

**ASSESSING THE IMPACT OF SUSTAINABLE FARMING TECHNIQUES ON
SMALLHOLDER FARM
ENTERPRISES IN ZIMBABWE**

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DECLARATION

By submitting this thesis, I declare that the entirety of the work contained therein is my own, original work, of which I am the sole author (unless explicitly stated otherwise) and that I have not previously submitted it for any qualification, in its entirety or in part.

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ABSTRACT

The aim of this thesis was to investigate if the Conservation Agriculture (CA) project being implemented by Zimbabwe Farmers Alliance Trust, a non-governmental organisation, has improved the livelihoods of participant farmers. The research was done in the Mazowe, Chiweshe area where the organisation has been working with farmers with the key objectives of improving food security, livelihoods and stabilising production for the rural households. The research also looked at production trends and adoption levels of CA in the area. Yields were viewed as an important element since food security of rural communities is constantly under threat because of droughts. A key element of the thesis was primary research done in Mazowe Chiweshe Ward 4, where farmers were interviewed to get information on their experiences with the CA project.

The study was informed by both primary and secondary data. A literature review was conducted to give a background on sustainability and multifaceted problems facing the globe; dubbed as a polycrisis. In order to assess the impact of the project, a framework was developed to define sustainability at global level and also at small-scale farmer level. The Sustainable Livelihoods Approach framework was used as the assessment tool that looks at capital assets as given by Conway and Chambers. The framework goes beyond financial gains and looks at capabilities, assets and activities required for a means of living. The CA project was thus assessed according to this framework as a yardstick for improvement of livelihoods in the area. Primary data was gathered from a sample of 25 farmers randomly selected from a total of 250 farmers involved in the project under ZFAT. The data was gathered through questionnaires, key informant interviews and participant observation techniques.

With regards to the adoption of CA and its principles, the research suggested that farmers are eager to practice sustainable agriculture, but the scale of the project is too small to expand the project to more than the 250 farmers already in this project. It was also found that non-governmental organisations have played a significant role in introducing sustainable farming and that the government now need to step up efforts in supporting the projects. The study concluded that the CA project has improved livelihoods and is helping to stabilise production through sustainable land use and advanced farm management practices. The project has not only benefited the direct project beneficiaries or key participant farmers but also the environment as soil fertility is improving and biodiversity is being protected and enhanced. The programme has managed to create a mind-set in

the community that; what we have today is a result of the way past generations operated and that we should feel challenged to leave behind a better-managed and flourishing environment for the next generation. This was concluded as a significant number of farmers in the interviews showed that they have changed perceptions since joining the project.

The study concluded with recommendations for up-scaling of the project as well as the need for collaboration between relevant stakeholders. This would promote projects of similar nature that promote sustainability and sustainable livelihoods. However, the case study was specific to the Mazowe Chiweshe area and the findings presented in this thesis cannot be viewed as representative of the larger smallholder farming sector though it may provide relevant and positive pointers for similarly beneficial projects to be implemented elsewhere.

OPSOMMING

Die doel van hierdie tesis was om te bepaal of die bewaringslandbouprojek van die nie-regeringsorganisasie Zimbabwe Farmers Alliance Trust (ZFAT) die deelnemende boere se lewens verbeter het. Die navorsing is in die Mazowe Chiweshe-gebied onderneem, waar die organisasie boere bystaan om landelike huishoudings se voedselsekerheid en lewensgehalte te verbeter en landbouproduksie te stabiliseer. Die navorsing het ook aandag geskenk aan produksietendense en die vlakke van aanvaarding van bewaringslandbou in die streek. Opbrengste is as 'n belangrike element beskou, aangesien droogte voortdurend die landelike gemeenskappe se voedselsekerheid bedreig. 'n Kerndeel van die tesis was primêre navorsing wat in Wyk 4 van Mazowe Chiweshe onderneem is, in die vorm van onderhoude met boere om inligting in te samel oor hul ervarings van die bewaringslandbouprojek.

Die studie is deur sowel primêre as sekondêre data gerig. 'n Literatuuroorsig is onderneem vir agtergrond oor volhoubaarheid, sowel as oor die veelseortige probleme waarmee die wêreld te kampe het en wat as die 'polikrisis' bekend staan. Om die impak van die projek te beoordeel, is 'n raamwerk ontwikkel om volhoubaarheid op algemene sowel as kleinboervlak te omskryf. Conway en Chambers se 'volhoubare bestaan'-benadering is as assesseringsinstrument gebruik om kapitaalbates te beoordeel. Die raamwerk strek egter verder as finansiële gewin en ondersoek ook die vermoëns, bates en aktiwiteite wat nodig is vir 'n volhoubare bestaan. Aan die hand van hierdie raamwerk is daar dus beoordeel tot watter mate die bewaringslandbouprojek plaaslike mense se lewens verbeter het. Primêre data is ingesamel uit 'n steekproef van 25 boere wat aan die ZFAT-projek deelneem. Die data is met behulp van vraelyste, onderhoude met sleutelinformante sowel as deelnemerwaarnemingstegnieke bekom.

Wat die aanvaarding van bewaringslandbou en die beginsels daarvan betref, toon die navorsing dat boere gretig is om volhoubare landbou te bedryf, maar dat die skaal van die projek te klein is om meer as die bestaande 250 boere in die projek te help. Daar is ook bevind dat nie-regeringsorganisasies 'n beduidende rol gespeel het in die inwerkingstelling van volhoubare boerdery, maar dat die regering nou sy pogings ter ondersteuning van die projek moet versterk. Die studie kom tot die gevolgtrekking dat die bewaringslandbouprojek, deur volhoubare grondgebruik en gevorderde bestuurspraktyke, lewensgehalte verbeter en produksie gestabiliseer het. Nie net die

deelnemende boere het by die projek baat gevind nie, maar ook die omgewing, aangesien grondvrugbaarheid verbeter en biodiversiteit beskerm en versterk word.

Die studie sluit af met aanbevelings oor die uitbreiding van die projek, sowel as die behoefte aan samewerking met tersaaklike belanghebbendes. Dit sal ander soortgelyke projekte vir volhoubaarheid en 'n volhoubare bestaan bevorder. Tog het die gevallestudie bepaald op die Mazowe Chiweshe-omgewing betrekking gehad en kan die bevindinge in hierdie tesis nie as verteenwoordigend van die groter kleinboersektor beskou word nie. Nietemin kan dit relevante en positiewe wenke bied vir soortgelyke voordelige projekte wat elders in werking gestel word.

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LIST OF ACRONYMS AND ABBREVIATIONS

AGRITEX	AGRICULTURAL TECHNICAL AND EXTENSION SERVICES IN ZIMBABWE
AICDD	AFRICAN INSTITUTE OF COMMUNITY DRIVEN DEVELOPMENT
AKST	AGRICULTURAL KNOWLEDGE, SCIENCE AND TECHNOLOGY
CA	CONSERVATION AGRICULTURE
CSO	CENTRAL STATISTICAL OFFICE
CSR	CASE STUDY RESEARCH
DFID	DEPARTMENT FOR INTERNATIONAL DEVELOPMENT OF THE UK
EU	EUROPEAN UNION
EU STABEX 1995	EUROPEAN UNION STABILIZATION OF EXPORTS 1995 PROGRAMME
FAB	FARMING AS A BUSINESS
FAO	FOOD AND AGRICULTURE ORGANISATION
FFS	FARMER FIELD SCHOOL
GHG	GREEN HOUSE GAS
GMO	GENETICALLY MODIFIED ORGANISM
GR	GREEN REVOLUTION
HEIT	HIGH EXTERNAL INPUT TECHNOLOGY
HH	HOUSEHOLD
IAASTD	INTERNATIONAL ASSESSMENT OF AGRICULTURAL KNOWLEDGE, SCIENCE AND TECHNOLOGY FOR DEVELOPMENT
ICRISAT	INTERNATIONAL CROP RESEARCH INSTITUTE
IFAD	INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT
IPCC	INTERNATIONAL PANEL ON CLIMATE CHANGE
LEIT	LOW EXTERNAL INPUT TECHNOLOGY
MEA	MILLENNIUM ECOSYSTEM ASSESSMENT

