery system as rural training centres ground to a halt due to lack of funds to support day to day operations. In addition, government could not replace resigned, deceased, or retired employees due to a recruitment freeze imposed

by the SAP thereby resulting in rapidly declining numbers of extension personnel (Ngwira, 2013). Furthermore ADMARC, which was primarily established to provide accessible input and output markets to smallholder farmers, could not successfully compete in a liberalised market and essentially stopped providing marketing services to smallholders. Phiri *et al*. (2012) argue that withdrawal of farmers' credit system under SAP, coupled with high input interest rates and a heavy reduction in funding allocated to agricultural research and development, further constrained smallholder agricultural production. The SAP represented a major shift in government policy which contributed considerably to the current situation of smallholder farmers in Malawi: poor food production, chronic hunger and food insecurity both at household and national level. This illustrates that government policies were critical in shaping the existing situation of smallholder farmers, and mitigating the consequences of the SAP has been the preoccupation of the Malawi government to date.

Over the years, the Malawi government has implemented various policies in the agriculture sector aimed at improving smallholder productivity and incomes. This includes lifting the ban that previously prevented smallholder farmers from growing export cash crops, with the most notable change being to allow small scale production of burley tobacco, which is the country's major foreign exchange earner (Malawi Government, 2016a). Nonetheless, Ngwira (2013) argues that smallholder farmers produced and continue to produce tobacco of lower quality and quantity compared to estate farmers due to factors including smaller land sizes, lack of access to credit or inputs and farm equipment and inadequate skills and knowledge in tobacco management. Tobacco growing by smallholder farmers has been linked to land degradation, particularly excessive deforestation in tobacco growing districts, due to uncontrolled harvesting of wood for constructing tobacco barns and curing of tobacco (Takane, 2005). Due to continued land degradation, agricultural production under smallholder farm management remains poor and the country experiences persistent annual food deficits (Chinsinga, 2011; Phiri, *et al.*, 2012; Mazunda, 2013).

Considering that maize is the staple food in Malawi, food security is largely determined by maize production (Chinsinga *et al.*, 2012), and agricultural policies focus on the same. Since

poor smallholder farmers were largely allocated less than ideal arable land for cultivation during the colonial era, the government instructed farmers to utilise soil and water conservation measures in order to enhance productivity (Nanthambwe and Mulenga, 1999). The policy was implemented in such a way that smallholder farmers were heavily fined or imprisoned for failure to implement soil and water conservation measures (Mlamba, 2010; Nanthambwe and Mulenga, 1999). This bred resentment which led to immediate abandonment of the policy enforcement immediately after the country attained independence in 1964.

From 1994, the government has made three notable input support interventions with a view to enhancing productivity of smallholder farming: the 'starter pack scheme' introduced during the course the country's transition period to democratic government in the mid-1990s; the 'targeted input programme' between 2000 and 2004; and the present 'farm input subsidy programme' introduced in 2005 (Sutcliffe, 2015). Initially, the starter park scheme emerged as a response to market failure brought about by the SAP which is widely believed to have brought high interest rates, high input prices and persistent hunger (Phiri *et al.*, 2012). However, Chinsinga (2011) argues that the starter pack scheme was also motivated by the first multi-party government's need to gain political mileage during the country's infancy in a democratic system of government. Under the starter pack scheme, up to 3 million poor farming households received between 10 and 15 kg of free inorganic fertiliser which was meant to be adequate to cover 0.1 ha per farm family. However, the scheme was largely unsuccessful, and was discontinued in 1999.

Since food security became a political issue particularly in the new multi-party system of government (Chinsinga, 2011), and in view of the food crisis that hit Malawi in early 2000, the government was compelled to re-introduce input support to smallholders under a new initiative called the 'targeted input programme'. The new scheme drew strong reaction from critics because the scheme provided poor farmers with only 5 kg of chemical fertiliser, which was seen to be insufficient to deliver significant boost in agricultural production (*Ibid*). After a political change in leadership, the scheme was upgraded in 2005 under Dr. Bingu Wa Mutharika's government to be known as the fertiliser input subsidy programme

(FISP). The scheme was initially meant to facilitate access to subsidised inputs for over 1.3 million poor smallholder farmers; each accessing subsidised inputs comprising 100 kg of inorganic fertiliser (50 kg for basal dressing and 50 kg top dressing), 5 kg hybrid maize and legume seed (Denning, *et al*., 2009; Malawi Government, 2010; 2015a). Yet in spite of the input subsidies, challenges of water shortages, declining soil fertility and poor, unstable crop yields remain (Chinsinga and Chasukwa, 2015), signifying that provision of input subsidies alone is not enough, and suggesting that a holistic approach is required to curb agricultural production challenges.

Despite many challenges associated with smallholder agriculture, the sub-sector continues to be widely regarded as key to economic and social transformation of the rural communities, not only in Malawi but in many sub-Saharan African countries (Future-Agricultures CAADP, 2012; FANRPAN, 2015). As such, substantial support and resources are channelled into the smallholder sub-sector by governments and their development partners: apart from farm input interventions, various innovative agricultural technologies have been generated and disseminated, both to improve agricultural productivity and as critical resilience strategies for smallholders (Pretty *et al*., 2011). CA is one of these agricultural technologies (Whitfield *et al*., 2014).

According to FAO (2010, 2015), CA has the potential to increase smallholders' productivity and resilience under characteristically erratic rainfall in a predominantly rain-fed agricultural system. Low productivity, coupled with small land holdings of smallholders underlines the importance of improving agricultural productivity per unit area (Munthali *et al*., 2006). For the staple maize, per unit area production of smallholders is characteristically very low; hybrid yield averages 1.5 to 2.5 tonnes per ha against a potential yield of 5 to 8 tonnes per ha, while local varieties yield much lower (Mloza-Banda and Nanthambwe, 2010). Such poor production levels have been claimed to contribute to incidents of hunger, malnutrition, poverty and food insecurity in the country (Mloza-Banda, 2011). According to Kakota (2011) and the Malawi Poverty and Vulnerability Assessment Report (Malawi Government, 2006), the issue of seasonality in food security is critical as most smallholder farmers produce insufficient food to consume all year round. The

Vulnerability Assessment report illustrates a pattern of high food availability and consumption during harvest months of May to August, gradually reducing to its lowest in January and February when less nutritious food is often consumed. Unsurprisingly, food shortage reaches its peak between January and February almost annually; however, this is also a critical period for crop growth and development, and labour demand for weeding is highest. At the same time, the price of maize (the country's staple food) reaches its peak in the lean months, and maize often becomes virtually unaffordable for most rural households. Since smallholder farmers in Malawi generally spend 78% of their income on food purchases (Vermeulen *et al*., 2014), most rural households are rendered vulnerable to hunger and frequently in need of food aid. For instance, 1,461,940 vulnerable rural people country-wide required food handouts or cash transfer to survive the 2014 lean period (Malawi Government, 2013). Low agricultural productivity, under increasingly unreliable climatic conditions leading to persistent food insecurity and poverty among rural communities provide a strong case for promoting CA in Malawi. In order to address these challenges, CA is widely promoted on the basis of its ability to enhance yields and build resilience to smallholder production systems (TLC, 2015).

2.6.2 Evolution and context of CA in Malawi

CA in Malawi has been strongly influenced by the Sasakawa Global 2000 (SG 2000) programme, which is widely credited for pioneering active promotion of the concept of CA to small scale farmers in Malawi (Dougill *et al*., 2017). SG 2000 introduced CA to the country following an international workshop in Zimbabwe in 1998 on 'Conservation Tillage for Sustainable Agriculture' (Benites *et al*., 1998). The SG 2000 programme primarily aimed to promote water and soil conservation, improve soil fertility and yields and reduce labour requirements (Sasakawa Africa Association, 2007). This was jointly implemented countrywide in cooperation with the Ministry responsible for agriculture and irrigation services in all Agricultural Development Divisions (ADDs). Apart from championing a new system of planting maize (planting one seed per planting station spaced at 25 cm apart and 75 cm between ridges to provide an optimum plant population of 53,333 plants per

hectare), the SG 2000 programme promoted CA alongside intensive use of chemical fertilisers, hybrid seed, herbicides, and agroforestry among smallholder farmers. This planting system, now commonly known locally as 'sasakawa' after the programme itself, has been institutionalised as the recommended planting method for maize in Malawi (Malawi Government, 2012). Being pioneers of CA, the SG 2000 set precedence in shaping current 'input-intensive CA dissemination approaches' (Williams, 2008) that prevail in the country. Implications of such CA dissemination approaches on (dis)adoption decisions of smallholder farmers in Malawi are not yet well known, considering that despite relative success of the SG 2000 programme, the CA component was largely unsuccessful and the initial CA momentum was lost.

Institutional challenges have been blamed for the relatively poor progress of CA adoption in Malawi. Ngwira *et al*. (2014) argue that limited success of CA under the SG 2000 programme could be attributed to use of supply-driven, top-down approaches which failed to instil farmer ownership and active participation. Enthusiasm in CA was revived in 2002, which led to formation of a stakeholder coordination platform called the national conservation agriculture task force (NCATF). Dougill *et al*. (2017) note that wider institutional issues continue to distract CA progress. Under the leadership of the Department of Land Resources and Conservation, the NCATF has the mandate to harmonise, coordinate and provide oversight on all matters relating to CA in Malawi (NCATF, 2016). However, the task force has remained relatively dormant even after re-launch in 2008, and it is yet to provide effective leadership in CA policy advocacy, resource mobilisation for participatory research and dissemination, knowledge exchange and coordination (Dougill *et al*., 2017).

2.7 Theoretical perspectives of the study

This study has situated CA dis-adoption within the agricultural technology adoption body of knowledge. According to Ndah (2014), adoption of an agricultural technology is a product of complex interactions between individual farmers, perceived attributes of the

technology, in this case CA and 'frame conditions' or surrounding contexts such as social-political systems. Therefore, the theoretical frameworks selected for this study cover all three aspects to adequately address the research aim. In order to effectively analyse smallholder farmers' dis-adoption, it is of primary importance to understand technology dissemination processes and frame conditions relevant to CA systems and identify the gaps. In this regard, this study has been informed by Diffusion of Innovation (Rogers, 2003) and Agricultural Innovation System (Spielman and Birner, 2008) theoretical perspectives. While the DoI covers the decision-making unit and its social system, the AIS covers (external) institutions and policy aspects (Gunter *et al*., 2016). Combining the theories covers all relevant angles, hence is suitable for this study. Though other theoretical frameworks e.g. theory of reasoned action (Fishbein and Ajzen, 1975) and theory of planned behaviour (Ajzen 1991) have been used in adoption studies (Garforth *et al*., 2004; Lalani *et al*., 2016), the DoI and AIS frameworks are most appropriate in conceptualising agricultural technology adoption decisions in developing countries (Ndah, 2014; Ndah *et al*., 2014) because they embrace perspectives of developing-country agriculture (Spielman, 2005), and each contributes unique but complementary perspectives to fully illuminate CA dis-adoption. In addition, the two theories are widely used in determining adoption of agricultural innovations including CA, and have been specifically recommended for studies on CA by many authors e.g. Lalani *et al*. (2017b); Corbeels *et al*. (2014) and Ndah *et al*. (2012). The theories are each further discussed in the following sections.

2.7.1 Diffusion of Innovation (DoI) theory

DoI is a meta-theory and is most appropriate for examining agricultural technology adoption and diffusion (Sahin, 2006). The DoI theory has its origins in attempts at explaining adoption/diffusion of technological change (Nutley *et al.,* 2002), encompassing conceptual perspectives of innovation decision process, individual innovativeness, rate of diffusion and perceived attributes of an innovation (Botha & Atkins, 2005). The innovation decision process (IDP) is particularly relevant to study dis-adoption because the framework engages extensively with individuals' decision making during implementation and confirmation

stages of perceived new innovations. During this period, real attitudes and perceptions emerge as the adopter utilises the innovation, a process out of which dis-continuance (dis-adoption) is a possible outcome (Rogers, 2003). The IDP is described by Rogers (2003) as comprising different stages through which the decision maker adopting an innovation passes: 1) knowledge stage; 2) persuasion stage; 3) decision stage; 4) implementation stage; and 5) confirmation stage (Figure 2.2).

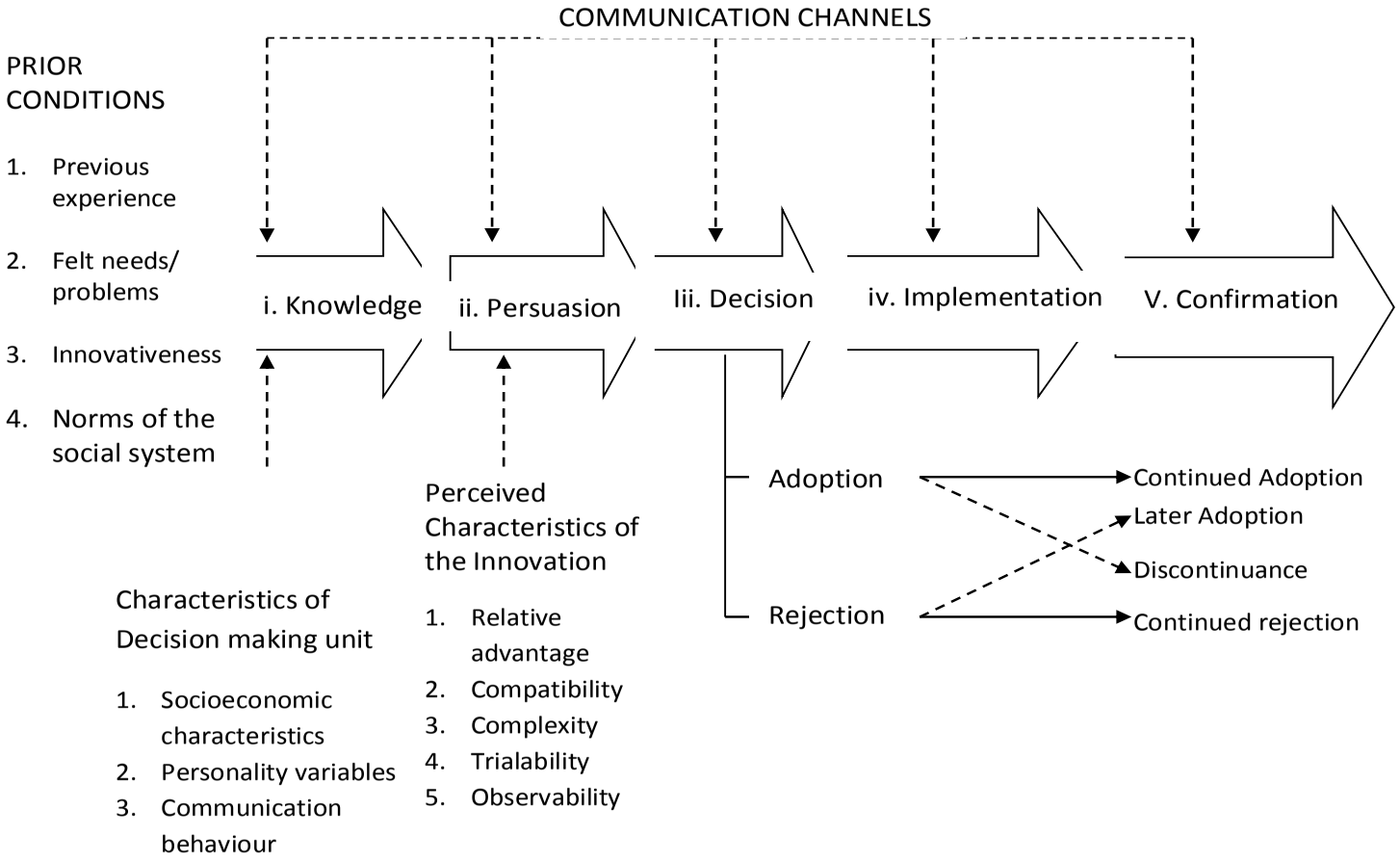


Figure 2.2: The Innovation Decision Process adapted from Rogers (2003)

Knowledge stage

This is the stage during which the decision-maker obtains knowledge about the existence of a "perceived" new technology, based on (1) individual's attributes, his/her resource endowments and (3) communication behaviour. In a typical agricultural extension model, knowledge on innovations emanates from researchers to extension agents who disseminate it to farmers (Vanclay and Lawrence, 1994). According to Rogers (2003), the most critical type of knowledge to a decision-making unit is 'how-to-knowledge', which is very useful during implementation stage, especially for perceived complex technologies such as CA. Sufficient level of how-to-knowledge or lack thereof is a critical determinant of whether or not an individual is able to continue using the technology or not (Sahin, 2006).

Persuasion stage

This is the stage where a person forms a positive or negative attitude toward the technology based on the knowledge gained. The individual evaluates the perceived attributes of the technology (i.e. complexity, defined as the extent to which an individual perceives the technology to be relatively difficult to understand or utilise; compatibility with existing (farm) management system, beliefs, values or felt needs; trialability and observability and; comparative advantage, described as the extent to which the technology is perceived to be better than the one it supersedes) (Sahin, 2006), weighing up its advantages and dis-advantages. Kwayu *et al.* (2014) emphasised the need for appropriate and timely information/knowledge as it can dispel individuals' (or farmers') fears and negativity while reinforcing positive views about the innovation.

Decision stage

This stage occurs when the individual engages in activities that lead to a decision either to adopt or reject the technology. As indicated by Rogers (2003), adoption is where the individual has decided that the best course of action is to utilise the innovation while rejection is a decision not to utilise the innovation (non-adoption).

Implementation stage

This is the stage where the perceived new idea is essentially put into use; as argued by Rogers (2003, p. 179) "it is one thing for an individual to decide to adopt a new idea and a quite different thing to put it into practice". Implementation stage is where favourable or unfavourable attitudes and subjective perceptions are formulated depending on experiences of the individual. As individuals experience the same phenomenon differently, this prompts them to make different decisions and develop different attitudes towards the phenomenon (Hay, 2010). According to the DoI, duration of the implementation stage varies from a short to long time, depending on the perceived attributes of the innovation (Figure 2.2). Though the implementation stage is very important in conceptualising discontinuance/dis-adoption decisions, Rogers argues that analyses of this stage are generally lacking in the adoption literature.

Confirmation stage

This is the stage where the individual seeks reinforcement for the decision made about the innovation or may reverse their decision, hence discontinue use of the initially adopted practice. Discontinuance or "dis-adoption" is a decision to reject or abandon a technology after initially adopting due to (1) replacement of an innovation with a new or superior idea/technology or (2) disenchantment. Rogers nonetheless highlighted the lack of scholarly attention into the concept of discontinuance (dis-adoption) and has urged researchers to examine why it occurs, in order to enhance efforts to achieve sustained adoption.

Critique of the DoI theory

Even though the DoI theory is widely applied, several authors have drawn attention to some of its limitations, particularly its inherent pro-innovation and individual blame biases (i.e. Botha and Atkins, 2005; Vanclay and Lawrence, 1994). Pro-innovation bias stems from the assumption that all members of a given social system are supposed to adopt an innovation (eventually), while individual blame bias pertains to a tendency to place

accountability for adoption decisions solely on individuals rather than the wider system in which the decisions are made (Botha and Atkins, 2005). The DoI is therefore arguably entrenched in the traditional linear agricultural extension model of knowledge generation, dissemination and utilisation, which suggests that innovations developed by agricultural scientists are 'improvements' to be disseminated to farmers without questioning their suitability under actual farm conditions (Vanclay and Lawrence, 1994). As the DoI assumes that individuals' adoption decisions follow a rational sequence of stages, adoption studies have largely centred on attributes of the decision-maker, thereby ignoring external drivers of adoption decisions (Nutley *et al.,* 2000). Due to its focus on the individual, the DoI does not fare well in enquiry seeking wider perspectives on how or why adoption decisions occur. Wendland and Sills (2008) emphasise that a farmer's decision to dis-adopt a technology is not a function of resource endowments alone, but to a larger extent, by experiences formed during utilisation stage or by forces beyond the farm-household. In addition, as end-users' views, indigenous knowledge or needs are not considered in the generation and dissemination of innovations, the DoI theory is largely devoid of a systems perspective and fails to capture sustainability issues (Hermans *et al*., 2013).

2.7.2 Agricultural Innovation Systems (AIS) theory

The AIS theory (Spielman and Birner, 2008) has its roots in the innovation systems concept which gained recognition due to its successful application in the industrial sector of developed countries (Anandajayasekeram, 2011). The AIS framework supersedes the national research systems (NARS), and the agricultural knowledge and information systems (AKIS) frameworks which informed agricultural research and development in developing countries during the 1980s and 1990s (Kaluzi *et al*., 2017). Employing the AIS framework is intended to address the problem of linearity inherent in the NARS and AKIS approaches (Anandajayasekeram, 2011). The AIS is presumed to embody a significant paradigm shift from earlier approaches in agricultural research and technology development: its emphasis is on the notion that innovations need not only originate from designated national research institutions, but also from various system actors including agricultural producers

(smallholder farmers). The AIS emphasises social learning and knowledge-sharing among various actors along the research-extension-innovation-utilisation pathway, as well as creating a conducive environment to foster such dynamic interactions. The AIS approach is considered to be more systems-thinking-oriented as it recognises the value of multi-directional interactions in technology generation, dissemination and use, processes of institutional learning and change, and seeks to integrate multiple sources of knowledge and innovation (Spielman, 2005; World Bank, 2012).

Spielman and Birner (2008) describe the AIS as comprising three main interconnected clusters namely: 1) agricultural research and education systems; 2) bridging institutions; and 3) agricultural value chain actors and organisations (Figure 2.3). An agricultural innovation system, as defined by Aerni *et al.* (2015), comprises a network of actors or organisations and individuals together with supporting institutions and policies in the agricultural and related sectors that bring existing or new products, processes and forms of organisation into economic and social use. Thus, the AIS approach involves different actors working in a dynamic and interactive manner, all contributing to the production, distribution, processing or value-addition and marketing of agricultural goods and services (Ndah, 2014). Public policies and institutions, both formal and informal, shape the frame conditions (i.e. capacity, procedures, motives and attitudes) that define interactions and how the AIS functions in generating and sharing knowledge, and developing and disseminating agricultural innovations (Hall *et al*., 2006).

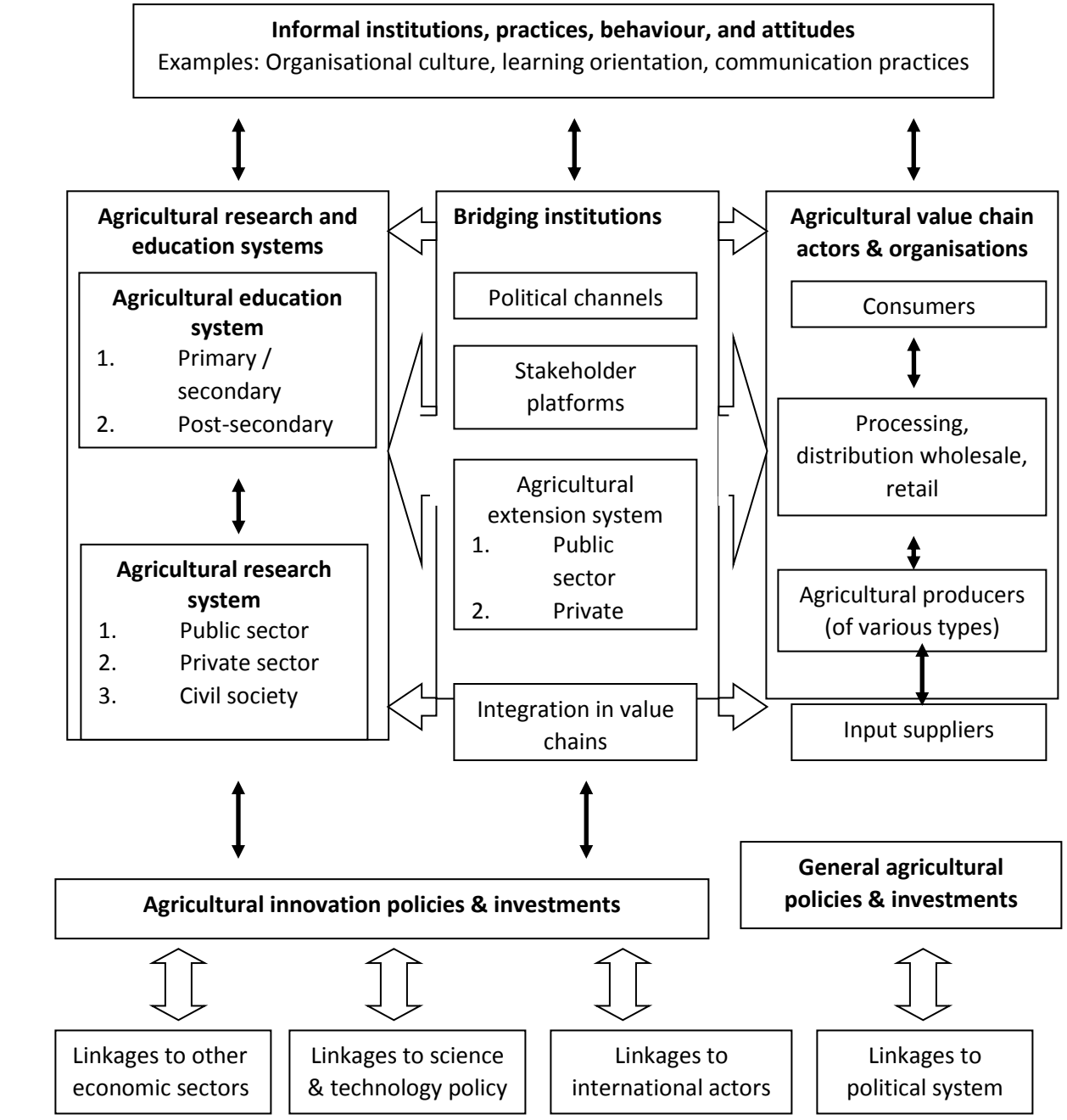


Figure 2.3: Agricultural Innovation System framework adapted from Spielman and Birner (2008)

It is widely demonstrated in the literature that the AIS framework is a useful guiding tool in the identification of key stakeholders, policies or coordinating mechanisms within the

agricultural system and can help to diagnose system components which are lacking or needed, therefore helping inform policy decisions (i.e. Dougill *et al*., 2017; Gunter *et al*., 2016; Hermans *et al*., 2013). The AIS framework provides an effective guide for examining structures, capacity, operations and processes of the various organisations governing the interactions within the relevant agricultural system (Sutcliffe, 2015), often overlooked in linear technology generation and transfer approaches (Kaluzi *et al*., 2017).

Critique of the AIS

Although the AIS is deemed more inclusive, participation of farmers in the knowledge generation domain of the framework is merely implied rather than clearly stated. The AIS places more emphasis on the upper level (institutional) perspective, thereby providing limited farmer level perspectives. With farmers apparently confined to a small role in the business and enterprise domain, the AIS framework fails to live up to its intention of encouraging greater farmer involvement in learning and knowledge co-production (key aspects of the innovation process). Consequently, it carries the risk of perpetuating linear technology transfer tendencies as researchers and other stakeholders may continue to perceive farmers chiefly as recipients of innovations (QUNO, 2015). There is insufficient consideration of the role of farmers as active participants in generation of knowledge and new innovations in the AIS. Under the broad AIS concept, specific roles, views, interests and needs of smallholder farmers are less visible, as such, promotion of technologies that are incompatible if not outright inappropriate under smallholder farming conditions is likely. Further, the AIS approach is indicator-driven, and more focussed on outcomes rather than processes, structures, and the capabilities of organisations in the innovation system (Sutcliffe, 2015). As such, despite its popularity with donor funding agencies, implementation of the AIS approach is prone to suffer 'operational difficulties' (*Ibid*). In addition, the AIS seems too market-oriented, yet rural households in sub-Saharan Africa are generally subsistence farmers whose primary objective in farming is to produce enough food for their families (Asfaw and Davis, 2018). That raises uncertainty in the ability of the AIS to capture the interests and motivations of smallholders like these.

Notwithstanding their limitations, the DoI and AIS provide the most suitable frameworks for this research. This study is novel in its use of both DoI and AIS theories; since farmers' dis-adoption decisions reflected in the DoI occur within the context of relevant AIS (in this case the CA innovation system). The two theories together specifically capture micro, meso and macro parameters which form a smallholder's subjectively perceived environment and whose interactions shape the (dis)adoption decision making process. Further, these theories have been designed and tested specifically for the field of agriculture (Ndah *et al*., 2012) and provide a robust framework for examining agricultural technology adoption decisions in particular innovation systems, such as CA innovation system (Corbeels *et al*., 2014). As adoption of innovations among Africa's smallholders is a complex issue (Ndah, 2014) and CA is considered more complex than single component agricultural innovations (Kaluzi *et al*., 2017), the need to use frameworks that can capture such complexities is paramount. Drawing from both theories provided complementary perspectives for informing a suitable methodological approach capable of comprehensively addressing the underlying objectives of this study. Detailed approach and methods are presented in the next chapter.

Chapter 3: Research Design and Methodology

3.1 Introduction

This chapter presents the research design and methodology used in this study. It begins by reiterating the objectives of this study before presenting its philosophical foundation and methodological approach in subsequent sections.

The study aimed to investigate underlying drivers of dis-adoption of agricultural technologies among smallholder farmers through a study of CA dis-adoption in Malawi. In order to achieve this overall aim, several objectives were established: 1) to analyse the role of promoters' institutional arrangements in farmers' dis-adoption of CA in Lilongwe and Dowa districts; 2) to explore how and why smallholder farmers experience and perceive CA, and the implications for these perceptions for dis-adoption; 3) to examine the role of national policies in CA implementation, and their implications for CA dis-adoption in Malawi; and 4) to develop a framework conceptualising pathways to CA dis-adoption among smallholder farmers in Malawi. This chapter articulates the research design and approaches to data collection that enabled accomplishment of the study objectives.

3.2 Study design

Taking a pragmatic philosophical stance (Creswell, 2014), the study employed an exploratory case study design (Yin, 1994) with a mixed methods approach (Creswell, 2014), to address the over-arching research question 'why do smallholder farmers dis-adopt CA in Malawi?' Case study research entails studying a phenomenon to explore its in-depth nuances and the contextual influences on, and explanations of that phenomenon (Hay, 2010). Case study research is regarded as the most appropriate approach in studies seeking to understand complex, contemporary social phenomenon so as to derive appropriate meaning within real-life contexts (Bryman, 2016), where the research is focused on answering "why" and "how" questions (Yin, 2004). While mixed methods case studies can either be predominantly qualitative or predominantly quantitative (Hay, 2010), the

approach used in this study was predominantly qualitative. A mixed methods approach in this research thus enabled the study to provide a more holistic understanding of CA dis-adoption among smallholders than would have been possible if only qualitative or quantitative approaches had been used in isolation.

3.2.1 Philosophical basis of the study

The study took a pragmatist stance (Bryman, 2016) which enabled use of both positivist (quantitative) and interpretivist (qualitative) approaches to investigate CA dis-adoption. Considering that dis-adoption is a complex social phenomenon, a pragmatic mixed methods approach (Cameron, 2011; Tashakkori and Teddlie, 2010) was the most appropriate because it offered philosophical and methodological flexibility (Johnson & Onwuegbuzie, 2004) necessary to effectively address the research problem. A pragmatic mixed methods approach allowed for prioritisation of the research problem, and how best to address it, rather than the prescriptive nature of positivist and interpretivist paradigms (Guba, 1990; Philip, 1998; Tashakkori and Teddlie, 2010). While mixed methods research effectively enables use of both quantitative and qualitative approaches in the same research (Bryman, 2016), associated paradigm debates have been extensively argued in social research literature; mainly concerning what knowledge to be sought, how it is accessed and interpreted (Cameron, 2011; Tashakkori and Teddlie, 2010; Bryman, 2008). Creswell (2009) and Teye (2012) assert that pragmatist mixed methods research is appropriate when research demands both breadth and depth; to uncover relationships/differences between variables or general patterns of distribution, while at the same time endeavouring to establish deep meaning of specific social phenomenon. In the same way, this study thoroughly elucidated deep perceptions relating to the complex social issue of farmers' dis-adoption, given the 'multiple constructs and interpretations of social reality' (Bryman, 2016; Teye, 2012). Due to the multi-lens and multi-angle approach, the study was able to gain multiple perspectives and interpretations of CA dis-adoption; this enhanced quality of evidence in comprehensively answering 'what', 'how' and 'why' questions in a single research project (Teye, 2012). A pragmatist mixed methods approach enabled this research to view the social world of CA smallholders from macro to micro

levels (Haq, 2015; Caruth, 2013), generating both the 'big picture and close-up illustration' of dis-adoption thereby produced findings with "real life resonance" (Mason, 2006 p3). Triangulation of methods and data produced rich, in-depth, more relevant and meaningful findings; conflicts were resolved by conducting follow-up interviews with key informants or re-examining the raw data or drawing explanations from promoters' relevant documents (Bhattacherjee, 2012). This ensured robustness of the evidence generated and enhanced transferability and applicability of the study findings (Hay, 2010).

The mixed methods used in this research were complementary: quantitative approaches were instrumental in collecting and analysing quantitative data used to describe patterns of distribution and association of variables, illuminating attributes of the smallholder respondents and provided relevant background to the study findings. On the other hand, qualitative techniques enabled collection of rich data; going beyond surface expressions to explore respondents' lived experiences, perceptions, traditional beliefs, motives, contestations, points of convergence, and emotions which gave valuable meaning, relevance and context in elucidating reasons for dis-adoption.

3.2.2 Theoretical foundation of methods used

The approach of this research depicts a "transformative mixed methods approach" (Creswell, 2009, p. 15), anchored in two theoretical frameworks; the Diffusion of Innovations (DoI) (Rogers, 2003), and the Agricultural Innovation System (AIS) (Spielman and Birner, 2008; World Bank, 2012) (see chapter 2).

The DoI framework captures micro level perspectives (farm household or community), but it fails to engage with broader stakeholder issues and interactions at the meso and macro levels (i.e. district, national or global) (Hermans *et al*., 2013). To address this shortfall, the research design also incorporated the AIS framework (Spielman and Birner, 2008) in order to achieve a more comprehensive approach to addressing the research problem. The AIS espouses system-wide involvement of stakeholders in knowledge generation and dissemination of agricultural innovations, with stakeholder collaboration and coordination being central pre-requisites to a well functioning innovation system (Kaluzi *et al*., 2017;

World Bank, 2012). The AIS therefore provided a comprehensive framework for identifying key stakeholders in CA, their capabilities and investigating the nature of interactions among such stakeholders (Spielman, 2005; Ortiz *et al*., 2013). Thus, based on AIS thinking, the research collected and analysed data pertaining to the functioning of the CA innovation system; particularly how institutional arrangements and national policies shape the environment in which farmers implement CA. For this, semi-structured and in-depth interviews were conducted with key informants from relevant stakeholders in Malawi's CA innovation system, to gain insights into their organisational structure to examine their capacity to promote CA, their dissemination approaches, collaboration with other CA stakeholders and their perspectives. In addition, the AIS necessitated examination of relevant national policies since they offer an important dimension in understanding the environment in which smallholders implement CA.

3.3 Approach to data collection

3.3.1 Choice of study area

The study was conducted in Lilongwe district, which lies between latitudes 13^0 30'S and 14^0 45'S and longitudes 33^0 15'E and 33^0 30'E, and Dowa district ($13^0$20'S and $13^0$40'S and 33^0 20'E and $34^0$10'E) Malawi (Figure 3.1). Lilongwe and Dowa districts were purposively selected for this study, in consultation with the Department of Land Resources and Conservation, for several reasons: (1) there is dominant CA project activity in the districts, mostly due to proximity to Lilongwe city (capital city of Malawi) where most development organisations are headquartered (Lilongwe District Council, 2013). With Government and multiple NGOs implementing CA projects in the same districts, the two districts were suitable for exploring institutional arrangements in CA dissemination; (2) the two districts were selected based on presence of potential respondents with the requisite experience since CA has been implemented for over five years, therefore study participants had depth of CA experience relevant to the research question; (3) since the two districts experience challenges of sustaining smallholder farmers' continued use of CA (Mwale and Gausi, 2012), they provided an adequate pool from which to sample dis-adopters for the study.

Figure 3.1: Map of Malawi showing study areas source: google maps

The two districts of Dowa and Lilongwe have a unimodal rainfall pattern and experience three distinct seasons: cool-dry season from May to August; hot-dry season from September to mid-November and hot-wet season from mid-November to April, the usual rainfall months (Table 3.1).

Table 3.1: Description of the study sites, adapted from Malawi Government (2008 & 2012).

District	Land area (km^2)	Arable land (ha)	Mean annual rainfall (mm)	Annual temperature range (^oC)	Population	Number. of farm families
Lilongwe	6,159	626,049	900	20-28	1,905,282	440,504
Dowa	3,041	250,991	1,250	15-30	556,678	225,372

Lilongwe district derives its name from Lilongwe River which flows through the centre of the district. It is predominantly flat hence the term *Lilongwe Plain* with the exception of a small part in the south-eastern and south-western area which have the Nkhoma hills and Dzalanyama forests in the Kirk Range Mountains respectively. According to the Lilongwe District Council (2013), Lilongwe has a population density of 216 persons per km^2, an average household size is 4.5 and 37.5% of the population are poor[1]. Over 90% of the population (Table 3.1) derive their livelihood from agriculture, mostly on customary land, with tobacco (Malawi's main foreign exchange earner) as the main cash crop and maize as the staple food. The average land holding size per farm family in Lilongwe district is 1.3 ha, and the predominant tribe is Chewa (*Ibid*; Malawi Government, 2008).