M & E	MONITORING AND EVALUATION
MDG	MILLENNIUM DEVELOPMENT GOAL
MoA	MINISTRY OF AGRICULTURE
NGOs	NON GOVERNMENTAL ORGANISATIONS
SAT	SUSTAINABLE AGRICULTURE TRUST
SI	SUSTAINABILITY INSTITUTE
SLA	SUSTAINABLE LIVELIHOODS APPROACH
SSA	SUB-SAHARAN AFRICA
UNDP	UNITED NATIONS DEVELOPMENT PROGRAMME
USA	UNITED STATES OF AMERICA
UP	UNION PROJECT
WFP	WORLD FOOD PROGRAMME
ZCATF	ZIMBABWE CONSERVATION AGRICULTURE TASK FORCE
ZFAT	ZIMBABWE FARMERS ALLIANCE TRUST
ZIMSTAT	ZIMBABWE NATIONAL STATISTICS AGENCY
ZIMVAC	ZIMBABWE VULNERABILITY ASSESSMENT COMMITTEE
ZNCAC	ZIMBABWE NATIONAL CROP ASSESSMENT COMMITTEE

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CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND AND MOTIVATION

For ages humans have tried to keep agricultural production high to meet their demand for food and raw materials. Globally, agricultural food production approaches that have been developed can be divided into two main categories: conventional agriculture and sustainable agriculture. The system most used globally is conventional agriculture, variously called modern, Green Revolution (GR) or industrialised agriculture, which has delivered tremendous gains in productivity and efficiency (Altieri, 2004; Borlaug, 2000). This approach as we know it today has also presented a myriad of negative environmental and socio-economic problems (Kate, 2008; Bowler, 2002; Brown, 2008). As populations increase, more pressure has been exerted on the land to meet demand for food and fibre through innovative means of production. However, there has been a growing focus within sustainability literature on whether the agricultural systems in use can maintain production without harming the environment and at the same time providing for the ever increasing population (Pretty, 2008; Food and Agriculture Organisation – FAO, 2007; Rosset, 2006).

The current food system has boasted of increasing production but its long-term viability is being questioned for many reasons (Gold, 1999; Rosenberg; 2006; Tripp, 2006). As stated above, the agricultural systems widely used now have been reported to bring a variety of economic, environmental and social problems (Altieri, 2004; Bowler, 2002; Kate, 2008; Feenstra, 1997). The news media regularly present us with the paradox of starvation amidst plenty, including pictures of hungry children juxtaposed with supermarket advertisements. Negative impacts of the current system have been witnessed on public health, ecosystem integrity, food quality, and in many cases bringing a disruption of traditional rural livelihoods, while accelerating indebtedness among many farmers (Altieri, 2009; Witt, 2011). The above problems are important indicators of a crisis linked to agriculture faced by a world where poverty has been a cause of concern for ages and food security issues are still prominent, especially in developing countries (United Nations Development Programme – UNDP, 2009). Corporate control in food systems has tightened while small scale farmers the world over are losing land to big corporations (Aziz, 2012; Feenstra, 1997). According to Pretty (2008) and Aziz (2012), African farmers have not been spared, especially the smallholder farmers (SHFs) who are the main focus of this research.

Conventional agriculture has both positive and negative consequences. At a global scale, some of the problems that are affecting the farmers and communities directly can be explained as follows:

- Soil productivity has declined because of degradation, pollution and overuse. Ploughing exposes it to erosion hence the fertile top soil is washed away whilst the heavy machinery used on farms compact the soil, limiting crop root penetration (Mann, 2008; Gold, 1999).
- The soil organic matter is very minimal, hence low water holding capacity and biological activity (Rosenberg, 2006). In some cases where irrigation is used, soils have become highly saline, causing a decline in soil biota activity.
- Agricultural practices have contributed to non-point source water pollutants that include: sediments, salts, fertilisers (nitrates and phosphorus), pesticides and manures (Brown, 2008).
- Natural cycles that maintain stable water availability have been disturbed by overuse of surface and ground water for irrigation (Brown, 2008).
- Excessive use of agrochemicals have caused the evolution of pests that have become resistant to one or more pesticides (Shiva, 1995; Kate, 2008).
- There has been a huge decline in populations of pollinators and other beneficial species through pesticide use, loss of wetlands and biota habitat, as well as reduced genetic diversity due to reliance on genetic uniformity in most crops and livestock breeds (Shiva, 1995; Kate, 2008).
- Forests have been cleared to pave the way for new farmlands reducing the tropical forests' buffer services and carbon sequestration, therefore elevated levels of carbon dioxide and other greenhouse gases contribute to climate change (Brown, 2008; Kate, 2008; Millennium Ecosystem Assessment – MEA, 2005).
- The gap between the incomes of rich and poor farmers is widening in the highly subsidized agricultural sector, with escalating concentration of agribusiness into fewer and fewer hands. Farmers have little control over farm prices, they are, in most cases, simply price takers and have lost their bargaining power because of globalised markets (Rosset, 2006; Tansey, 2008).
- Smaller farmers have lost their land due to economic pressures, leaving the land to work in the cities or on large farms. This contributes to the disintegration of rural communities and loss of their livelihoods. In the end this fuels the sprawl of shacks in towns (Rosset, 2006).
- As with many industrial practices, potential health hazards are often tied to farming practices. The health of the farmer and farm worker should also be considered in all farming practices (Kate, 2008; Patel, 2007).

The issues noted above are part of many other problems referred to as a 'polycrisis', which is thoroughly discussed in Chapter 3. The polycrisis is a multiple set of crises that tend to reinforce each other (Swilling, 2008) and has affected our agriculture while at the same time being perpetuated by the unsustainable way our agriculture is designed. Sustainable development was thus started, so that we can deal with the challenges of climate change, social inequity, ecosystem degradation and poverty, among other things.

In the search for alternatives the concept of sustainable agriculture was designed and is interpreted and used in many ways (Menalled, Bass, Buschena, Cash, Malone, Maxwell, McVay, Miller, Soto & Weaver, 2008; Rosenberg & Linders, 2004; Gold, 1999). Different definitions have been coined for this concept but there is a common thread that emphasises farming practices that meet current and future needs socially and economically whilst taking care of the environment. According to Sullivan (2001), sustainable agriculture produces abundance of food without depleting the earth's resources and without polluting the environment. This is supported by Menalled, et al. (2008) and Earles (2005) who adds that the emphasis is on a profitable system where environmentally sound practices are used in an energy efficient way that improves the quality of life in communities.

Zimbabwe is a country that was once recognized as the bread basket of southern Africa (FAO, 2009; Miles, 2010). That status has however been lost over the years since the late 1990s and the country is now a net importer of staple grains in order to boost food security for the poor rural communities (Miles, 2010; Dhewa, 2009). It also now applies for urban households, many whom are food insecure and unemployed. The situation worsened after the land reform programme as many government support programmes for SHFs have been discontinued due to lack of funds (Ministry of Agriculture, 2012). Therefore, yields dwindled and the agriculture is afflicted by droughts. The Zimbabwe Vulnerability Assessment Committee (ZIMVAC) advised that in 2012 the situation has worsened as compared to 2011 as the number of people in need of food aid actually doubled from 600 000 to about 1.2 million due to crop failures (Ministry of Agriculture, 2012). To help this situation and help the poor SHF in Zimbabwe, non-governmental organisations (NGOs) came up with a plan to introduce more sustainable farming methods (Hungwe, 2012; Marongwe, Kwazira, Jenrich, Thierfelder, Kassam & Friedrich, 2011). With the sustainable development courses I took at the Sustainability Institute, I also felt that there was a need for SHFs in Zimbabwe to seriously consider alternative sustainable farming methods for improvement of their livelihoods.