The eastern part of Dowa district is predominantly hilly, the highest point being Dowa hills at 1698 m above sea level and is also endowed with numerous rivers emanating from the hills. Though Dowa west is a low-lying area and warmer, the weather in the whole district is mostly influenced by the eastern hills, making the district generally colder especially during the months of May to July. Dowa's population has a population density of 183 persons per km^2 with an average household size of 4.6 and, 36.6% of the people in the district are poor. Over 90% of the population rely on agriculture for their livelihood, mostly on customary tenure land with maize as the main food crop, and tobacco and food legumes

[1] Live below $1/day

as the main cash crops. The average land holding size is 0.8 ha per farm family. Like Lilongwe, the main ethnic group in Dowa is Chewa (Malawi Government, 2008, 2012).

3.3.2 Data sources and sampling method

Within both Lilongwe and Dowa, two Extension Planning Areas (EPAs) were selected in collaboration with relevant District Agriculture Development Officers (DADO). An initial list of all EPAs in each of the two districts was compiled from which a second list of EPAs with relatively high CA activity was made. From the second list, two EPAs per selected district with relatively high adoption and dis-adoption of CA were chosen, to reduce the number of ineligibles[2]. Owing to the scoping study (see section 3.4), four EPAs (EPA1, EPA2, EPA3 and EPA4)[3] were chosen for this study. Data collected from the EPAs was aggregated and reported by district.

Sampling for study participants

To identify key informants for semi-structured and in-depth interviews, an inventory containing all CA stakeholders in Malawi's CA innovation system was compiled in collaboration with the Department of Land Resources and Conservation, the host department of the National Conservation Agriculture Task Force (NCATF). From that list, prominent CA stakeholders at national level were purposively selected, validated by the relevant District Agriculture Development Office. Purposive sampling was used to identify experts for interviews to understand the role of institutional arrangements in CA dis-adoption. Only informants with in-depth knowledge of CA (gained through first-hand experience in the following diverse groups: CA promotion, implementation, training, research, education, policy-making process, funding, advocacy or farm input supply) were eligible for interview. Key informants to interview within and between the groups were chosen using a snow-balling strategy which, according to Bryman (2016) involves

[2] Individuals not meeting the sampling criteria

[3] Names of EPAs anonymised to protect the identity of study participants, as part of informed consent procedures

identifying an initial list of individuals relevant to the subject under study, whose social networks are then used to identify key informants in relevant organisations. Informants were always requested to suggest individuals with alternative views on CA to enhance credibility and triangulation of data. Though snowballing strategy may not produce a representative sample (Bryman, 2016), it was the only way to reach potential participants who would provide in-depth knowledge on dis-adoption. Such interviewees were nevertheless very difficult to find given the perceived sensitive nature of the research (see section 3.3.3). Next, in-depth interviews were conducted with key informants from Government and NGOs (as prominent CA promoters in Lilongwe and Dowa districts) to get insight into their organisational structure, CA strategies, dissemination procedures, interactions with other promoters and challenges encountered in CA implementation. Follow-up interviews were done with other key informants in the CA innovation system in order to triangulate, supplement and validate information and to enhance the breadth, depth, and richness of information with diverse interpretations (Baxter and Eyles, 1997). To avoid premature closure (Bradshaw and Stratford, 2010), sample size was determined by means of saturation whereby no new information or knowledge was emerging from key informants' responses (Baxter and Eyles, 1997).

To identify farmers as respondents for questionnaires and FGDs, a multi-stage sampling procedure was used. In each selected EPA, purposive sampling was used to identify smallholders with at least two[4] years' experience in CA to obtain rich and relevant data. The smallholders had to have practised a minimum of two CA practices. Purposive sampling was employed to select survey respondents validated by traditional leaders and fellow farmers so that only smallholders who were still practising CA for a minimum of two years at the time of data collection or those who had practised CA for at least two years but dis-adopted were targeted. Sensitivity of the research question made it difficult to use random sampling as some farmers were either not willing to participate in the study or were prohibited by CA gatekeepers in the districts. 300 questionnaires were administered from which suitable participants for FGDs were selected. Only participants who freely expressed

[4] Definition of CA adoption set by the National Conservation Agriculture Task Force in Malawi

their opinions in the survey, were willing and had given consent to participate in group discussions were selected for FGDs. In total, 8 FGDs were conducted across the two districts with 82 participants.

Purposive sampling was used to select documentary materials as secondary sources of data for policy analysis. The documents selected were Malawi government sectoral policies published by the Ministry of Agriculture, Irrigation and Water Development (MoAIWD) and the Ministry of Natural Resources and Environmental Affairs (MNREM). To ensure document authenticity (Scott, 1990), policy documents were physically obtained from the relevant department at the Ministry headquarters.

3.3.3 Ethics, positionality, and challenges

The study was conducted in conformity with the ethics requirements of the University of Leeds (see ethical approval in Appendix i). The ethics assessment was done to make sure that the research would safeguard and protect the privacy and anonymity of all participant names and their identifying features. Before data collection commenced, sensitisation meetings were held to create awareness about the research and to establish rapport with traditional leaders and potential study participants. It emerged during the meetings that rumours had spread, especially in Dowa district, claiming that research participants might receive subsidised farm inputs; perhaps due to the fact that the time of data collection coincided with the period that identification of beneficiaries and distribution of coupons for the government's farm input subsidy programme (FISP) would normally take place. I therefore sought verbal consent and made sure to avoid taking people's signatures to avoid being misconstrued as registration for FISP coupons. The sensitisation meetings offered an important forum to clear any misconceptions and concerns that participants had. My interactions with local communities were positive; my ability to speak Chichewa, the local language, in addition to my knowledge of the local culture helped to facilitate good rapport with respondents, and my research assistants (see section 3.4 for information on their training) were well received in all communities.

Unlike many professional key informants who initially seemed puzzled by the study's focus on dis-adoption (instead of adoption), most traditional leaders and their subjects across the study sites seemed to understand the importance of the study, and showed interest in research on CA dis-adoption. During every data collection visit, the researcher had to first pay a courtesy visit to the village chief or group village headman (GVH), to brief them of the agenda of the visit and to reconfirm their support. Many traditional leaders were also very instrumental in mobilising respondents. Immediately after completing each research activity (e.g. FGDs/interviews) in the village, the chief/GVH was visited again for a wrap-up briefing and they were given a chance to clarify or add things; thus, traditional leaders were also used to validate or triangulate data which facilitated collection of rich evidence to provide invaluable insights concerning CA dis-adoption from smallholder's perspectives.

It is argued in literature that a researcher's general characteristics, such as gender, age, social class, tribe or ethnicity can determine access to respondents and knowledge thereof (Teye, 2012). Considering the significance of situating knowledge in particular contexts in social sciences, declaring the researcher's positionality is paramount (Teye, 2012). Due to the breadth of the study, which sought perspectives of stakeholders across the CA innovation system, I had to manage ever-changing power relations with respondents ranging from top government officers, top NGO and international donor agency officials at national level to smallholder farmers at the grassroots.

As a postgraduate researcher at the University of Leeds, but also on leave from a middle-level management position in government to do the PhD, some top national officials still viewed me as a junior officer not worth much of their time and either ignored my requests to participate in the study or constantly became unavailable despite initially agreeing to be interviewed. Being a civil servant had advantages and disadvantages; on one hand, I was able to have relatively easier access to certain people and information sources within and outside government system than would have otherwise been the case. For example, on several occasions I had to negotiate my way past 'gatekeepers' who allowed meetings with senior government, some NGO/civil society officials, representatives of local and international institutions, at times on very short notice, only upon confirmation of my

status as a civil servant. On the other hand, my status as researcher 'from government' placed some initial hurdles in accessing information especially from some NGOs. Several NGO key informants were noticeably cautious; perhaps in an effort to make sure they did not divulge sensitive information unintentionally to a government employee, and considering that implementing CA projects was their prime means for accessing international donor funds. Some informants explicitly expressed concern that they did not want their views to be misconstrued by government officials. To mitigate this challenge, I had to make sure that I always introduced myself first as a PhD research student, rather than a government employee on study leave. In this regard, my student identification and ethics letter were furnished at the earliest opportunity in order to gain the trust of key informants. While it is possible that my positionality would have some influence on the data obtained from some key informants, necessary precautionary measures were deployed to minimise bias i.e. use of audio recordings wherever informants consented, and wherever necessary letting my well-trained research assistants to conduct the interviews.

At grassroots level, my pursuance of doctoral studies in the UK evidently made some male frontline extension staff and chiefs view me as an over-ambitious Malawian woman; perhaps not surprising considering that women are largely portrayed as subordinate to men in the local culture (Chinyamunyamu, 2014). This was apparent, for example, in one episode at a remote study site where upon arrival for the first meeting, the chief and other village elders immediately assumed that one of the male research assistants was the team leader, and female team members were practically ignored during initial proceedings. I had to be cautious and tactical in my approach to overcome the gender prejudice in order to gain their trust as team leader. Among other things, I made sure that I was respectful in my approach and that I dressed appropriately (for example wearing *chitenje* (traditional wrap-around cloth), flat shoes and head gear when going to villages), interacted freely with the village women, and spoke only in the local language when interacting with community members. This approach helped in overcoming unfavourable pre-conceptions regarding my positionality, and I managed to gain acceptance as a local woman leading research that addressed a pertinent problem in their community.

The over-arching research question of the study being 'why smallholder farmers dis-adopt CA' seemed to create suspicion when presented as the subject of the research. Some key informants from government, development partners' local representatives and particularly NGOs erroneously thought that the underlying aim of the study was to generate evidence that would prove to international donors that farmers in Malawi are dis-adopting CA *en masse*. Others expressed fear that their participation would jeopardise future funding opportunities for CA, which is a flagship intervention and important means of accessing international donor funding for many NGOs implementing agricultural development projects. Perhaps such fears were fanned by the fact that being a Commonwealth Scholarship holder, I was viewed as a student sponsored by the same UK government which is a major donor of development projects including agricultural interventions like CA. On those grounds, many informants stressed that they would only be interviewed on condition that I guarantee their anonymity in my reports (thesis), because they did not want to be misunderstood or considered unpatriotic to their organisation and country by apparently jeopardising CA funding. Some also disallowed audio recordings, as they feared that '*mudzayamba kuulutsa pa MBC'* (*I don't want to risk the interview being aired on state radio station*). In such instances, detailed hand-written notes were made. Instant validation was also done in all interviews by repeating informants' responses back to them, to avoid misinterpretation and to instil trust (Bhattacherjee, 2012). Nonetheless, working in the agriculture sector gave me access to a wider CA network and information that I could not have accessed otherwise. While some potential informants consented to participate and gave me inside information, with some clearly stating that *'ndiwathu uyu, mpatseni'* (*she is our very own, give her the information)*, others still had reservations and refused to be interviewed. Despite the rejections, I made every effort to gain access to other relevant key informants with varied information and views in order to minimise potential for bias in the findings.

At district level, some misconceptions also arose during the reconnaissance study. When I was conducting research briefings with CA stakeholders, some informants wanted a study on adoption, as their view was that studying dis-adoption was a waste of scarce resources

while some wondered how studying dis-adoption would help improve long-term adoption of CA. Others wrongly thought that my study was trying to quantify dis-adoption in their projects. To resolve this, it was agreed with such stakeholders that the study would recruit equal numbers of farmers still continuing with CA and the dis-adopted. I also used a divorce analogy: *'If divorced, would you not be interested in finding out why your spouse left to avoid similar mistakes in your next relationship*?*'* Posing this question helped some informants to understand the essence of the study, and in the process, negative perceptions relating to studying CA dis-adoption transformed to positive anticipation of findings of the study. Even key informants' perceptions of me as the principal researcher, appeared to transform during the process; from being considered a fault-finder to being viewed as someone wanting to improve CA sustainability. This increased stakeholders' interest and willingness to participate in my research. In certain instances, I used third parties trusted by those targeted potential informants to help explain the aims and importance of this study so that I could have their trust transferred to me, thus enabling me to obtain their consent to participate. I also took every opportunity in workshops or meetings to engage with CA stakeholders and create awareness about my study. For instance, I used the national biennial symposium on CA/CSA that took place from 28-30 May, 2015, in Lilongwe and the training workshop on the draft national CA guidelines from 9-11 November, 2015 (organised for EPA-level staff in Lilongwe district) to discuss the concept of dis-adoption with participants. This active engagement with stakeholders at different levels was vital in that it helped to de-mystify dis-adoption, and encouraged stakeholders to openly discuss the phenomenon which was (and still is) relatively sensitive. Apart from raising awareness of my study and invigorating debate on CA dis-adoption, I obtained valuable contributions from many stakeholders during such forums. While the findings may not be broadly generalisable, they are transferable to similar situations in sub-Saharan Africa and other developing countries as the mixed methods approach applied was robust enough for collection of rich and relevant data. In this regard, it is imperative that findings of this research are disseminated widely to further aid positive transformation of stakeholder attitudes towards dis-adoption research.

3.4 Data collection

Data collection was in two main phases. Three months were spent conducting fieldwork in Malawi from April-June, 2015 and another three months from October-December, 2015. The fieldwork was arranged in the dry season so as to avoid the time when rural households are busy working in their farms. During the dry season, demand for agricultural labour is low hence participation in this research presented minimal disruption to smallholders. It was however observed that rural communities were engaged in all sorts of social/cultural activities (e.g. weddings, initiation ceremonies) during the same period which is also considered as the rest period by farmers. On the other hand, tobacco farmers were busy preparing their tobacco nurseries, and from October to November, many farmers were preparing their farmland in readiness for planting with early rains. As a result, some study participants had to be followed to their farms which could only be accessed by bicycle (*kabaza*) or ox-cart (*ngolo*) because there were no roads to allow passage of vehicles to the fields. On two occasions, FGD participants were ferried from their respective farms to a designated place and transported back after discussions.

The first phase of the data collection commenced with a scoping study from April to May, 2015. The main aim of scoping was to determine feasibility of this study in terms of: 1) relevance of the research question and whether this would derive meaningful and practical evidence for improved understanding of dis-adoption and sustainability of CA; 2) ensuring local stakeholder involvement in this study to produce appropriate high quality evidence, enhance relevance and use of findings; and 3) plan for logistics and verify research design and data collection tools in preparation for the main data collection activity (Kakota, 2011). During the scoping period, I made several exploratory visits to study sites, conducted briefings with professional stakeholders in the CA innovation system and conducted meetings with rural communities. This was done to create awareness, build rapport, establish social context and verify study sites. This period was also used for recruiting and training research assistants (further discussed below). After completion of the scoping study and customised data collection tools, data collection commenced in mid-May and continued up to end June 2015. After my transfer in Leeds to full PhD registration status

in September 2015, I went back to Malawi and continued with the data collection till December 2015. Between January and March 2016 follow-up interviews were also made with some key informants.

Training of Research Assistants

I recruited four research assistants who had previous research experience and a minimum qualification of an undergraduate degree from Lilongwe University of Agriculture and Natural Resources, to assist in data collection. The research assistants underwent a two-day training workshop to orient them to the research objectives, methods, instruments to be used and issues of positionality and research ethics. Role play and pre-testing were used to enable my research assistants acclimatise to the questions, enhance their skills thereby build their confidence (Kakota, 2011). Every research assistant was given a list of ethics' instructions as stipulated in the University of Leeds ethics permit number AREA 14-100, as a constant reminder of the rights of study participants and how to conduct themselves during fieldwork.

3.4.1 Primary data

Primary data was collected through key informant interviews, questionnaire surveys and FGDs (Table 3.2).

Table 3.2: Primary data collected for this study.

Fieldwork session	Description	Location	Number of respondents/ remarks
April- June, 2015	Key informants' interviews with CA stakeholders on their role in CA, their CA knowledge, perspectives & challenges	National	40
	Questionnaire survey with CA smallholders	Lilongwe (EPA1 & EPA2) & Dowa (EPA3 & EPA4)	130
	FGDs on farmers' CA experiences and perceptions	Lilongwe (EPA1 & EPA2) & Dowa (EPA3 & EPA4)	4 FGDs (maximum participants/group: 11, minimum 9)
	Follow-up/validation interviews with chiefs, extension staff & other key informants	Lilongwe & Dowa	5
October- December, 2015	In-depth interviews with CA promoters on their organisational capacity, CA delivery mechanisms, collaboration efforts & challenges	Lilongwe & Dowa	10
	Key informants' interviews with CA stakeholders on CA continuity	Lilongwe	2
	Questionnaire survey with CA smallholders- done in different sections of the EPAs	Lilongwe (EPA1 & EPA2) & Dowa (EPA3 & EPA4)	170
	FGDs on farmers' CA experiences and perceptions	Lilongwe (EPA1 & EPA2) & Dowa (EPA3 & EPA4)	4 FGDs (maximum participants/group: 14, minimum 7)
	Follow-up/validation interviews with chiefs, extension & other key informants	Lilongwe & Dowa	9
January- March, 2016	Follow-up/validation interviews	Lilongwe	3

Key informant interviews

Key informant interviews (Hay, 2010) were geared towards gathering information on, and understanding if and how, promoters play a role in facilitating smallholders' dis-adoption of CA. The interviews were guided by an interview schedule (Appendix ii) with key topics on the nature of the organisation, their knowledge and understanding of CA, opinions and perspective of CA, including challenges and possible solutions. As institutional structures, processes and knowledge exchange are key features of a well-functioning innovation system (Spielman, 2005), in-depth interviews were also done with prominent CA promoters in Dowa and Lilongwe districts to illuminate features of Malawi's CA innovation system. Such interviews collected in-depth information on organisational capacity of promoters to implement CA, how CA messages are packaged and disseminated to smallholders, if and how CA promoters collaborated with fellow promoters operating in their vicinity and other stakeholders in the wider CA innovation system. Wherever spontaneous remarks with potential implications for dis-adoption were made by key informants, the nature of the semi-structured interviews enabled further probing to get more insight (Hay, 2010). Though English is the official language for conducting business in Malawi, during interviews, most professional key informants mixed both English and Chichewa. The Chichewa language was being used particularly when expressing their in-depth opinions or when emphasising or clarifying a point.

Questionnaire surveys

Questionnaires were used to generate a structured dataset which could provide an overall picture of respondents' household-farm general characteristics, CA practices implemented including other on-farm and off-farm livelihood activities. The questionnaires (Appendix iii) were administered face-to-face to sampled smallholder farmers who had at least two years' experience practising CA, a criterion used even for dis-adopters. Though survey-based approach is widely regarded as unimaginative, rigid and detached from social reality (Falconer and Mackay, 1999), it is well renowned in overcoming subjectivity (Philip, 1998; Haq, 2015). Accordingly, some questions were left open-ended to make the questionnaire more imaginative and unrestrictive and to give respondents the freedom to express

themselves and to draw different perspectives on the same issue (Creswell, 2014). The survey aimed to administer a minimum of 30 questionnaires/EPA for each adoption category to facilitate statistical analysis. It is generally recommended in social research that the smallest stratum should have a minimum statistical sample size of 30 (Sekaran and Bougie, 2010). In this study, an EPA was the smallest stratum, hence a minimum of 60 respondents were recruited in each EPA. To ensure reliability and validity of findings, standard questionnaire survey procedures were adhered to i.e. scoping, pre-testing the questionnaire tool and training research assistants.

Focus group discussions

FGDs were conducted (Table 3.2) to explore how smallholders experience and perceive CA and why, as responses to these two questions have implications for dis-adoption. Since identification of participants and pertinent discussion points was done during administering of questionnaires, FGDs were only convened after completion of the survey data collection and preliminary analysis in each EPA. Each focus group comprised a combination of male and female farmers; farmers still practising CA and dis-adopters; CA group leaders or lead farmers and followers. FGD participants were selected based on their knowledge and pertinent opinions expressed during the questionnaire survey, and had expressed willingness and given consent to participate in FGDs. To get insight into participants' experiences and perceptions of CA, discussions were guided by topics broadly categorised into: vernacular translation of CA and underlying meaning; CA implementation; engagement with promoters; perceived CA benefits and constraints; opinions and sustainability of CA. Two FGDs (one per district) involved only ordinary group members (follower farmers) in order to capture their experiences and views independent of influential group leaders (lead farmers). The absence of lead farmers/group leadership allowed followers to freely express their experiences and views on CA implementation which helped to further explore intra-group issues and get to their root. All the FGDs were carried out in Chichewa. As facilitator in all FGDs, my roles included: initiating discussions, probing for more details and managing the group by ensuring that all participants' views were heard. These elicited rich descriptions of (CA) knowledge, experiences, opinions,

perspectives, values and meaning which are 'important to the FGD participants' (Ryan *et al*., 2014; Onwuegbuzie *et al*., 2009). The main role of my research assistants was to record participants' responses by use of audio recording device and to note down salient issues during the discussions. To triangulate the FGD data, follow-up interviews with key informants were conducted and this enhanced the richness of the qualitative data (Ryan *et al*., 2014).

Several social research methods authors have demonstrated advantages of using FGDs over individual interviews or oral histories, although the latter have several benefits such as allowing a researcher to explore contextual insights of a phenomenon from an individual perspective, participation of marginalised individuals, and to get contextual insights of how issues evolve over time (Bryman, 2016; Hay, 2010). Bryman (2016) notes that memory gaps in oral histories may introduce distortions in the data, while in a FGD setting, such distortions can be challenged and clarified by other FGD participants. Bryman (2016) further argues that since FGD participants challenge each other's views, FGDs produce more realistic accounts and balanced viewpoints of people's experiences of a phenomenon. Arguments by Hay (2010) indicate that the group setting in FGDs may have synergistic effect, where one comment can trigger a chain of comments resulting in far more information being generated than in individual interviews or histories. Additionally, in a sensitive research topic, FGDs offer participants the security of being in a group, therefore FGDs allow freer participation of individuals. From a cost perspective, individual interviews/oral histories often tend to be costlier and time consuming than FGDs. FGDs were therefore considered the most appropriate for generating robust data to unearth reasons underlying CA dis-adoption, albeit in conjunction with other participatory approaches.

FGDs nevertheless need to be appropriately managed. Hay (2010) argues that FGDs can be dominated by opinion leaders in society, hence facilitators need to set ground rules at the onset, ensuring that every participant gets a chance to speak uninterrupted and that all participants' views are heard and respected. In this regard, facilitators need to have strong facilitation skills and immense knowledge of FGD topics and respondents' culture to steer

discussions in the desired direction. While findings from purposive sampling may not be generalisable, FGDs offered the most suitable avenue to generate "complex, rich, nuanced, and contradictory accounts of how people ascribe meaning to, and interpret their lived experience, and unearth useful evidence to bring social change and policy" (Kamberelis and Dimitriadis, 2005, p.546); these were the most relevant aspects for answering why dis-adoption occurs.

3.4.2 Secondary data

Secondary data sources were national policy documents obtained from the headquarters of the MoAIWD and MNREM in Lilongwe city. The following main documentary materials were selected for analysis: 1) National Agriculture Policy; 2) Agriculture Sector-wide Approach (ASWAp); 3) Guidelines for Implementing CA in Malawi; 4) Guide to Agricultural Production and Natural Resource Management; 5) National Climate Change Management Policy; and 6) National Environment Policy. These documents helped to illuminate how national policies, at higher level, can influence CA implementation at the grassroots. Extension activity plans for 2014-2015 were sourced from extension officers and lead farmers to understand the workload of extension officers/lead farmers and provision of extension and advisory services to smallholders.

3.5 Data analysis

3.5.1 Qualitative data analysis

The process of analysing qualitative data commenced during fieldwork when key informant's interviews and FGDs were underway and continued until thesis write-up. Qualitative data from interviews and FGDs were transcribed and analysed using thematic analysis (Bryman, 2016). Analysis involved thoroughly reading and examining transcripts to identify concepts embedded in the data that could answer the research question therein and the generation of codes for labelling the textual data relevant to each theme (Rubin and Rubin, 2005). The coding was done manually in Microsoft Word 2016 by using highlighters such that text with potential relevance to a theme had the same colour. The

coding helped to organise data into meaningful and manageable parts for easier retrieval (Braun and Clarke, 2006). From inception and throughout the analysis, the data was processed with a specific aim to address the research question: 'why do smallholders dis-adopt CA?' Since the interviews and FGDs produced enormous amounts of qualitative data, only data that was relevant to the research question was fully transcribed and analysed. Organising the data into various themes produced coherent, logical, detailed, interesting though complex accounts, whose comprehensive analysis and interpretation revealed their meaning and implications on smallholders' dis-adoption. Thematic maps (Braun and Clarke, 2006) were developed, which guided the write-up of the accounts. The detailed accounts gained from interviews and FGDs shed light on the research question and generated invaluable insights often lacking in typical adoption studies (Knowler & Bradshaw, 2007).

For documentary materials, thematic content analysis (Bryman, 2016) was employed to analyse the extent of CA integration and coherence of selected national policies in the context of CA. According to Creswell (2009) and Hay (2010), thematic content analysis is commonly used to analyse textual data. This involved critically examining both the manifest and latent content of the text (Sarantakos, 2013), to decipher its appropriate meaning and significance in the documentary materials (Scott, 1990). Analysis of CA integration involved thoroughly examining dominant narratives in the documentary materials to determine the presence and prominence of CA and the context in which it appears in the text. The criteria for establishing CA integration in the selected policies were adapted from Mwase *et al*. (2014), while the criteria to determine policy coherence were adapted from Nilsson *et al*. (2012) and Oberthur and Gehring (2006).

3.5.2 Quantitative data analysis

Statistical analysis techniques were employed to analyse data derived from questionnaire surveys. Statistical Package for Social Scientists (SPSS) v20 was used to first generate descriptive statistics. Statistical differences within the sample were then explored using Pearson's chi square tests, which are suitable for categorical data (Bryman, 2016).

Conclusion

This chapter has presented a robust research design and methodology used to accomplish the objectives of this study. Taking a pragmatic philosophical stance, a mixed methods approach was employed to comprehensively investigate underlying drivers of smallholders' dis-adoption of CA in Malawi, a complex, contemporary social phenomenon. The study used both primary and secondary data. By articulating the design and philosophical underpinnings of the research approach, the chapter provides an essential bridge to the results which are presented in chapters 4, 5 and 6.

CHAPTER 4: The role of institutional arrangements in smallholder farmers' dis-adoption of CA in Malawi

4.1 Introduction

Investigating the role of institutional arrangements is important in understanding dis-adoption of agricultural technologies, considering that farmers' decision to abandon a technology is not only influenced by household-farm level parameters, but to a larger extent by forces emanating from institutional arrangements and systems in the social political environment (Kiptot *et al*., 2007; Wendland and Sills, 2008). In this regard, the decision by a smallholder farmer to dis-adopt CA is not necessarily determined by his/her personal characteristics alone, but by existing social, institutional and political environment, and his/her position in the (CA innovation) system (Hay, 2010). Since different social systems produce different adoption decisions (Rogers, 2003), it is crucial to examine how institutional arrangements in the CA innovation system in Malawi influence smallholder farmers' dis-adoption of CA.

Institutional arrangements are defined as organisational capacity, strategies, processes, procedures, formal and informal rules and regulations used to achieve organisational goals or objectives in an efficient and effective manner (UNDP, 2014). Organisational capacity refers to the structure, and the human and financial resources an organisation commits in order to plan, design and execute its activities (Lowe, 1999). The depth of resource commitment determines the degree of success, efficiency and sustainability of service delivery (*Ibid*). Although the institutional arrangements are considered as 'frame conditions' for agricultural technology adoption decisions in a given system (Ndah, 2014), their role in the dis-adoption of CA is not known. Considering that CA is both knowledge intensive (Mloza-Banda *et al*., 2012; Kassam *et al*., 2009) and context-specific (Whitfield *et al.*, 2014), organisational capacity, dissemination strategies, processes, and collaboration of CA promoters became areas of particular interest for investigation in this study in order to understand their implications for CA dis-adoption.

The chapter sets out to analyse the role of promoters' institutional arrangements in smallholder farmers' dis-adoption of CA in Lilongwe and Dowa districts. Specifically, the chapter will: (1) identify and characterise organisations involved in CA across Malawi (2) examine organisational capacity of CA promoters (3) analyse their dissemination approaches and collaboration in promotion of CA to smallholder farmers.

4.2 Methodological approach

A thorough literature review informed the development of initial focus areas, guided by the World Bank's Agriculture Innovation System (AIS) (Spielman and Birner, 2008) and Rogers' (2003) Diffusion of Innovations (DoI) theoretical frameworks (see Chapter 2). Discussions with key informants enabled the identification of relevant stakeholders within Malawi's CA system to be targeted for data collection. Using snowball sampling (Bryman, 2016), semi-structured interviews were conducted with key stakeholders at national level (see section 3.3.2) to understand their role and knowledge in CA, and their assessment and perspectives of CA. To derive rich qualitative data, in-depth interviews were conducted with prominent CA promoters in the study districts to gain insight into their capability to promote CA, motivations, collaboration with other stakeholders within the CA innovation system, and their dissemination strategies, procedures and processes. In order to supplement, validate and triangulate responses from in-depth interviewees, focus group discussions with smallholder farmers and follow-up interviews with other key informants were conducted (see section 3.4). The qualitative data was analysed using thematic analysis (Bryman, 2016) to understand whether or not CA promoters play a role in smallholder farmers' dis-adoption of CA. A list of primary data sources for this chapter is shown in Table 4.1.

Table 4.1: Primary data sources for analysis of institutional arrangements

Data collection method	Stakeholder category	Number of respondents
Key Informant Interviews	Government	21
	NGO and civil society organisations	15
	Research and Academia	5
	Traditional Leaders	4
	Lead farmer	4
	Donor Agency	2
	Private organisation	1
Focus group discussions	Smallholder farmers	82 (8 FGDs)

4.3 Results

This section begins by identifying prominent stakeholders in Malawi's CA innovation system. Findings pertaining to characterisation of CA promoters are presented next, followed by results concerning organisational capacity. The section ends by presenting findings on dissemination and collaboration approaches employed to promote CA to smallholder farmers.

4.3.1 Prominent stakeholders in the CA Innovation System in Malawi

Interviews with key informants revealed a diverse array of stakeholders involved in the promotion of CA in Malawi. Stakeholders play roles in: policy formulation and advocacy, research and outreach, education and training, extension, input and output supply and technology implementation among others. Multiple organisations were involved in CA extension service delivery at the grassroots.

Eight main categories of stakeholders were identified according to their key roles in CA (Table 4.2).

Table 4.2: Categories of key stakeholders in Malawi's CA innovation system

Major role in CA innovation system	Smallholder farmers	Government	Non-governmental Organisations**	Donor agency	Academic institutions	Research institutions	Civil Society Organisastions	Private sector
	Stakeholder category							
CA implementer	x	x	x					
Cordinate national CA programmes & projects		x						
Education & training		x			x	x		
Extension service delivery		x	x					
Research & outreach		x			x	x		
Provide technical support		x		x				
Policy formulation & legislation		x						
Policy advocacy			x				x	
Financial & material support		x		x				
Farm input supply & markets		x						x
Consultancy services					x			x

Source: Key informant interviews
*** includes non-profit organisations, faith-based and community-based organisations*

Although the government has the most extensive responsibility in the CA innovation system (Table 4.2), evidence from key informants suggests that NGOs dominate the CA agenda in Malawi. Findings further revealed that farmers are largely regarded as just implementers of CA, with little or no involvement in CA research and policy consultations. This depicts a one-way linear type of interaction, not in tandem with AIS thinking.

4.3.1.1 Profile of sampled CA promoters

In-depth interviews were undertaken with informants representing 10 CA promoting organisations, to understand their basic features. Results are presented in Table 4.3. Anonymity of key informants and their organisations is maintained for ethical reasons.

Table 4.3: Profile of sampled CA promoters (Lilongwe and Dowa)

ID	Category	Core agenda	Motivation for promoting CA	Implementation structure & coverage
1	International NGO	Improving rural livelihoods	To enhance soil fertility, reduce production costs and reduce climate change impacts	Temporary structure in selected districts
2	International NGO	Promoting social and economic development	To improve food security of smallholder farmers and adaptation to climate change	Temporary structure in selected districts
3	International NGO	Economic empowerment of rural communities	To increase yields per unit area, save time and money, reduce hunger and poverty	Temporary structure in selected districts
4	Local NGO	Improving livelihoods of smallholder farmers	To improve land productivity, save labour and mitigate impact of climate change	Semi-permanent structure in selected districts
5	Local NGO	Improving rural livelihoods	To improve crop yields, conserve soil, reduce labour costs, save time, adapt and mitigate climate change impacts	Temporary structure in selected districts
6	Local NGO	Improving rural livelihoods	To improve rural livelihoods and mitigate impacts of climate change	Temporary structure in selected districts
7	International NGO	Improving livelihoods of rural communities	To build resilience to climate change shocks and hazards and reduce hunger	Temporary structure in selected districts
8	Government Ministry	National food security, poverty reduction and sustainable economic growth	To improve soil moisture and fertility, save labour & time, reduce soil erosion, reduce production costs and stabilise yields during drought conditions	Permanent structure Nationwide
9	Local NGO	Improving livelihoods of smallholder farmers	To improve soil fertility, conserve soil moisture, suppress weeds, reduce soil erosion, reduce labour, raise incomes and climate change adaptation strategy	Temporary structure in selected districts
10	International research organisation	Improving rural livelihoods and landscapes	To enhance soil health, improve crop productivity & climate change mitigation	Semi-permanent structure in selected districts

Source: Key informant interviews

The Malawi Government, through the Ministry of Agriculture, Irrigation and Water Development (MoAIWD) remains the largest CA promoter in terms of geographic coverage and established permanent implementation structures from national to grassroots level (Table 4.3). From a CA perspective, relevant departments in the MoAIWD are: Department of Land Resources and Conservation (DLRC), Department of Agricultural Extension Services (DAES) and the Department of Agricultural Research Services (DARS). The DLRC is the host department for CA in Malawi, mandated to plan, coordinate, implement, monitor and evaluate sustainable and efficient utilisation and management of land-based resources, programmes, projects, policies and/or strategies nationwide (Malawi Government, 2012). It is also the Secretariat of the National Conservation Agriculture Task Force (NCATF), a national coordinating structure for CA stakeholders in Malawi.

Key informants' data shows that implementation of CA activities is hugely dependent on international donors and funding agencies, notably the European Union, Norwegian Agency for Development Cooperation, UK DFID, Japanese International Cooperation Agency (JICA), USAID, World Bank, and African Development Bank. However, disapproval of donor reliance was evident in several informants' comments: "*Donors tend to fund particular areas that we feel are not urgent to us, but we cannot transfer their money to such pressing areas since we have to strictly comply with their demands"* (High ranking Ministry Official), and *"My view is that Malawi's long-term goal, Vision 2020, should read: by year 2020, Malawi will be a donor-fearing nation, not a God-fearing nation as indicated. I can say that what we do, even how we do it, is dictated by those who give us money- the donors*" (Civil Society Commentator).

In line with their core agendas, promoters were involved in implementing numerous projects with CA being just one component in their wider programme agenda: "*We are dealing with a range of programmes to empower the smallholder farmer and to build capacity of local authorities, communities and individuals to address the impacts of climate change"* (NGO Field Officer). Assuming a broad core agenda appeared to allow the organisations to cast a wider net for funding by orienting their programming to match changing donor focus. Evidence shows that 'mitigating climate change impacts' was the

most commonly mentioned motivation for embarking on CA projects. This suggests that access to climate financing was probably their motivation to venture into CA promotion, due to the prevailing international donor interest in climate change adaptation and mitigation (Wood *et al*., 2016). Focused on attracting donor funding, FGD comments show that some NGOs introduced CA in areas where the intervention did not address local communities' urgent priorities: "W*e, as a community, chose to have a borehole [during pre-project consultations] but they brought us this CA instead*" (FGD member, Dowa). Such sentiments suggest that some promoters 'pushed' CA to communities that were unwilling or not ready to embrace the technology. Under such circumstances, it was unlikely for CA to endure.