In Zimbabwe, agriculturists do not always agree on the agricultural pathway to follow but at least NGOs have introduced sustainable farming programmes that are at the centre of recent agricultural initiatives (FAO, 2009). The most popular pathway is conservation agriculture which is promoted as an alternative to conventional farming and as a way of improving rural livelihoods (FAO, 2009; Twomlow, Urolov, Jenrich & Oldrieve, 2008; Marongwe, et al., 2011). Farmers are encouraged to adopt sustainable farming techniques that emphasise land use management, crop management and water conservation methods to avert hunger in the drier areas of Southern Africa including Zimbabwe where communities experience drought once every two or three years (Twomlow, et al., 2008). The sustainable agriculture interventions have been promoted by Union Project Trust (UP) and other NGOs which promote sustainable livelihoods in Zimbabwe (Dhewa, 2009; Twomlow, et al., 2008). As efforts to revive the agriculture sector in Zimbabwe gathered momentum in 2004, UP and the Food and Agriculture Organisation in Zimbabwe engaged in an initiative towards enhancing and stabilizing agricultural productivity for communal farmers through advanced land use and management practices (Dhewa, 2009).

When I enrolled at the School of Public Leadership of Stellenbosch University for a BPhil in Sustainable Development, I gained much knowledge pertaining to sustainability and many issues around food security, biodiversity, leadership and ethics, ecological design and sustainable farming methods. The modules I attended were a good eye-opener. I did not know we were living in such an 'unsustainable' world. At the beginning of the year I had that ego of an ignorant scholar boasting of the B.Sc. Agronomy I had completed as my first degree. The modules were a bit challenging in the beginning but as the year proceeded I felt empowered with knowledge causing me to reflect on the life I had been living and the way I wanted to live from that very moment on.

In the module, Systems and Technologies for Sustainable Agriculture, I was surprised to learn much about numerous methods alternative to conventional agricultural production. Having been in the agriculture fraternity for many years, I wondered why I had not been shown the other side of the coin because honestly, in my Agronomy classes, I do not remember any lecturer mentioning alternative systems. After finishing my first degree, I joined an NGO, UP, which was promoting conservation agriculture projects. I thought the methods we were using with the farmers only applied to the poor because they did not have machinery and money to buy hybrid seeds and other high value inputs. I was lost! The modules in sustainable agriculture helped me to decide on my pathway to an MPhil. research topic. Up until the end of the year, I had not had a concrete topic but was pretty sure I wanted to work on something to do with food security and sustainable livelihoods.

I also adopted the statement by Masanobu Fukuoka that the “ultimate goal of farming is not the growing of crops but the cultivation and perfection of human beings” (Rosenberg, 2011). I mourned the approach held by many people who think that they could just farm without an attachment to the land, the biota and the ecosystems.

Having a background in agronomy, I have always had a dream of making a contribution to the world by improving agricultural production to feed the increasing world population. However, after taking the sustainable development modules at the School of Public Leadership, I felt the need for a paradigm shift in the way we approached our agriculture if we were to deal with the polycrisis facing the globe. Through all of these phases, I finally decided to conduct a farmer level assessment of the impacts of these project on the livelihoods of the communal farmers who are engaging in sustainable agriculture projects. I now believe that the promotion of sustainable agriculture in the SHF sector is a noble idea for the benefit of present and future generations. I later decided to do my research in Zimbabwe, which is my country of birth, and felt that it was going to be easy for me to fit into the UP project which was already running. From the knowledge I had acquired in many of my courses, I decided on doing a study that would help in understanding the way we could use sustainable agriculture to improve livelihoods.

After negotiations with the UP management, I was given the green light to work as a student attaché to facilitate my research in one of the districts the NGO worked in. The research was to assess the impact of sustainable farming techniques on smallholder farm enterprises. I established that the organisation had done another research project in my natural choice of area called Domboshava. The area is near Harare town and I had chosen it for its ease of accessibility. Due to a number of technicalities and indications that the NGO had earlier used Domboshava in their end of 2010/2011 season evaluations, I chose another district. I then settled for the Mazowe Chiweshe district so that I would not be replicating an assessment already done. I again got to understand that the evaluation done in Domboshava was at an upper meso-level of Sustainable Livelihoods Approach (SLA) intervention (levels of SLA are fully explained at length in Section 3.5.2). The meso-level deals with interventions at support level whereby supervision is done at district level to influence strategic plans and policy dialogues within the relevant subject or issues for effective execution of a programme. The organisation wanted to evaluate if it had managed to implement their project effectively to meet the objectives which were mostly centred on institutional arrangements.

Because of the fact that an evaluation had already been done, I had to do something different and make considerations on the choice of research area to work in as well as the approach I took in my case study research. My research was thus to be done at a lower level of intervention which dealt directly with the households at community level. At this time, Union Project (a coalition of Commercial Farmers Union – CFU, Zimbabwe Farmers Union – ZFU and Zimbabwe Commercial Farmers Union – ZCFU) was folding their programme and another NGO, Zimbabwe Farmers' Alliance Trust (ZFAT) was taking over but with only two Farmers' Unions (CFU and ZFU) remaining in the coalition. This was because the pilot project which had been used by the European Union (EU) as an experiment on helping farmers out of poverty using sustainable farming techniques, was being concluded (Hungwe, 2012).

The organisation has projects in the other seven provinces of the country, but for this study the research was carried out in Mashonaland Central province. The organisation felt that much effort has been invested in the province and that there was a need to evaluate the progress in one of the districts which rated among some of the biggest uptake areas. The research looks at smallholder farm enterprises and therefore views farming operations on small portions of land as a business unit and source of livelihoods. The definition of smallholder farmers (SHFs) differs from country to country and in different agro-ecological zones. In the Zimbabwean context, 'smallholder sector' refers to communal, old resettlement and small scale commercial farmers with land sizes varying from 0.1 ha to 7.5 ha (Rukuni, 1994). These land sizes generally lead to subsistence agriculture where farmers only produce to feed a family and have a few surpluses to sell, if any.

In Zimbabwe, many black farmers were pushed to marginal and drier areas during the colonial era and were allocated land averaging from 0.1 to 1 ha per household in the crowded communal lands or reserves (Miles, 2010). In this research, the focus will be on the households which have a long history of low production and have been perennially supplied with food aid by NGOs to boost food security. These are the communities where sustainable agriculture is being promoted to increase production and reduce the dependency syndrome by improving farm incomes and hence livelihoods (Farming for the Future – FFF, 2011; Dhewa, 2009).

Farming provides households and individuals with income and food, and according to the United Nations Development Programme (UNDP, 2009) to improve food security and have a meaningful economic impact in Zimbabwe, it is best to support communal farmers practicing sustainable agriculture who are generally smallholders. The global essence of a smallholder farm enterprise is to

ensure food security and financial viability especially in a world which is pushing for food sovereignty (Greenberg, 2011). There are calls for farmers to take up improved farming techniques and better land use management practices in order to graduate from just growing crops for subsistence to profit making enterprises (Dhewa, 2009). There is also a need for capacity building to help farmers, especially SHFs, to move from the concept of subsistence farming to food security and sustainable farming for a profit and benefit for future generations (Zimbabwe Conservation Agriculture Task Force – ZCATF, 2008).

1.2 PROBLEM STATEMENT

Communal farmers in Zimbabwe form almost 70 percent of the total populace in an agriculture oriented country where land and agriculture are highly contested issues (Rukuni, 1994; Dhewa, 2009). The challenge of SHFs is to grow crops efficiently for a profit which calls for a great deal of innovation by the land holders and those willing to help. In the past, relief agencies have traditionally provided inputs but, because of a lack of appropriate land and crop management interventions, farmers failed to translate these relief investments in seed and fertilisers into sustained gains in productivity and incomes (Twomlow, et al., 2008). Recently, sustainable agriculture techniques have been implemented as the drivers and means to sustainable livelihoods (Dhewa, 2009).

In Zimbabwe, the revival of the agriculture sector entails increasing farm productivity to ensure household level food security and sustainable livelihoods. Livelihoods in this context mean capabilities, assets and activities required for a means of living. According to Conway and Chambers, a livelihood is deemed sustainable when it is resilient enough to recover from external and internal stresses and shocks, enhancing capabilities, assets and activities (intra- and intergenerational) without undermining the natural resource base (1991). The NGO, UP, felt the need to introduce the 'farming as a business' concept in Chiweshe and other areas. Many SHF communities are very poor and it has been argued that poverty mostly resulted in food insecurity (Pretty, 2008; Laing, 2011) as the poor are unable to buy food. The organisation felt the need to look at SHFs to unlock the full potential of communal lands, hence reducing poverty and inequality through sustainable agricultural systems.

ZFAT took over the on-going project from UP which has been running since 2004. In conjunction with ZFAT, I decided there was a need to assess the project at farmer level to determine how it has

impacted their livelihoods. The study sought to investigate whether the project, which attempts to implement more sustainable agricultural techniques, is also having the desired effect of reducing poverty by improving livelihoods in the Chiweshe area. An improvement would mean that the farmers' livelihoods are now more sustainable and that they will be better off than before. Livelihoods in this case was defined as sustainable for the farmers when their capabilities, assets and activities required for the means of living can cope with and recover from recurrent stresses and shocks and maintain or enhance capabilities and assets for now and the future (Conway & Chambers, 1991). More detail on sustainable livelihoods is explained in Section 3.5.

On this note, the research also looked into the levels of adoption of the sustainable agriculture as well as productivity trends to help measure the way the farmers are improving or not owing to the adoption of conservation agriculture principles. Given the erratic rainfall and poor soils in Zimbabwe, communal farmers are always very vulnerable to food insecurity hence the dire need for systems that increase agricultural and farm yields and perhaps improve livelihoods.

1.3 RESEARCH OBJECTIVES

The main objective of the research is to assess whether the conservation agriculture project being implemented as an alternative to conventional agriculture has brought about significant changes as far as sustainable livelihoods for the SHFs in Mazowe Chiweshe are concerned. The organisation made an assumption that the conservation project it is supporting has improved the livelihoods of farmers taking part in the programme. I made it my objective to ascertain how the project has affected the livelihoods of farmers using SLA as a measurement tool for the success or failure of the project.

The study also investigated the trends in the adoption of conservation farming in the area. Farmers have many reasons for adopting practices of sustainable agriculture and this study presents and creates an opportunity for them to tell their side of the story. The sampled area also helps to make some conclusions on the level of adoption in the district under study.

To elaborate further on these objectives, research questions were formulated to guide the study in such a way that the design of the study and the literature gathered goes hand in hand to meet the

objectives. Below are the key research questions which were used in the formulation of the thesis. The research questions would further address clearly stated research objectives.

- i) Have sustainable farming techniques helped to achieve more sustainable livelihoods for the participant farmers?
- ii) What are the production trends of the specific crops (maize and sugar beans) after the adoption of sustainable farming techniques in Chiweshe as compared to when farmers used conventional agriculture?
- iii) What are the factors affecting adoption of the sustainable farming techniques in Chiweshe?
- iv) What are the levels of adoption of sustainable farming techniques by SHFs in the area?

1.4 DEFINITION OF TERMS AND CONCEPTS

Terms often used in this study are hereby defined as:

- Smallholder farmer (SHF) – a farmer with land holding of less than 2 ha for growing of crops. In the Zimbabwean context, these farmers operate in communal areas and in this specific study area this is the average size of land per household.
- Conservation agriculture (CA) – growing of crops with any tillage sequence that minimizes soil disturbance, the loss of soil and water and with low application of external inputs like fertilisers and agrochemicals (Twomlow, et al., 2008).
- Livelihood – capabilities, assets and activities required for a means of living. According to Conway and Chambers, it is deemed sustainable when it is resilient enough to recover from external and internal stresses and shocks, enhancing capabilities, assets and activities (intra- and intergenerational) without undermining the natural resource base (1991).
- Sustainable Livelihoods Approach (SLA) – a toolkit, or checklist, to understand livelihoods in responding to poor people’s own understanding of their situation (Kollmair & Gamper, 2002). It can be used to plan development activities and assess the contribution that existing activities have made to sustaining livelihoods (Serrat, 2008).
- Sustainable agriculture – a farming system capable of maintaining productivity and usefulness to society indefinitely whilst conserving resources, being socially supportive, commercially competitive and environmentally sound.

1.5 SIGNIFICANCE OF THE STUDY

The study can provide useful information to the stakeholders, especially ZFAT, on how well they are achieving their aims and whether participants are benefiting from involvement. It can also help identify areas for improvement. The study could also be used by other NGOs implementing or contemplating the implementation of sustainable farming techniques to help SHFs. It can also be motivational to farmers if there are any positive impacts realised from the past endeavours of the projects.

The study may bring up important areas for future research that could inform policy making. The Zimbabwean government has supported SHF agriculture since independence and therefore they need information to inform policy-making to help turn around the sector which has been dogged by problems since the late 1990s. NGOs and other stakeholders have been involved in complementing government efforts to help farmers, hence the need to assess successes and failures for improvement and continuity.

With the help of government and its extension services, the study may also help promote adoption of more sustainable farming techniques among SHFs, NGOs and other stakeholders trying to uplift livelihoods in communal areas. Last, but not least, the study could contribute to the enrichment of the agricultural knowledge systems not only in Zimbabwe but in the whole southern African region since farming practices in the region are similar and the challenges and opportunities in the agricultural sector are similar across the region.

1.6 AREA OF RESEARCH AND INTRODUCTION TO RESEARCH DESIGN AND METHODOLOGY

This section will start with an introduction to the area selected for the study and then move on to introducing the chosen research design and methodology implemented to gather data.

1.6.1 Study Area

The research was done in the Mazowe Chiweshe area, Ward 4, which is in Mashonaland Central Province in Zimbabwe. Mazowe is the district and Chiweshe is the specific communal area of study. In this study I often refer to the area as Mazowe Chiweshe. Mazowe is a valley about 104 km north of Harare, the capital city of Zimbabwe. Mazowe is known for its fertile red soils, and therefore farming is important, ranging from small to intensive large scale farms. The study area was selected after several considerations surrounding the organisation I was attached to during the research period. At first I had chosen the Domboshava area which is about 60 km from Harare but due to technicalities and changes within the organisation, I had to change to Mazowe Chiweshe (Ward 4) area. In Chiweshe, the organisation has about 250 farmers under the CA programme (Hungwe, 2012). After discussions with the management and from a research point of view, Chiweshe was chosen, given that it was also close to the capital where I was based.

The area was chosen after considering the climatic conditions and soil types which allows the study to be done in natural conditions where crops are rain-fed like in most communal areas in Zimbabwe. However, it is also important to note that Chiweshe is a very small area and therefore may not be truly representative of the SHF sector in Zimbabwe. The bio-geo-physical conditions in terms of Chiweshe's fertile soils and favourable climate in the Mazowe district offer a potential for high crop yields and even in bad years farmers get a few bags of grain rather than total crop failure.