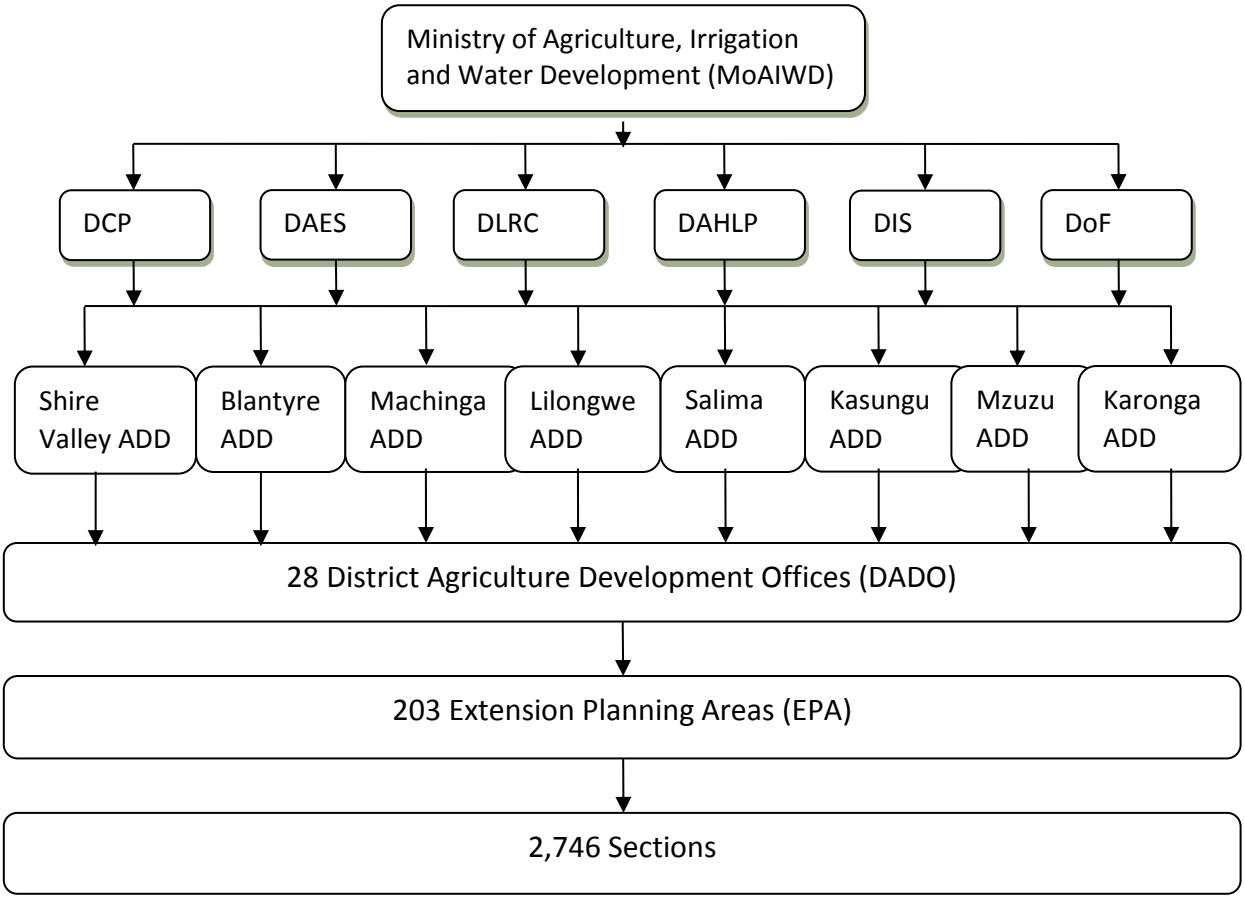
Owing to increasingly shorter donor funding cycles: "*We are currently implementing an 18 months' project, it used to be 5 years, then 3 years, now it's 18 months; I wonder what comes next"* (NGO Manager); NGOs employed temporary implementation structures: "*The way we operate normally is that, depending on project guidelines, when that project phases out, we move from one area to another"* (NGO Manager). This was seen as problematic by government officials: "*The problem is that NGOs have a tendency of bringing projects but don't want to work with us but at the end of their short-lived projects, they want government to come in and take over their sites"* (District Extension Officer). Further comments showed that NGOs were often concentrated in the same areas of the district: *"Every NGO is introducing CA in these areas yet there are other parts in our district that have never seen [never had] an NGO [project]"* (Government Department Official). With the need to show positive results quickly, concentration of NGOs in the same area fuelled competition for farmers: "*It appears that the NGO that gives more incentives gets more beneficiaries*" (Agricultural Development Division Technical Officer). CA promoters' concentration in certain areas of the district meant that other parts of the district remained under-served. Comments from some key informants suggest that, since CA benefits take a long time to be achieved, "*projects end before farmers testify that CA really works*" (NGO Project Officer).

4.3.2 Organisational capacity of CA promoters

This section examines the organisational capacity of Government and NGOs as the major CA promoters in Malawi, focusing on their implementation structures, capacity of frontline extension personnel to deliver CA as well as financial capacity.

4.3.2.1 Government implementation structure

Considering that the MoAIWD historically remains the biggest implementer of CA, analysis of its implementation structure is vital in understanding how the CA delivery system operates in Malawi. Scrutiny of the MoAIWD shows that it has permanent implementation structures with multiple technical specialists at higher management levels but not at the frontline level. From an extension service delivery perspective, the Ministry has six main technical departments at national, Agricultural Development Division (ADD) and district levels, with each department headed by a subject matter specialist (SMS). All agricultural extension-related services at district level including CA activities fall under the responsibility of the District Agricultural Development Officer (DADO). Each district is geographically sub-divided into extension planning areas (EPA) headed by an Agricultural Extension Development Coordinator (AEDC). EPAs are further sub-divided into sections consisting of 10-15 villages depending on population density. Each section is manned by an Agricultural Extension Development Officer (AEDO) and it is where extension and advisory service is delivered to smallholder farmers. Figure 4.1 depicts the operational structure for extension delivery of the MoAIWD.



Key:
DCP=Department of Crop Production, DAES=Department of Agricultural Extension Services, DLRC=Department of Land Resources and Conservation, DAHLP=Department of Animal Health and Livestock Production, DIS= Department of Irrigation Services, DoF= Department of Fisheries, ADD= Agricultural Development Division.

Figure 4.1: Operational structure of the MoAIWD, adapted from Malawi Government (2012).

Comments from government frontline extension informants (AEDO) show that lack of replication of the six technical departments at the EPA (Figure 4.2), created bottlenecks in extension service delivery to farmers.

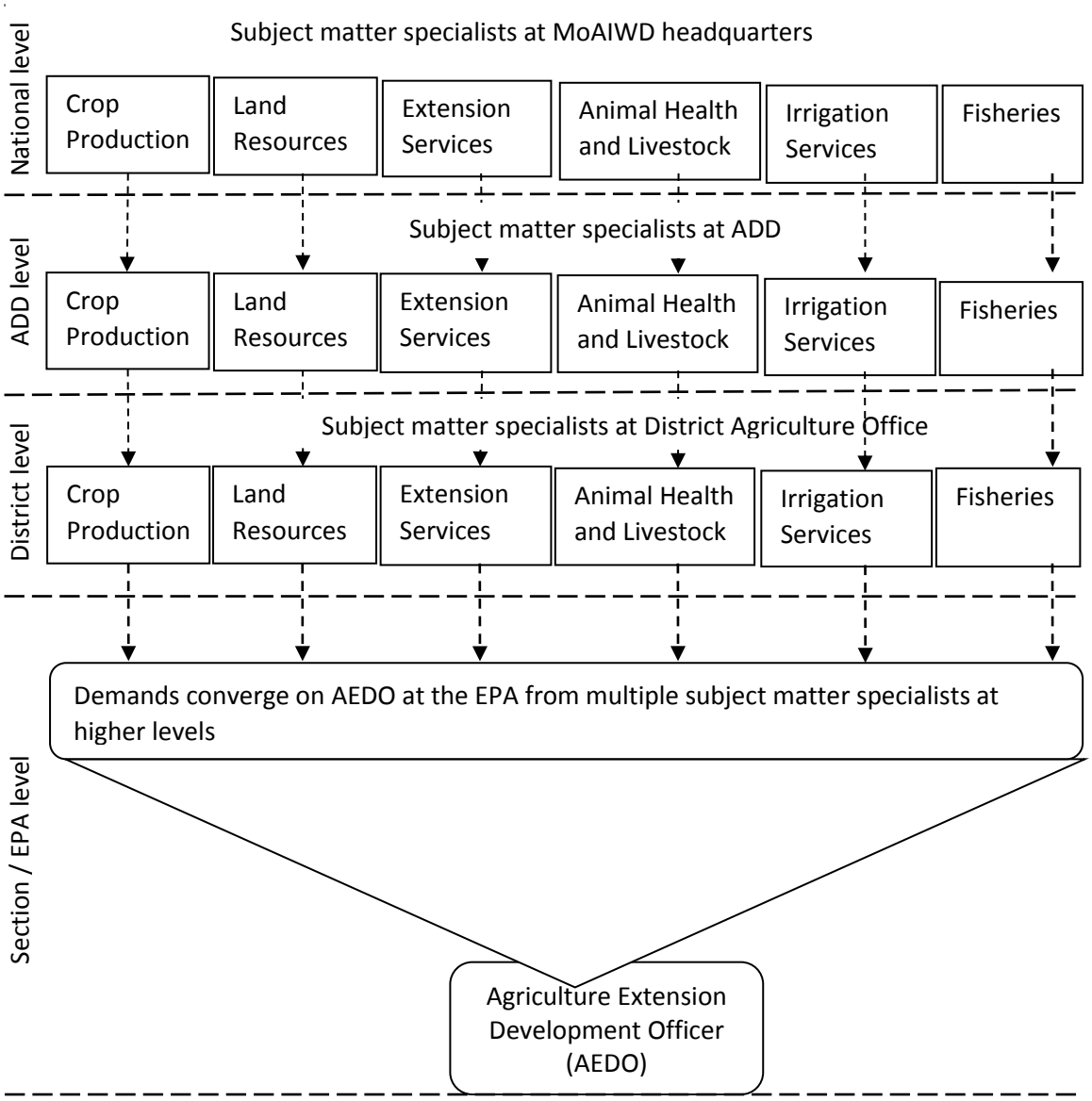


Figure 4.2: MoAIWD structure illustrating the demands on Agricultural Extension Development Officers from Subject Matter Specialists. Source: Interviews

All subject matter specialists (SMSs) at the district level used the same AEDO to implement their programmes: *"I work with each and every SMS and I get overwhelmed when activities collide"* (AEDO). This structural shortfall concentrated demands from various SMSs on a single AEDO at the section level, thus effectively turning AEDOs into 'jack of all trades' (extension generalists) implementing a diverse array of programmes. The use of extension

generalists to execute 'specialist' activities arguably compromised the quality of extension support rendered to CA farmers.

While recent government decentralisation strategy requires MoAIWD structures at district level to operate through the District Assembly (DA), headed by the District Commissioner (DC) who is under the Ministry of Local Government and Rural Development, evidence suggests that this arrangement may have complicated operations of the district SMS. By making the DC overall controlling officer, SMS activities needed the approval of both the DADO and the DC for funds to be disbursed. Although the set-up was intended to enhance financial accountability, some officers were of the view that it posed unnecessary obstructions: *"On several occasions, my planned activities have suffered because I have to wait for the DC to countersign the vouchers before funds are released.... you need to have a vehicle plus fuel for you to get to the DC's office, it is frustrating at times"* (District SMS). This suggests that the decentralisation arrangements, though essential, potentially impeded the DADO's execution of activities, including CA extension delivery.

4.3.2.2 NGO implementation structure

Structural set up for many NGOs tended to mimic the government set-up. In-depth interviews showed that all field officers were simultaneously implementing an array of programmes including CA: "*Our field officers are involved in so many programmes, for example, if he or she is not involved in CA activities, then he or she might be involved in community development or education or health activities or environment; it's not about agriculture only*" (NGO Programme Manager). Like government extension agents, NGO field officers were 'generalists' who simultaneously implemented a diversity of programmes, thus, the quality and intensity of extension support offered to farmers was diminished.

In addition to the programme diversity, NGO field officers faced similar challenges to government extension officers in their quest to meet targets of their programme specialists: "*I have four project managers, all waiting for me to execute their programmes on the ground; it's hectic, it's like a servant with four masters*" (NGO Frontline Officer).

Figure 4.3 illustrates convergence of technical demands from multiple programme specialists on one frontline field officer in an NGO.

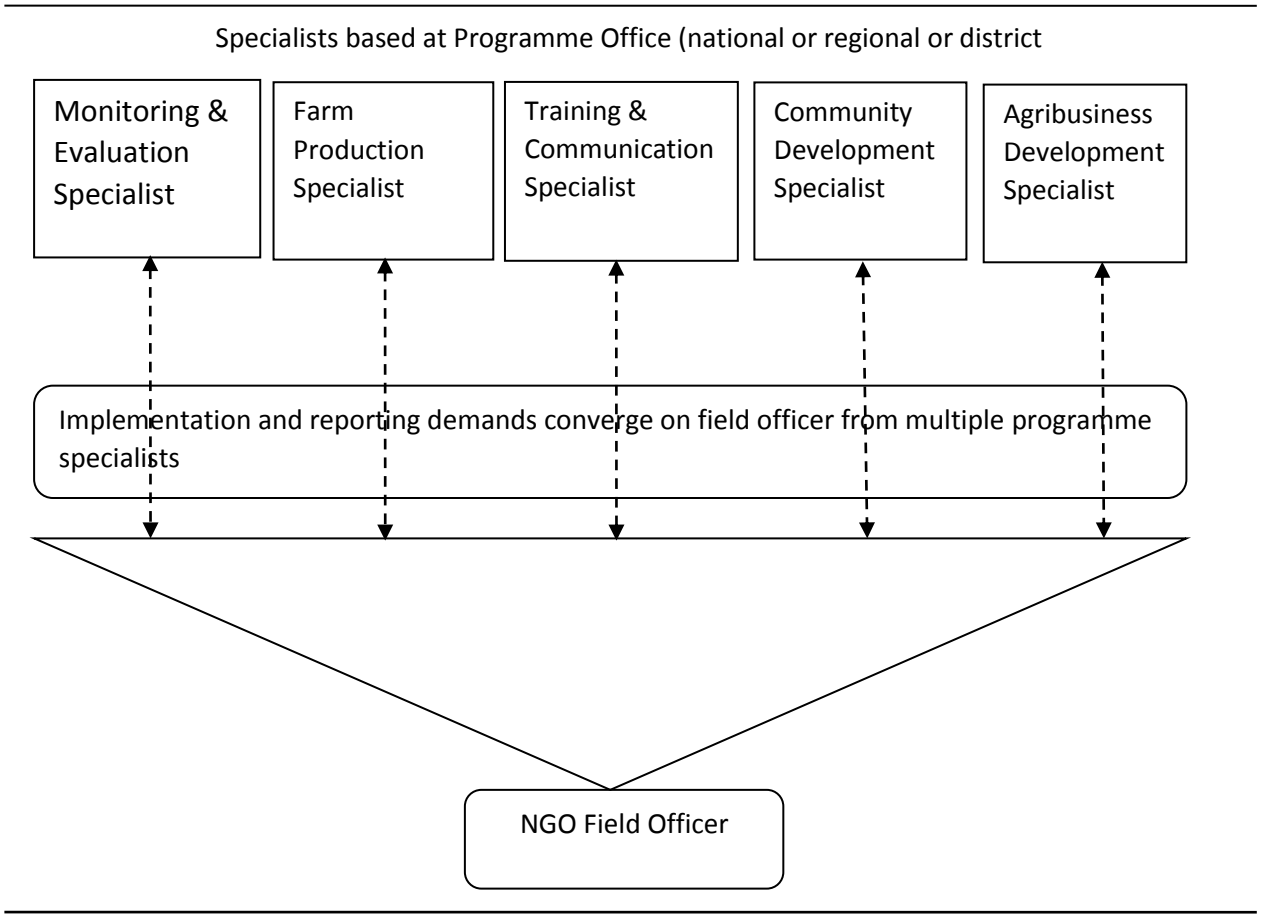


Figure 4.3: NGO structure depicting demands on a field officer from multiple programme specialists Source: Interviews

Further evidence shows that programmes funded by the main international donors monopolised NGO field officers' time and effort at the expense of other equally important activities for the farmer: *"This one project alone on nutrition, [X] being our main donor, occupies most of my time… for reporting, you complete so many forms, it's too complicated. I am more concerned with completing [X] project activities than the rest"* (NGO Extension Officer). It transpired that although the nutrition project involved production and utilisation of soy bean, CA was not incorporated. As such, extension and advisory support for 'non-priority' or poorly funded activities was inadequate, even though such activities may have been integrated with the well-funded intervention.

4.3.2.3 Human resources capacity

Shortfalls in human capacity, particularly low staffing levels, inadequate competence and low motivation of frontline extension personnel, were challenges frequently mentioned by both government and NGO interviewees. Key informants unanimously identified high vacancy rates to be a major challenge in the MoAIWD, despite the Ministry having permanent implementation structures. For example, 31% of the Ministry's technical positions were vacant in 2011 (Masangano and Mthinda, 2012). Further evidence from this study suggests that staff attrition, particularly at the lower levels of the MoAIWD overstretched AEDOs: "*We have not had adequate numbers of AEDOs for years, one AEDO is now manning two or even three sections yet more and more programmes keep coming"* (AEDC). EPA records showed that the AEDO:farm family ratio in the study districts was 1:2688 contrary to the recommended ratio of 1:500 (Suarez *et al*., 2008). According to one key informant, persistent loss of government extension staff to NGOs and the private sector contributed to a critical shortage of qualified AEDOs: "*NGOs are in the habit of poaching our highly experienced and qualified AEDOs by enticing them*" (Ministry Extension Official). Apart from overburdening AEDOs, the acute shortage of extension officers has the potential to cause long-term disruption of programmes, as many activities remain un-implemented because, government vacancies remain un-filled for a long time (Suarez *et al*., 2008).

Evidence from interviews suggests that a growing tendency of AEDOs residing far away from their designated areas of work, preferring to commute from nearby towns to their sections, exacerbated the impact of staffing shortfalls on extension service delivery. As such, several line supervisors expressed their displeasure and questioned the commitment of such AEDOs: *"It is these new AEDOs that want to work in town. They do not have the real desire to work with farmers*" (AEDC). AEDOs residing far away from their sections increased time for commuting to and from work, leading to failure to visit farmers frequently and reducing the time spent interfacing with farmers. Considering that the mode of transport for most AEDOs is either on foot or by bicycle, some remote villages never received

extension support: "*I have areas in my section that are mountainous with no roads, even management has never visited those villages"* (AEDO).

For NGOs, staffing levels tended to be top-heavy with no frontline extension personnel at the section level, where implementation of CA activities occurs. NGO field officers were either positioned at their district programme office or area project office or Traditional Authority (T/A) level, with one field officer overseeing an area equivalent to one or two EPAs. Location of frontline extension personnel for both government and NGOs is presented in Figure 4.4.

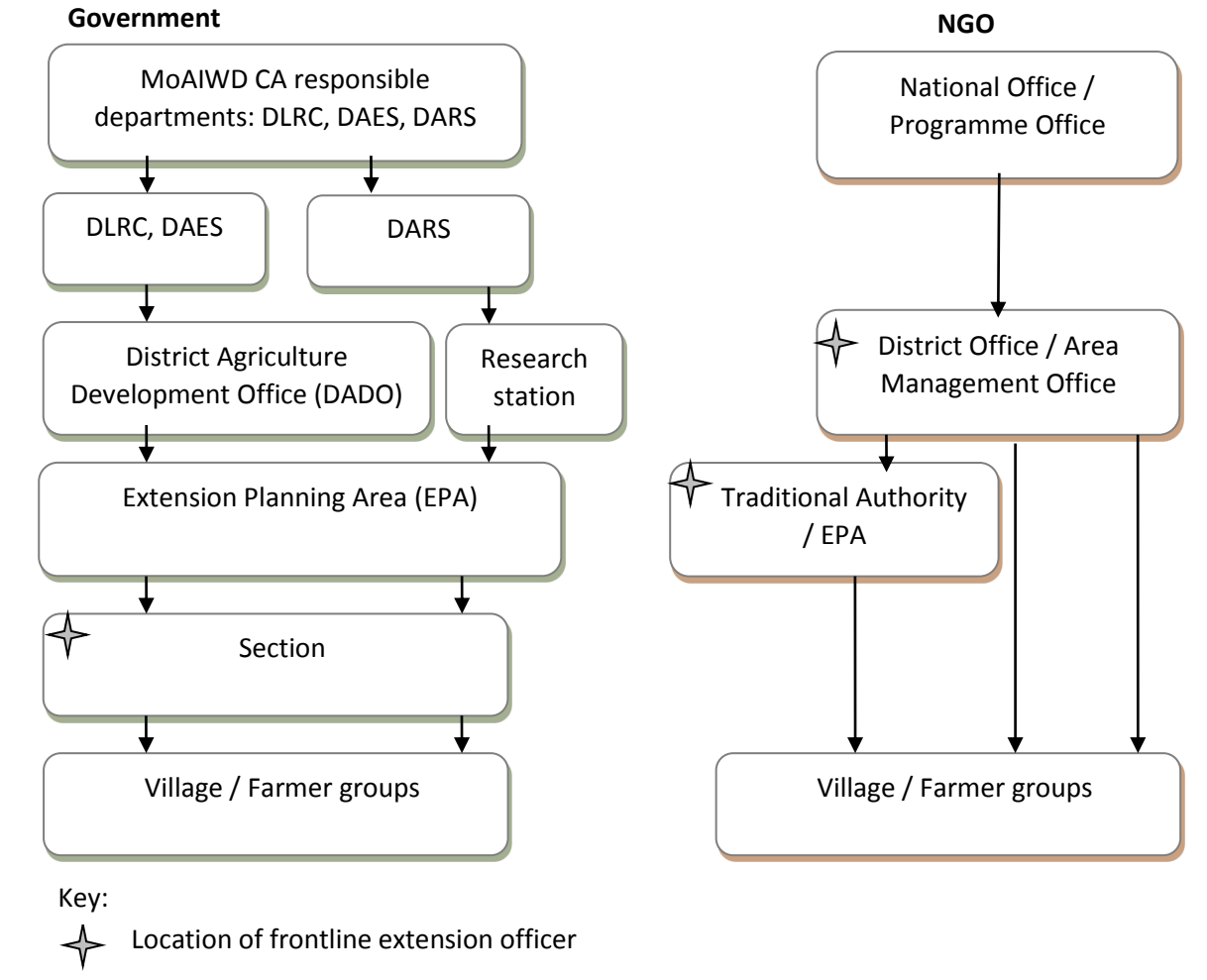


Figure 4.4: Location of frontline extension officer for government and NGOs in Dowa and Lilongwe districts, Malawi. Source: Interviews

While government AEDOs are located at the section level, where interface with farmers occurs, NGO field officers are located further away from the grassroots (Figure 4.4). An

NGO extension officer hinted at the challenges of his positioning: *"I have project sites in two EPAs because I have to establish more clubs to meet my target. I am always travelling from one site to another, supervising lead farmers"* (NGO Extension Officer). While locating the extension officer upstream allowed NGOs the ability to extend the project beneficiary catchment to a wider area, to increase chances of fulfilling expectations for increased numbers of project beneficiaries, such an arrangement increased travel time and reduced the amount of time for interfacing with farmers.

Findings from this study show that many extension workers lacked technical competence to offer effective extension support to CA farmers. Interviews with key informants revealed that most government extension officers were unqualified, hence had the title Assistant AEDOs (AAEDO), and held a Malawi School Certificate of Education qualification (equivalent of GCSE), but were required to discharge the duties of a qualified AEDO. Since the MoAIWD guidelines stipulate that the minimum qualification for an AEDO is a 2-year Diploma in Agriculture from a government-accredited institution, preferably the Lilongwe University of Agriculture and Natural Resources (LUANAR) or its equivalent, AAEDOs were recruited in the hope that they would upgrade at a later stage: "*Once government hires these AAEDOs, we send them to NRC [LUANAR] for a 2-year diploma so that they gain the necessary skills"* (ADD Official). Comments from an EPA key informant showed that AAEDOs took too long before undergoing necessary training for upgrading to AEDO status: *"Eleven extension workers [out of twenty] in this EPA are AAEDOs and have been waiting for upgrading for years"* (AEDC). Sentiments from some AAEDOs suggest that they were not viewed in high regard once farmers realised their grade, and were considered less capable: "*They [farmers] even don't believe me if I give them [extension] advice; if I go to their farms, I find that they have done their own thing, not what I told them"* (AAEDO). AAEDOs' lack of contemporary knowledge and critical agricultural extension skills undermined effectiveness of extension support.

Further, an assessment of CA knowledge amongst CA promoters revealed that most informants, lacked in-depth knowledge of the technology. This was exemplified by failure to articulate the three CA underlying principles, often confusing CA principles with CA

practices: "*We follow the three pillars of CA which are crop rotation, pot holing [planting basins] and mulching; the combination of the three is what we call CA"* (NGO Field Officer). Another stated: "*I know that there are three pillars of CA but to tell you precisely the pillars, it's hard"* (NGO Project Officer). This was further evidenced by their promotion of practices to smallholder farmers which were not aligned to all three CA pillars. Although the extension personnel demonstrated poor knowledge of CA, they were given the responsibility of developing technical messages for dissemination to smallholder farmers, albeit a few engaged CA consultants. Extension messages were unsynchronised as they came from multiple promoters with inadequate knowledge and understanding of CA, hence conflicts and distortions in CA messages were inevitable.

4.3.2.4 Financial capacity

Although the Malawi Government has since 2004 committed >10% of its national budget to the agriculture sector, in compliance with the Comprehensive African Agriculture Development Programme (CAADP), most of the funds are used for fertiliser subsidy activities (Chinsinga, 2011; Mazunda, 2013), thus, lack of funds was still cited as one of major challenges impeding effective CA delivery in the country. Expression of frustration was not uncommon among government informants who felt severely under resourced to effectively discharge their duties: "*We are even failing to purchase stationery for this office, what more with bicycles [for AEDOs]*" (District SMS). While some were unable to purchase motor cycles or bicycles, those with motor cycles claimed to have insufficient fuel or none at all for extended periods, while others could not repair their 'unreliable' motor cycles.

To understand the prevalent financial resource constraints faced by extension officers, the study examined the budgeting processes in the MoAIWD, which is said to be activity-based and follows a bottom-up approach (see Lilongwe Agricultural Development Division, 2009). According to key informants, the budgeting process in the MoAIWD starts from the section level (grassroots) where AEDOs consult communities to prioritise activities within their sections, and then present their activity-based budgets to the EPA. The EPA consolidates budgets from all the sections, re-prioritises activities and compiles a consolidated budget

for the entire EPA, which is then submitted to the relevant district. The consolidation and re-prioritisation of activities and budgets is repeated at the district, ADD and the Ministry headquarters. After further re-consolidation and re-alignment to national priorities, the MoAIWD prepares a provisional itemised annual budget, guided by the Ministry of Finance budgetary ceilings and is finally submitted to Parliament for approval.

However, despite utilising activity-based budgeting process, frequent cuts in budgetary allocations and reprioritisation of activities at multiple levels undermined availability of financial resources. A government official expressed concern with incessant budget cuts: "*It has now become the norm for Parliament to enforce budgetary cuts annually*" (ADD Officer), and this forced funding reductions for implementation of activities. In addition, the reduced, approved budget translated into (even) smaller monthly disbursements such that "*budget ceilings for important items such as fuel and allowances are reached before the end of the financial year*" (District SMS). Although the budgetary process is touted to follow a bottom-up approach, reprioritisation at multiple levels of the Ministry resulted in a final national budget that was hardly aligned with priorities at the grassroots.

The problem of limited finances was compounded by frequent *ad hoc* activities in the Ministry which nonetheless had to be executed (e.g. hosting a Ministerial visit, attend a Presidential or Ministerial function, attend delegated meetings or workshops, organise supervisory visits from top management). One informant explained: "*If my Director calls me and tells me to attend a meeting at such and such a place, I have to go*" (District SMS). These activities have to be executed promptly since they are sanctioned from "above" despite being neither planned nor budgeted for. Such *ad hoc* activities drain already meagre budget pots: "*So far, we have already spent a reasonable chunk of our budget on these never-ending ad hoc functions*" (ADD Officer).

Conversely, findings on financial resource constraints among NGOs revealed that some field officers felt that resources were unnecessarily tightly controlled by top management, which often restricted them from reaching out to more farmers: "*Some programme specialists do not regularly provide fuel, yet they expect me to implement their*

programmes. I have five programmes but the fuel I receive is less compared to the number of activities I am supposed to implement" (NGO Field Officer). However, a top management official explained that "*fuel is tightly controlled because it's easy to abuse; imagine a motorcycle consuming more fuel than a car*" (NGO Manager). Such comments suggest that some NGOs struggle to strike the right balance between preventing abuse of resources and ensuring accountability, without stifling extension service delivery.

Findings in this section have shown that despite rhetoric of participatory budgeting and project implementation approaches, CA activities largely reflect or serve the interests of promoters rather than local communities. Availability of financial resources at the frontline is compromised by imperfect budgeting processes, resource control methods, and a disproportionate level of *ad hoc* activities.

4.3.3 Dissemination strategies

This section examines how CA promoters package CA, the primary agricultural extension approaches, and stakeholder collaboration in the CA innovation system.

4.3.3.1 CA packaging

CA packaging in this study encompasses naming of CA, its selling points, and incentives. Interviews with key informants and FGDs with farmers revealed that different promoters locally translate and interpret CA differently (Table 4.4), mirroring the promoters' implicit understanding of CA and particular practices or principle(s) being focused on, and fuelling debates on what constitutes CA in the local context.

Table 4.4: Different names/translations of CA in Malawi and their interpretation

Vernacular name	English translation	Focus	Interpretation
Mleranthaka	Soil nurturing	Focus on soil health improvement	CA involves caring for land with a diverse range of practices
Mtayakhasu or mtayajembe	Abandon the hoe (no-till)	Emphasis on no tillage	CA only entails no-till system. CA is non-traditional farming
Ulimi wa m'bwezera	Farming that restores soil fertility	Emphasis on soil health restoration	CA is practiced on unfertile farmlands
Ulimi wa mapesi	Farming that uses maize residues	Emphasis on mulching with maize stalks	CA can only be done if a farmer has maize stalks
Ulimi wa m'phimbira	Farming that uses soil cover/mulch	Emphasis on mulching with any biomass	CA can only be done if a farmer has mulch
Ulimi wa bulandi	Farming that uses a thick blanket/mulch	Emphasis on thick mulching with any biomass	A lot of mulch is needed to practice CA
Ulimi wa makono	Modern farming	Emphasis on use of various farming techniques	CA is a new and progressive technology
Mleranthaka wa mitengo	CA with trees	Emphasis on planting trees	CA includes planting trees

Source: Interviews and FGDs

FGD comments revealed divergence between CA selling points advanced by promoters and farmers' personal experiences. Proponents that brand CA as *mtayakhasu* present CA as a low cost, time and labour-saving technology yet several FGD participants indicated contrary experiences: "*When I stopped ploughing the soil, weeds grew profusely and neighbours started laughing at me, saying that my land is getting barren*" (FGD member, Lilongwe). Farmers in Malawi believe that excessive growth of weeds, especially Witch weed (*Striga asiatica*), is a sign that the land is becoming unproductive. While CA proponents discourage weeding using hoes and instead advocate uprooting weeds by hand, to minimise soil disturbance (Ngwira *et al*., 2012), farmers stated that the technique required even more time and more labour to remove weeds which ultimately increased production costs: "*Weeding by hand is back-breaking, very slow and time-consuming*" (FGD member, Dowa).

Another stated:" *Since it is difficult to properly plant, apply fertiliser or weed through the mulch, casual labourers charge you even more"* (FGD member, Lilongwe).

As CA promoters over-emphasised the use of maize stalks for mulching in CA fields, many farmers believed that maize stalks were the only source of mulch. FGD participants pointed out that it was difficult to find sufficient biomass (let alone maize stalks) and keeping the mulch on the farm was another challenge considering their equally important multiple uses: "*All the trees are gone in this village therefore my wife uses maize stalks as firewood*" (FGD member, Lilongwe). While some reported that their residues were burned by other people, others indicated that cattle herders deliberately targeted CA-mulched farms as grazing fields: "*I laid the crop residues immediately after harvest as advised by our extension agent but two weeks later, I was shocked to find cattle grazing in my farm and everything was wiped out"* (FGD member, Dowa). Sentiments expressed in FGDs suggest that when CA is branded as *ulimi wa mapesi* or *ulimi wa m'phimbira* or *ulimi wa bulandi* (see Table 4.4), smallholder farmers believe that one automatically ceases to be a CA farmer when mulch materials are lost or unavailable.

Interviews with key informants unanimously illustrated that CA promoters provided non-monetary incentives such as bicycles, inorganic fertilisers, hybrid seed, herbicides, sprayers, wheelbarrows and market opportunities while others gave financial incentives particularly to lead farmers. Some projects issued farm input incentives on loan, others provided them for free. While some promoters issued incentives to all CA club members throughout the project period, others, including government, provided farm inputs to all members only in the first year of the project "*to encourage swift uptake of CA"* (ADD SMS). In subsequent years, projects provided incentives to lead farmers only in the form of demonstration materials: "*We provide inputs in the first year, every CA farmer gets 15 kg urea, 10 kg NPK [fertilisers], 5 kg hybrid maize [seed] and 2 kg soya for crop association. In year two, we only give inputs to lead farmers and advise follower farmers to buy their own inputs or rely on FISP"* (District SMS). Reminiscent of Rogers' (2003) DoI theory, follower farmers were expected to continue practicing CA without receiving further input support in subsequent years either with the assumption that they realised CA benefits in their own

farm during the first year or had observed the efficacy of CA through the demonstration plots. Those that performed well were rewarded as a means of encouragement: "*We reward farmers that continue doing well without input assistance at the end of every harvest. We organise field days and give them bicycles, t-shirts, wheel barrows and many more*" (NGO Project Officer).

Sentiments from some FGD members however suggest that the use of incentives (chemical fertilisers and hybrid seed) has led some farmers to perceive CA as being so expensive that they could not practice it without support from projects while others felt that they deserved some reward for their participation in a CA project: "*I cannot do CA without receiving something*" (FGD member, Lilongwe). Remarks from key informants suggested that some farmers held 'extended' expectations from a CA project: "*These farmers have higher expectations from a project, so when they see that we are not doing what they want, like giving them a goat or a pig, then they decide to drop out"* (NGO Programme Manager). Interviews further showed that some NGOs lost CA club members when they stopped issuing incentives: "*Once we stopped giving out fertilisers, we noticed a decrease in the number of farmers"* (NGO Project Officer). To some farmers, CA projects were viewed as a means of getting what they really want: farm inputs or livestock.

4.3.3.2 Primary extension approach

Key informant interviews showed that the primary extension approach used to deliver CA to smallholder farmers was an integration of the group approach and the farmer-to-farmer approach: *"Extension providers in Malawi these days generally combine farmer-to-farmer and group approaches to impart knowledge and skills to smallholder farmers*" (ADD SMS). Through these approaches CA promoters utilised field visits, demonstrations, field days, trainings or campaigns to convey their messages.

The group approach involved organising smallholder farmers into clubs/groups of a specified number of members. This approach enables CA projects to register larger numbers of participants in a short period and to reach many farmers at once: "*Those*

interested to join our project were required to register in groups, minimum 20, maximum 50 per group" (NGO Field Officer) however, addressing individual farmers' needs became problematic. Further, while key informants insisted that they only played the role of facilitator in the formation of the farmer groups, as recommended in extension guidelines (Malawi Government, 2000), FGDs revealed that the leadership in many CA clubs were actually hand-picked by those in authority: "*A meeting was convened to choose office bearers for the club, but to our surprise, it was just announced that the chairman of the club is so and so*" (FGD member, Lilongwe). FGDs revealed existence of disputes between club members and their leaders, claiming that group leaders monopolised resources meant for the group: "*The project official brought t-shirts and caps [for the group to share], but up until now, I have received nothing*" (FGD member, Dowa). Others expressed their frustration at un-democratic processes in the CA club: "*The club chairman has been in office since 2008, he's very arrogant but nobody can remove him because of his connections*" (FGD member, Lilongwe). Such governance issues, frequent occurrence of disputes and unresolved conflicts undermined continuity of CA clubs, thus bring into question the *modus operandi* of the group approach in CA promotion.

Findings revealed wide variations in the application of the farmer-to-farmer approach, albeit identified by different names; for example, village extension multiplier, model farmer, "*pompo-pompo*" (meaning "on the spot"), and lead farmer (the most widely used name). Whilst some promoters used both frontline extension workers and lead farmers (LFs), others solely relied on LFs to deliver agricultural extension services. CA promoters consistently indicated that LFs enabled them to overcome the shortage of frontline extension officers and limited resources: *"We normally use LFs and we encourage farmers to be in groups because it's easier to work with them in groups. Since extension workers are few and farmers are many, the individual approach is impossible. We train our LFs and then they go back to their farmers' club to teach other farmers, then as an extension worker, I just go to do follow-ups*" (NGO Field Officer). Interviewees perceived the LF concept to be effective such that many NGOs preferred to have very few frontline extension workers, or none at all but instead have as many LFs as possible: "*We are reaching out to more farmers*

now than when we used extension workers; our LFs have helped us to achieve our targets with very little cost" (NGO Manager). Although all key informants claimed not to pay wages to LFs in compliance with state extension guidelines, comments from some informants hinted that wages are disguised as training allowances, reimbursements or some form of income generating activity: "*We don't pay our LFs, we only reimburse certain expenses incurred like transport or telephone expenses and a small allowance for meals and accommodation when they attend training workshops"* (NGO Manager).