Zimbabwe is divided into geographical zones depending on the amount of rainfall an area receives per year and the type of farming practiced in that area. These are called agro-ecological zones or regions, which range from Region One to Five with Region One receiving more than 1000 mm of rainfall per year. The last region, Region Five, receives less than 450 mm and is only suitable for extensive farming and cattle ranching. Mazowe is in Region Two, which covers about 15 percent of Zimbabwe's land area, and receives lower rainfall than Region One within the range of 750 mm - 1000 mm (ICRISAT, 2009 in Marongwe, et al., 2011). According to the Zimbabwean classification, which is based on conventional farming, the region is suitable for intensive crop and livestock production. There was much information I did not know about the area which I also discovered during my research. I decided to write more on this in my findings in Chapter 5 (which also includes a map of Zimbabwe showing the study area). This was more on the socio-economic status of the area and issues like population dynamics, the community culture, politics and their means of living. I was

lucky that many people in the area, including the leadership, were so willing to tell me openly how they lived.

1.6.2 Introduction to Research Design and Methodology

After selecting the study area, I developed my research design and methodology to meet the objectives and closely answer the research questions posed earlier in Section 1.3. I followed a qualitative research approach which utilised a number of tools to collect data that would address complementary aspects of the investigation. According to Holliday, a qualitative approach has an advantage of looking deeply into social life, and I felt the subject under study is located in a social setting (2002). With the overall objective of assessing the promotion of sustainable livelihoods at farmer level, I found a literature review design useful in this case where I needed to address non-empirical questions posed as research questions. Question i was to be addressed with the first part of literature found in Chapter 3 and Question ii was to be addressed by literature in Chapter 4 and the case study. The research utilised two designs: a literature review design and a case study research design.

During the research period I worked as a student attaché in the Monitoring and Evaluation (M & E) Department of ZFAT, making it relatively easy for me to access people relevant to the study and some archived project documents. In Chapter 2, a detailed research design and methodology will be outlined, giving a clear view of the role I played as a student attaché at ZFAT. For my assessment to be focused, I adopted the Sustainable Livelihoods Approach (SLA) as a measuring tool for the impact of the project on the participant farmers. A literature review was used to gather scholarly information on sustainability and the SLA. This literature review in Chapter 3 as well as that in Chapter 4 focusing on technical aspects of CA and its adoption in Zimbabwe were utilised to provide a methodology against which the livelihoods and adoption of sustainable techniques were assessed. The literature review and even the case study were however used to address almost all of the objectives since all objectives do not rely solely on one design. Findings from one data set are validated by the findings from at least one of the other data sets, thus helping to improve the integrity of the findings.

The first objective is to investigate what the project has brought to the livelihoods of farmers who adopted the sustainable farming techniques being promoted by ZFAT. According to Mouton (2001),

when using a qualitative case study design, ethnographic data collection is best suited. Therefore I made use of interviews, participant observation and documents or grey literature. In this research, an area visit ensured interaction with participant farmers and opportunities for observation. The information collected was then used together with the literature tools around sustainable development and the SLA gathered in the literature review.

The second objective was to assess the production trends for the two crops, maize and sugar beans, being promoted in the CA project. To obtain information on this, data was collected from participant farmers, the organisation's records and the Central Statistical Office (CSO) of the Zimbabwean government, so that data will not be one-sided. The data from the CSO was useful for checking on the general production trends in the district. Data collected from farmers, especially those who were involved since the inception or those who have been in the project for a couple of years, were of the utmost importance. The data collected from farmers was from the 2006/2007 agricultural season to the 2010/2011 agricultural season to ensure that trends, which are more specific to this particular project, were analysed. The production trends were then compared to conventional agricultural plots in the area or the yields farmers used to get before they converted to CA.

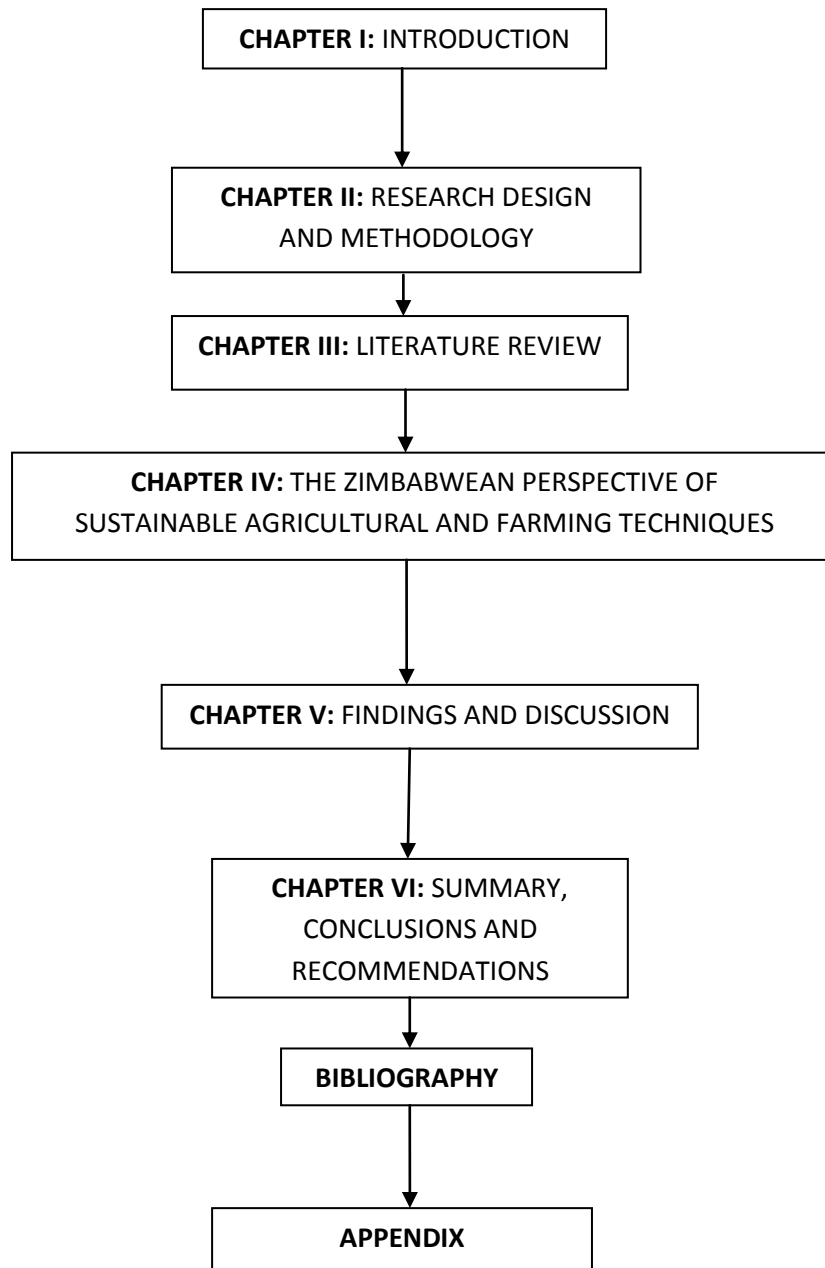
The objectives of assessing adoption levels and factors affecting adoption of the sustainable agricultural techniques called for information from the participant farmers in the community. The farmers were asked to supply reasons for adoption and what they think of the project after the NGO no longer offered agricultural inputs as an incentive. This was meant to help answer the research questions around adoption such that recommendations could be sought, if the project has brought any significant advantages to the community which could be communicated to those not participating in the programme.

The data was compiled from a sample of 25 farmers randomly picked from those participating in the project. A detailed outline of the sampling method used is given in Section 2.5. A limitation was however observed in only interviewing farmers involved in the CA project, who might be biased in support of their practices and this is discussed in the following chapter. After data was compiled from the sample of farmers, it was then analysed and interpreted to arrive at some conclusions and recommendations. Recommendations were more on the understanding of sustainable farming techniques and what can be done for them to be appreciated given their contribution to sustainable agriculture and development and as alternatives to the low yielding and problematic unsustainable practices of conventional farming.

1.7 OUTLINE OF THE THESIS

The flow diagram below shows the thesis outline.

Figure 1: Thesis Outline



CHAPTER TWO: RESEARCH DESIGN AND METHODOLOGY

2.1 INTRODUCTION

An outline of the design and methods used for data gathering and analysis in this study as well as the justification thereof is hereby presented. According to Marshall and Rossman, “research conduct represents decisions the researcher has made that a particular theoretical framework, design and methodology will generate data appropriate for responding to the research questions” (1999:22). The research used two distinct designs: literature review and case study. The literature review was used to understand SD and SLA theory and methods in order to design the questionnaires and interview questions which were used in the case study, correctly. Use of literature and a case study complemented each other in assessing the impacts of the CA project on livelihoods of the farmers in Mazowe Chiweshe area.

The chapter begins by giving a more detailed account of the operational NGO and then the history of CA, a sustainable farming technique being promoted by ZFAT in Mazowe Chiweshe area. An account of how the NGO operates helps in understanding the problem formulation and research objectives chosen as well as the research design to meet the research objectives. Research methodology is given thereafter to show the data gathering tools used. Data was gathered from a sample of farmers and their selection criteria are well laid out. I also discuss data collection instruments used, where I acted as a participant observer whilst administering questionnaires and interviewing key informants. This chapter ends by discussing how I analysed data and the limitations and possible sources of error in this qualitative research.

“Unlike a pristine and logical presentation in journal articles, real research is often confusing, messy, intensely frustrating and fundamentally non-linear” (Marshall & Rossman, 1999:21). This was my experience as I worked through the methodology I used and kept changing strategies to suit the environment I worked in. An idea borrowed from Kelly’s thesis (2009) said that often methodology does not have to use a prescribed set of tools, but is an on-going task of justification. Decisions made are merged through intuition, complex reasoning and weighing of a number of possible conceptual frameworks and alternative designs and strategies for gathering data. The literature review and case study design was implemented so that different sets of data could be used to address complementary aspects of the research.

2.2 ZFAT AND THE CONSERVATION AGRICULTURE PROJECT

This section is going to give a brief background of the situation in Zimbabwe and a short history of CA in the country. It also discusses how ZFAT was formed from the original project which was run under FAO by the Union Project (UP). The project approach is also discussed in terms of the ways in which it tries to assist SHFs.

2.2.1 History of CA in Zimbabwe

CA projects were first implemented by Brian Oldrieve in the north-eastern part of Zimbabwe around the late 1980s to increase yields and at the same time curb soil erosion (Oldrieve, 1993 in Marongwe, et al., 2011:2). The farming system was first introduced as a combination of traditional farming systems and the modern methods introduced by colonialists. The composite technology, which has now spread to almost all parts of the country, is a modification of the earlier traditional farming systems used to address factors that have been identified as the main causes of low agricultural yield levels in the SHF sector (Marongwe et al., 2011). Marongwe et al. added that, outside of the UP setup, CA was introduced to SHFs in the 2003/2004 agricultural season as a brainchild of donors and NGOs in a bid to improve food security and overall cereal production (2011). Recognition of the positive impacts of CA on crop productivity in other parts of the world led to intensive promotion in Zimbabwe by many of the NGOs in 2003 (Marongwe, et al., 2011). In order to co-ordinate the activities of these NGOs, a CA Task Force was set up with members cutting across the board of key NGOs, Universities, FAO, Ministry of Agriculture and research centres. The Task Force also came up with key and practical implementation guidelines for CA activities, monitoring and disseminating information on this sustainable farming technique (Zimbabwe Conservation Agriculture Task Force – ZCATF, 2009 in Marongwe et al., 2011).

According to Marongwe et al. (2011), the involvement of the private sector to supply inputs for some CA projects has helped to initiate a market-oriented agricultural production system. This supply of inputs was coordinated by the Union Project which started back in 2004 when three farmers' unions in Zimbabwe joined forces to form a trust for joint operations in the drive for reviving the agricultural sector of Zimbabwe through sustainable farming methods in communal areas (Dhewa, 2009). The ZCATF helped in the setup of the UP and provided guidelines for CA activities co-ordinated through UP project with funds from Delegation of the European Commission

(EC). FAO executed the monitoring of funds as UP did the Conservation Agriculture project between the 2004/05 and 2010/2011 agricultural seasons in the rural communities.

2.2.2 CA project since UP and Transition to ZFAT

The unions referred to in the above subsection have operations in all eight provinces of Zimbabwe with areas of influence distributed between the organisations. In every province, the organisations shared districts to work in and would have workshops where the farmers shared ideas and showcased their achievements as well as take learning courses. According to Mr Hungwe, who was the project manager since inception, the project was already showing that all-inclusive support can enable farmers to increase their productivity and stabilise livelihoods significantly (2012). It is his view that many of the perceived poor and vulnerable households are transforming their subsistence-based production into commercially-oriented production, thanks to appropriate support.

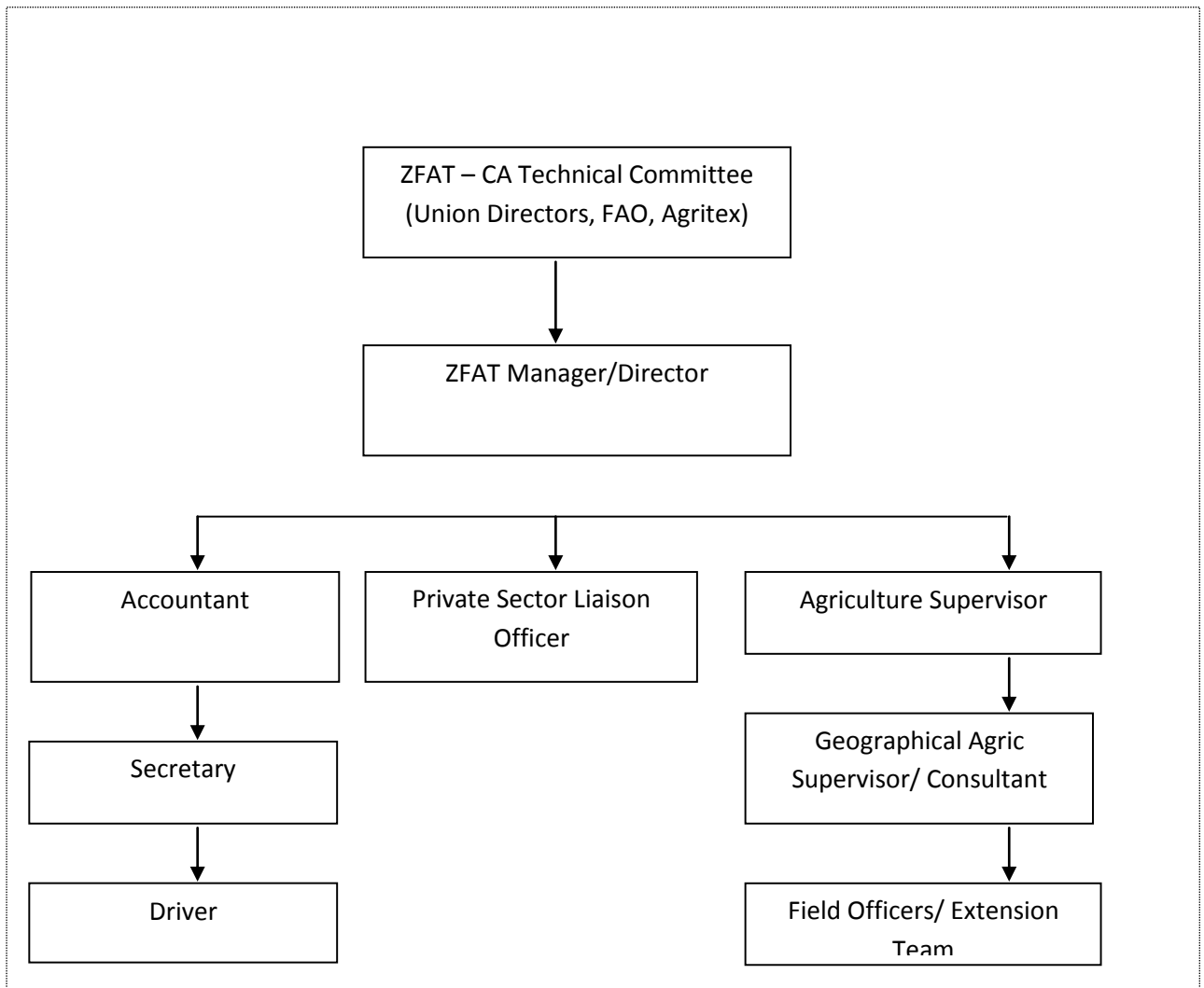
The project under UP was being implemented aiming to facilitate the rehabilitation of the agricultural sector in Zimbabwe through collaboration with farmers' unions and the private sector among other key players in the agricultural sector (Dhewa, 2009). The programme is still being funded by the EC, as they seek to increase food security and improve livelihoods using sustainable farming methods to help the poor smallholder farmers. Based on CA principles, UP set up an Innovative Agriculture Development Model in a multi-stakeholder approach bringing together farmers' organisations, government departments, farmers, the private sector, financial institutions and donors (Dhewa, 2009) for the full implementation of the programme. Training and capacity building of farmers and farmer organisations were the key activities of the organisation directly supporting small-scale farming communities, enabling them to increase productivity and become better integrated into markets (Dhewa, 2009).