Comments from interviewees suggested that LFs were overburdened with activities as many undertake double roles in the community as office bearers in various village development committees (VDC) in addition to being LFs. Considering the huge responsibilities, some LFs expressed their expectation for some form of compensation for the vital services rendered: "*I do similar work to facilitate development in my area just like an extension agent, and he is paid for doing this job* (LF, Lilongwe). However, FGDs revealed that incentives precipitated friction between LFs and follower farmers. Some followers were of the view that LFs received a lot of incentives at their expense and they also deserved to receive similar things: *"The things that come are for everyone in the club, not just one person. All of us need what they [projects] give to LFs because we are all farmers"* (FGD member, Lilongwe). LFs held contrary views insisting that the materials they received were meant for use in demonstration plots. Findings herein suggest that concentration of incentives on LFs in CA promotion undermined group cohesion in CA projects, and thereby threatened continuity of CA implementation among disgruntled follower farmers.

4.3.3.3 Competence of lead farmers

Although use of LFs was the most favoured CA dissemination approach, evidence showed that they lacked the necessary CA competence. While CA promoters stated that initial training was provided to LFs to enable them to discharge their duties effectively, such training was not effective since it was mainly classroom-based and only lasted a few days after which LFs were expected to immediately start discharging their duties. Interview data revealed that in general, government offered LFs much shorter initial training sessions (2

days) while NGOs provided 5 days' training. There was agreement in FGDs that "*activities under CA are complicated and one has to remember many things*" (FGD members, Dowa). LFs commented that they preferred a practical hands-on experience instead of the classroom-based training: "*It's impossible for me to master all the CA activities just by listening*" (LF, Lilongwe). Others indicated that it was difficult for them to concentrate in class, considering the diverse topics that facilitators teach: "*They teach us too many things at once and it is difficult to remember everything"* (LF, Dowa). Such a lack of comprehensive hands-on training resulted in some LFs failing to properly assist their followers. In one FGD, respondents unanimously expressed their dissatisfaction with their LF: "*Time and again we asked our LF about CA, he could not assist"* (FGD members, Dowa). In addition, monitoring of LFs to offer hands-on guidance tended to be sporadic as supervisors heavily depended on mobile phone communication: *"I bring reports to her office and as for other [project] activities, she just phones me"* (LF, Lilongwe). Overall, LFs' lack of CA competence, coupled with inadequate technical training and back-stopping from extension officers, diminished the quality and effectiveness of extension delivery to follower farmers, even though LFs were heavily relied upon by CA promoters.

4.3.4 Collaboration of CA stakeholders

It became apparent from the numerous interviews that there was limited collaboration between government and NGO sectors at the grass root level and also between different departments within the MoAIWD. Malawi Government (2001) stipulates that the entry point and pathway for all agricultural extension services delivery to communities is through the District Assembly (DA). This arrangement was designed to enhance coordination and collaboration of extension service providers at the district and local levels. However, interviews with informants revealed that many NGOs by-passed the DA coordinating structures (Figure 4.5) when implementing their project activities.

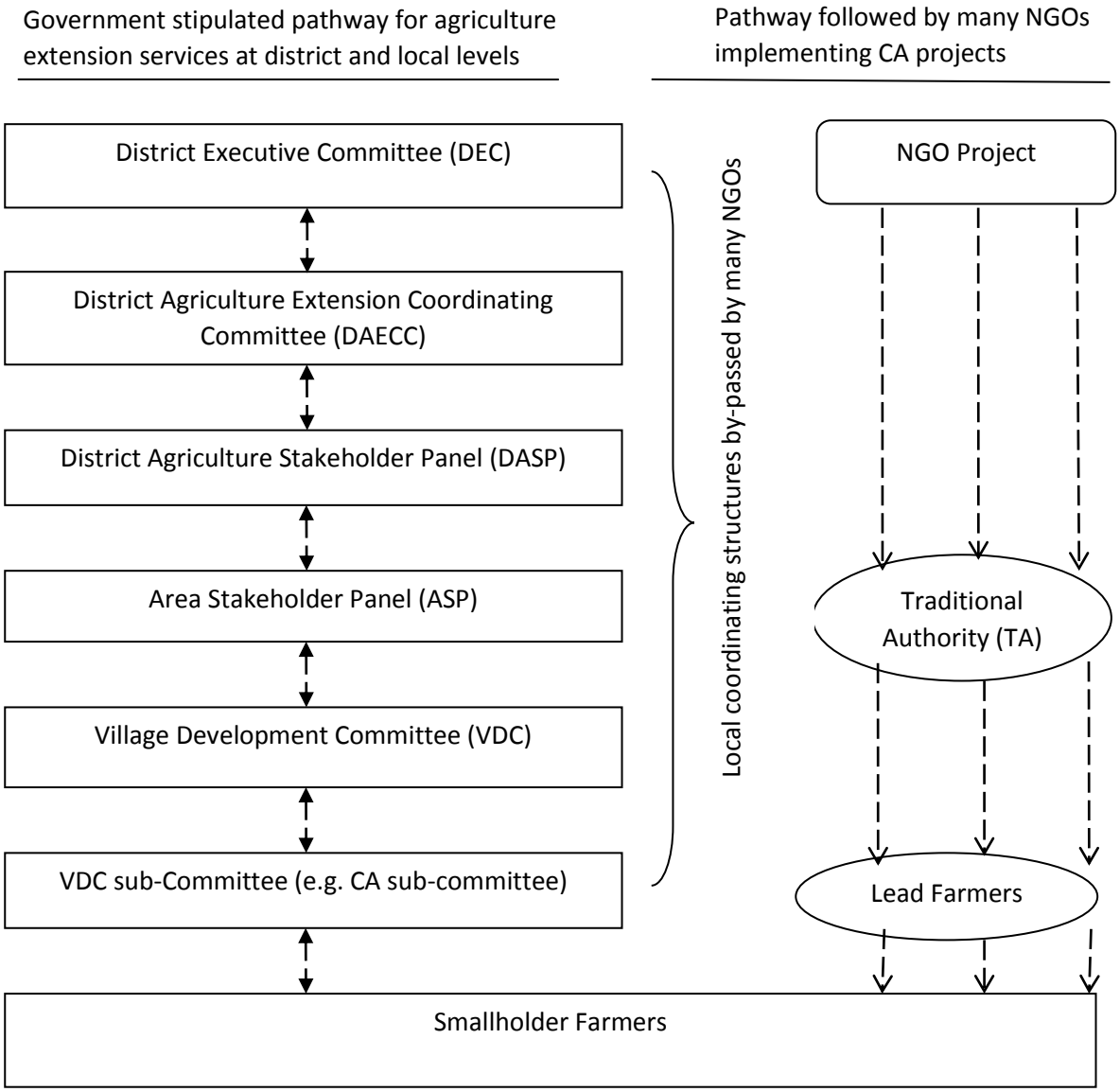


Figure 4.5: Entry point and implementation pathway for CA. *Source: Interview data*

Numerous government informants expressed concern at the by-passing tendency of NGOs: *"We have well defined DA coordinating structures but only a few NGOs use them, the majority just go straight to the farmer, undermining our efforts"* (DAECC Official). Some informants however argued that they by-passed the district structures and directly work with local authorities "*to avoid delays by government bureaucracy"* (NGO Manager). NGOs' side-lining of government staff appeared to erode the collaborative spirit as the state employees felt disrespected in their own 'jurisdiction': "*NGOs honour a LF more than me,*

the owner of the section. *Just one NGO has worked with us from project inception until now, the rest, they side-line us and go straight to farmers*" (AEDO). One informant however argued that they seem to side-line government staff when implementing activities because "*they expect to receive allowances every time we go to the field yet they are working in their own backyard*" (NGO, Manager).

While senior staff consistently indicated that they collaborated with other stakeholders in the promotion of CA, interviews with junior extension staff revealed little collaborative effort in practice on the ground. Some government interviewees described collaboration efforts of most NGOs as superficial, probably meant to fulfil their reporting requirement or simply feign solidarity with local structures with no real commitment: "*These NGOs claiming collaboration, they are just using our AEDOs behind our back, is that real collaboration?"* (District SMS). Another noted: *"What happens is that NGOs attend DEC meetings just to show in their reports that they're working with government, but it will not be the Manager attending, it will be a very junior person who cannot make any decisions, let alone influence things in his organisation"* (DAECC official). One key informant however described the DEC meetings as "*too government*, *during DEC meetings, government side controls everything and I am there as an outsider,"* (NGO Project Officer).

On information sharing, interviews revealed the tendency of some government employees to withhold public information: "*What happens is that officers at Land Resource [host department for CA] and DARS [agricultural research department] just keep information, they don't share it with us*" (NGO Field Officer). The above comments point to challenges between government and NGOs in building genuine working relationships capable of collectively advancing agricultural development or extension agendas at local levels.

Information sharing among NGOs was also limited. This was exemplified in one informant's elaboration of the then recent event: "*At the onset of heavy rains this January [2015], NGO [X] advised its farmers to temporarily remove mulch in their CA fields and re-mulch days after the rains stopped [which was followed by a prolonged dry spell]. Other NGOs operating in the vicinity did not know of this development thus did not provide similar advice*

to their members. Their [farmers'] fields were water logged and harvested nothing, and some farmers were even blaming CA for losing their crop" (Civil Society Official). Some NGOs sought to work with others only when introducing a new project to take advantage of their knowledge and experience in the area. Such collaborative efforts however proved sporadic and short lived as the organisations pursued their individual interests without proper frameworks for continued engagement and knowledge sharing: *"We initially worked together with NGO (Y) when they wanted to introduce CA to the community. They wanted our advice because we have been implementing CA for some time, but then things changed and we don't interact that much anymore"* (NGO Field Officer). Such sentiments suggest that NGOs perhaps viewed each other as competitors rather than collaborators in CA, hence failed to share critical information which resulted in unfavourable CA experience for farmers.

Collaboration of key departments in the MoAIWD was limited especially between DARS, having a research mandate to generate new technologies, and DAES, mandated to disseminate the developed technologies to farmers and channel feedback from farmers back to DARS. Views from a cross section of informants suggest lack of inter-departmental collaboration in the Ministry and 'encroachment' of responsibility: "*DARS [officers] work in a silo [isolation]. They have now taken over, and are duplicating the role of technology dissemination which is our mandate"* (DAES Officer). However, a key informant from DARS explained: *"We are now including a dissemination component in our research programmes to quickly popularise and scale-up adoption of the new technology,"* (DARS Officer). The mentality of working in isolation persisting amongst CA promoters coupled with lack of sharing of information, knowledge or resources has weakened the research-extension-farmer linkage, thereby stifling valuable contributions from farmers which are vital in effective technology development, dissemination and (sustained) adoption.

4.3.3.5 Conflicting messages in CA dissemination

A wide range of key informants indicated that CA practices and messages to smallholder farmers were riddled with conflicts, which had the potential to confuse farmers. Such conflicts were typified by the comments made during interviews (Table 4.5).

Table 4.5: An illustration of inter and intra organisational conflicts in CA dissemination in Dowa and Lilongwe districts

Category of conflict	Example of conflicts
Inter-organisational conflicts	"*In our case, we are promoting the use of herbicides in CA fields but when we go to farmers, we hear a lot of stories and resistance; they say our AEDOs [government extension agents] advise us that herbicides damage the soil and make people sick, just apply mulch*" (NGO Project Officer). *While we are promoting fertiliser application to improve soil fertility, others come and advise [the same] farmers that fertilisers are chemicals and they damage the environment, use manure"* (NGO Manager). *"Some NGOs encourage farmers to use any kind of biomass for mulching, even weeds, which we totally discourage"* (District SMS). *"Some NGOs promote mono-cropping and give out maize seed only or legume seed only yet CA includes crop association* (ADD SMS). *"We are promoting zero tillage yet the government extension officers tell farmers to do ridge alignment, contour ridging, box ridges"* (NGO Field Officer). *"For example, we advise farmers to plant maize 25cm apart and another extension worker will come and tell the same farmers that plant 10cm, farmers get confused"* (AEDO). *"The confusion is coming from NGOs issuing handouts to attract farmers to their projects, so farmers stop coming to our projects because there is nothing to take home,"* (Ministry SMS).
Intra-organisational conflicts	"*Conflicts are coming from the MoAIWD itself, for example the DLRC is advancing minimum soil disturbance under CA while the Department of Crops is advocating ploughing and ridging through a tractor hire scheme in all ADDs. The same DLRC is implementing CA on one hand and advancing residue soil incorporation, contour ridging on the other; this is happening within the same Ministry*" (Senior Civil Society Official).

Source: Interview data

In addition, this study also found that most extension agents 'do not practice what they preach' to smallholder farmers. One FGD participant wondered: "*Our extension agents hire casual labourers every year to clear and plough their farms, make ridges and hoe- weeding, why should we practise no-till?*" (FGD member, Dowa). Considering that extension agents have farms within local communities, farmers notice that they (extension officers) do not practise CA themselves therefore it becomes difficult for the smallholders to be convinced about CA.

4.4 Discussion

Within the context of AIS (World Bank, 2006) and Rogers' (2003) DoI theoretical frameworks, this chapter set out to examine how institutional arrangements influence smallholder farmers' dis-adoption of CA. While findings in this chapter show that institutional arrangements drive CA dis-adoption in many ways, analysis of the evidence reveals that reliance of CA promoters on international donor funding, organisational capacity shortfalls, and lack of collaboration among CA promoters play a crucial role in CA dis-adoption.

Findings show that (over)reliance on international donor funding to implement CA was a common feature amongst CA promoters in Malawi. This precipitated unfavourable practices amongst CA promoters, probably due to focus on satisfying donor requirements. Evidence shows that CA was reportedly introduced even where the community had prioritised other interventions, for example a borehole. As a result, mismatch existed between promoters' interests and farmers' immediate needs, preferences/priorities. This is consistent with arguments in the literature suggesting that due to influence of international donors, fund-recipients in developing countries tend to implement internationally-defined interventions (Wood *et al.* 2016; Koutsouris, 2012) which may lack relevance with urgent needs or interests of local communities. When projects/programmes fail to align with the immediate priorities and needs of the communities, depth of local commitment and ownership is undermined (Kamoto *et al*., 2013; Masangano and Mthinda, 2012), therefore dis-adoption follows.

Further, as some promoters issued incentives with the aim of attracting more beneficiaries and the best LFs to their CA projects, they reinforced dependency mentality among farmers. Sentiments from some respondents, insisting on receiving 'something' as incentive for them to continue practicing CA, is testament to lack of project ownership and dependency of some CA farmers and/or communities. Flawed dissemination approaches, including poor engagement of farmers and 'misuse' of incentives not only precipitated dependency, but also dis-empowered smallholders because they believed that they could not practice CA without external support. Therefore, continuity of CA becomes problematic especially when projects expire or incentive provision is discontinued (Twomlow and Delve, 2016). Smallholders often dis-adopt agricultural innovations when projects wind up because they are 'unable' to continue implementation without the expected input support and incentives from promoters (Kiptot *et al*., 2007).

Findings reported in this chapter further show that limited financial and human capacity of CA promoters made extension service inadequate to support smallholders to implement CA successfully. Contrary to findings reported by Mlamba (2010) and Mwale and Gausi (2012), interviews with numerous informants revealed that supervision by technical specialists was insufficient; this resulted in poor quality control/quality assurance of extension messages delivered to farmers. Limited financial resources constrained mobility of extension officers because they did not have reliable motor cycles nor fuel to adequately reach out to all farmers with extension support. Moreover, the limited financial resources restricted efforts to recruit or (adequately) train extension agents and/or lead farmers; this further weakened the extension delivery system. These findings resonate with observations by other authors that the extension delivery system in Malawi is undermined by acute shortage of extension personnel. For example, Suarez *et al*. (2008) reported that up to 48% of smallholder farmers in Malawi did not have any contact with an extension officer for the entire 2008 crop growing season.

CA extension support was further undermined by AEDOs serving a disproportionately high number of farm families. Evidence herein shows that on average, one AEDO served 2688 farm families, instead of the government recommended 500 farm families (Malawi

Government 2012). Several key informants attributed this situation to high vacancy rates in the MoAIWD due to high staff attrition of government staff especially at EPA level, partly due to poaching by NGOs and other organisations. As AEDOs were generally overloaded, their morale and productivity diminished (Chinsinga, 2012) due to stress from increased workload (Suarez *et al*., 2008). Consequently, AEDOs failed to offer the required levels of extension support to smallholders. On the other hand, poaching of best performing and qualified AEDOs was contrary to the pluralistic rationale of the existing extension policy (Malawi Government, 2000). The issue of poaching was also observed by Nyanga (2012) in Zambia where NGOs recruited competent government extension officers which negatively affected farmers' membership in government CA projects, hence was counter-productive to the country's CA agenda. As CA is a knowledge-intensive technology (Kaluzi *et al*., 2017), farmers needed more intensive support from extension agents but was not available due to financial and human resource limitations of CA promoters. Without adequate extension support farmers had insufficient knowledge, skills or expertise to successfully implement CA and therefore their motivation to continue implementing CA waned, leading to dis-adoption.

In spite of the available local stakeholder platforms within the district assembly, collaboration among CA promoters at the grassroots was found to be deficient, contrary to AIS stipulations. The AIS emphasises the importance of collaboration amongst agricultural development stakeholders in the innovation system to accomplish institutional learning, change, and socioeconomic development (Aerni *et al*., 2015; Spielman, 2005). Evidence presented in this chapter shows that interactions in the CA innovation system were predominantly one-way, top-down, and with a common tendency by many NGOs to by-pass DAECC structures. By circumventing the district extension coordinating structures, NGOs failed to capitalise on the various stakeholder platforms that government established for building partnerships, sharing field experiences and institutional learning (Mloza-Banda *et al*., 2012). Apart from facilitating collective action for coherence in implementation of interventions, DAECC structures provide for greater visibility which is necessary to garner support for CA projects and their assimilation into the government system for continuity in the post-project period. Due to ineffective collaboration, CA approaches and messages

were not harmonised, leading to dissemination of conflicting extension messages (see Table 4.5) which confused farmers and eroded their interest in continuing to implement CA. This finding affirms conclusions of Jere (2007) that limited collaboration in Malawi's AIS is undermining agricultural development, hence his call for institutional transformation.

4.5 Conclusions

This chapter has fulfilled the first objective of the thesis, analysing the role of institutional arrangements in CA dis-adoption among smallholder farmers in Malawi. The chapter provides important perspectives in understanding the reasons smallholders dis-adopt CA. Findings show that constraints in institutional arrangements create adverse conditions that undermine CA implementation in many ways. Considering that CA implementation relies on international donor funding, CA promoters tend to focus on satisfying donor requirements for project implementation. In the process, they not only overlook priority needs of communities, but also deploy dissemination strategies that are unsustainable for smallholders' long-term CA implementation, for instance, through perverse use of incentives in CA projects. At the same time, technical and financial capacity shortfalls, coupled with lack of collaboration among stakeholders in the CA innovation system, propagate unfavourable conditions for generation and sharing of knowledge, including undermining provision of effective extension support for CA smallholders. Since institutional arrangements frame prevailing conditions of the innovation system, constraints therein compromise the environment in which farmers implement CA and dis-adoption is enabled. Findings herein suggest that apart from identifying 'appropriate' CA project participants, greater attention needs to be directed at investigating and resolving institutional challenges, particularly dissemination processes, with a view to informing relevant improvements that would reduce incidents of dis-adoption.

CHAPTER 5- Smallholder farmers' experiences and perceptions in CA dis-adoption in Malawi

5.1 Introduction

The role of technology adoption has been widely demonstrated in agricultural development literature (Lalani *et al*., 2017; Ngwira *et al*, 2014; Mlamba, 2010; Ng'ombe *et al*., 2014). However, studies have emphasised farm-household characteristics and have provided only a limited understanding of how smallholder farming households and their production systems function (Andersson, and D'Souza, 2014). In addition, by focusing on farm-household characteristics, researchers "fail to see adoption as a process" (Lalani *et al*., 2017b, p104) therefore fail to uncover motivations underpinning (dis)adoption decisions (Sietz and Van Dijk, 2015). Regardless of personal attributes, individuals derive different experiences, meanings, interpretations and perceptions from the same phenomenon, ultimately triggering different decisions and/or behaviour (Hay, 2010). Considering that smallholder farmers experience CA differently, it was imperative to investigate smallholder farmers' lived experiences and perceptions within the CA innovation system in Malawi to understand why many farmers dis-adopt CA practices.

As CA is widely considered one of the most appropriate agricultural technologies for smallholder farmers in sub-Saharan Africa (Africa Congress on Conservation Agriculture, 2014; African Conservation Tillage Network, 2016; Thierfielder *et al*., 2013), strong international support has been provided towards its promotion (Pittelkow *et al*., 2015). In Malawi, the Government and other stakeholders have been actively promoting CA to solve challenges such as deteriorating soil health, erratic rainfall coupled with frequent prolonged dry spells and poor agricultural production. Although efforts in CA promotion and dissemination generate promising initial adoption figures (e.g. TLC, 2015b), studies have shown that many smallholder farmers stop using the practices after initially adopting (Andersson and Giller, 2012; Baudron *et al*., 2011; Mlamba, 2010). As farmers' experiences and perceptions have rarely been examined, very little is known about circumstances underlying CA dis-adoption decisions in smallholder farming communities.

This chapter aims to explore how and why smallholders experience and perceive CA, and their implications for dis-adoption. Specific objectives are: (1) to profile smallholder farmers involved in CA in Dowa and Lilongwe districts; (2) to investigate their lived experiences in implementing CA practices; (3) to analyse smallholder farmers' perceptions of CA and their implications for CA dis-adoption.

5.2 Methodological approach

A mixed methods approach (Tashakkori and Teddlie, 2010) involving a household questionnaire survey and focus group discussions was used during the 2015/2016 cropping season. Purposive sampling was used to identify smallholder respondents for the study (see section 3.3.2). Only smallholder farmers who had previously practised CA for at least two years but dis-adopted or those still practising CA for a minimum of two years were eligible for inclusion. According to Malawi's CA guidelines, a farmer is considered to have adopted CA if he/she continuously utilises CA practices (see section 2.5) for two years minimum, and considered to have dis-adopted if he/she stops using CA practices after initially adopting (NCATF, 2016). The NCATF definition of CA adoption/time frame employed in this research is the one widely used by Government, NGOs and other CA promoters in Malawi hence the decision to use this definition in order to make recommendations emerging from this study more relevant, meaningful and acceptable to the stakeholders.

The questionnaire was administered to 300 respondents face-to-face. The survey was used to identify suitable participants and relevant discussion topics for further probing in FGDs, thus get to the root of the underlying reasons for farmers' dis-adoption of CA practices. A total of 8 FGDs with 82 participants were conducted. Follow-up interviews with traditional leaders and extension agents were used to validate or triangulate the FGD data. Statistical Package for Social Scientists (SPSS) version 20 was used to analyse questionnaire survey data, and descriptive statistics, cross tabulations and chi-square tests were computed. Thematic analysis was used to process the qualitative data to understand from farmers' perspectives on why smallholders dis-adopt CA in Malawi.

The research question 'why' and 'how' smallholder farmers dis-adopt CA guided selection of the research design to understand complex, contemporary social phenomenon and to derive appropriate meaning within (smallholders') real-life contexts (Yin, 2004). The study was not about 'what' but focussed on answering 'why' and 'how' questions to unearth underlying reasons of dis-adoption hence this research did not seek to disaggregate study participants based on adoption categories or socio-demographic characteristics. Such disaggregation would distract from the core message emerging from the research. And, as reasons for dis-adoption were not exclusive to those that dis-adopted, aggregating experiences of both adoption categories provided broader and more robust elucidation of how smallholders eventually arrive at the decision to dis-adopt CA. Overall, the research design employed in this research was robust enough to investigate more in-depth why and how farmers dis-adopt CA hence effectively generated pathways to CA dis-adoption -see Figure 7.1 (the study's significant contribution to knowledge).

5.3 Results

This section begins by illuminating key attributes of the survey respondents, to provide necessary background and elucidate the context of smallholder study participants. The next section presents findings on respondents' lived experiences in implementing CA practices. The final section illustrates smallholder farmers' perception of CA farming.

5.3.1 Key attributes of survey respondents

Findings from the questionnaire survey show that study participants had broadly similar attributes in the two districts (Figure 5.1).

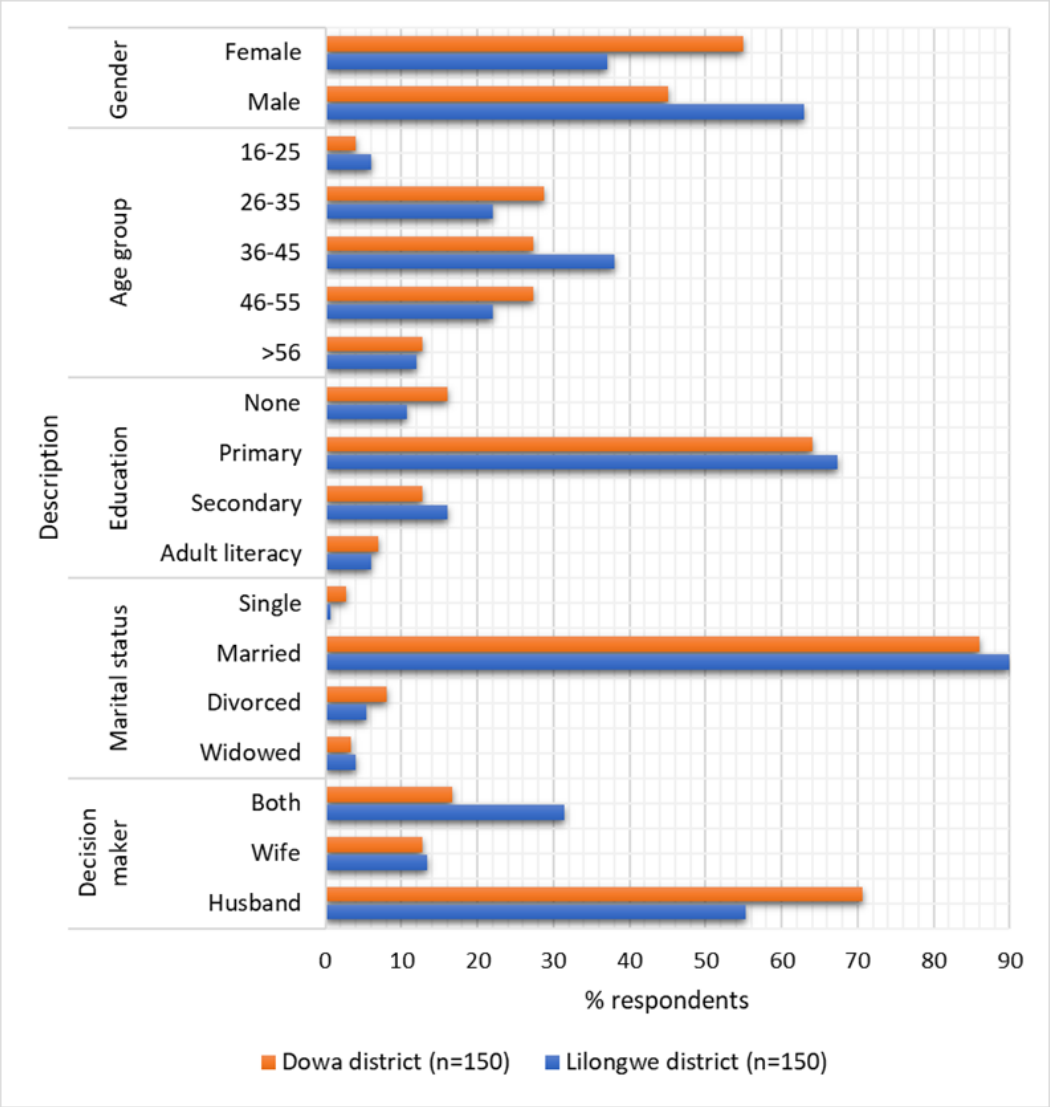


Figure 5.1: Key attributes of survey respondents in Lilongwe and Dowa districts.

A chi-square test only showed significant difference between the two districts in terms of gender of the respondents (X^2= 9.071, p=0.003), and household decision maker (X^2=9.547, p= 0.008). A similar pattern in respondents' attributes was observed between the two adoption status categories (i.e. those still practicing CA and the dis-adopted), with significant difference only observed in respondents' age (X^2= 12.657, p=0.013). Similarities in farm attributes were also observed between the districts (Figure 5.2).

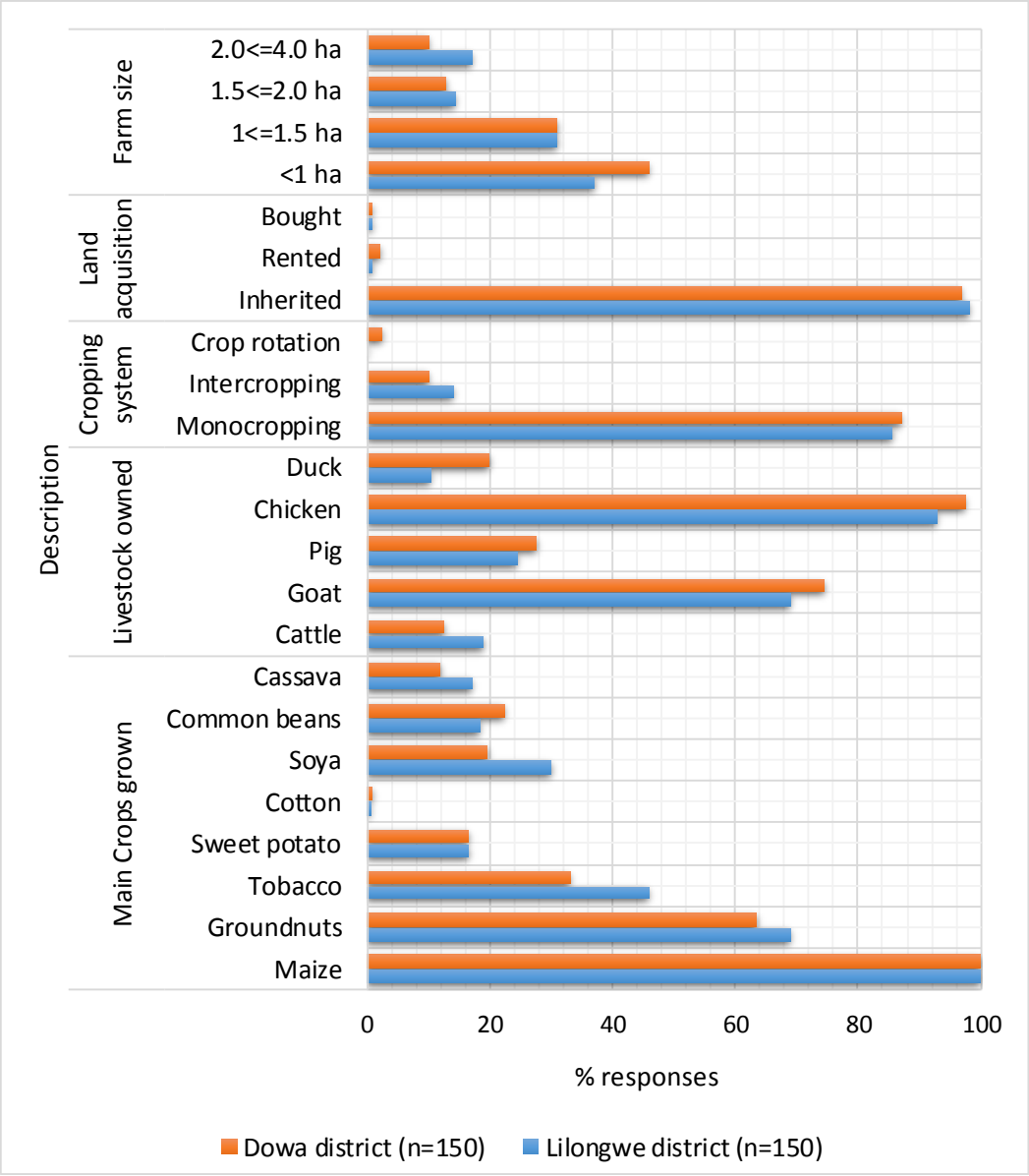


Figure 5.2: Survey respondents' farm attributes in Dowa and Lilongwe (Crops grown and livestock reared were multiple responses).

FGDs provided insights regarding the salient issues pertaining to respondents' farm attributes, some of which had implications for CA dis-adoption. Typical of a smallholder farmer in Malawi, the majority of respondents in the study districts had small farm sizes of <1ha (Figure 5.2), of which only a small portion of land was allocated to CA. Many respondents believed that the size of a CA plot was 0.01 ha (Appendix iv) as is normally the case in government CA demonstrations, also confirmed in FGDs: "*I have been hosting*

demos for five years now and every year, I am requested [by the EPA] to keep 10 x 10 m for CA" (Male, Practising, Lilongwe). Others explained that they deliberately chose not to expand their CA plots for fear of being called lazy, because culturally, hand-hoeing and keeping the farm clean showed that one is a 'hard worker'. It is debatable whether or not farmers could obtain tangible benefits from such small plots. Another notable feature was the location of the CA plot; 73% of respondents had their CA plots close to, or along a road because most farmers were keen on showing off CA to others: "*Who will admire my efforts if my CA plot is far away from the road?*" (Male, Practising, Dowa). In addition, extension staff encouraged farmers to locate their CA plots close to or along the road "*for ease of accessibility during supervision, but mainly we want maximum visibility since they [CA plots] act as [open] classrooms*" (Extension agent, Lilongwe). However, evidence suggests that distortion in extension messages, encouraging location of CA fields close to the road, probably misled farmers to believe that they could only practice CA when they had a farm by the roadside; some discontinued CA when they no longer owned their roadside farmland: "*I lost my land to that road expansion project you saw when coming here, that's how I stopped CA*" (Male, Dis-adopted, Dowa). Further probing revealed that this participant dis-adopted though he had another farm located some distance away from the road, signifying that there were other underlying reasons other than land that contributed to dis-adoption.

Monocropping was the cropping system used by 86% of the respondents with maize, being the staple food crop, grown by all. FGDs revealed that families culturally aspire to be self-sufficient in maize: "*If you don't have maize, everybody thinks that you are poor… it is cheaper to grow your own maize as it is scarce and expensive during hunger months*" (Male, Practising, Lilongwe). The emphasis on growing maize under a monocropping system, be it for cultural or food security reasons, poses challenges in advocating CA's principle of crop association. FGD participants were unanimous in pointing out that intercropping maize with food legumes was problematic, hence most resorted to monocropping despite contrary advice from extension officers. For some, food legumes reportedly attracted too many pests and/or diseases: "*I planted cowpeas last season and I had to spray*

Dimethoate™ five times between planting and podding period to get rid of aphids" (Male, Practising, Dowa). Some could not spray any chemicals due to cost and claimed to have harvested nothing, while others did not seem to know what pesticides or dosage to use. Conversely, the participants generally held the view that they harvested more from food legumes when grown as a sole crop (not intercropped) due to a better management regime, translating into more money since legumes reportedly fetched better prices than maize.

Respondents disclosed that they obtained livestock from projects that had livestock-pass-on components. Apart from keeping livestock for consumption and income purposes, FGD participants highlighted various other uses: (1) dowry or bride price (2) symbol of wealth (3) manure and (4) coping mechanism during hunger periods. Participants viewed livestock as a higher income source than CA, with some suggesting that their CA project was actually imposed on them: "*We did not initially want CA but the project officer promised to bring us livestock, so we held on until we received the [dairy] cows*" (Male, Dis-adopted, Lilongwe). Project officials fulfilled the 'promise' of bringing cows towards the end of the project and the once-CA club switched completely to a vibrant dairy club. Evidence reaffirmed that participants attached more value to livestock than CA: "*I would rather feed maize stalks to my cows than use them for CA because the reward from milk sales is pompo-pompo [instant]*" (Male, Dis-adopted, Lilongwe). The dairy enterprise seemed viable as dairy farmers were seen purchasing Rhodes grass (*Chloris gayana*) to feed their cows. Some respondents were eager to point out that they finally received what they had always wanted: livestock.

Main income sources of sampled respondents

Although agriculture was the primary source of livelihood, with all respondents involved in crop production, study participants pursued other income sources (Figure 5.3).