I have known this organisation since 2009 when I was working as an Extension Officer, but I did not understand well how the projects were going to help the farmers. To me sustainability did not mean anything besides carrying on with a project for a long time. I could see that it was to some extent a bit cheaper for farmers to produce using CA but always doubted if the projects were not promoting a donor dependency syndrome by giving farmers inputs at the beginning of each season which they could pay back after harvesting. I also thought we were just helping farmers to remain in the farming sector to produce food and fibre but did not really care about the environmental and social

sustainability issues. However, the desire to gain more knowledge on sustainability led me to enrol at Stellenbosch University for the Sustainable Development Programme.

UP folded its programme at the end of 2011 as the funders wanted to evaluate the ‘experimental’ projects. ZCFU pulled out of the trust, making way for the formation of another trust, Zimbabwe Farmers Alliance Trust (ZFAT), which took over projects in some of the provinces. ZFAT had only CFU and ZFU (Hungwe, 2012) as members. Since ZFAT took over at the beginning of 2012, most of the information used in the research is based on UP’s account of the programme which set the ground for the projects. ZFAT took over almost all of the CA projects promoting sustainable livelihoods in communal areas. The organisation’s organogram is presented below.

Figure 2: ZFAT Conservation Agriculture Organogram



2.2.3 The Project Approach

Priority areas of intervention which ZFAT took over from UP are the livestock, crop, the institutional and the trade/marketing sectors which are run as separate projects in each and every district across the country. The organisation decided not to concentrate efforts in one place but spread the interventions such that each specific area could be helped in a way that enhance the activities the community had already been engaging in (Hungwe, 2012). The project works with the communal farmers facilitating training and capacity building as their key activities. Of the many projects run by the organisation, CA is the one of interest for this study and implemented in Mazowe Chiweshe area located in Mashonaland Central province which has mostly dryland field crop farming as its core livelihoods activity.

I joined the organisation in mid February 2012 as a student attaché under the Monitoring and Evaluation Department. From the time I joined, I had very little time to work in the field since the organisation was still doing a handover from UP. My main duty was provision of assistance to the Monitoring and Evaluation Coordinator whose duties were development and implementation of appropriate M&E systems, laying down tools and indicators to enable use of information for decision making within ZFAT, disseminating of M&E data and reports internally and externally, as well as ensuring competence of staff and peer educators in M&E data collection, analysis, interpretation and use through capacity building programmes.

This M&E department works closely with the organisation extension team which is in direct contact with the farmers and the latter is the link between the organisation and the communities. My job as a student attaché gave me more time to work on organisation documents and other data that link to the way the projects are being run. This department also checks regularly if the organisation is in line with its mission of directly supporting the small-scale farmers, enabling them to increase productivity, become better integrated into markets and improve their livelihoods. The strategy is to move away from short-term single activity actions to medium and long-term integrated support. The mainstay of the project has been the use of existing local approaches instead of imposing foreign strategies. Project interventions include extension, market linkage and input support (Dhewa, 2009).

2.3 PROBLEM FORMULATION AND RESEARCH QUESTIONS

Formulation of research questions was necessary to set the study parameters and guide the objectives in order to focus my research. The questions are again given below:

- i) Have sustainable farming techniques helped achieve more sustainable livelihoods for the participant farmers?
- ii) What are the production trends of the specific crops (maize and soya beans) after adoption of sustainable farming techniques in Chiweshe as compared to when farmers used conventional agriculture?
- iii) What are the factors affecting adoption of sustainable farming techniques in Chiweshe?
- iv) What are the levels of adoption of sustainable farming techniques by SHFs in the area?

These are the questions which were developed for elaborating on the research objectives such that the data gathered would directly address the problem statement. The SLA framework was then utilised to inform the questionnaires/interview questions giving a thread that runs from the literature review through to the case study to reach the research conclusions. The other questions were taken care of through the trends of adoption observed in the community, from the records of the organisation and what the farmers are saying about CA. Farmers gave direct answers on what they feel were the factors affecting the adoption of the practices and how others can be influenced to adopt the CA practices.

2.4 RESEARCH DESIGN

A research design is referred to as an overall plan that is used to obtain answers to questions that are being studied (Polit & Hungler, 1999). However, in order to generate a clear and well-presented design, the researcher needs to understand the problem statement and research objectives to be met. Decisions on the design are also affected by the context of information to be dealt with. In this case, a qualitative research approach was preferred to a quantitative since the former gives room for a deeper understanding of situations as the research population narrate their own stories. Holliday (2002) adds that qualitative research has an advantage of looking deeply into social life. The subject being studied can be located in a social setting. The researcher can thus be afforded an opportunity to explore the variables that are available in society and set boundaries that are manageable. A

qualitative approach was therefore deemed necessary since the research was concerned with collection and analysis of information that are non-numeric and non-linear (Loraine, Hughes & Tight, 1996).

The research utilised a literature review and a case study design. As indicated in the introduction above, the literature review in this case is a bit different from the normal literature review. It is utilised to develop a framework that defines sustainable livelihoods and thereby helps to answer the main research objective that seeks to investigate if farmers are achieving a sustainable livelihood. The literature review design was informed by Mouton (2001) who articulated that research design mainly focuses on the end product which is, in this case, the assessment results from the case study. The literature used for this research provides an overview of scholarship in SD which was then narrowed down to arrive at an understanding of sustainable livelihoods at farmer level in Chapter 3, Section 3.5. The idea was to give a thorough overview of wider literature concepts to do with SLA (used as an assessment tool) such that it will be easy to formulate interview questions and apply primary data in answering the research questions.