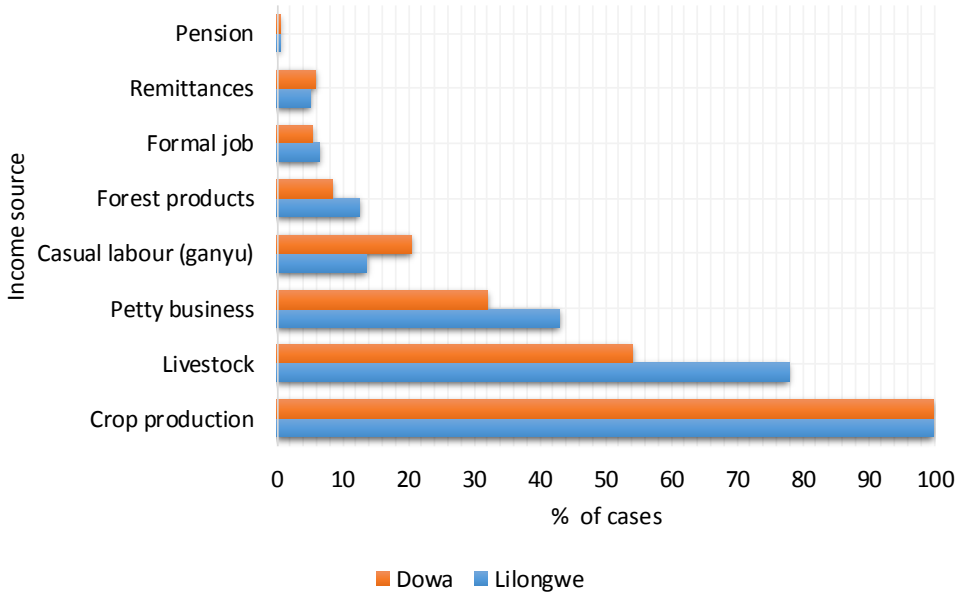


Figure 5.3: Income sources of questionnaire respondents in Lilongwe and Dowa (multiple responses).

38% of respondents boosted their livelihoods by running petty businesses: bicycle hire (*kabaza)*, ox-cart hire *(ngolo*), handcrafts, selling small dried fish (*usipa or bonya*), doughnuts (*mandasi*), fruits, locally distilled liquor (*kachasu*), brick-making, tearoom, hawker, milk vending, local butchery and/or braai business (*kanyenya*). Evidence emerged in FGDs that some farmers stopped practicing CA because it was a distraction to doing business: "*To me, CA was just too involving, it was very difficult for me to do my business and CA simultaneously"* (Female, Dis-adopted, Lilongwe). Conversely, some participants explained the usefulness of having a business venture and farming at the same time: *"Money earned from my business helps a lot to hire ganyu (casual labourers) to help in my farm"* (Male, Practising, Lilongwe). Questionnaire data revealed that 17% of the respondents did *ganyu* to survive. *Ganyu* entails all manner of on-farm or off-farm piecework payable either in cash or in kind -usually maize grain, maize bran or salt (Chinyamunyamu, 2014). It was noted in FGDs that doing *ganyu* was an important means of survival for some families especially during the leanest months: *"January and February are the most critical, I cannot do without ganyu otherwise my family will not survive the hunger"* (Male, Practising, Dowa). FGD comments show that participants who did *ganyu*

realised that working in other people's farms during such critical farming months reduced the time available to work in their own CA farms: "*I could not keep up with CA [activities] in my own farm but what else could I do for my children to survive?* (Female, Dis-adopted, Dowa). Such evidence, indicating that farmers were willing to forego CA activities in their own farms opting to do *ganyu* in other peoples' fields, suggests that farmers did not view CA as a means of addressing their immediate needs. Further, CA farming might not have helped to increase participants' food situation to a level that they no longer had to rely on *ganyu* to survive the critical hunger months.

On the whole, findings presented in this section reveal that respondents still practising CA and those that dis-adopted had largely similar social-economic attributes; no significant differences were observed in gender, education, main decision maker, farm size and marital status. Nevertheless, despite their similarities, respondents drew different experiences and perceptions from practicing CA, consistent with Hay (2010). The next section engages with smallholder farmers' experiences and perceptions in implementing CA.

5.3.2 Smallholder farmers' experiences in implementing CA

To illuminate smallholders' CA experiences, this section begins by presenting CA practices implemented by questionnaire survey participants (Figure 5.4). It goes on to explore their motivations to start CA and then highlights challenges and controversies in the implementation of CA practices.

5.3.2.1 CA practices implemented

Figure 5.4 shows specific CA practices implemented by respondents (n=300).

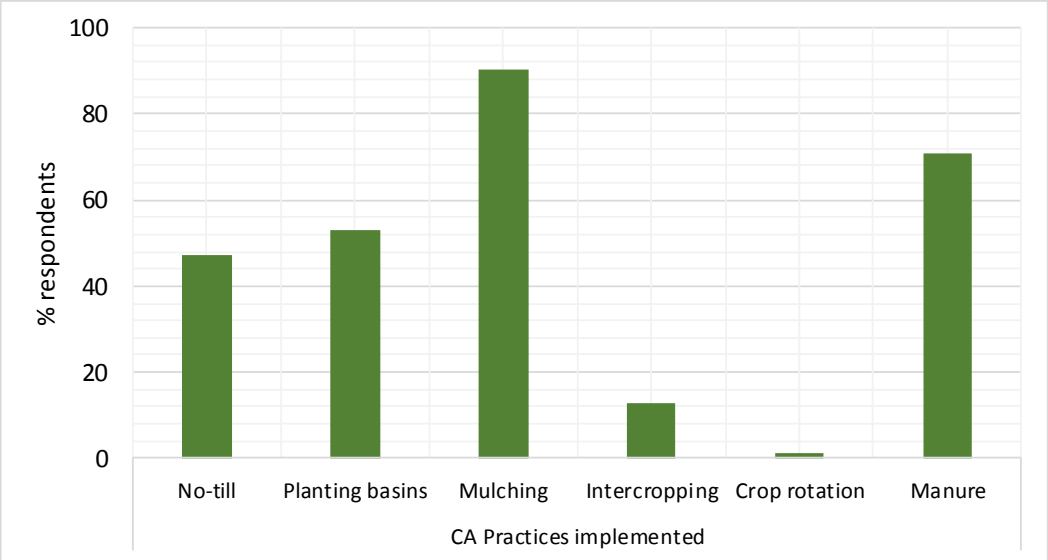


Figure 5.4: Specific CA practices implemented by respondents in Dowa and Lilongwe (multiple responses).

Findings revealed that questionnaire respondents implemented different CA practices (Figure 5.4), minimum of two per respondent. No-till and planting basins were implemented under the CA principle of minimum soil disturbance; mulching under the principle of continuous soil cover; while intercropping/rotation were implemented under crop association principle. Manure application was the most prevalent CA complementary practice.

Despite that 47% of questionnaire respondents (Figure 5.4) implemented no-till, FGDs revealed that many practised it merely because it was a requirement from project promoters: *"No-till was brought in this village by the [CA] project, we just followed what they wanted*" (Female, Dis-adopted, Lilongwe). Others commented on the contradiction of a no-till system with their tradition of clearing and ploughing land for cultivation: "*Farming has entailed clearing the farm every year, making ridges, things like that. Then the project people came saying no more tilling the soil, we should abandon our hoes*" (Male, Practising, Dowa). It was demonstrated in FGDs that tilling seemed to be entrenched in traditional belief systems: "*A good, hardworking farmer is someone whose field is properly ploughed, with ridges and kept clean*" (Male, Practising, Dowa).

5.3.2.2 Farmers' motivations to start CA

Findings show that farmers were motivated by varying reasons to start CA (Table 5.1).

Table 5.1: Farmers' main motivation for starting CA and illustrative FGD comments

Motivation	Percent of survey respondents	Illustrative FGD comments
Soil moisture retention	34	"*If the soil is well covered and you are using planting basins, the moisture stays longer in the soil and you still harvest something [averts total crop failure]*" (Female, Practising, Dowa)
Improve soil fertility	22	"*When the project people came for orientation, they promised to give fertilisers to those willing to join*" (Female, Dis-adopted, Lilongwe)
Increase yields	15	"*When the soil is fertile and contains moisture, the result [improved yield] is automatic*" (Male, Practising, Lilongwe)
Reduce labour	12	[No particular illustrative comment identified]
Peer pressure	7	"*I am the chairman of the VDC[1] so I have to do CA, otherwise people will think that I am against development"* (Male, Practising, Lilongwe)
Self-initiative	7	"*I also have land along the road, close to the CA demo plot and I did everything as shown. When the field day came, I was given literally nothing*" (Male, Dis-adopted, Lilongwe)
Control soil erosion	3	[No particular illustrative comment identified]

Source: Questionnaires (n=300) & FGDs; VDC[1]= Village Development Committee.

Aligned with their main motivation of soil moisture retention, more respondents used planting basins than no-till, and/or mulching (Figure 5.4). Use of basins was hailed across all FGDs to be effective in conserving soil moisture and preventing total crop failure under dry spells. FGDs disclosed that the main motivation for digging basins was to conserve rainwater *in-situ* with participants testifying that maize remained vibrant, and yielded relatively more from a small plot, apparently out-performing maize grown under conventional tillage: "*Me and my son dug 800 basins in our [CA] farm, the maize remained*

green throughout and we harvested 5 cart loads[5] of maize" (Female, Practising, Lilongwe). While some respondents were drawn to CA to improve soil fertility, FGD evidence suggest that such expectations were largely premised on inorganic fertilisers promised by the project rather than belief in CA itself. Yield increase was surprisingly not the main motivation mentioned for embarking on CA. Though 12% of respondents were initially motivated to start CA to reduce labour, sentiments from FGDs disclosed that this expectation was largely unfulfilled. Further, FGDs revealed that many respondents who started CA on their own expected to receive rewards and eventually felt discouraged when the project 'ignored' them.

Regardless of the underlying motivation, external input support to farmers played a key role in kick-starting CA as promoters issued various farm inputs to accelerate uptake. Questionnaire data showed that at the start of CA, respondents received different combinations of inputs namely chemical fertilisers, herbicides, hybrid seed and sprayers; 64% of the respondents received the inputs as grants, 14% government subsidy, 8% on loan while 14% bought their own inputs at commercial price. However, from year 2 onwards, a majority had to self-finance inputs as only 13% received the grants. Though respondents received incentives from CA projects, comments from FGDs showed that the amount of inputs received were very small, probably to match with the usually small CA plot sizes: "*I received 5 kg maize seed, 10 kg NPK and 15 kg Urea [fertiliser]*" (Female, Practising, Dowa). Nonetheless, FGD participants unanimously agreed that they could not use government subsidised inputs meant for their conventional tillage farms on a CA plot, as one confirmed: "*The fertiliser I obtain through FISP is for my conventional tillage [main] farm, not CA*" (Female, Practising, Lilongwe). In contrast, many admitted to using excess inputs from a CA plot on their conventional farms instead of expanding the CA area.

5.3.2.3 Challenges in implementing CA

Figure 5.5 depicts challenges encountered by survey respondents as they implemented CA practices.

[5]cart load= 300-350 kg of maize

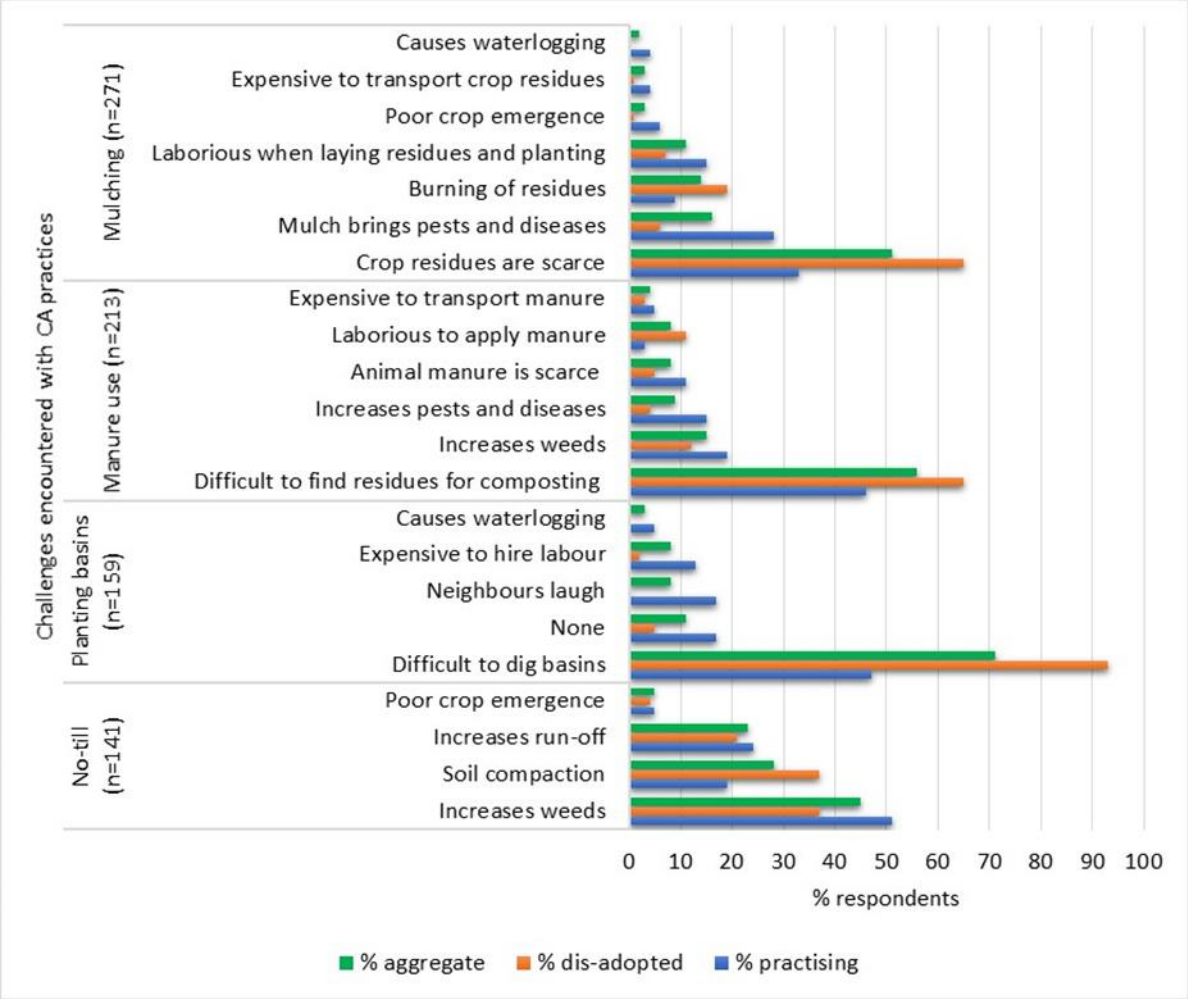


Figure 5.5: CA challenges reported by questionnaire respondents in Dowa and Lilongwe.

FGDs provided greater insights into the challenges encountered by smallholder farmers when implementing no-till, planting basins, manure, and mulching. These are now detailed in turn.

Challenges with no-till

Questionnaires and FGDs showed that respondents encountered increased weed infestation under no-till: "*In my own CA field, weeds grow excessively after harvest*" (Female, Practising, Dowa). Others observed that weeds persisted even after applying herbicides: "*When I sprayed Roundup™ [glyphosate], weeds grew even more profusely*" (Male, Dis-adopted, Lilongwe). FGD participants reported buying agrochemicals from local

agro-dealers who some suspected of malpractice; hinting that they sold expired or fake products. Hence use of such ineffective herbicides aggravated the challenge of weeds. In addition, many FGD participants indicated that they had never attended training in herbicide application and lacked the necessary expertise in handling agrochemicals, compounding the weed problem. A few respondents who failed to sustain the application of herbicides after their CA project expired experienced excessive growth of weeds in their CA fields: "*Weeds grew even more when we stopped applying herbicides"* (Female, Dis-adopted, Lilongwe).

FGDs also unearthed some conflicts between farmers' desire to intercrop maize with pumpkin and the project's requirement to apply herbicides in CA plots: *"The herbicides we sprayed killed all the weeds and my entire pumpkin crop, only the maize survived*" (Female, Dis-adopted, Dowa). Traditionally, pumpkin leaves are a popular vegetable relish (*nkhwani*) in the local diet, usually eaten with *nsima* (maize pulp) and the pumpkin itself is a vital alternative food during lean times. As respondents could not practise intercropping in CA maize plots, some reverted to conventional tillage. Further issues concerning herbicides were reported in FGDs e.g. while many lacked proper equipment (i.e. sprayers and protective clothing), some were worried about the safety of herbicides to human health and soils, others highlighted the prevailing water scarcity in their area, arguing that herbicides required a lot of water for dilution: *"My wife and daughters wake up at 3am every day and walk for a long distance to fetch water just enough for domestic use*" (Male, Practising, Dowa).

Evidence from FGDs also shows that farmers experienced soil compaction when practicing no-till: "*The soil in my [CA] plot became very dry and my hoes kept breaking"* (Male, Dis-adopted, Lilongwe). Due to the compacted soils, farmers often had to use hoes for planting and weeding purposes, though contrary to strict no-till guidelines. Some stated that shoots under no-till took longer to emerge, whilst others claimed that most of their seeds failed to germinate: "*When we planted maize in the third year, only a handful emerged*" (Female, Dis-adopted, Dowa). The participants attributed the poor crop emergence to no-till because the same stock of seed germinated well in their conventional farms where soils were tilled. Furthermore, while strict proponents of no-till discourage ploughing, ridging or

hoe-weeding, one village headman expressed reluctance to fully support CA because no-till diminished prospects of *ganyu* (piecework), which was a crucial source of income for his subjects during food shortage months.

Challenges with planting basins

Although 53% of questionnaire respondents used planting basins, FGD comments show that some farmers found constructing planting basins challenging and needed technical guidance: *"It is difficult and confusing to remember the precise procedures"* (Male, Practising, Lilongwe). While extension agents claimed that planting basins lasted three years, respondents revealed that they were digging or de-silting basins every year. Worse still, evidence showed that some projects were also recommending shallower basins to reduce drudgery, yet shallower basins silted up quickly therefore required more labour for de-silting: "*I dug my basins 30 cm x 20 cm x 15 cm and all of them disappeared the moment rains came*" (Female, Dis-adopted, Dowa). Comments showed that respondents not only had difficulties with the complexity of digging basins, but also that the recommended timing for preparing basins (May-July) interfered with important social obligations in the community. The timing clashed with the time at which most communities conduct traditional ceremonies, since households generally have relatively enough food and money: "*After harvest, it is our time to rest, have weddings, initiation ceremonies and enjoy gule wa mkulu (spiritual masked dance)"* (Female, Practising, Lilongwe). Consequently, many respondents delayed preparing basins until October, against guidelines stipulated in Malawi Government (2012), and they encountered challenges as the soil became dry and hard. Evidence showed that preparing planting basins was further compounded by lack of appropriate implements and know-how. As a result, many respondents expressed that implementing planting basins was labour demanding. Some FGD participants still found planting basins beneficial despite the challenges: "*Basins help me to harvest enough to feed my family*" (Female, Practising, Lilongwe).

Challenges with manure

Manure application was a widely implemented CA complementary practice amongst 71% of the sample, largely to offset costs of using chemical fertilisers: "*Fertiliser is very expensive so we apply a little bit [of inorganic fertiliser], and use a lot of manure*" (Female, Practising, Dowa). Many participants expressed appreciation of the benefits of applying manure as "*maize grows with vigour and develops big stalks and the cobs are also big*" (Male, Dis-adopted, Dowa). However, during FGDs, challenges associated with manure application, particularly increased weeds, surfaced regularly. Although extension agents promoted use of dung as animal manure or booster in decomposition of crop residue-based compost, FGD comments showed that farmers lacked technical know-how to properly prepare or cure manure before applying it to the field: "*I just collect cow dung from the kraal and spread it in my [CA] farm"* (Male, Practising, Dowa). Curing the dung before application was particularly necessary because originating livestock were mostly free ranging. Since the animal dung contained weed seeds, applying improperly cured dung probably increased weed infestation commonly reported in FGDs. In addition, participants attributed increased prevalence of brown leaf spot disease to manure use. Due to increased weed and disease infestation, farmers experienced increased labour demand for weeding, translating into more costs in CA than conventional tillage.

Challenges with mulching

Although mulching was implemented by the majority (90%) of respondents, findings revealed that farmers experienced many challenges with the practice, mainly due to scarcity and various competing uses of crop residues. FGDs uncovered that despite mulch materials not being readily available, the government's Department of Land Resources and Conservation (DLRC) implemented programmes that encouraged conflicting uses of crop residues; promoting composting while urging the same farmers to preserve biomass for mulching in CA: "*It's hard enough to find crop residues. I don't know whether I should follow the campaign advice [make compost] or I should just use them [crop residues] as mulch*" (Female, Practising, Lilongwe). This not only left farmers confused, but it also encouraged CA farmers to source mulch materials off-site because *in-situ* crop residues were not adequate to satisfy mulching requirements. Additionally, importing mulch into one's field

was discouraged by Malawi Government (2012) guidelines as doing so facilitates transmission of pests and diseases which could reduce CA performance. Some FGD participants' experiences seemed to validate the risks associated with biomass importation: *"I obtained maize stalks from my relatives. My maize was heavily attacked by stalk borers, I thought somebody had cast a spell"* (Male, Practising, Dowa). FGDs further revealed a lack of synergy and coherence in livestock and CA activities. Participants highlighted the irony in some CA projects promoting and distributing vetiver grass (*Chrysopogon zizanioides*) as a soil and water conservation measure, when that type of grass was not suitable for feeding livestock. As residues became scarcer, respondents in mixed crop-livestock systems preferred to use the residues to feed their livestock, therefore did not have mulch for CA. FGDs unearthed conflicts pertaining to crop residue use between livestock rearing and CA as illustrated in Box 5.1.

"*The project people are discouraging us from rearing cattle since they always insist that we leave all the crop residues for CA*" (Male, Practicing, Dowa).

"*During the rainy season, we restrict livestock movement because we have crops growing in our farms; we tether our livestock this time because there is green grass all over. But after the harvest period, the land is dry with no fodder around, if I restrict movement this time, what will the livestock feed on?"* (Traditional Chief, Lilongwe).

"*If livestock should not graze in dambos (wetlands) [because of irrigation] and should also not feed on crop residues during the dry season [because of CA], then where should they graze*?" (Male, Practicing, Lilongwe).

"*Cattle herders deliberately graze their livestock in our CA fields*" (Male, Practicing, Dowa).

Box 5.1: CA-livestock crop residue conflicts captured in Lilongwe and Dowa FGDs.

Crop residues were also used for various other purposes in the farming household which compounded the problem of residue scarcity. Figure 5.6 illustrates prevalence of competing uses of biomass in the smallholder CA communities.

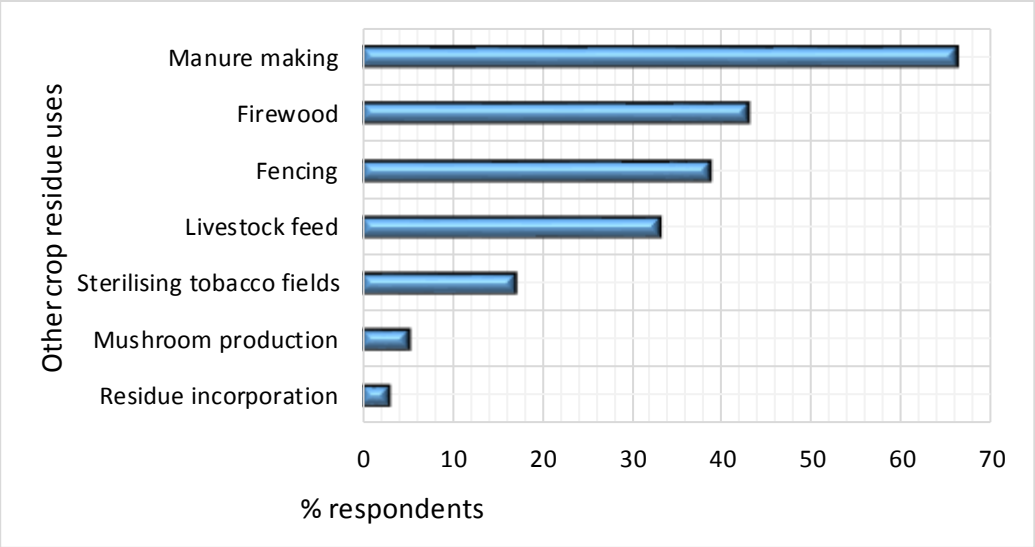


Figure 5.6: Competing uses of crop residues in Dowa and Lilongwe (multiple responses).

Since maize stalks were the main source of mulch materials for most respondents (91%), CA appeared to make the maize stalks unavailable for other important functions in the household: *"If you say just use maize stalks for CA, what else can we use for cooking?"* (Female, Practising, Dowa). Under such circumstances farmers had to prioritise: *"Priority was to find maize stalks for fencing my cassava farm to keep away goats"* (Male, Dis-adopted, Lilongwe). FGDs disclosed that many participants believed maize stalks were the only source of mulch materials, and often distorted extension messages were to blame. This intensified pressure on maize stalks; consequently, farmers prioritised the (perceived) instantly rewarding non-CA use, and often applied only very thin mulch that was less effective for CA.

Poor crop emergence under mulching was a recurring concern during FGDs though only 3% of questionnaire respondents cited it as a challenge. Evidence emerged that farmers who applied thick mulch[6] (*ulimi wa bulandi,* see Table 4.4) experienced the most severe germination problems: "*I applied a good thick mulch as advised, but most of the maize did not germinate"* (Female, Dis-adopted, Lilongwe). Across the FGDs, participants expressed concern that seed germination was often poor under mulch. Specifically, farmers described

[6] Field observations showed mulch thickness of up to 15cm with 100% ground cover

that maize was often yellowish and feeble at germination stage. This could arguably be attributed to the thick mulch creating unfavourable conditions for crop emergence. FGD comments showed that some farmers often had to replant in mulched fields, and some only persevered with CA in the hope that they would benefit from the government's farm input subsidy programme (FISP). Other participants believed that they deserved compensation for the extra resources used for re-planting: *"If government does not give us [FISP] coupons this year, we will forget CA because it is becoming more expensive*" (Male, Practising, Lilongwe). While FGD participants attributed poor seed germination to mulching, the evidence suggests that the challenge emanated from farmers' lack of technical know-how on how best to apply mulch.

Apart from technological challenges in use of mulch, farmers experienced various social challenges. CA plots covered with mulch provided a fertile breeding ground for mice which attracted mouse hunters who set fire to fields as they hunted. While providing a vital protein source to rural communities' diets (as mice kebabs), mouse hunting led to frequent loss of hard-earned mulch through deliberate fires: *"You cover the CA plot nicely with maize stalks but these mice boys just come and set everything on fire"* (Female, Practising, Dowa). Additionally, CA farmers often suffered acts of vandalism or theft of mulch: "*Some people [deliberately] set fire to maize stalks, others steal them, so the [CA] plot has to be close enough to the household to guard against that*" (Female, Practising, Dowa). This however has potential negative implications on up-scaling CA to farmers' main farms which are often situated further away from their homesteads.

Since land was mostly governed by traditional rules under customary land tenure, CA farmers failed to restrict trespassing in their fields as a means of safeguarding their mulch: "*We are all one in this village and this land is for all of us, so you cannot prohibit me or my child from stepping on your farm*" (Male, Dis-adopted, Dowa). FGDs further revealed that some people acted out of envy and deliberately burned mulch materials; therefore, some dis-adopted when they saw that they could not get help from their traditional leaders who appeared to condone anti-CA practices: *"I knew who stole my maize stalks, but when I reported him to the chief, no action was taken*" (Male, Dis-adopted, Dowa). It transpired in

FGDs that some chiefs did not act against those that stole or burned mulch probably because they (chiefs) were tobacco growers and/or owned livestock themselves; therefore, had more interest in letting crop residues be used for sterilising tobacco nurseries or feeding livestock. Due to frequent loss of mulch and the extra burden involved to replace them, some smallholders were frustrated and dis-adopted CA: "*I figured that even if I manage to replace the mulch, envious people would continue burning it, so I just stopped CA altogether"* (Male, Dis-adopted, Dowa). However, some FGD participants explained that they systematically piled their maize stalks upright in the field to safeguard them from theft or torching: "*If you gather maize stalks and leave them vertically like that, people think that the owner is a tobacco farmer so they don't vandalise*" (Male, Practising, Dowa). However, extension agents insisted that farmers had to lay crop residues in the field immediately after harvest, in order to satisfy the principle of maintaining soil cover under CA, therefore the mulch became more vulnerable to loss.

5.3.3 Farmers' perceptions of CA

FGDs revealed several dominant perceptions and narratives associated with smallholder farmers' CA dis-adoption decisions (Table 5.2). These are elucidated in more detail in the narration that follows.

Table 5.2: Dominant narratives in farmers' perceptions, illustrative FGD comments, and underlying issues

FGD comment	Dominant narrative/perception	Underlying issue(s)
"With CA, you are busy searching for maize stalks, laying mulch and guarding it, digging or de-silting basins, uprooting weeds and everything is regimented" (Female, Dis-adopted, Dowa)	CA is labour demanding and difficult to implement	Insufficient extension support; complexity of CA; distorted extension messages; ineffective engagement/ learning from farmers' CA experiences and contexts
"*CA requires many things, you need [inorganic] fertilisers, hybrid seed, others say spray herbicides. As poor as I am, how can I afford all that?* (Female, Dis-adopted, Dowa)	Implementing CA is expensive	Associating CA with expensive inputs
"*Why should I buy my own inputs when I am helping them implement their project?* (Male, Dis-adopted, Lilongwe)	Rewards/incentives prerequisite for CA implementation	Imposing CA on communities; enticing farmers with incentives
"*If a family has ten children but the mother only provides food to one child and tells the rest to fend for themselves, will they feel as being part of that family? Same with CA [projects]"* (Traditional Chief)	Unfairness/CA projects benefit lead farmers more than follower farmers	Concentrating support and resources on lead farmers, alienating followers
"If livestock should not feed on crop residues during the dry season [because of CA], then where should they graze?" (Male, Practising, Lilongwe)	CA conflicts with other livelihood options	Focus on biomass as main source of soil cover; limited integration of CA in farming systems
"*We hear on the radio, even our extension officers say that CA improves soil fertility [yield] yet for five years now, I still have to use [chemical] fertilisers otherwise the harvest is miserable*" (Male, Practising, Lilongwe)	Contradictions and unfulfilled expectations in CA	Emphasising high yields and profits in CA promotion

Although most questionnaire respondents (54%) perceived CA to be suitable, FGD comments revealed that most participants found it more labour demanding and difficult to implement than conventional farming: "*Everybody knows our traditional way of farming, but with CA, you have to do this, you have to do that, very confusing*" (Female, Practising, Dowa). Findings further reveal that inadequate extension aggravated the difficulties farmers faced in implementing CA. While many respondents (72%) required a lot of technical hands-on training to practise CA, extension support was inadequate: only 2% of the respondents were visited twice a month; 23% were visited once every month; 35% were visited once in two months; 22% were visited once the whole cropping season; and 18% did not receive any extension visits at all. Participants across FGDs expressed dissatisfaction with inadequate extension visits: "*In our section, the extension worker just came to introduce CA and has never come back since*" (Female, Dis-adopted, Dowa). A sense of frustration prevailed because many farmers did not get the necessary technical support; particularly follower farmers who felt alienated by extension officers: "*He (extension officer) is supposed to help every farmer not only lead farmers*" (Female, Practising, Lilongwe). The general sense of alienation among follower farmers drove some to dis-adopt CA, since they often expressed the view that extension officers generally concentrated their efforts helping lead farmers while they grappled with many problems including weed infestation, poor crop emergence, pests, and plant diseases when implementing CA.

In addition, follower farmers believed that CA project promoters favoured lead farmers who appeared to benefit more from implementing CA. FGDs revealed that many followers disliked the perceived favouritism of lead farmers by extension officers or project promoters: "*Imagine, our lead farmer was given a bicycle and he gets free fertilisers, seeds, an allowance but for us, what do we benefit?"* (Female, Practising, Dowa); "*We work hard, we make the extension agent and his office shine, but in return, no recognition, not even a trophy*[7]" (Male, Practising, Lilongwe). Although lead farmers justified their receiving extra

[7]Participants were reminiscing the defunct Sasakawa Global 2000 project which used to publicly reward deserving farmers with trophies, farm implements or inputs

incentives: "*Being a lead farmer is not an easy job, we train club members, compile reports and do many things for the project to move forward*" (LF, Lilongwe), followers believed it was unfair that lead farmers received a lot of incentives at their expense; this led some to make the decision to dis-adopt CA.

It was evident during FGDs that many participants believed CA was relatively expensive as it required use of farm inputs (Table 5.2). At the same time, the view that CA performance generally failed to meet expectations of increased yield and profits, as 'promised' by extension agents, was dominant in FGDs. FGD comments indicate that yield improvement in CA was mainly attributed to use of inorganic fertilisers: *"The two years I received fertilisers, I saw a big improvement in soil fertility and harvested a lot"* (Female, Dis-adopted, Lilongwe). Some participants believed they could not maintain soil fertility in CA plots without continued use of chemical fertilisers. As a result, withdrawal of input support was a contentious topic in all FGDs, with participants clearly indicating that continued implementation of CA was subject to continued provision of inputs by project promoters because they could not afford the expensive inputs.

5.4 Discussion

This chapter aimed to explore how and why smallholders experience and perceive CA, and their implications in dis-adoption in Malawi. Findings presented reveal that the experiences and perceptions derived during implementation of CA affect smallholder farmers' dis-adoption decisions. The findings further show that such experiences and perceptions are shaped by complex interactions of technological, social, institutional and economic challenges; these are discussed in greater detail in the following sections to elucidate their implications for CA dis-adoption.

FGD comments suggest that farmers were often frustrated by CA due to overwhelming technological challenges experienced during CA implementation. This elucidates implications of shortfalls in extension service delivery of organisations promoting CA which were identified in chapter 4. Given that CA is considered to be a knowledge-intensive technology (Corbeels *et al*., 2014; Mloza-Banda *et al*., 2012), smallholder farmers lacked

frequent reinforcement of appropriate knowledge and skills necessary for successful implementation of CA. FGDs revealed that lack of CA technical know-how was widespread among farmers, therefore many could not properly implement the various CA practices. For instance, while some farmers applied a thick mulch which led to incidents of waterlogging and/or poor seed germination, others used very thin mulch which escalated soil compaction leading to increased surface runoff and soil erosion. Furthermore, participants widely reported increased weed growth and greater incidences of pests and diseases in CA fields compared to their conventional tillage fields. This not only compelled farmers to require herbicides and pesticides, but arguably reduced crop yields. While some smallholders incurred extra costs buying herbicides and pesticides, others could not afford them as they were generally poor (Food Security Information Network, 2017; Malawi Government, 2006, 2013). Consequently, smallholder farmers widely found CA to be less rewarding and less attractive, therefore some dis-adopted and returned to conventional tillage. This resonates with the argument put forward by Rogers (2003) that when an innovation is perceived to be complex, the amount of 'how-to' knowledge needed for its continued adoption is much greater than less complex technologies. Thus, complexity of CA posed overwhelming technical challenges which, without adequate extension support from CA promoters, led to unfavourable experiences and dissatisfactory CA performance. This culminated into frustration prompting many to dis-adopt CA. Based on findings in this chapter, this research echoes Dougill *et al*. (2017) and Lalani *et al*. (2017) in calling for greater collaborative learning in CA promotion. Specifically, there is need to develop simplified CA configurations that take into account smallholder farmers' real capabilities and contexts. At the same time, strengthening CA extension support for smallholder farmers is paramount.

Findings herein show that social challenges associated with availability and competition for mulch materials hinder long term implementation of CA among smallholder farmers. Evidence showed that since crop residues had various competing uses in smallholder farming communities, use of crop residues in CA added pressure to a limited resource, and in the process aggravated social tensions, manifested in acts of sabotage from envious

individuals, including burning of mulch by mouse hunters and deliberate grazing of livestock in mulched CA fields. This echoes observations by Williams (2008) who reported similar constraints faced by CA farmers in Malawi. Due to lack of strong support for CA interventions from traditional leaders, who could protect CA mulch through local by-laws, farmers were usually frustrated by malicious acts, and some decided to give up CA altogether. This finding reinforces sentiments of Dorward *et al.* (2007) who call for development agents to use participatory methods to identify and effectively address smallholder farmers' constraints.

Scarcity of mulch materials, exacerbated by generally insufficient biomass yields from smallholder plots (Baudron *et al*., 2011; Giller *et al.*, 2015), forced households to prioritise or switch to alternative income sources which were perceived to deliver more and instant benefits, such as livestock or cassava; thus, CA farmers were prone to replacement discontinuance (Rogers, 2003). Moreover, sourcing extra mulch materials off-site was time consuming, costly, and was claimed to facilitate pest and disease transmission. Findings presented show that although literature suggests that multiple income sources encourage technology adoption (Mwale & Gausi, 2012; Moser & Barrett, 2003), such multiple sources may not necessarily support continued CA implementation. FGDs revealed that participants generally were unwilling to use income from other sources to buy inputs to continue implementing CA when project support ended. Since farmers are rational (Vanclay and Lawrence, 1994), they often choose to allocate resources (e.g. mulch materials) to enterprises perceived to provide greater rewards. Consequently, some abandoned CA because they perceived it to be relatively less rewarding, in spite of purported benefits in CA promotional messages.

FGD comments show that some organisations promoted no-till practices rigidly while overriding local preferrences that would define appropriate CA configurations, perhaps because no-till was the preferred CA practice of the organisation. Evidence was given indicating that some farmers implemented no-till just because it was a project requirement; otherwise they would have preferred to use planting basins as they believed that crops performed better in planting basins even when rainfall was insufficient. These

findings align with Wood *et al*.'s (2016) observation that some organisations tend to ignore local priorities or preferences in rural development interventions. The findings also confirm Dorward *et al*.'*s* (2007) assertions that change agents seldom conduct suitability assessments of interventions before implementation, and that undermines local commitment (Masangano and Mthinda, 2012). Further evidence presented in the chapter suggests that some farmers implemented the 'rigid' CA just to have access to benefits provided by the project. Since such farmers lacked genuine interest and commitment to the project, they dis-adopted when inputs or other incentives were withdrawn.

Associating CA implementation with application of high cost inputs (e.g. inorganic fertilisers, hybrid seeds, and herbicides) made farmers generally perceive CA to be expensive. Similar findings were also observed by Mlamba (2010) and Baudron *et al*. (2007). Considering that input support in CA projects was often withdrawn before farmers started reaping benefits from CA, many dis-adopted once they were weaned from input support of CA projects or when projects expired. Although CA promoters usually maintained input grants to lead farmers only for demonstration purposes, this usually fuelled squabbles in CA clubs and a sense of alienation among follower farmers who felt dis-advantaged. Consequently, many follower farmers were disgruntled and some dis-adopted CA.

Due to the various technological, social, and economic challenges, widespread disparity between promoters' CA selling points and real experiences of smallholder farmers implementing CA eroded smallholder farmers' enthusiasm for CA. While promotional messages generally claim that CA reduces production costs, labour, and time while increasing profits (Ngwira *et al*., 2012; TLC, 2015), respondents widely reported contrary experiences. For instance, respondents required more labour and time to pull weeds by hand, (re)plant seeds or apply fertiliser through surface mulch, and dig planting basins, which increased production costs. Then again, although promoters persistently advocate CA on the basis of yield increases (Thierfelder *et al*., 2016), many respondents failed to realise the 'promised' yield gains. Perhaps this is not surprising considering that other studies have reported that accrual of soil enhancement or yield benefits of CA is gradual

(Giller *et al*., 2015), and that this can make CA less appealing to subsistence farmers who typically expect quick benefits (Corbeels *et al*., 2014). These findings suggest that by CA promoters overstressing economic benefits of CA, probably to enhance the perceived appeal of CA and attract project participants (see chapter 4), it generates expectations which fail to materialise in the short-term. Since emphasising economic benefits of CA builds unrealistic expectations, farmers are disappointed when the anticipated economic benefits fail to materialise, and many dis-adopt CA to pursue other ventures.

Though often under-stated during CA promotion, evidence from this study shows that other environmental attributes of CA (e.g. soil moisture retention) are important motivations of many farmers in taking up CA. This agrees with the argument that yield improvement is rarely farmers' main rationale for adopting CA (Baudron *et al*., 2015), and the observation that farmers may still abandon CA even when research evidence associating CA with higher yields exists (Pedzisa, 2015). Considering that evidence of increased yield and incomes from CA in the short-term remains contentious (Pittelkow *et al*., 2015; Whitfield *et al*., 2015), perhaps greater incorporation of environmental benefits of CA in promotional messages would be more beneficial as it would enhance alignment of CA selling points with farmers' desire for soil and water conservation in response to frequent dry spells (Sutcliffe *et al*., 2016). In the same vein, incorporation of participatory approaches for managing climate variability under smallholder farming systems (e.g. Dorward *et al*., 2015) would be relevant considerations for CA projects.

5.5 Conclusion

This chapter has explored how and why smallholder farmers in Malawi experience and perceive CA, and their implications for CA dis-adoption. Findings show that farmers encounter various technological, social, and economic constraints which undermine their experiences in CA implementation. While various organisations promote CA as a time-saving, labour-saving and yield-enhancing technology, farmers often experience contrary outcomes. Smallholder farmers commonly encounter various challenges because they lack adequate technical know-how while extension support is generally inadequate for

successful implementation of perceived complex CA practices. These constraints generate unfavourable experiences and perceptions which often build frustration and disappointment, leading to loss of interest in CA and culminating in dis-adoption. The findings suggest that CA promoters and other stakeholders need to be attentive to smallholder farmers' experiences and perceptions in implementing CA in order to draw relevant lessons for refining CA dissemination in a way that would realistically address dis-adoption.

CHAPTER 6: The role of government policies in CA implementation in Malawi

6.1 Introduction

Though national policies shape the environment in which farmers operate (Friedrich *et al*., 2009) and impact long-term implementation of activities (Runhaar *et al*., 2006), studies have often overlooked the relevance of policies in (dis)adoption decisions (Feder *et al*., 1985; Doss, 2006). It is stipulated in the AIS that policies are a critical component in the functioning of an innovation system (Hall *et al*., 2006; Spielman and Birner, 2008). National policies are not only important in guiding national priorities and allocation of resources, but also influence on-the-ground implementation of activities (Kalaba *et al*., 2014; Lowe *et al*., 1999). There is need to understand the role of national policies in CA implementation by exposing policy linkages to institutional constraints (see chapter 4) which undermine farmers' experiences and lead to dis-adoption (see chapter 5). Of particular interest is the examination of policy integration and coherence for CA to illuminate the policy environment in which farmers are operating. Integration and coherence manifest in policy documents, actions, programmes or other institutional structures (Sharp and Richardson, 2001).

Policy integration is defined as the extent to which a social, economic or environmental objective or consideration is embeded into (national) policy (Oberthur, 2009). Research on policy integration has mostly been devoted to assessing the extent of integration of international agreements into national policies (Stringer *et al*., 2009; Nilsson *et al*., 2012; England *et al*., 2017; Atela *et al*., 2016), while globally, integration of sectoral policies remains a common challenge (Oberthur, 2009). Thus, there is considerable lack of knowledge on the integration of agricultural and environmental considerations and issues at sectoral/sub-sectoral levels (Gomar *et al*., 2014). Analysing integration of policies at lower governance levels is important to understand how policies at national level can affect agricultural technology adoption decisions at the grassroots, since this is where policy intent translates into action.

Policy coherence relates to how policies and/or their implementation arrangements interact in achieving their objectives (May *et al*., 2006). The effectiveness of policies (e.g. at national or sectoral/sub-sectoral level) is either reinforced or undermined by other policies, producing either mutually-supporting or adverse outcomes (Dixon *et al*., 2014; Lasco *et al*., 2006; Soderberg, 2008; Urwin and Jordan, 2008). In view of the importance of coherence in determining policy effectiveness, coherence has become a crucial variable in policy analysis (Atela *et al*., 2016), especially considering that implementation arrangements often involve multiple sectors and stakeholders (Chandra and Idrisova, 2011), and the need for policies and/or their implementation arrangements to be coordinated and mutually supportive (Soderberg 2008). However, research into coherence has mostly focussed on examining policies at top governance levels (e.g. Kalaba *et al*., 2014; Atela *et al*., 2016) with little scholarly attention focusing on sub-sectoral/departmental policies at lower governance levels. With CA being a multi-sectoral technology (Chinsinga and Chasukwa, 2015), exploring coherence is necessary to identify where policy statements or actions in different sectors and departments are supporting or conflicting with each other in the context of CA. As CA is associated with improving smallholder food production and building resilience to farming systems while conserving soil and water resources (FAO, 2015; Mloza-Banda and Nanthambwe, 2010), this chapter focuses on selected policies in Malawi's two key line Ministries: the Ministry of Agriculture, Irrigation and Water Development (MoAIWD) and Ministry of Natural Resources, Energy and Mining (MNREM). The aim of this chapter is to analyse the role of national policies in CA implementation, and their implications for smallholders' dis-adoption in Malawi. Specific objectives are: (1) to analyse the extent of CA integration in the agriculture and environment policy documents of Malawi; and (2) to analyse the coherence of departmental implementation strategies, guidelines and activities in the MoAIWD, and their implications for smallholder farmers' dis-adoption of CA.

6.2 Methodological approach

To adequately address the chapter objectives, a qualitative document analysis approach (Sarantakos, 2013) was used to scrutinise government policies and implementation arrangements pertaining to CA. Purposive sampling was deployed to identify documents which would provide meaningful interpretation on the role of policies in dis-adoption of CA by smallholder farmers. What matters most in the choice and sample size of text for document analysis is the "richness of textual detail" (Waitt, 2010, pp 222), its usefulness and relevance to the research objectives (Baxter and Eyles, 1997), so the study selected documents as shown in Table 6.1 for in-depth analysis. Only official Malawi government documents were sampled and were examined for integration and coherence of CA.

Table 6.1: Malawi national policy documents selected for analysis

Policy document	Responsible sector	Description	Analysis focus
National Agriculture Policy (NAP)	MoAIWD	National policy on agriculture (Malawi Government, 2016a)	integration
Agriculture Sector-wide Approach (ASWAp)	MoAIWD	Programme-based agriculture investment plan outlining the national agriculture development agenda (Malawi Government, 2010)	integration
National Environmental Policy (NEP)	MNREM	National policy on environment (Malawi Government, 2004)	integration
National Climate Change Management Policy (NCCMP)	MNREM	National policy on climate change adaptation and mitigation (Malawi Government, 2016b)	integration
Guide to Agricultural Production and Natural Resources Management in Malawi (GAPNRM)	MoAIWD (all departments in the Ministry)	Departmental guidelines on good agriculture practices in Malawi (Malawi Government, 2012)	coherence
Guidelines for Implementing CA in Malawi (GICAM)	MoAIWD	National guidelines on CA implementation in Malawi (NCATF, 2016)	coherence

Policy documents were analysed using thematic content analysis (Bryman, 2016), which is a commonly used method for analysing textual data (Creswell, 2009; Hay, 2010). The researcher critically examined both the manifest and latent content (Sarantakos, 2013) to decipher appropriate meaning and significance of the text in the selected documentary materials (Scott, 1990; Mogalakwe, 2009). Analysis of CA integration entailed systematically examining dominant narratives in the national sectoral policy documents (Table 6.1) to establish the presence, prominence and context in which CA appears in the

text. Criteria for assessing the extent of CA integration into policy documents were adapted from Mwase *et al*. (2014), shown in Table 6.2.

Table 6.2: CA integration assessment criteria

Rating	Description
Very weak	CA completely absent in the policy document
Weak	The policy does not explicitly mention CA but some aspects related to CA are specified
Moderate	CA explicitly specified only in policy strategies and/or implementation plan
Strong	CA explicitly specified in policy objectives, strategies and monitoring and evaluation framework
Very strong	CA explicitly specified in policy objectives, strategies, monitoring and evaluation framework and funding mechanism

Policy coherence was analysed through the perspective of policy interaction (Nilsson *et al*., 2012; Young, 2002). This entailed analysing CA guidelines (NCATF, 2016) and implementation strategies derived from the Guide to Agricultural Production and Natural Resources Management, which contains the 'how-to' technical knowledge from all departments in the MoAIWD and is the reference manual for extension officers (Malawi Government, 2012). Interactions and consistency of implementation strategies, guidelines and activities were examined to determine their relationship with CA implementation. This entailed first compiling an inventory of strategies and activities from the selected documents, from which a screening matrix was developed. The next step was to isolate strategies and activities relevant to CA implementation, and to examine key interactions. Coherence or conflict with CA implementation was illustrated using criteria adapted from Nilsson *et al*. (2012) and Oberthur and Gehring (2006) denoted as: (1) positive - where departmental activities support CA implementation (2) negative - where activities undermine or conflict with CA implementation or (3) neutral - where no clear effect on CA implementation was established. Data on key outcomes was displayed qualitatively to elucidate whether or not the policy implementation arrangements were mutually

reinforcing, impeding or contradicting implementation of CA in Malawi and implicated in smallholders' dis-adoption.

6.3 Results

Findings pertaining to CA integration in selected policies are presented first, highlighting the extent of CA integration, gaps and/or missed opportunities for enhancing integration. The subsequent segment presents findings on coherence of departmental policy documents, revealing conflicts and contradictions with CA implementation.

6.3.1 CA integration in policy documents

CA integration in agriculture policy documents (NAP and ASWAp) was only moderate, while environment policies ranked weak and strong for NEP and NCCMP respectively (Table 6.3).

Table 6.3: Extent of CA integration in the agriculture and environment policy documents

	Extent of CA integration					
Policy	Very weak	Weak	Moderate	Strong	Very strong	Remarks on CA
NAP			X			Not emphasised
ASWAp			X			Not emphasised
NEP		X				Not explicitly mentioned
NCCMP				X		Emphasised

Key: NAP= National Agriculture Policy (2016)[8], ASWAp= Agriculture Sector-Wide Approach (2010), NEP= National Environment Policy (2004), NCCCMP= National Climate Change and Management Policy (2016)

CA is moderately integrated in the NAP and only appears at the lower level of the policy, in implementation plans, under "*promoting investments in climate smart agriculture and sustainable land and water management including integrated soil fertility management and conservation and utilisation of Malawi's rich agrobiodiversity"* (Malawi Government, 2016a). An absence of CA in broader policy statements (goals, objectives and priority areas) of the NAP demonstrates that CA is not anchored sufficiently for resource allocation as a

[8] Year published

priority sectoral strategy. This suggests that CA lacks political recognition and support at the national governance level. Considering that no funding mechanisms are outlined in the NAP, availability of finances and other resources for implementing CA activities on the ground is uncertain.

The NAP's implementation plan has overlooked the role of several key stakeholders in the CA innovation system such as Departments of Crops Production (DCP), Animal Health and Livestock Development (DAHLD), Irrigation Services (DIS) and Environmental Affairs (EAD); academic experts, CGIAR and the private sector (e.g. seed companies and agro-dealers). This questions the level of inclusiveness and involvement of other stakeholders in the formulation of the policy. Only a few organisations have been mentioned as having a role in the implementation of CA: the MoAIWD's three departments of Land Resources and Conservation (DLRC), Agricultural Extension Services (DAES) and Agricultural Research Services (DARS), NGOs and farmers' organisations. Excluding such important stakeholders is likely to lead to disjointed efforts in CA and raises the likelihood of both political and practical contradictions among stakeholders in CA dissemination and implementation, negatively affecting the operating environment of farmers.

Although the NAP recognises the need for sustainable management of land and water resources to accomplish improved and resilient socio-economic growth and agricultural development, there is only superficial incorporation of CA. With commercialisation of the smallholder sector as a central theme, the policy has given prominence to supply of inorganic fertilisers and other agrochemicals, improved crop and livestock breeds, and has minimised the role of sustainable land management (SLM) practices such as CA. The new NAP was launched in 2016 with the overall goal "*to achieve sustainable agricultural transformation that will result in significant growth of the agriculture sector, increased incomes for farming households, improved food and nutrition security for all Malawians and increased agricultural exports"* (Malawi Government, 2016a). Nonetheless, the policy acknowledges that poor management of land, soil and water are threatening food security and nutrition efforts and acknowledges low adoption of agricultural technologies amongst smallholder farmers as limiting the sector's performance. Monitoring indicators for CA in

the NAP are stated as average yield increases of maize, rice, tobacco, legumes, sunflower, sorghum, millet, cassava and potatoes- which do not relate to CA explicitly. As such, tracking the real progress of CA is problematic, underscoring the lack of CA focus in national implementation plans.

Similar to the NAP, integration of CA in the ASWAp policy document is moderate with deficient implementation arrangements. The ASWAp articulates the purpose of CA as to: *"increase soil water and nutrient buffer capacity to ensure higher productivity of rain-fed crops"* (Malawi Government, 2010). However, this projects a narrow focus of the role of CA in increasing agricultural production as it associates CA to rain-fed agriculture and obscures the broader role of CA in irrigation farming. Such a limited focus constrains CA integration in the agricultural policies, evident in that although the ASWAp acknowledges that sustainable land and water management (SLWM) is crucial to attaining sustained agricultural production, the role of CA in SLWM is not clearly mentioned. In addition, despite ASWAP's stated rationale: "*to better coordinate and harmonise investments to increase agricultural production, food security and incomes of rural masses"* (Malawi Government, 2010), crucial stakeholders have been overlooked in CA implementation, just as in the NAP. The ASWAp is regarded as a comprehensive programme and investment budgetary framework that guides government, development partners and other stakeholders on national agricultural priorities. The government adopted the principal elements and priorities of the African Union's Comprehensive African Agriculture Development Programme (CAADP) (NEPAD, 2009), forming the basis for ASWAp which operationalises the NAP (Malawi Government, 2016a). The main aim is to "*increase productivity and growth in the agricultural sector by at least 6% annually"* (Malawi Government, 2010). The ASWAp identifies agriculture as the driver of the country's economy and recognises food security as a pre-requisite for economic growth and wealth creation. The policy has therefore placed emphasis on increasing maize productivity as a key strategy for achieving food security. Consequently, national priorities and resources have been heavily biased towards this strategy (Chinsinga, 2011) at the expense of sustainable land management strategies. Accordingly, the ASWAp advocates intensifying

use of inorganic fertilisers, hybrid crop varieties, herbicides and pesticides to increase and stabilise maize production and to stimulate smallholder agricultural commercialisation and exports (Malawi Government, 2010). However, the technologies being intensified constitute high-input farming (see chapter 5) and put doubt on the achievement of the policy outcome without the emphasis on sustainable land and water management practices, given the frequent dry spells (FANRPAN, 2014; Sutcliffe *et al*., 2016). Considering that funding for ASWAp is heavily reliant on international donor aid (Mazunda, 2013), implementation and sustainability of activities is uncertain, especially taking into account the country's zero-aid national budgeting system (Malawi Government, 2015; Burtscher *et al*., 2013).

CA integration in the NEP is weak. Although the policy acknowledges that increasing agricultural production requires the promotion of recommended and sustainable farming techniques to farmers, it does not explicitly mention CA nor specify farming techniques in its agriculture sector strategies. Notably, the NEP was formulated at a time when awareness of CA in the country's policy formulation arena was low, and growing momentum of climate change especially in the international arena has since steadily enhanced recognition of CA as an adaptation and mitigation strategy (Mwase *et al*., 2014). The rationale of NEP is to integrate environmental considerations in all social and economic development sectors to achieve sustainable development, and the main goal is "*to promote sustainable social and economic development through sound management of the environment and natural resources"* (Malawi Government, 2004). The NEP therefore seeks to provide guidance and set standards for all relevant sectoral policies in environment and natural resources to ensure their consistency with sustainable development principles. The NEP's over-arching strategy for the agriculture sector is to encourage sustainable crop and livestock production, recognising that poverty and food insecurity are some of the root causes of environmental degradation in Malawi (Malawi Government, 2004). In its guiding principles, the policy highlights research and dissemination of appropriate and sustainable technologies to attain long-term self-sufficiency in food, fuel wood and other energy requirements, however specific technologies are not identified.

There is a strong integration of CA in the NCCMP, present both at the higher and lower levels of the policy, albeit more predominant under climate change mitigation rather than adaptation, where CA is merely implicit. The NCCMP has set clear CA indicators with an ambitious target to increase the area under CA by 600 hectares by the year 2020, and the mitigation output of increased below-ground and above-ground carbon sinks, yet no funding mechanisms are stipulated. The NCCMP's main goal is "*to promote climate change adaptation, mitigation, technology transfer and capacity building for sustainable livelihoods through green economy measures"* (Malawi Government, 2016b). The policy acknowledges that natural resources and the environment play a significant role in the social and economic development of Malawi. It also recognises the vulnerability of the country's ecosystems to climate change impacts and thus seeks to integrate environmental issues in all sectors to achieve sustainable development. Although the NCCMP endeavours to harmonise and enhance coordinated climate-resilient planning and development, financing and implementation of climate change initiatives and programmes in all relevant sectors including the agriculture sector, the policy has not outlined coordination mechanisms with the MoAIWD, which is the Ministry mandated to implement all agricultural-related programmes and activities in the country. This shows that despite apparent strong CA integration in the NCCMP, linkages to mechanisms for translating policy into action are weak, thus diminishing commitment to actual implementation of planned CA activities.

6.3.3.1 CA gaps and/or missed opportunities in the policy documents

Table 6.4 shows gaps and missed opportunities for integrating CA in key thematic areas, further discussed in the sections that follow.

Table 6.4: CA missed opportunities and gaps in key thematic policy areas

Key thematic area	Policy			
	NAP	ASWAP	NEP	NCCMP
Food security	*x*	x	x	x
Agricultural risk management	*x*	x	x	x
Catchment restoration and conservation	*x*	x	x	x
Irrigation and rainwater harvesting	*x*	x	x	x
Research and technology transfer	*x*	x	x	o
Soil health	*o*	o	x	o

Key: *x = gap identified*
o = no gap identified

Findings reveal that in both agriculture and environment policies, CA was only considered in the narrow perspective as a farm-level intervention for producing crops under rain-fed agriculture. The broader role and potential of CA in many policy areas was not recognised. For instance, under the priority area of food security, the NAP has not included CA among the strategies but focuses on increasing the use of inorganic fertilisers, improved crop varieties, herbicides and pesticides. CA has space in this priority area as one of the sustainable land and water management strategies, since these are pre-requisite to any sustainable agricultural production system (Mloza-Banda, 2011; Mwase *et al*., 2013)**.** Further, both the NAP and ASWAp identify attaining maize self-sufficiency as a priority in the national development agenda: "*there has been emphasis on increasing maize production to achieve food security in Malawi*" (Malawi Government, 2016a), but have excluded CA as a strategy in the food and nutrition security priority area despite its potential to improve yields (FAO, 2015; Ngwira *et al*., 2012b; Thierfelder *et al*., 2016; TLC, 2015) and thus contribute to food security. Intensification of chemical fertiliser use and other green revolution technologies is not only deemed expensive by poor smallholder farmers (see chapter 5), but is also less likely to achieve long lasting impact independent of sustainable land and water management techniques, such as CA.

CA has an important role to play in irrigation by improving water infiltration and water holding capacity of soil while reducing surface runoff and soil erosion through the principles

of permanent soil cover and minimum soil disturbance (Friedrich and Kassam, 2009; Njira and Nabwami, 2013a). Despite CA's exclusion within the sustainable irrigation development priority area, the important role of CA is obvious, more so considering that siltation of rivers/streams coupled with reduced flows particularly during the dry season and moisture stress in crops are constantly reported as challenges encountered in most irrigation schemes in Malawi (Department of Irrigation Services, 2010 and 2015).

Though development partners such as FAO and others regard CA as an adaptation strategy to prolonged dry spells and weather variability in general, CA is conspicuously missing in relevant policy areas such as in the NCCMP's climate change adaptation component, the NAP agricultural risk management priority area, and ASWAp's climate change sub-component. For managing agricultural risk, the policies have only prioritised strategies such as: increasing adoption of drought tolerant crop varieties, promoting weather-index crop and livestock insurance and early warning systems, strengthening commodity exchange systems and rainwater harvesting. In Malawi, rain water harvesting implies construction of physical structures such as dams and underground or above-ground water tanks (RHAM, 2013), not necessarily CA. This means that CA is excluded from resources allocated for rain water harvesting especially if it is not specifically mentioned in the policy area. Nonetheless, in conjunction with other agricultural risk-combating interventions, CA has the potential to capture and conserve rainfall *in-situ*, recharge ground water, thereby maintaining the water table within the root zone. This can prevent total crop failure especially in drought prone areas (NCATF, 2016; Thierfelder *et al*., 2013).

CA is not mentioned among the policy priority research areas, despite the many challenges and controversies associated with its implementation (see chapter 5). Evidence in the literature suggests a growing need for adaptive research to enhance the performance of, and contextualise CA to different agro-ecological and social contexts (Whitfield *et al*., 2014). The NAP policy statement on research aims to "*establish effective, demand-driven agricultural innovation systems for research and technology generation and dissemination*" (Malawi Government, 2016a), however implementation strategies are focusing on developing new, high yielding, disease-resistant, and drought-tolerant crop varieties. Thus,

a gap exists for incorporating CA in the agricultural research agenda, including adaptive research and performance evaluation of technologies already developed and disseminated to smallholder farmers to enhance understanding of interactions among technological, social, political and environmental factors in adoption and dis-adoption decision processes (Baudron *et al*., 2015; Twomlow and Delve, 2016). This would enable researchers and practitioners to obtain valuable evidence required to customise technologies to local contexts, necessary for enhanced and sustained adoption of agricultural innovations among smallholder farmers.

Opportunities for stronger CA integration are not captured in the NCCMP as well as NEP strategies such as those targeting integrated catchment management to reduce siltation in rivers and lakes, prevention and/or rehabilitation of degraded land and catchment areas, minimising environmental impacts of cultivation, promotion of water retention technologies, restoration of ecosystems and biodiversity, promotion of vegetative cover and research into climate resilient land use practices and soil water conservation measures. Despite the NCCMP's acknowledgement that food security and nutrition status of households are pre-requisites to conservation and sustainable management of the environment and natural resources, CA's presence is largely in the context of removal or reduction of greenhouse gases.

Findings herein show that CA integration is moderate in the two main agricultural policy documents (NAP and ASWAp), weak in the NEP and strong in the NCCMP. In the NAP and ASWAp, CA has only been included in implementation activities, but is not visible in broader policy objectives and priorities. Absence of CA in the broad policy direction (goals, priority areas and objectives), especially in the agriculture policy documents, threatens CA's ability to solicit top-level backing upstream where the nation's decisions on priorities and resource allocation are made. Although CA integration in the NCCMP appears strong, linkages to the key implementing partner (MoAIWD) are not clearly defined. Relevant stakeholders have been excluded in all policy documents' implementation plans, despite collaboration rhetoric in the sectors. Findings have further shown that monitoring mechanisms are not specific for CA in the key agriculture policy and funding arrangements

are uncertain. Insufficient integration of CA has further been exemplified by a prevalence of gaps in key policy areas, illustrating the narrow perspective of CA inclusion in the policies, and revealing missed opportunities for further enhancing CA integration.

6.3.2 Coherence of departmental strategies in the MoAIWD with CA

Results of the analysis of coherence of departmental strategies of the MoAIWD unveiled both positive and negative interactions in CA implementation (Table 6.5). The departmental strategies, derived from the Guide to Agricultural Production and Natural Resources Management (GAPNRM) manual (Malawi Government, 2012), are anchored in the NAP, which is itself operationalised through the ASWAp (Malawi Government, 2016a).

Table 6.5: Key interactions between MoAIWD departmental strategies and CA implementation

Department	Strategy being promoted	Interaction with CA
DCP	Tractor hire ploughs, ridgers & cultivators	-ve
	Oxen hire ploughs & ridgers	-ve
	Herbicides and pesticides	+ve/-ve
	Chemical fertilisers & hybrid seed	+ve/-ve
	Crop diversification	+ve
	Sasakawa planting method	-ve
	Deep ploughing & ridges	-ve
DAHLD	Crop residues for livestock feed	-ve
	Improved pastures	+ve
	Off-pasture grazing	-ve
	Stall feeding	+ve/-ve
DLRC[9]	Planting ridges (tied/box ridges, ridge alignment contour ridging)	-ve
	Crop residue incorporation	-ve
	Minimum tillage	+ve
	Cover crops & mulching	+ve
	Compost manure	+ve/-ve
	Agroforestry	+ve
	Planting basins	+ve
	Vetiver hedgerows	+ve/-ve
	Herbicides	+ve/-ve
DAES	Lead farmer approach	+ve/-ve

Key: DCP= Department of Crop Production; DAHLD= Department of Animal Health and Livestock Development; DLRC= Department of Land Resources and Conservation; DAES= Department of Agricultural Extension Services
+ve= positive interaction; -ve= negative and/or conflicting interaction

Table 6.5 illustrates that numerous strategies exist across key departments of the MoAIWD that are incoherent with CA due to their negative interaction with CA principles and/or social-economic aspects of CA implementation. In addition, some strategies though apparently positive, have the potential to exert negative impacts on CA if poorly designed and executed, thus carrying a risk of undermining CA promotion and implementation efforts.

[9] host department for CA

Promotion of conventional tillage strategies by the DCP and DLRC stands in conflict with the minimum soil disturbance pillar of CA. One of the national priority areas, to facilitate agricultural development as stated in the NAP, is to intensify farm mechanisation hence the promotion of tractor and animal-drawn ploughs, ridgers and cultivators by the DCP, being the host department of tractor and oxen hire programmes (Malawi Government, 2015a). Also, the DLRC is self-conflicting as it simultaneously promotes tillage practices such as contour, marker and tied/box ridges as soil and water conservation measures and CA (Table 6.5). Ploughing and ridging involve turning the soil every season and have been the benchmark of the agriculture policy since the colonial era (Nanthambwe and Mulenga, 1999). While promotion of farm machinery is well intended to reduce the labour burden on farmers (Friedrich and Kassam, 2009), exclusion of CA compatible equipment such as soil rippers and specialised planting equipment in the NAP mechanisation strategy, in addition to the department's promotion of conventional tillage practices, promulgate conflicting signals to extension agents and CA farmers, thereby undermining CA implementation efforts, despite CA being part of the national agricultural development strategy.

The DAHLD strategy of emphasising preservation of crop residues for livestock feed as indicated in the GAPNRM: "*collect, stack crop residues and protect them by thorn bush barriers"* (Malawi Government, 2012), constrains crop residue supply for CA farmers particularly in mixed crop-livestock systems. Although vetiver grass is considered appropriate for soil and water conservation purposes (Malawi Government, 2012), it is deemed unsuitable for livestock feeding as compared to alternatives such as Rhodes grass (*Chloris gayana*) or Napier grass *(Pennisetum purpureum)* (Gondwe, 2015), hence its promotion by the DLRC intensifies conflicts over crop residues between livestock and CA. The DLRC also exacerbates competition for crop residues by promoting residue incorporation (to make compost *in-situ*), limiting the availability of mulch materials and undermining CA's principle of continuous soil cover as farmers resort to applying very thin mulch (see chapter 5). While compost manure is useful in improving soil health (Mereu *et al*., 2018; Njira and Nabwami, 2013b), the strategy can reduce the availability of crop

residues for CA mulching (see chapter 5) especially under smallholder farming conditions which mostly produce insufficient biomass (Andersson and D'Souza, 2014; Baudron *et al*., 2011). Negative interactions of applying compost manure and crop residue mulch highlight the need to explore alternative strategies (such as liquid manure or cover crops) capable of minimising (unintended) negative consequences while enhancing CA synergistic interactions in the smallholder farming system.

While the sasakawa planting method is promoted by the DCP to optimise plant population and increase crop yield per unit area, the strategy produces negative signals for mixed cropping because it encourages pure maize stand (monocropping). Promotion of the sasakawa method of planting, locally known as the 'one-one' planting method (Malawi Government, 2012) not only undermines the crop association pillar of CA but also sends conflicting signals to CA farmers who are simultaneously advised by the DLRC to adopt intercropping in CA systems. This suggests that coordination between the DCP and DLRC is deficient, hence the propagation of inconsistent and incoherent strategies. Under such circumstances, extension messages disseminated to farmers are likely to be conflicting as departments push their agendas without synchronising with each other's strategies. This leads to confusion among smallholder farmers (see chapters 4 and 5). In addition, other departmental strategies such as intensifying the use of chemical fertilisers, hybrid seed, herbicides and other agrochemicals, to improve and stabilise agricultural production, carry the risk of precipitating economic constraints among CA farmers if not properly designed and executed, and thus negatively impacting CA implementation (see chapter 5).

6.3.4. Incoherence of Malawi's CA guidelines

Although the CA guidelines are meant to "*harmonise extension messages and minimise confusion and controversy over the definition and practice of CA in Malawi*" (NCATF, 2016), inconsistencies and contradictions exist (Table 6.6).

Table 6.6: Incoherencies, controversy and contradictions in Malawi's CA guidelines

Extract from the CA manual (NCATF, 2016)	Elucidation/Remarks
"CA produces higher and more stable yields under variable rainfall" (p3)	Yield increases under CA take time (>5 years). May raise false expectations particularly among smallholder farmers who largely expect immediate benefits.
"Achieving the benefits of CA necessitates the adoption of practices that require a break in cultural norms such as ploughing, ridging and keeping the fields completely clean" (p3)	Inconsistent with other pronouncement in the same document stating that "*one of the attractive features of CA is …. compatibility with common methods of planting"* (p8)
"Minimum soil disturbance[10] is fundamental and non-negotiable" p9	Inconsistent with document sentiments of the need for flexibility to adapt CA to local circumstances and farmer preferences: *"adapt CA with farmer-specific circumstances"* p29, and *"adapting a technology to their specific needs and circumstances is crucial to attract interest in adoption"* (p28)
CA's effectiveness, simplicity and affordability without explicit needs for inputs and tools is a key feature to attract adoption" (p8)	Conflicts with another section of the same guidelines which has included inorganic fertilisers, hybrid varieties, herbicides, jab planters and soil rippers in "*Malawi's system of CA"* (p9); these inputs are deemed expensive by smallholder farmers who also perceive CA to be complex (see chapter 5)

Although the NCATF guidelines acknowledge that "*CA is a soil and water conservation practice rather than a soil fertility practice per se*" (p14), they simultaneously offer contradicting sentiments which seem to discourage the use of planting basins, the most appropriate *in-situ* water conservation practice for the Malawi context (Malawi Government, 2012; Twomlow *et al*., 2008). While emphasising no-till systems, the guidelines have amplified negative aspects of planting basins while down-playing their benefits: *"Digging planting basins involves significant soil disturbance and labour for*

[10] Refers to no-till system

digging"(p 15), and "*In Malawi...the added value of water conservation in basins has not been established against the high labour cost of digging basins" (p55).* Consequently, planting basins have been excluded from the frame of "*Malawi's system of CA*" (p9). Such inconsistencies not only confuse CA practitioners, but also conflict with farmers' motivations to harvest rainwater *in-situ,* especially in the wake of frequent dry spells (see chapter 5). In addition, research needs identified in the CA manual have only listed economic benefits of CA and biophysical factors as areas of study "*to provide evidence of its performance*" (p29), and have overlooked social-cultural and institutional aspects that can help in understanding farmers' adoption, up-scaling or dis-adoption decisions. In-depth knowledge derived from such analyses will be useful in modifying or tailoring CA projects to farmers' unique conditions in order for CA's sustained adoption/ up-scaling to materialise.

Findings in this chapter show that insufficient CA integration in the agriculture and environment sectoral policies, and lack of coherence for CA in agricultural department strategies, are linked to institutional constraints which undermine the environment in which smallholder farmers implement CA and constrain the continued adoption of CA practices.

6.4 Discussion

Although CA is a dominant rhetoric in agricultural development in Malawi, its integration in the NAP remains weak. Findings in this chapter reveal inadequate integration of CA particularly in the agricultural policies, despite stated intentions of promoting SLM as a means of achieving sustainable agriculture production and resilient socio-economic development. Considering that Malawi government annual budgets are finalised at the national level at the Ministry headquarters, where national objectives and strategies get re-prioritised following numerous prioritisations at lower levels of government (see chapter 4), weak integration obscures CA from national priority funding. Therefore, even though CA features at lower policy levels in implementation plans, poor allocation of resources is inevitable (see chapter 4), and that undermines implementation on the ground

(Kaimowitz, 2003; Lasco *et al*., 2006). As argued by Lasco *et al*. (2006), policy strategies and actions that are prioritised at national policy level stand a better chance of being implemented due to their high priority at the top level of governance since sufficient financial as well as technical resources are allocated. Thus, CA's low priority at the top governance level explains why inadequate financial and human resources for carrying out CA activities feature as one of the commonly cited institutional constraints in CA implementation (see chapter 4).

Although the environment policy, namely the NCCMP, has integrated CA, linkages with the agricultural Ministry are poor. While CA integration in the NCCMP appears strong, lack of formal coordination mechanisms between agricultural and environment policies jeopardises translation of agricultural (CA) strategies in the NCCMP into action. The MNREM does not have the mandate to implement CA nor the structural means to directly reach out to farmers and thus has to rely on the MoAIWD. This suggests that despite the apparent strong presence of CA, the NCCMP has no capacity to carry out the CA plans therefore seems to be mere policy rhetoric or a case of '*much ado about nothing'* (Soderberg, 2008). Since lack of mechanisms to implement joint actions are commonplace in developing countries (Gomar *et al*., 2014; Stringer *et al*., 2014), weak linkages between agricultural and environmental policies undermine incorporation of CA strategies, resource availability and efficiency between the environment and agriculture sectors. Further, considering that the MoAIWD comprises six technical departments (see chapter 4), coordination is fundamental for effective implementation of policy objectives, as outcomes of a policy (e.g. sustainable land management or sustainable food production) are a sum of all decisions, policies and actions from more than one government agency (Willows and Connell, 2003; Glasbergen, 1996).

Narrow perspectives on CA in the agricultural and environmental policies, where CA is mainly viewed as a farm level technology for rain-fed agricultural production, have restricted inclusion of CA in other relevant policy areas. The limited awareness of CA and its broader application in agriculture and environment sectors signifies weak collaboration among researchers, practitioners and policy makers within the CA innovation system (see

section 4.3.3.4) hence the constricted CA focus. This has hindered broader integration of CA in key policies and undermined potential to demonstrate multiple functionality of CA, thereby diminishing its stature in the policy arena. Strengthening stakeholder collaboration within the CA innovation system and greater advocacy in policy are thus paramount in deepening CA awareness and integration (Dougill *et al*., 2017).

Weak incorporation of CA in the government's research agenda of key policies has conceded the research function to NGOs, which arguably have a limited and potentially biased research agenda (Wood *et al*., 2016). This has compromised availability of local, independent research evidence to inform CA implementation, considering that CA research is locally dominated by a few NGOs (e.g. Total Land Care and Concern Worldwide), funded by international donor agencies. For instance, the CA guidelines for Malawi, endorsed and adopted by the national conservation agriculture task force (NCATF) and the MoAIWD, are a mirror image of Total Land Care's CA implementation guidelines and approach (see TLC, 2015). Overreliance on NGOs' evidence, which is primarily generated to serve their own organisational interests, potentially undermines stakeholder consensus in development of a robust and widely acceptable national CA policy.

Focus of the government's research agenda is to develop new varieties that are drought tolerant, disease resistant and high yielding in response to challenges of declining agricultural productivity and weather-related risks (Malawi Government, 2016a). Without highlighting CA research in the policies, resource mobilisation would be daunting, despite wide acknowledgement in the literature of the need for more research to adapt and contextualise CA to achieve sustained adoption (Twomlow and Delve, 2016; Baudron *et al*., 2015; Andersson and D'Souza, 2014; Whitfield *et al*., 2014). In the Malawi CA guidelines, a narrow research agenda, focused on biophysical and economic analyses to support the efficacy of CA, has overlooked the important role of participatory and interdisciplinary social and political-institutional aspects of CA, which are crucial for sustaining adoption among smallholder farmers (Friedrich *et al*., 2009; Shiferaw *et al*., 2009). Lack of a robust CA research programme has led to paucity of local evidence pertaining to social, political, and institutional features which shape the environment in which farmers implement CA

(see chapter 4) and their experiences (chapter 5), and thus have a crucial implication for dis-adoption.

Coherence analysis findings revealed negative interactions between various departmental strategies (in the same MoAIWD) and CA implementation. Although some overlaps exist, they are not maximised. While the DCP is rationally mandated to modernise and mechanise agriculture by promoting tractor-drawn or oxen-drawn ploughs, cultivators and ridgers, exclusion of specialised CA equipment puts the strategy in conflict with CA's minimum soil disturbance principle, which discourages ploughing or ridging (Derpsch *et al*., 2010; African Conservation Tillage Network, 2016). Similarly, promotion of residue incorporation by the DLRC and DAHLD's crop residue livestock strategies have negative impacts on CA's pillar of continuous soil cover, as they limit availability of mulch materials in smallholder communities and may prompt dis-adoption decisions (see sections 4.3.3.1 and 5.3.2.3).

Though aimed at being the handbook for CA implementation in Malawi, the CA guidelines contain inconsistencies and controversies capable of undermining CA. Notably, despite calling for flexibility in CA dissemination to adapt CA to local contexts, the CA guidelines demonstrate rigidities in dissemination approaches exemplified by declaring that a no-till system is '*non-negotiable*' (NCATF, 2016; TLC, 2015). Rigidity in CA projects may fuel farmers' perceptions of being forced to adopt CA configurations pre-determined by promoters, disregarding local needs and aspirations, thereby jeopardising local project ownership (see chapter 4). In addition, rigid farming regimes are unable to effectively cope with current and future stresses therefore limiting their adaptive capacity and growth (Dixon *et al*., 2014). Similarly, Dyer *et al*. (2014) emphasise flexibility and two-way communication as essential in project design. As "*one size does not fit all*" in project or programme design (Young, 2003 p.390), Giller *et al*. (2015) and Twomlow and Delve (2016) recommend a flexible CA package and a non-purist approach, to fit CA with farmers' unique situations and motivations for sustained adoption to occur. Nonetheless, while the CA guidelines are meant to act as a key tool for promoting CA, rigidities and inconsistent statements therein reinforce organisational practices that ignore farmers' aspirations, motivations and/or local context, which often lead to dis-adoption.

6.5 Conclusion

This chapter has examined the role of policies in CA implementation in Malawi, specifically examining CA integration and coherence of agricultural and environmental policies, and their implications for CA dis-adoption. Findings show that integration of CA in agricultural and environment policies is insufficient, and coherence of agricultural departmental strategies, in the context of CA implementation in Malawi, is lacking. These policy deficiencies are mainly propelled by narrow focus of CA in the sectoral policies; weak political support for CA; poor sub-sectoral collaboration and coordination; poor knowledge-exchange in planning and implementation; and un-harmonised departmental strategies. Deficient CA integration in sectoral policies, and lack of coherence for CA in agricultural department strategies engender institutional constraints which impinge on CA implementation (see chapter 4) and produce unfavourable experiences and perspectives of smallholders (chapter 5), thus prompting dis-adoption decisions. Greater engagement of policy makers and processes to strengthen CA integration in relevant policies and improving CA-coherence of agricultural strategies is necessary to enhance the farming environment for more enduring implementation of CA among smallholder farmers.

Chapter 7: Integration and synthesis of results chapters

7.1 Introduction

This chapter adds an essential component to the thesis, providing a comprehensive understanding of drivers of smallholder farmers' dis-adoption of CA. The chapter aims to integrate and synthesise the findings of the studies which have been presented in chapter 4, chapter 5 and chapter 6. While fragmentation of the results into separate chapters was necessary considering the extensiveness and complexity of the findings, an integrated synthesis is vital to highlight the interconnectedness of the dis-adoption drivers identified in the separate chapters. Since CA dis-adoption is a complex phenomenon, it not only requires in-depth understanding of drivers in individual domains (national policies, institutional arrangements and farmers' social-political and economic environment), but also understanding of how those drivers in separate domains are interlinked. This research broadens the understanding of smallholder farmers' *ex-post* technology adoption decisions, beyond the limited perspective of household and farm attributes which are dominant in existing adoption literature.

The chapter proceeds by first presenting an integrated framework conceptualising CA dis-adoption drivers in Malawi's CA innovation system, termed the CA dis-adoption drivers framework, drawing on findings presented in each of the results chapters. The chapter then proceeds to engage with the framework to concisely illustrate the contribution of its various components to the overall understanding of CA dis-adoption among smallholder farmers. The chapter ends with a brief discussion and conclusion.

7.2 Conceptualisation framework of pathways to dis-adoption

Findings of this research across the results chapters show that drivers of CA dis-adoption are complex, multi-dimensional and multi-layered. This is illustrated in the integrated framework, which demonstrates various pathways to CA dis-adoption among smallholder farmers in Malawi (Figure 7.1).

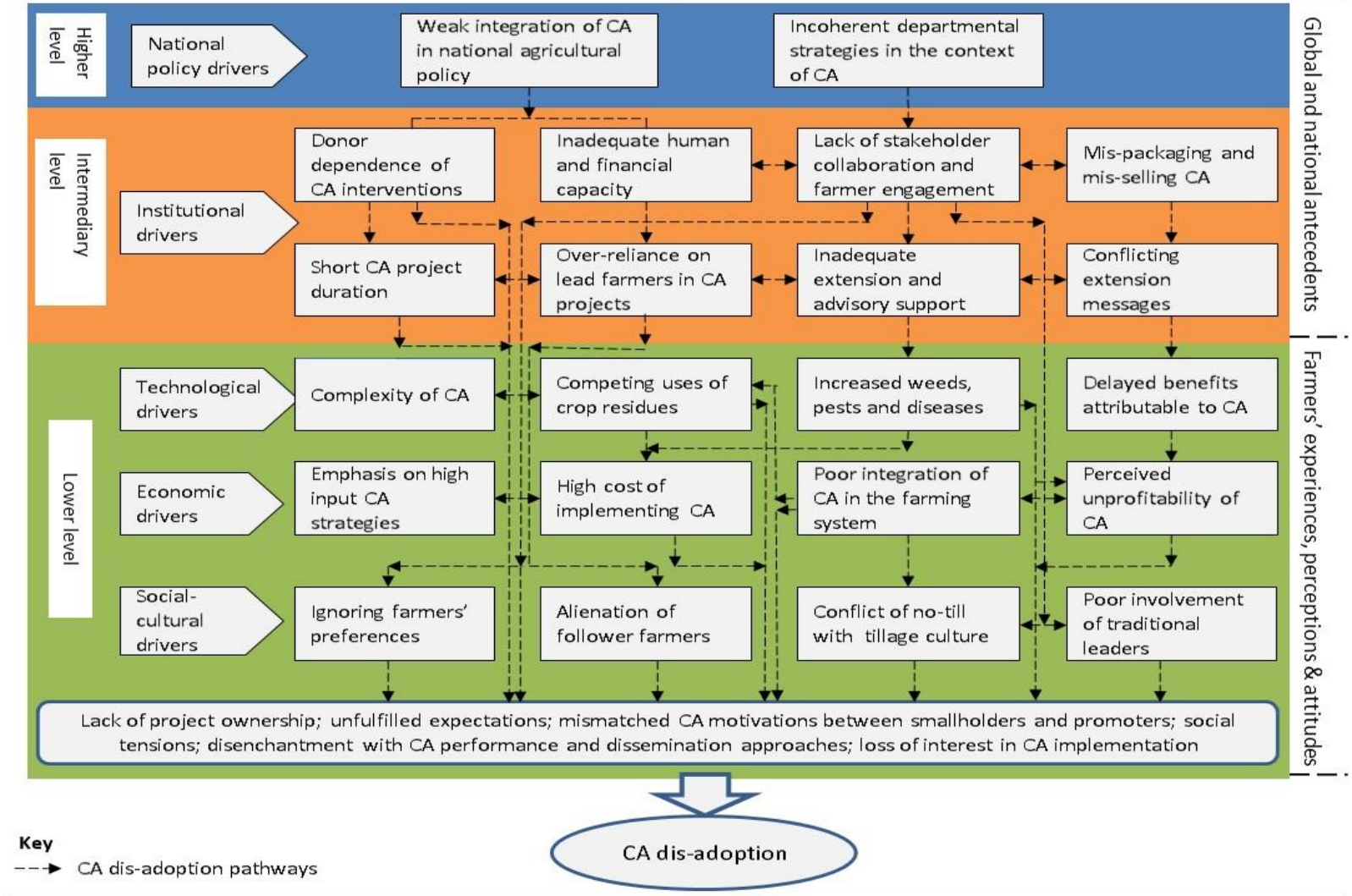


Figure 7.1: Framework conceptualising CA dis-adoption in Malawi

The CA dis-adoption drivers framework demonstrates that understanding CA dis-adoption requires consideration of multiple drivers in policies, promoters' institutional arrangements and farmers' social-political and economic environments. The following section details the various elements of the framework, and illustrates in a concise manner, the role of the various dimensions and layers of CA dis-adoption drivers within the context of the findings of this research.

7.2.1 National policy drivers of CA dis-adoption

This section illustrates key drivers of CA dis-adoption in agricultural and environmental policies. Since government policies shape the agenda and resource allocation at national level (Kalaba *et al*., 2014), they are relevant instruments which define the local context in which smallholder farmers implement CA. While interconnections of policies and CA dis-adoption may be indirect and less obvious, analysis of policies in this study has revealed that weak integration and incoherencies in relevant policies contribute to CA dis-adoption. The findings further show that weak integration of CA in policies is influenced by lack of political will to promote CA and lack of broader understanding of the wider role of CA in policy strategies. Conversely, poor collaboration and lack of harmony within the MoAIWD's various departments fuel the formulation and implementation of incoherent agricultural strategies.

Weak integration of CA in agricultural policies

Despite the NAP (Malawi Government, 2016a) under MoAIWD being the target policy for all agricultural strategies, CA integration is weak. Findings in this research suggest that CA has not (yet) been strongly embraced by the Malawian government as a priority strategy for agricultural development. As CA is invisible in the broader policy statements, implementation of CA activities suffers inadequate resources (see section 4.3.2.4) as the activities appear at the lower levels of the NAP, in implementation plans (see section 6.3.1). Considering that national priorities are clearly reflected in the broader statements of national policies, and therefore receive priority budgetary allocations (Lasco *et al*., 2006), the absence of CA at higher policy level shows the lack of high-level political will to ensure

sufficient allocation of resources for CA implementation. Evidence presented further reveals that the lack of broader understanding of CA's wider applicability in agricultural and environmental strategies limits wider integration of CA in relevant government policies. This suggests that CA experts fail to effectively engage with relevant policy making mechanisms and advance understanding and knowledge of CA among key policy stakeholders, especially in the government hierarchy. As power and politics shape policy outcomes (Nightingale, 2017) and that 'closer proximity to the decision-making body' matters in driving the policy agenda (Wamsler, 2017), poor engagement of influential contacts in agricultural policy formulation arguably contributed to weak integration of CA in national policies. While NGOs deploy relatively more financial resources than government in the promotion of CA, their project implemention cycles are very short (18 months to three years maximum). They also usually have temporary structures (section 4.3.1.1.) such that once projects expire, dis-adoption becomes inevitable. Hence, long-term implementation of CA amongst smallholders is curtailed by resource limitations due to weak integration of CA in relevant government policies; considering that allocation and availability of financial resources are critical determinants of organisational performance (Burtscher *et al*., 2013) and sustainability (Lowe *et al*., 1999).

Incoherent agricultural strategies

Findings show that incoherent agricultural strategies (simultaneously) promoted to smallholder farmers by various departments in the MoAIWD (see Table 6.5) contribute to smallholder farmers' decision to dis-adopt CA. Lack of harmonisation of strategies in the MoAIWD departments, both internally and externally, results in the promotion of agricultural practices that are not synchronised with CA principles and practices. While some strategies being promoted are positively aligned with CA, others are contradictory to or undermine CA. A case in point is where the DLRC is simultaneously promoting planting ridges under conventional farming (which entails ploughing annually) and minimum tillage under CA to the same farmers, despite being the host department of the NCATF, expectations of which include the provision of leadership in promoting coherent CA messages and approaches. Due to incoherence of departmental strategies, smallholder

farmers receive conflicting messages from extension officers (see Table 4.5), and consequently some get confused or lose interest and dis-adopt CA. Similarly, May *et al*. (2006) argued that incoherencies in policies send confusing messages to policy targets and undermine project implementation success. Cejudo and Michel (2015) further note that poor coordination among members of an organisation/innovation system results in the formulation of disjointed strategies. Together, the findings show that weak CA integration in key policies and lack of coherence in agricultural departments' strategies exert a critical influence in dis-adoption by propagating institutional inefficiencies that undermine farmers' continued implementation of CA.

7.2.2 Institutional drivers of CA dis-adoption

Considering that institutional arrangements of CA promoters are key moderators of policies and farmers' experiences in the CA innovation system, chapter 4's findings provide a central constituent in framing understanding of CA dis-adoption. Results revealed the major CA dis-adoption drivers in institutional arrangements of CA promoters which can be grouped into three clusters: donor dependence of CA projects; financial and human capacity shortfalls; and lack of stakeholder collaboration at the local level.

Donor dependence of CA interventions

CA implementation in Malawi overly relies on funding from international donor agencies, which subjects CA projects to donor-prescribed short project implementation cycles of three years or less (see section 4.3.1.1). Such short project durations are unsuitable for CA considering that farmers have to implement the CA practices for up to five years before realising tangible benefits of soil improvement and yield increase attributable to CA (Giller *et al*., 2015). This shows an important limitation of the NCATF CA timeframe that is used as restriction of CA projects to short implementation cycles therefore results in CA projects winding up before farmers can see the 'real' benefits of CA. Consequently, there is limited buy-in and premature discontinuation of CA practices amongst many smallholders who generally expect quick benefits (Baudron *et al*., 2015). Findings further show that due to pressure from donors demanding progress in CA promotion, some NGOs tend to push CA

to communities even when those communities have different priorities. These findings concur with Wood *et al.* (2016) who observed that CA promoters in Malawi mostly utilise expert-led, top-down approaches that are detrimental for project success. Such a tendency leads to mismatched priorities and expectations between technology promoters and local communities (Bagdi *et al*., 2015). Under such circumstances, acceptance and ownership of CA projects is weakened. Conversely, since funding recepients have to show positive results quickly to maintain donor support, NGOs often concentrate their efforts in the same areas where farmers had previous project experience (Mloza-Banda *et al*., 2012). Findings presented suggest that this tendency enhances competition amongst CA promoters, leading to unsustainable use of incentives to attract project participants. Kiptot *et al.* (2007) warned that misuse of incentives in projects draws participants with no real interest in the project itself but with interest in the incentives. When the bigger picture is considered, a 'push' strategy in CA projects appears to encourage the emergence of 'serial dis-adopters' as competition for project beneficiaries among CA promoters incentivises farmers to continuously move from one project to the next in search of more or better incentives.

Human and financial capacity shortfalls of CA promoters

Prevalent shortfalls in capacity of CA promoters undermines the quality and intensity of extension service support to farmers. In the first place, bottlenecks in organisational structures of the extension system leave both government and NGOs to rely on extension generalists to offer specialised CA extension and advisory support to farmers (see Figures 4.2 and 4.3). Due to the demanding nature and complexity of CA (Whitfield *et al*., 2015), extension officers are in many instances overwhelmed by technical demands from multiple programme specialists, amidst limited supervisory support. Consequently, the quality and integrity of technical messages and support rendered to CA farmers is compromised. In addition to organisations' structural flaws, extension support to farmers is further constrained by an acute shortage of extension personnel, fuelled by high staff attrition and unfilled vacancies in the government extension system (Suarez *et al*. 2008; Chinsinga, 2012). While farmers need regular extension support and reinforcement of knowledge due to complexity of CA, extension visits are infrequent as extension agents serve up to five

times the government recommended number of farm families (see section 4.3.2.3). Due to the low ratios of extension officers: farm families, extension visits to CA farms are not only infrequent but often brief as the officers usually travel long distances, mostly on foot or by bicycle, to reach farmers and are often responsible for extensive geographical areas (Masangano and Mthinda, 2012; Burtscher *et al*., 2013). Hence, extension officers often spend very little time interacting face-to-face with farmers to reinforce CA knowledge and skills despite many requiring more intensive extension support (see section 5.4).

While enrolment of unqualified and inexperienced extension officers (assistant AEDOs) and LFs is regarded as remedy for problems of acute extension shortages, the strategy is not suited to the promotion of CA. Since the technology is complex, it requires in-depth knowledge and experience to offer effective CA extension and advisory support (Ndah *et al*., 2012). Without adequate hands-on training and technical know-how, AAEDOs and LFs fail to effectively assist CA farmers. In addition, limited financial resources allocated to CA activities further constrain CA promoters' ability to provide required technical and advisory service to farmers. Mobility of extension officers tends to be severely restricted when resources are limited (MEAS, 2014), and the number of demonstration plots is also reduced (Chinsinga, 2012). Since demonstration plots act as open classrooms where farmers exchange knowledge, experiment and 'learn by doing' (Friedrich *et al*., 2009), a reduction in demonstrations limits farmers' access to vital learning platforms for reinforcing knowledge and skills necessary for effective CA implementation. CA smallholders encounter tremendous technological challenges (see Figure 5.5) to implement complex CA practices in the absence of proper and adequate extension support. As smallholders fail to independently implement CA practices properly, expected benefits from CA (e.g. TLC, 2015; Thierfelder *et al*., 2016) often do not materialise; consequently, farmers fail to justify their continued implementation of CA.

Lack of CA stakeholder collaboration

While the AIS framework regards stakeholder collaboration as a key element in technology dissemination (Aerni *et al*., 2015), findings reveal a predominant lack of collaboration among CA promoters at the local level. For instance, some NGOs tend to by-pass

government structures established to coordinate district agricultural extension and development activities (see section 4.3.3.4). Such tendency undermines the collaborative spirit, and often results in non-existent or superficial knowledge-exchange and information sharing between government and NGO staff, hence dissemination of contradictory extension messages becomes commonplace. In addition, evidence shows that lack of collaboration leads government extension officers to be reluctant to take charge of expiring NGO projects when they perceive to have been sidelined by NGOs during project inception and implementation stages. Given that most NGOs only have temporary structures through which various interventions are implemented, lack of collaboration leaves many farmers without reliable access to technical advisory services and support necessary to effectively continue practicing CA beyond the NGO project period. This demonstrates dire consequences of institutional failure precipitating poor collaboration and leading to implementation deficits manifested on the ground (Atela *et al*., 2016). These findings suggest that attempts at strengthening collaborative structures in Malawi's CA innovation system (Dougill et al., 2017) need to include reinforcing collaborative practices among CA implementers to facilitate continuity of extension service support beyond project periods. This requires that innovation (CA) promoters need to change their traditional linear technology transfer mindset, habits and practices to make participatory approaches and collaborative efforts more effective (Hall *et al.,* 2006).

Regarding engagement of farmers, evidence shows that farmers were largely regarded as intervention receipients, such that knowledge and information flow in the CA innovation system is predominantly linear and top-down, from CA promoters to farmers, contrary to assumptions in the AIS (Spielman, 2005; Anandajayasekeram, 2011). Due to linear and top-down approaches, CA projects not only fail to align with farmers' priority interests and unique situations, but also fail to learn and contextualise design and implementation of CA projects to suit specific local situations. This has negative consequences for CA because it encourages imposition of supply-driven interventions and practices devoid of local ownership, commitment, and sustainability (Malawi Government, 2000; Masangano and Mthinda, 2012; Kwayu *et al*., 2014).

7.2.3 Technological drivers of CA dis-adoption

Technological drivers were evident in experiences and perceptions of farmers reported in chapter 5. Evidence from FGDs revealed that delayed benefits from implementing CA; increased weeds, pests and diseases; and complexity of CA implementation are the main technological drivers of CA dis-adoption among smallholders in Malawi.

Delayed technological benefits in CA

"CA does not live up to expectations" was a recurrent sentiment expressed across FGDs during the study. While smallholders expect to see yield increases and other promised benefits by the end of the first year of implementing CA practices, tangible benefits from implementing CA may only become visible after implementing CA practices over a relatively longer period of time, due to its inherent attributes (Andersson and Giller, 2012; Baudron *et al*., 2011 & 2015). As a result, there is often a mis-match between farmers' expectations and attributes of CA (Pannell *et al*., 2014), typified in this research by widespread expression by FGD participants that CA failed to deliver rewards "*pompo pompo*" (instantly). Similarly, Corbeels *et al*. (2014) observed and reported that a lack of appreciation of delayed benefits from CA is a common occurrence among smallholder farmers. Added to the seemingly unfavourable attribute of delayed benefits in CA, findings show that promoters often raise farmers' expectations unrealistically by 'marketing' CA primarily based on its potential to increase yield, reduce time and labour costs of smallholders. As promoters emphasise commercially oriented attributes (increased yield, cost reduction and increased profits), possibly with the underlying aim of attracting farmers to try CA, farmers expect an immediate return on their investment in CA. As a result, many smallholders get frustrated when anticipated benefits are not realised, and they dis-adopt CA to pursue other enterprises perceived to be more (instantly) rewarding than CA.

Furthermore, findings show that despite soil moisture retention being a major motivator for smallholder farmers implementing CA, it is widely subdued as a selling point in CA promotional messages. This suggests that CA promoters 'miss the mark' by over-emphasising economic attributes of CA (which CA is perceived to fail to deliver), and under-

selling its soil and water conservation attributes, which are aligned with farmers' major motivation to start CA (section 5.3.2). While CA is inherently slow in delivering anticipated commercial benefits (Baudron *et al*., 2011), rewards from soil moisture retention are relatively more immediate (Njira and Nabwami, 2013a). The perception that CA fails to meet farmers' expectations is principally fuelled by promoters mis-selling CA. This demonstrates critical interconnections between technology attributes, promoters' dissemination processes and approaches, and farmers' perceptions in CA dis-adoption. Based on these findings, re-framing CA promotional messages, to incorporate more prominently the wider environmental benefits of CA, would be a plausible option for promoters to enhance sustained implementation. This would work to re-align smallholder farmers' expectations from CA with its inherent attributes, since farmers will be able to realise immediate environmental benefits of soil moisture retention while enabling commercial benefits to gradually build up and become more evident in the long run.

Increased weeds, pests and diseases associated with CA

Increased weed pressure, pests and diseases were common issues respondents cited in questionnaires and FGDs. Similar challenges in CA have been reported by other authors (e.g. Grabowski and Kerr, 2014; Kirkegaard *et al*., 2014). Evidence from this research shows that some respondents experienced profuse weed growth (such as witch weed) when they embarked on no-till system and became a laughing stock in the community as neighbours sneered saying that "the land was becoming barren" (section 4.3.3.1). Application or importation of mulch materials into CA fields seemed to exacerbate pests (such as termites, white grubs, cutworms and stalk borers) while application of (improperly-prepared) manure further increased weed pressure. Respondents also experienced increased incidences of diseases such as maize streak and brown leaf spot. This increased labour demand for weeding, increased production costs for pests and disease control, and reduced crop yields. While farmers faced such technological challenges, extension advisory support remained inadequate amidst conflicting CA messages from different promoters (see section 4.3.3.5). Consequently, many farmers were left frustrated as they experienced

CA outcomes contrary to their expectations of increased yield, labour-saving and cost-saving as promised in CA promotional messages. Disparity between farmers' expectations and actual experiences led many to lose interest and dis-adopt CA.

Complexity of CA

Findings in chapter 5 demonstrate that smallholder farmers find implementing CA to be complex and laborious, because CA entails implementing several intricate practices simultaneously (Ndah, 2014). Evidence from FGDs overwhelmingly illustrates that smallholders face difficulties in implementing regimented activities required to fulfil the requirements of the three pillars constituting CA (minimum soil disturbance, maintaining soil cover, and crop association or crop rotation). Considering that strict adherence to the core principles is central in most CA projects in Malawi (Kaluzi *et al*., 2017), many smallholders are not only reluctant to expand their CA fields but also fail to continue with CA implementation for long periods after initial adoption. Further evidence illustrates that complexity of CA is aggravated by inadequate technical knowledge among smallholders receiving inadequate and poor quality extension and advisory support from extension agents. Sentiments expressed regularly by participants suggest that often, smallholders only persevere with (rigid) CA for the main purpose of gaining continued access to incentives coming through CA projects, otherwise many dis-adopt immediately project incentives cease. These findings concur with the views expressed in literature that CA is complex (Corbeels *et al*., 2014), and that promoting rigid CA prescriptions may not be well suited to smallholders (Giller *et al*., 2011 and 2015), as such prescriptions hinder efforts to package CA in line with local needs/interests and context, leading to subsequent dis-adoption.

7.2.4 Social and cultural drivers of CA dis-adoption

Chapter 5 revealed various social and cultural drivers that influence CA dis-adoption in smallholder communities. Findings suggest that alienation of follower farmers in CA clubs, deep-rooted tillage culture in smallholder farming communities and social tensions

particularly relating to mulch materials are major social-cultural drivers of CA dis-adoption. These are further elucidated in the following three sub-sections.

Alienation of follower farmers in CA clubs

Evidence was given showing that concentration of CA project resources on lead farmers, such as training, incentives and extension visits, instigated a feeling of alienation amongst followers. The perceived unequal distribution of resources in CA clubs results in conflicts and withdrawal of members, mostly exacerbated by lack of conflict resolution skills amongst group leadership. Under such circumstances, keeping club members long-term becomes challenging, let alone expanding the membership base. Some FGD participants described that once farmers drop out of clubs, they are viewed as enemies of progress, hence excluded from development activities, and therefore it becomes more challenging for them to continue with CA on their own owing to frustration, lack of support or resources. Ramdwar *et al*. (2014) and Kamoto *et al*. (2013) draw attention to the importance of addressing governance issues in farmers' clubs, to effectively utilise the group approach to deliver extension service in agricultural development interventions.

Tillage culture in smallholder farming communities

Findings in chapter 5 illustrate that the deep-rooted land preparation culture of clearing land, tilling and ridging before planting crops compromises wider acceptability of CA among some smallholder farming communities in Malawi. This tradition stands at odds with the practice of no-till, which is the most common practice advocated under the CA pillar of minimum soil disturbance (Jat *et al*., 2014; Pedzisa, 2016), even deemed "non-negotiable" for participation in many CA projects (e.g. TLC, 2015). The evidence suggests that CA promoters fail to actively and genuinely engage with local communities to properly contextualise CA interventions. To illustrate this point, evidence has shown that naming CA as "*mtayakhasu*" (abandon the hoe) (see section 4.3.3.1), in communities with tillage culture where the hoe is a valued symbol of a 'hard working farmer', weakens the support of traditional leaders and general buy-in from the wider community. As locals strive to conform to societal norms (Rogers, 2003) and avoid being labelled *mlesi* (lazy), farmers practise no-till only on small portions of their farmland (just to be part of the CA project)

while the rest is under conventional tillage (Mazvimavi and Twomlow, 2009). Since no-till is perceived to contravene traditional values (Concern Universal Malawi, 2012), some farmers dis-adopt CA once the project phases out. FGD comments suggest that smallholders may initially take-up CA merely because they do not want to be seen to reject 'development' or risk being locally labelled *adani a chitukuko* (enemies of progress) which deters participation in future projects. In addition, traditional tillage practices provide *ganyu* (on-farm piece work) which is highly valued as an annual food security coping mechanism in rural smallholder farming communities (Chinyamunyamu, 2014; Takane, 2005). Therefore, while strict no-till proponents discourage ploughing or hoe-weeding (Derpsch *et al*., 2010), poor households that depend on *ganyu* to survive food shortage periods are negatively affected. As such, participation in strict no-till projects that seem to ignore the importance of tillage in rural societies is often devoid of genuine commitment and dis-adoption becomes inevitable.

Social tensions related to mulch materials

Due to (distorted) promotional messages suggesting dead mulch from crop residues are the main way of maintaining soil cover in CA, farmers face various social challenges concerning mulch materials for implementing CA (see section 5.3.2.2). Findings show that CA farmers experience frequent loss of crop residues laid for mulching in CA fields to acts of sabotage, such as torching mulch materials among others. As crop residues are scarce and are needed for various competing uses in the household (Figure 5.6), farmers get frustrated with frequent loss of mulch; particularly where support of traditional leaders is lacking or where measures or bylaws are not enforced to ensure that CA fields are protected from livestock grazing or sabotage (Kaluzi *et al*., 2017). Lack of commitment of village authorities to enforce CA bylaws to protect mulch mainly emanates from lack of project ownership, probably because of top-down approaches commonly used by promoters in CA projects (Wood *et al*., 2016). As distorted extension messages make farmers believe they can only practice CA using dead mulch, persistent loss of mulch laid in CA fields becomes unbearable and many farmers settle on dis-adopting CA because they cannot practice mulching as required by promoters.

Although soil cover can also be achieved by using live mulch (such as cover crops), extension messages have largely overlooked this option and have concentrated on encouraging farmers to use dead mulch from crop residues, particularly maize stalks. This intensifies demand for maize stalks and in the process, increases social tensions since maize stalks are traditionally used for various important purposes including firewood for cooking. In addition, (mis) branding of CA as *ulimi wa mapesi*, *ulimi wa bulandi or ulimi wa m'phimbira* (see section 4.3.3.1) by some CA promoters, appears to inculcate the misconception among farmers that they cannot continue with CA when they lose their mulch materials. This shows that mis-branding CA may perpetuate social tensions which frustrate and dissuade smallholders from continuing with CA. As the name of an innovation structures perceptions and determines compatibility with societal norms and values (Rogers, 2003), incorporating local contexts in project interventions becomes even more paramount.

7.2.5 Economic drivers of CA dis-adoption

Results in chapter 5 illustrate that emphasis on expensive farm inputs in CA and poor integration of CA into the wider livelihood options of smallholder communities constitute major economic drivers of CA dis-adoption. The following sub-sections highlight the main issues related to these drivers.

Emphasis on high-cost CA strategies

While the vast majority of smallholder farmers' annual incomes are relatively very low (World Bank, 2012; FAO, 2017), CA promoters emphasise high-cost CA strategies involving use of hybrid seed, inorganic fertilisers, herbicides and other agrochemicals. This suggests lack of convergence between the core approach of current CA interventions and the economic realities of smallholders. Although CA projects help farmers to get off the ground by providing input grants in the initial year of implementing CA, many fail to acquire the required inputs in subsequent years when such grants are withdrawn. Since promotional messages associate CA with high cost inputs (TLC, 2015), many farmers believe they cannot implement CA without such inputs. Evidence in chapter 5 shows that associating CA with

high cost inputs, while overlooking strategies for lowering implementation cost, entrenches the perception that CA is expensive and unaffordable in the absence of input support from organisations promoting CA. Similar perceptions were observed by Mlamba (2010). In alignment with Williams (2008) and van der Poel (2016), this research shows that such perceptions encourage dependency mentality among smallholders, and that most implement CA only for as long as they receive project input support. While input grants may be arguably necessary to boost initial adoption by encouraging farmers to try CA (Mlamba, 2010), many smallholders end up dis-adopting after practicing for a short while because they cannot afford such expensive inputs on their own. These findings strongly suggest that low cost CA strategies need to be more vigorously explored by practitioners and incorporated in the design of CA interventions, in view of low income status of targeted smallholder farmers.

Poor integration of CA in the farming system

Owing to poor integration of CA in the farm system, and taking into account the diversity of livelihood options available in smallholder farming communities (Figure 5.3), the technology (CA) is largely perceived to be in competition with other income generating opportunities of farmers. This is exemplified by perceived conflict between CA and livestock enterprises widely reported in FGDs (see Box 5.1). Evidence shows that failure of CA promoters to properly integrate CA and livestock enterprises encourages competition for crop residues, when the two enterprises could be mutually reinforcing if properly integrated (Thornton *et al*., 2018; Gondwe, 2015; Dorward *et al*., 2007). For example, cover crops could be promoted for maintaining soil cover in CA, while crop residues could be used in cattle enterprise as feed and bedding in livestock housing, and dung could be used as manure. In addition, growing strips of pasture (unlike vetiver grass) could be incorporated to address the dual purpose of soil and water conservation strategies while offering source of feed for livestock (Mloza-Banda, 2003), therefore easing pressure and competition on crop residues. Due to promoters' failure to disseminate extension messages in a way that highlights synergies among livelihood options in the farm system, evidence shows that smallholder communities often view CA as competing with, rather than complementing,

other enterprises. Under such circumstances, smallholders prioritise allocation of resources (e.g. time, money, labour, crop residues) to those enterprises that appear to be instantly more rewarding; and as CA is usually judged to be less appealing, dis-adoption often follows.

The CA dis-adoption drivers framework illustrates that shortcomings in institutional arrangements are a common factor influencing dis-adoption drivers across the spectrum. Without suggesting that institutional arrangements are sole drivers of CA dis-adoption, their central role in the CA innovation system in moderating smallholder farmers' CA experiences, perceptions, and ultimately influencing dis-adoption decisions, is clearly evident in the findings of this research. Dis-adoption drivers across the spectrum often have multiple underlying dimensions and layers linking to promoters' institutional arrangements. This is exemplified in linkages between several CA dis-adoption drivers and underlying shortcomings in institutional arrangements, illustrated in Table 7.1.

Table 7.1: Illustration of institutional arrangements as a common factor in dis-adoption drivers.

Description of CA dis-adoption driver	Illustration of underlying shortcoming(s) in institutional arrangements contributing to the dis-adoption driver
Weak integration of CA in agricultural policies	Weak advocacy of CA in the policy arena; lack of broader understanding of CA among policy stakeholders; lack of political will to advance CA in key policy objectives
Incoherent agricultural strategies	Poor sectoral/departmental inter-linkages and coordination; lack of harmony in departmental strategies in the context of CA
Donor dependence of CA interventions	Aligning CA with international donor agendas; imposing CA on farmers; emphasising high-input CA; short project cycles
Human capacity shortfalls of CA promoters	Bottlenecks in organisational structures of the extension system; high staff turnover in government extension system; low ratios of extension agent: farm families; inadequate extension service
Lack of CA stakeholder collaboration	Competition for project beneficiaries among CA promoters; by-passing district stakeholder collaboration platforms; top-down approach
Delayed technological benefits from CA	Misrepresented extension messages raising unrealistic expectations among farmers
Complexity of CA	Inadequate extension and advisory support; complex set of practices in CA design
Conflict with smallholder tillage culture	Emphasis on rigid no-till system; ignoring local values/interests
Social tensions	Encouraging use of dead mulch as the only source of soil cover; concentrating resources on lead farmers as followers feel alienated
High input CA strategies	Associating CA with hybrid seeds, inorganic fertilisers and herbicides
Poor integration of CA in the farm system	Lack of contextualising CA to complement existing livelihood options; limited engagement with farmers; poor design of CA projects

The finding that institutional arrangements are central in driving CA dis-adoption, suggests that reducing dis-adoption not only requires improvement in economic and biophysical attributes of the technology; but more importantly, such efforts need to be coupled with improvements in how promoters implement CA projects, including rethinking their dissemination approach, organisational capacity and collaboration with pertinent stakeholders such as smallholders. Similarly, Hall *et al*. (2006) identified institutional change and learning as critical tools for improving performance of particular agricultural

innovation systems. In this regard, (dis)adoption studies need to further widen their perspective on understanding how broader institutional factors in the innovation system influence farmers' experiences and perceptions, rather than considering farm-household level determinants independently. In the same vein, broader CA stakeholders need to acknowledge the role of relevant national policies and dissemination approaches in CA promotion.

7.3 Discussion

Findings from this research show that dis-adoption is a complex phenomenon, understanding of which requires a holistic approach to unravel constraints in multiple domains including interaction of dis-adoption drivers across spheres and levels of the CA innovation system. Evidence presented strengthens growing arguments in the literature suggesting that socio-economic parameters which have traditionally been used to predict adoption decisions (e.g. education) fail to adequately explain dis-adoption (e.g. Wendland and Sills, 2008; Pedzisa *et al*., 2015). While household and farm attributes may offer valuable predictors of the likelihood of CA initial adoption (e.g. Ng'ombe *et al*., 2014), they do not adequately account for farmers' experiences and perceptions which influence the ultimate decision whether or not to dis-adopt. This affirms the literature suggesting that factors exogenous to the household/farmstead play a critical role in confirming or rejecting farmers' *ex-ante* adoption decisions (Kiptot *et al*., 2007; Giller *et al*., 2011). As society, policies and institutional arrangements are integral in framing the conditions in which smallholder farmers implement CA (Ndah *et al*., 2012), they are key elements in understanding the decisions farmers make during the implementation period. This research therefore concurs with Andersson and D'Souza's (2014) argument suggesting that broadening of adoption studies, to incorporate parameters from the wider social, institutional and policy environment of farmers, is necessary to achieve more comprehensive understanding of *ex-post* adoption decisions.

Findings of this research, showing that implementation of multiple practices under CA increases perceived complexity and drudgery, reinforces arguments in the literature for greater flexibility in the design and packaging of CA (e.g. Kaluzi *et al*., 2017; Twomlow and Delve, 2016; Giller *et al*., 2015). Strict adherence to simultaneous implementation of various practices in alignment with all three core principles of CA appears to be unsuitable for smallholder farmers as it enables CA to be perceived as complicated and more labour demanding than conventional farming. At the same time, proclaiming certain practices as 'non-negotiable' (e.g. TLC, 2015; NCATF, 2016) stands in the way of proper contextualisation of CA interventions. Greater flexibility among promoters is needed to enable re-packaging of CA in line with local needs, preferences, capabilities and wider social-cultural, political and economic conditions of diverse smallholder farming communities in sub-Saharan Africa (Sietz and Van Dijk, 2015).

Although the lead farmer (LF) approach is applied extensively in smallholder agricultural extension service delivery (Khaila *et al*., 2015), findings from this research suggest that the approach is not effectively applied in current CA dissemination. From a technological perspective, LFs in this study were found to largely have inadequate depth of CA knowledge and lacked necessary capacity to impart appropriate technical know-how to fellow farmers, contrary to Mkwambisi *et al*. (2013). While the LF approach may allow CA promoters to reach out to greater numbers of farmers than they would otherwise (see chapter 4 and Kundhlande *et al*., 2014), its application needs to recognise mismatch of knowledge demand in complex CA systems and limited technical capacity of LFs. Although many LFs receive CA training, findings reveal it to be classroom-based for only 2-5 days such that their capacity to absorb and transfer knowledge of intricate CA techniques to follower farmers is limited. Contrary to (extreme) calls for abandoning CA principles altogether (e.g. Giller, 2015), this study's findings provide evidence to motivate further scientific investigation into options for simplifying CA packages. This is relevant owing to increasing reliance of LFs in CA promotion attributable to acute shortages of extension personnel and limited financial resources. Simplified forms of CA would close the gap between capability of LFs and knowledge demands of CA, thereby enhancing effectiveness of the LF approach;

LFs would have greater ability to learn simplified techniques and offer effective extension support to followers. Re-configuration of CA practices could therefore enhance the fit between CA design and limited capacity of LFs and smallholders in general; thus, potentially enhancing availability of extension support beyond the timelines of CA projects to prop up continued CA implementation.

Although findings of this research appear to be at odds with the tradition of promoting CA on the basis that it reduces labour costs (Baudron *et al*., 2015) while increasing yields and profits (Thierfelder *et al*., 2013, 2016), the findings herein do not dispute empirical evidence of potential economic benefits of CA. However, there appears to be dis-proportionate emphasis on the commercially oriented benefits of CA in the literature and promotional messages (e.g. Wall *et al*., 2013; TLC, 2015; Thierfelder *et al*., 2016). Evidence from this study shows that promoters' focus on commercially oriented benefits distorts CA promotional messages and raises farmers' immediate expectations which are incongruent with the slow build-up of CA benefits, and are likely unachievable in the short term under smallholder farming conditions. Therefore, portrayal of CA benefits should be more realistic, and based on evidence from smallholder-managed farms rather than researcher-led on-station or on-farm trials, which usually produce different technology performances because they do not truly replicate smallholders' true conditions (Lalani *et al*., 2017; Michler *et al*., 2016; Kiptot *et al*., 2007). Perhaps greater emphasis on the wider environmental benefits of CA in the promotional messages (e.g. soil moisture retention and soil erosion control) provides a better opportunity for realigning CA with the primary aspiration of many farmers practising CA. Such a strategy would enable farmers to achieve expected soil and water conservation benefits in the interim, and allow gradual economic benefits to accrue.

7.4 Conclusion

This chapter has made a significant contribution to the thesis by presenting an integrated synthesis of the findings of the research, and revealing how the results presented in separate results chapters are linked in building an integrated framework of CA dis-adoption

drivers in Malawi. The framework demonstrates that understanding CA dis-adoption requires in-depth examination of multiple drivers in policies, institutional arrangements and farmers' political, social-cultural and economic environments. Particular attention is drawn to assessment of complex interactions of drivers within and across multiple levels of the CA innovation system i.e. national, district and community levels, to acquire a more comprehensive understanding of farmers' dis-adoption decisions. While providing a succinct account of multiple pathways to CA dis-adoption, the framework reinforces systems thinking approaches in agricultural research, development and dissemination which are also called for in the new Dryland Development Paradigm (Stringer *et al.,* 2017).

Chapter 8: Conclusions and recommendations

8.1 Introduction

The study was motivated by the paradox of dis-adoption of seemingly appropriate agricultural innovations, specifically CA. Despite that NGOs and national governments vigorously promote CA as a suitable innovation for improving agricultural productivity, profitability and for building resilience to climate change impacts, widespread dis-adoption persists among smallholder farmers especially in sub-Saharan Africa (Twomlow and Delve, 2016; Andersson and D'Souza, 2014; Arslan *et al*., 2014). Limited knowledge of dis-adoption has not only presented a perplexing scenario for CA proponents, but has also prompted critical views of several researchers in recent years (e.g. Andersson and Giller, 2012; Whitfield *et al.,* 2015). A thorough review of agricultural technology adoption literature reveals a dearth of dis-adoption research; researchers have focused on *ex-ante* and/or household-farm determinants of adoption (e.g. Mugwe *et al*., 2009; Mlamba, 2010; Ngwira *et al*., 2014; Lalani *et al*., 2017), and have overlooked *ex-post* adoption dynamics of farmers' adoption decisions (e.g. Pedzisa, 2015). Thus, despite dis-adoption (or discontinuance) being a critical constituent of the innovation decision process (Rogers, 2003), the phenomenon is relatively poorly understood. Consequently, CA dis-adoption has largely been ignored; rarely debated effectively, particularly among organisations promoting the innovation, despite evidence of its widespread occurrence in agricultural development interventions.

As existing adoption studies have largely been preoccupied with identifying household-farm level determinants of adoption (e.g. Pannell *et al*., 2014), little is known about the experiences and perceptions of farmers, as they implement agricultural technologies within the wider agricultural innovation system. This study diverged from traditional adoption research by drawing from both the DoI (Rogers, 2003) and AIS (Spielman and Birner, 2008) theoretical frameworks; in order to comprehensively explore *ex-post*, smallholder farmers' lived experiences during implementation of CA and to elucidate underlying drivers of CA dis-adoption across the innovation system. A pragmatic mixed

methods approach (Creswell, 2014) was used, involving key informant interviews, questionnaire surveys, FGDs and content analysis of relevant national policy document materials. Results were analysed to illuminate the underlying reasons for farmers' dis-adoption of CA; a practice widely regarded as an appropriate innovation for smallholder farmers across sub-Saharan Africa and other developing countries (Africa Congress on Conservation Agriculture, 2014). In-depth understanding of dis-adoption is crucial to enlighten debate on CA dis-adoption, and to inform design and implementation of sustainability strategies of CA projects, with a view to enhancing achievement of long-term desired outcomes from CA and similar project-based agricultural interventions.

8.2 Review of research objectives and main findings

The overall aim of the study was captured in the over-arching aim: to identify and analyse underlying drivers of CA dis-adoption among smallholder farmers in Malawi with a view of providing insights into organisational structures, processes and delivery mechanisms that can improve and sustain CA adoption. To address this aim, three objectives were developed and used to guide the research process and to structure reporting of the findings in three results chapters (chapters 4, 5 & 6). The main objective of chapter 4 was to analyse the role of promoters' institutional arrangements in smallholder farmers' dis-adoption of CA in Dowa and Lilongwe districts. This objective was accomplished by analysing data derived from sampled key informants in Malawi's CA innovation system. Chapter 5 aimed to explore how and why smallholder farmers experience and perceive CA, and the implications of these experiences and perceptions for dis-adoption. To this end, I analysed data derived from a questionnaire survey and FGDs with farmers to get to the root of underlying reasons why smallholders dis-adopt CA. Chapter 6 set out to analyse the role of government policies in CA implementation, and their implications for smallholders' dis-adoption in Malawi. To accomplish this objective, I analysed the extent of CA integration in key government policies of the agriculture and environment sectors, and coherence of departmental strategies within the MoAIWD. The main objective of chapter 7 was to develop an integrated framework conceptualising pathways to CA dis-adoption among

smallholder farmers in Malawi. This objective was achieved by integrating and synthesising findings and discussions of the separate results chapters.

Findings of this research show that dis-adoption occurs due to unfavourable experiences and perceptions of smallholder farmers during the implementation stage of the innovation decision process. While unfulfilled expectations, frustration and dis-enchantment appear to be prevalent immediate triggers of CA dis-adoption, evidence shows that the decision to dis-adopt is fuelled by complex interactions of multi-faceted drivers originating from global, national, district and local levels of the CA innovation system.

At the global level, international donor agencies advance project prescriptions under short project durations that are not in tandem with the gradual impact nature of CA. Consequently, CA is widely perceived as failing to live up to smallholder farmers' expectations because projects often wind up before project participants attain tangible benefits. Conversely, donor expectations of increased CA adoption numbers appear to influence promoters to work in competition and unsustainably deploy farmer incentives as a way of out-competing one another. Considering that CA implementation is almost entirely dependent on funding from international donor agencies (Wood *et al*., 2016), farmer dissatisfaction prevails when CA projects end and dis-adoption ensues. Thus, repercussions of donor influence at global level result in unsuitable strategies of CA promoters; this undermines project implementation and is ultimately linked to CA dis-adoption in smallholder communities.

At the national level, weak integration of CA in agricultural policies and incoherent agricultural strategies constrain resource availability and effectiveness of extension support offered to CA farmers. Due to weak integration of CA in relevant agricultural policies, mobilisation of financial resources for both extension and participatory research activities concerning CA is undermined. As a result, extension and advisory services to CA farmers are inadequate, especially considering that many smallholders perceive simultaneous implementation of multiple CA practices to be complex (Ndah *et al*., 2014) and require regular knowledge reinforcement through frequent visits of extension officers.

In addition, dissemination of conflicting extension messages (see Chapters 4 and 6), largely due to incoherent agricultural development strategies, confuses CA farmers and prompts many to dis-adopt and go back to traditional conventional tillage practices which are more familiar and perceived to be less complex.

At the grassroots level, various technological and social-cultural factors drive CA dis-adoption across smallholder farming communities. For instance, extension messages associating CA implementation with use of dead mulch from crop residues (despite acute shortages and competing uses of the crop residues in rural communities) exemplify flaws in CA dissemination approaches. Distorted extension messages precipitate mulch-related social tensions in CA communities such as theft and sabotage of mulch laid in CA fields; livestock grazing disputes; burning mulch by mouse hunters; and tension from competing crop residue uses. Additionally, lack of flexibility in CA systems (Giller *et al*., 2015) facilitate CA to be widely perceived to contravene the tillage culture of smallholders (see chapters 5 and 7). Though only introduced during the past century by the colonial government, tillage or ploughing is now deeply rooted in the Malawian farming culture (Nanthambwe and Mulenga, 1999). The ineffective CA dissemination approaches of CA promoters exacerbate social tensions and perceived incompatibility of CA with traditional values, thereby dis-incentivising continued implementation of CA.

Evidence from this research further reveals that the institutional arrangements of CA promoters exert critical influence in the environment in which smallholders implement CA and are central in illuminating drivers of CA dis-adoption in the CA innovation system (see Figure 7.1 and Table 7.1). While dis-adoption drivers radiate from multiple domains and levels of the innovation system, immediate triggers of CA dis-adoption are manifested largely through inefficiencies in practices of CA promoters. Therefore, while CA stakeholders need to acknowledge the multi-faceted nature of CA dis-adoption, particular focus is needed on minimising institutional drivers of dis-adoption in order to achieve more sustained CA implementation among smallholder farmers.

8.3 Implications and contribution to knowledge

This research provides new perspectives to the literature and debates around agricultural technology development and transfer, more specifically empirical knowledge of *ex-post* adoption decisions of smallholder farmers. While the DoI (Rogers, 2003) recognises the concept of dis-adoption (referred to as discontinuance), research has up to now concentrated on determining *ex-ante* factors in the agricultural technology adoption continuum (e.g. Mlamba, 2010; Ngwira *et al*., 2014; Thierfielder *et al*., 2013). Since e*x-post* studies are rare, probably because most adoption researchers are primarily concerned with the rate at which innovations diffuse (Rogers, 2003), dynamics underpinning dis-adoption have relatively been under-explored, and the phenomenon remains largely mis-understood. In the context of Malawi, this study is the first independent, empirically grounded study on dis-adoption among smallholder farmers. In this regard, it enriches the little existing empirical knowledge on dis-adoption in sub-Saharan Africa more widely too (e.g. Pedzisa *et al*., 2015). The suggestion that most adoption studies have inherent biases since they are either sponsored or carried out by promoters and/or their funding agents (Glover *et al*., 2016) underscores the relevance of this research. Thus, it contributes independent insights into the dis-adoption debate, considering that dis-adoption of agricultural technologies has largely been 'the elephant in the room' among many stakeholders globally. Thus, this *ex-post* study contributes valuable knowledge on a phenomenon which is counter-productive to agricultural and rural development efforts particularly in developing countries. The knowledge gained is applicable towards curbing dis-adoption, and in this way, the study takes a positive stride towards informing strategies aimed at achieving sustained adoption of agricultural innovations and sustained impacts of agricultural development efforts more broadly.

The research has demonstrated a robust mixed methods approach to adoption studies, departing from typical adoption studies which largely rely on quantitative analyses to link farm and household characteristics to adoption decisions (e.g. Ng'ombe *et al*., 2014; Ngwira *et al*., 2013; Mazvimavi and Twomlow, 2009). By using a mixed methods approach in the research design, the study provides a more complete understanding of underlying

triggers of dis-adoption in the CA innovation system. Furthermore, the study actively engaged farmers, thereby giving voice to end-users who are often ignored in typical adoption studies. Findings of this research are therefore able to provide useful and relevant evidence for practice and policy. As the study explored dis-adoption drivers and integrated analysis across multiple levels of the CA innovation system, it has catalysed a more encompassing methodological approach to understanding farmers' *ex-post* adoption decisions. The findings show that a multi-level approach, integrating analyses of policies at national level; institutional arrangements at local level; and farmers' experiences at community level, provides a systems-understanding of underlying drivers manifesting in dis-adoption of seemingly suitable agricultural innovations. Farm-household characteristics alone provide a limited understanding of how smallholder farming households and their production systems function (Andersson and D'Souza, 2014). For example, a dis-adoption study by Pedzisa *et al*. (2015) which employed econometric analysis, failed to show how and/or why smallholder farmers dis-adopted CA in Zimbabwe. In contrast, as the study herein comprehensively engaged smallholders' views and opinions, it provided a deeper, more encompassing and relevant perspective of dis-adoption. In addition, institutional analyses by Phiri *et al.* (2012) and Shiferaw *et al*. (2009) which focused on markets and other infrastructural issues failed to uncover distinct interactions between promoters' institutional arrangements and farmers' experiences in the broader context of smallholder agriculture in sub-Saharan Africa. The approach used in the present research provided comprehensive insight into dis-adoption by interrogating interactions of national policies, promoters' institutional arrangements, farmers' experiences, and post-adoption decisions. Such interactions show that policies and institutional arrangements are critical components in understanding or exploring dis-adoption because they affect how farmers experience and perceive an innovation, and their subsequent decision whether or not to continue with it.

The research has further under-scored the relevance of exploring farmers' experiences and perceptions in attempts to understand why dis-adoption occurs. Evidence herein shows that a farmer may have the appropriate general characteristics (e.g. education) to adopt

an innovation, however external pressures from the social system, flawed dissemination approaches and/or a non-conducive policy and institutional environment can inhibit continued adoption. This research advances the argument that relying on quantitative analyses of individuals' general characteristics alone to predict/determine (dis)adoption overlooks constraints in the broader innovation system that are capable of undermining farmers' experiences and fuelling dis-adoption (Andersson and D'Souza, 2014; Kiptot *et al*., 2007). By engaging farmers' experiences and perceptions in utilising an innovation, this study has taken a farmer-centric posture in illuminating dis-adoption. Based on this study's findings, what matters most in dis-adoption is farmers' lived experiences and their perceptions of an innovation; after all, individuals' characteristics are not static over time. In this regard, a longer-term study across multiple agro-ecological regions would provide more insights on how temporal and spatial variability modify farmers' experiences and their subsequent adoption decisions.

Finally, the research has developed and synthesised an independent, empirically grounded CA dis-adoption drivers framework, anchored in DoI and AIS theories (see chapter 7), mapping underlying dis-adoption drivers in Malawi's CA innovation system. By identifying drivers in multiple domains (i.e. public policies, institutional arrangements of promoters, and farmers' social-political environment) and at multiple levels (global, national, and local), the framework provides a comprehensive conceptualisation of underlying drivers of CA dis-adoption; including their complex interactions, and how they affect smallholder farmers' experiences, perceptions, and ultimately the decision to dis-adopt CA. The framework emphasises that the complexity of drivers underlying dis-adoption decisions demands a robust examination of triggers in the three domains in order to generate a broader understanding of the multiple pathways to CA dis-adoption. The framework therefore provides dual benefit in that it not only provides a comprehensive understanding of complex dis-adoption drivers of CA, but also avails a useful troubleshooting guide in interventions that can inform improvements in the design and implementation of smallholder agricultural projects seeking to achieve sustained adoption. While the dis-adoption framework has been developed in the context of CA in Malawi, it could be usefully

applied more widely to conceptualise dis-adoption of similar project-based innovations in agriculture, forestry, sustainable land management and other livelihood-enhancing interventions among smallholder farming communities in comparable environments across sub-Saharan Africa. Further research to explore applicability of the framework in different contexts and technologies would therefore be relevant.

8.4 Lessons and recommendations for policy and practice

In light of findings of this study, various lessons and recommendations for policy and practice are drawn within the context of participatory agricultural development, dissemination and research for development in sub-Saharan Africa. Despite purported shifts in agricultural development interventions from traditional technology transfer towards AIS approaches (Future Agricultures, 2012), evidence herein reveals that the traditional linear technology transfer remains the dominant dissemination approach in Malawi. Since linear technology transfer approaches consider researchers and research institutions as sole generators of knowledge and technologies (Vanclay and Lawrence, 1994), while farmers are viewed as mere end-users (QUNO, 2015), relevance or suitability of agricultural technologies developed, acceptance and/or commitment by smallholders are likely to be undermined. These findings therefore highlight the need to re-align agricultural technology dissemination approaches with innovation systems approaches, as AIS emphasises knowledge co-generation and information sharing between and within different actors in the system (World Bank, 2012). Knowledge co-generation with farmers would be particularly relevant considering that learning from farmers, and from the local indigenous knowledge in general, is necessary given the heterogeneity of smallholder farming communities (Cacho *et al*., 2018) and contextual nature of agricultural innovations, particularly CA (Whitfield *et al*., 2015; Giller *et al*., 2015). Findings of this research show that under the current (linear) dissemination approach, knowledge and/or feedback from smallholders (the target users of the technology), is often ignored and rarely sought by extension officers, promoters, and researchers (see Chapters 4 and 5). Consequently, the top-down approaches compromise ownership of projects since the extent of genuine

participation (from project inception), the ability to influence decisions, and creation of common goals, determines the extent of individuals' (farmers) commitment and ownership to interventions and sustainability (Arnstein, 1969; Wamsler, 2017). These findings imply that there is also need for strengthening social interaction processes (Waters-Bayer *et al*., 2009) amongst stakeholders, including stronger involvement of farmers to stimulate two-way social participatory experiential learning and sharing of knowledge (Future Agricultures, 2012). Taking a broader perspective, these findings reinforce calls for strengthening of stakeholder platforms, not only nationally, but at district and local levels of relevant project-based innovation systems (Dougill *et al*., 2017).

While CA promoters overly rely on lead farmers (or opinion leaders (Rogers, 2003)) to convey CA extension messages and technical support to follower farmers because of an inadequate extension workforce, current application of the lead farmer (LF) approach instigates social challenges which undermine its effectiveness. Mis-application of the LF approach breeds social tensions due to perceived unequal distribution of project resources or incentives between LFs and followers. As follower farmers widely observe that LFs receive much more attention and incentives (e.g. allowances, bicycles, livestock, clothing materials, fertilisers, seeds, and herbicides), perception of inequality in CA clubs leads to disenchantment among followers. Similar intra-group issues have been reported in the works of other authors (e.g. Mapila *et al*., 2010 and Ramdwar *et al*., 2014). Challenges of widening social inequalities amongst participants of rural agricultural development interventions undermine the effectiveness of using LFs. Though effective farmer groups are important constituents of innovation systems (Future Agricultures, 2012), existence of accountability and governance issues in CA clubs/groups (see chapters 4 and 5), is a constraint requiring due attention of promoters. Evidence from this research shows that application of the LF approach in its current form would fail to facilitate sustained CA implementation among poor smallholders. Therefore, CA promoters need to re-design the LF approach to incorporate strategies that remove perception of alienation among follower farmers due to perceived concentration of incentives, training, and extension visits on LFs. Thus, refining the LF approach would probably help to curb elements that breed social

inequalities and tensions leading to dis-adoption amongst follower farmers in CA clubs. In addition, re-designed LF approaches need to take into consideration the limitations in technical capacity of LFs, which have major implications for the quality of how-to-knowledge shared with follower farmers. Further research would be necessary to investigate ways of addressing issues of social inequality and alienation associated with the LF approach in CA interventions, taking into account contextual conditions.

Although how-to-knowledge has critical influence in dis-adoption of innovations (Rogers, 2003), findings from this research show that most change agents concentrate their efforts on creating awareness-knowledge of CA. Despite having reasonable awareness-knowledge of CA, FGDs revealed that lack of how-to-knowledge was widespread among smallholder farmers participating in this study. Due to limited how-to-knowledge, farmers are overwhelmed by various technological challenges encountered as they implement CA practices and many hold the perception that CA is too complex to be implemented independently (Ndah *et al*., 2014), as required by promoters. The lack of appropriate how-to-knowledge compromises farmers' competences to effectively practise CA, amidst technological constraints (e.g. increased weeds, pests and diseases) and insufficient or poor extension support. Under such circumstances, smallholder farmers get exasperated and are prone to dis-adoption.

Greater effort is needed in co-learning, generation, and dissemination of appropriate CA knowledge. Invigoration of the national CA research agenda is necessary, since weakness in CA research permeates knowledge gaps that have been shown to undermine CA implementation (Whitfield *et al*., 2014). Current inclusion of CA in government's national research agenda is insufficient (Chapter 6); unsurprisingly NGOs dominate CA research, which may be skewed towards serving their own interests, priorities and (internationally-inclined) agendas (Wood *et al*., 2016). It is imperative to broaden the national research agenda to encompass nationally-appropriate technological, social, political, and institutional dimensions in order to complement the biophysical and economic analyses currently dominant in CA research. Such a comprehensive approach would advance farmer-centred approaches in technology generation and dissemination, while addressing

constraints along entire value chains. To engender relevance and applicability of research outputs to smallholder farmers, researchers, promoters and change agents should regard and actively involve farmers as innovators, not beneficiaries, as they have the ability to experiment and adapt innovations to fit their unique situations and aspirations (Sumberg *et al*., 2003). In this regard, long-term multi-disciplinary participatory research integrating bio-physical, technological, economic, social, policy and institutional aspects would be suitable (Stringer *et al.,* 2017).

Longer project implementation cycles, not less than 5 years, are necessary in CA implementation. Long implementation cycles enable longer-term institutional support for farmers (Ouagadougou Declaration, 2015; Wettasinha *et al*., 2014), and provide ample time to incorporate lessons learnt into the project to maximise adoption (Bwalya Umar, 2017). Considering that such a shift in strategy would require commitment of even greater resources than in the current short duration projects, strong and independent empirical evidence of implications (e.g. costs, outcomes, and trade-offs), is necessary to inform any shift in approach. While initial costs of longer-term projects would inevitably be comparatively higher than in current shorter duration CA projects, perhaps empirical evidence of potential wider gains from reduced dis-adoption and more sustained implementation, could justify investment in longer term projects. With longer-term projects, smallholders would access extension and advisory support for periods long enough to sufficiently build their how-to-knowledge, and enable the build-up of tangible benefits before projects wind up, in consideration of slow accrual of technological benefits under CA (Pittelkow *et al*., 2015). In this way, smallholder farmers would have ample time to make a more realistic assessment of CA, and perhaps sustained adoption could be achieved and dis-adoption reduced. This has been the case in other contexts. For instance, provision of longer-term institutional support in finance, extension, advisory services and marketing proved successful with farmers in Uganda (Future Agricultures, 2012).

In summary, based on findings of this research, the following recommendations are proposed to minimise smallholder farmers' dis-adoption of CA in Malawi: 1) strengthen integration of CA in agricultural and environment policies with a view to facilitating

resource mobilisation, achieving CA coherent strategies, enabling institutional practices, and to foster a conducive environment for smallholder farmers implementing CA; 2) employ longer term, flexible, and low-cost CA strategies adaptable to various farming conditions, preferences and contexts, recognising that smallholder farming communities are not homogeneous; 3) improve the approach in utilisation of lead farmers in CA interventions, taking into account their capacity limitations, and also to eliminate perceived alienation of follower farmers and inequality or unfairness issues in CA clubs; 4) enhance stakeholder collaboration, including genuinely engaging communities from inception and throughout the project life span, seeking feedback and continuously learning to modify and adapt CA projects accordingly; and 5) strengthen CA research in the national research agenda, apply systems thinking approaches in knowledge co-generation, and properly integrate CA in the farm system in order to minimise conflicts and/or unintended consequences.

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Appendix 1

Ethics approval document

Performance, Governance and Operations
Research & Innovation Service
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UNIVERSITY OF LEEDS

Edna Chinseu
School of Earth and Environment
University of Leeds
Leeds, LS2 9JT

ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee
University of Leeds

8 April 2015

Dear Edna

Title of study:	**Smallholder Farmers' Dis-adoption of Agricultural Technologies: The Case of Conservation Agriculture in Malawi**
Ethics reference:	**AREA 14-100, response 2**

I am pleased to inform you that the above research application has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and following receipt of your response to the Committee's initial comments, I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	Version	Date
AREA 14-100 supervisor's response.txt	1	31/03/15
AREA 14-100 Ethics-response-guide.docx	1	20/03/15
AREA 14-100 Edna-ethics-edited-.docm	1	20/03/15
AREA 14-100 Edna-ethics-.docm	1	02/03/15
AREA 14-100 Ed-Fieldwork RA form.doc	1	02/03/15
AREA 14-100 Consent-professionals-sign.docx	1	02/03/15
AREA 14-100 Consent-mmunity.docx	2	20/03/15
AREA 14-100 Consent-professionals.docx	2	20/03/15

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval, including changes to recruitment methodology. All changes must receive ethical approval prior to implementation. The amendment form is available at http://ris.leeds.ac.uk/EthicsAmendment.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at http://ris.leeds.ac.uk/EthicsAudits.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

Jennifer Blaikie
Senior Research Ethics Administrator, Research & Innovation Service
On behalf of Dr Andrew Evans, Chair, AREA Faculty Research Ethics Committee

CC: Student's supervisor(s)

Appendix ii

Interview schedule for key informants

1. What is the role of your organisation in CA?
2. How does your organisation define CA?
3. What are the CA components you are promoting?
4. Why does your organisation promote/implement CA?
5. What is/are the source(s) of funding for the CA activities being promoted/implemented by your organisation?
6. Do you have frontline extension workers? If yes, where are they based? What minimum qualifications do they have?
7. Does your organisation collaborate with other stakeholders in the promotion/implementation of CA? If yes, provide details - with whom and areas of collaboration.
8. How does your organisation deliver CA messages to farmers?
9. Do you think other CA promoters disseminate conflicting messages to farmers? If yes, please give examples.
10. In your view, are there any farmers that have stopped practicing CA or likely to stop practicing CA? What could be the possible reasons for dis-adoption?
11. Do you encounter challenges in promoting CA? If yes, please explain. What could be possible solutions to these challenges, if any?
12. Any further views on CA dis-adoption among smallholder farmers in Malawi?
13. Do you know of any individuals who may provide insights into smallholder farmers' dis-adoption of CA?

Appendix iii

Household survey questionnaire

Name of respondent: _____ District: _____ EPA: _____ Section: _____ Village: _____

Interviewer's name: _____

Date: _____ Questionnaire number (office use only): _____

A. SOCIO-ECONOMIC INFORMATION

1. Gender**:** 1= Male 2 = Female

2. Age: 1= 16-25 2= 26-35 3= 36-45 4= 46-55 5= 56 and above

3. Marital status**:** 1=Single 2=Married 3= Divorced 4=Widowed

4. Highest education level attained: 1. None 2. Primary 3. Secondary

4. Tertiary 5. Adult literacy

5.Household size: How many people including yourself, currently live and eat in your house? _____

6a. Size of land cultivated during the 2014/15 season

_____

6b. How did you acquire this land for farming?

1 = Inherited 2= Rented
3= Bought 4= Other, specify.....

7. Who makes farming decisions in your household?
1.Husband 2. Wife 3. Both
4.Other, specify.....

8a. Main income source(s) in the household

Income source	Tick as many boxes
Crop production	
Livestock production	
Formal (permanent) employment	
Casual labour (*ganyu*)	
Pension	
Forest products, specify.....	
Remittances /Gifts	
Petty business/income generating activities (specify)	
Other (specify).....	

8b. What is your total annual income estimate? (Kwacha)

.....

9. Main crops grown

Code	**Crop**	**Area (acre)**	**Cropping system used**	**Yield (kg)**
1	Maize			
2	Groundnuts			
3	Tobacco			
4	Sweet potato			
5	Cotton			
6	Soya			
7	Common beans			
8	Cassava			
9				

Codes for cropping system

1=Monocropping 2=Intercropping/mixed cropping 3=Crop rotation

10. Do you own livestock?

1. Yes 2. No

If yes, mention the type of livestock owned

Code	Type of livestock	(tick as many boxes)
1	Chicken	
2	Ducks	
3	Guinea fowl	
4	Pigs	
5	Goats	
6	Cattle	
7	Rabbits	
8	Doves	
	Other (Specify)	

B. Conservation Agriculture Information

11. Adoption Status

1. Currently practising CA 2. No longer practising CA

12. Which CA components do/ did you implement?

For current CA adopters, use the table below, while for dis-adopters use the second table

Which year did you start CA?	List CA practices being implemented (Use codes below)	Area under CA (acre)	Why did you start CA? (use codes below)

CA practices codes:

1. No-till (old ridges) 2. Basin planting 3. Mulching 4. Intercropping 5. Crop rotation
6. Manure 7. Other, specify: _____

Reasons for starting CA codes: 1**.** Higher yields 2. Improve soil fertility 3. Improve soil moisture
4. To save labour 5.Control soil erosion 6.Peer pressure 7.Self initiative 8. Other, specify……

For those that dis-adopted, use the table below

Which year did you start CA?	Which year in you stop practicing CA?	List CA practices you implemented (Use codes below)	Area under CA (acre)	Why did you start CA? (use codes below)	Why did you stop CA?

CA practices codes:

1. No-till (old ridges) 2. Basin planting 3. Mulching 4. Intercropping 5. Crop rotation
6. Manure 7. Other, specify: _____

Reasons for starting CA codes: 1**.** Higher yields 2. Improve soil fertility 3. Improve soil moisture4. To save labour 5.Control soil erosion 6.Peer pressure 7.Self initiative 8. Other, specify……

13. What is/was the location of your CA field?

1. Along the road 2. Near the homestead 3. Far away from the road or home 4. Other, specify: _____

14. Do/did you hire labour to manage your farming activities?

1. No 2. Yes

15a. How do/did you obtain initial inputs to kick-start CA?

1. Grant 2. Loan 3. Bought with my own cash
4. Government Input Subsidy 5. Other, specify: _____

15b. Mention the farm inputs in 15a above? (tick as many)

1. Inorganic fertiliser 2. hybrid seed 3. herbicides 4. sprayer
5. Other, specify: _____

15c. From year 2, how do/did you obtain farm inputs?

1. Grant 2. Loan 3. Bought with my own cash
4. Government Input Subsidy 5. Other, specify: _____

B1 No-till (Old/ridges)

(Q16 is *for those practising/ previously practise (no-till/ old ridges)*

16. What challenges do/did you face with the use of no-till/old ridges?

1. Soil compaction 2. Increased surface runoff 3. Increased weeds
4. Other, specify……

B2 Mulching (*Only for those practising/previously practised mulching-check Q12 table above)*

17. Where do/did you obtain crop residues for mulching?
1. From own field 2. Collected from neighbour's fields
3. Provided by NGO 4. Other, specify_____

18. What is/was the type of mulch used in your CA field?
1. Maize stover 2. Legume residues
3. Old thatch/grass 4. Weed residues 5. Other, specify_____

19. Do/did you use crop residues for other purposes?
1. No 2. Yes

19b. If yes, what are the other uses?

Other crop residue uses	Tick as many boxes
Firewood	
Livestock feed	
Manure-making	
Fencing	
Sterilising tobacco fields	
Other, specify	

20. What is the main challenge do you/did you encounter with the use of mulch?
1. Burning crop residues
2. Crop residues are scarce
3. Poor crop emergence
4. Mulch bring pests and diseases
5. Causes water logging

6. Laborious when laying residues and planting
7. Expensive to transport crop residues
8. Other, specify: _____

B3 Manure application (*Only for those who applied/previously applied manure-check Q12 table above)*

21. What type of manure do/did you apply in your field?

1. Compost manure 2. Animal manure
3. A mixture of compost and animal manure
4. Other, specify.....

22. How do/did you obtain the manure above?

1. I make/made to the manure myself 2. Collect from neighbours
3. Bought by NGO 4. Other, specify_____

23. What challenges do you/did you encounter with the use of manure?

1. Difficult to find composting materials 2. Scarcity of livestock manure
3. Increased pests/diseases 4. Increased weed infestation
5. Laborious to apply manure 6. Expensive to transport manure
7. Other, specify_____

B4 Weed management

24. Do/Did you apply herbicides in your field?

1. No 2. Yes

B5 Planting basins

For those who do/did use planting basins (Please cross-check with Q12)

25. What are the main challenges you encounter/encountered with the use of planting basins?

1. Waterlogging 2. Difficult to dig basins 3. Neighbours laugh at me 4. Expensive to hire labour 5. Other, specify……..

B6 CA Dissemination

26. Do you have an extension worker in your area?

1. No 2. Yes

27. If yes to 26 above, how many times does the extension worker visit you?

1. Never visits 2. Once a month
3. Two times a month 4. Once in two months
5. Once in a year

28. How much technical training do you need to successfully implement CA?

1. No any training required 2. Very little training required
3. A lot of training required 4. Don't know

29. Have you ever attended training in CA?

1. No 2. Yes

30. Are you a member of a CA farmer's club/group?

1. Yes 2. No

31. How do you obtain information on CA?

Information channel	Tick as many boxes
1. Field days	
2. On farm demonstrations	
3. Government extension worker	
4. NGO extension worker	
5. Farmer-to farmer interaction	
6. Radio	
7. Television	
8. Other, specify	

B7 Farmer's perception

32. In your opinion, which is easier to implement between CA and conventional farming?

1. CA 2. Conventional farming

3. No difference

33. In your opinion, has/had CA improved your crop yields?

1. Yes 2. No 3.Don't know

34. Do you think CA has improved/improved soil fertility in your farm?

1. No 2. yes 3. Don't know

35. Do you think CA is suitable to smallholder farmers? Explain your choice

1. Yes 2. No 3.Don't know

_____
_____
_____
_____

36. Why do you think smallholder farmers abandon CA? Please explain

_____
_____
_____
_____

37. What do you think should be done to successfully promote CA in Malawi?

_____
_____
_____
_____
_____
_____

End of questionnaire, thank you!

Appendix iv
Area of CA among respondents

Appendix iv: Table of CA area among survey respondents

Minimum	Maximum	Mean	Mode	N
0.01ha	0.37ha	0.0342ha	0.01ha	300