Literature reviews function to establish the underlying research paradigm and show an understanding of the research and the intellectual traditions it gains support from (Marshall & Rossman, 1999). I used this reasoning in discussing and understanding the sustainability concepts which apply to SHFs in Mazowe Chiweshe and the way farmers are affected at their level of livelihoods. However, in applying the literature review design, I also learnt from Mouton that it has some limitations. He emphasised one, namely that a “literature review, no-matter how critical, will not generate, or validate existing empirical insights” (2001). He points out further that reviews often lead to theoretical insights which would need empirical study to be tested. In this instance, I use the case study of the Mazowe Chiweshe communal area project. The case study also worked as a check to how the literature reviewed applied to the area under study.

A case study was carried out utilising qualitative research methods that applied ethnographic tools for data gathering. Case study research (CSR) is preferred when ‘how’ and ‘why’ questions are being posed, when the investigator has little control over events and when the focus is on contemporary phenomena within some real-life context (Yin, 2003). Much of the data was collected from the farmers involved through interviews, questionnaires and participant observation by the researcher. Case study design helps more generally with providing an overall framework to review events within their real-life context (Yin, 2003). Retaining the holistic and meaningful characteristics of real-life events is particularly advantageous when the relevant theory underlying the research is of a holistic

nature (Yin, 2003). In the context of this research, CSR was adopted as a way to assess the impact of sustainable agriculture in the Mazowe Chiweshe area.

Case studies are so informative that, when sites are selected on the basis of typicality as opposed to uniqueness, they can be used to derive lessons that can be applied to other developmental projects to scale up recommendations as well. During the CSR, researchers collect detailed information using a variety of data collection procedures over a sustained period of time (Creswell, 2003). Hamel, Dufour and Fortin (1993) support the use of case studies as they tend to bring a greater insight and understanding of the dynamics of a specific situation. Although it can be useful to scale up recommendations, case studies are also inherently context specific and not specifically seeking replication (Robson, 1993). The most important aspect of case study strategy is its flexibility, but authors like Kane and O'Reilly de-Brun also found some limitations in their use (2001). In most cases, the intended time for finishing a study is compromised owing to the case studies being more time-consuming than expected. This is usually caused by time constraints on the part of the researcher or interviewees (Kane & O'Reilly de-Brun, 2001). On another note, case studies require a mix of research skills for data collection and analysis and this could be a source of error when the researcher lacks rigour in analysis (Mouton, 2001).

2.5 METHODOLOGY

According to Mouton, the methodology focuses on the research process and the kind of tools and procedures used (2001:56). The specific tasks undertaken in the research are hereby presented. Ethnographic tools are used to provide an in-depth description of a group or community (Mouton, 2001). The type of data being sought is mainly qualitative as the research looks deep into the social life of participant farmers. In order to gain access to the farmers, relevant information and the right people for this study, I had to get attached to ZFAT as indicated in Subsection 2.2.2. Here I begin by giving an account of the literature review methodology used in the case study and analysis using data from both literature and case study designs.

2.5.1 Process and Methods in Literature Review

The literature review I conducted was a traditional literature review, though it can be argued to be almost divided into two parts. According to Mouton (2001), a literature review can be informed by

themes the research is focuses on. In this research, the first part situates the study, in other words it provides the background to the main concepts of sustainability. I was very familiar with SD from the B.Phil. classes I attended in 2011 at the Sustainability Institute. Through the guidance of my supervisor, I realised how adopting a framework for use in assessment and analysis would help as a guide to relevant papers and a focused study. I then worked on the second part of the literature review that was used specifically to help set up an assessment framework which would help to address the main research question on sustainability at farmer level and sustainable livelihoods, directly. I had a rich library with literature on SD from books and sources I had acquired at the SI where Professor Swilling had introduced the polycrisis concept using findings from internationally recognised research reports. My analysis of the polycrisis literature which emanates from an SD perspective helped me to determine what framework to use to assess the impacts of the CA project on the livelihoods of participant farmers.

I also picked up some ideas from my supervisor who had previously conducted research on a similar topic, focusing on the impact of the Green Revolution on SHFs in India. Kelly's 2009 thesis already covered an extensive literature on sustainability at farmer level. We discussed how I could avoid duplicating her work and came up with the idea of using an SLA framework to guide the assessment of the farmers' livelihoods. My search for literature thus began on papers with the SLA framework of which some were provided by the supervisor. As I was conducting the research, I again got the idea from Kelly (2009) that besides using search engines with specific studies or papers, informal channels, such as primary and secondary channels, can be used. She quoted Cooper (1984) who argues that "judgement about relevance of studies to a literature search are related to a reviewer's open-mindedness and expertise in the area, the way the research is documented in the retrieval system and even the amount of time the reviewer has for making relevant decisions". This was a guide to which papers to include and which to exclude, though I am no expert in this area.

According to Cooper (in Kelly, 2009), an ancestry approach tracks studies cited in already obtained research. The ancestry approach helps to find sources used by other researchers in line with the same theme. Secondary channels were also utilised for they contain the information most closely approximating all publicly available research (Cooper in Kelly, 2009). The second part of my literature review was very specific to the practices of CA and adoption trends in the country. CA and other alternatives to conventional agriculture have been practiced for quite a long time and many studies were carried out on how these can be used to the advantage of the SHF sector.

I had an advantage of accessing unpublished papers and working papers for workshops used by NGOs, especially the one I was attached to. The organisation also linked me to other organisations which possessed relevant information on my study area. Lastly I used the internet to find some papers and obtained some from colleagues studying various modules related to my degree programme. According to Kelly (2009) this can be termed an 'invisible college' which can also be utilised to have informal discussions on the subject matter. I used the literature review's outcome to design interview questions used in the case study and set up the analysis of data using themes I obtained from the SD concept and SLA framework.

2.5.2 Process and Methods in Case Study

2.5.2.1 Sampling

Data gathering was done from a sample of farmers selected from a population of 250 farmers involved in the CA project in the area of Chiweshe. This subsection speaks into the target population of the research and then goes on to discuss and justify the method used in sampling the population of farmers interviewed.

Polit and Hungler specify that the researcher must be specific on the criteria defining the target population to be included in the research (1999). The target population for this research was the SHFs in Mazowe Chiweshe area who are involved in the CA project being implemented by ZFAT. These farmers involved in the project are the ones with first-hand information and they can tell if it has improved their livelihoods or not. The total research population of farmers engaging in CA under the ZFAT programme is 250 (Hungwe, 2012). I had to utilise data sampling techniques to select a sample of farmers who took part in the research process. I decided to familiarise myself with the people and the area by living there for about two weeks whilst interviewing the farmers I had picked randomly.

According to Haralambos and Holborn, "a sample is a part of a larger population and the researcher needs to decide upon a sample of the actual people to be studied" (2000). For the case study random sampling was used, though there are a considerable number of probability sampling techniques that could be used to select a fraction of a population. Sampling is essential because populations tend to be large whilst time, funds and other resources are limited resulting in it being impossible to study persons individually (Anyaeibunam, Mefalopulos & Moetsabi, 1998). For this

reason there is little choice but to select a sample from the population and from it make projections to the entire population. However, it is important to draw a representative sample population in such a way that it contains all the key characteristics of the population from which it was drawn.

Researchers find it difficult to answer the question about the size of an adequate sample. According to Anyaegbunam et al., in order to achieve the study objectives, it is essential to plan an investigation to decide how many people need to take part for high representation and validity of data (1998:92). Tull and Hawkins (1993) argue that it is impractical or even impossible to work with the whole group, hence the necessity of sampling. Anyaegbunam et al. (1998) further allege that there is a strong belief among researchers that the bigger the sample the more representative and therefore the more accurate the results. However this might not be the case and often the number is determined on logistical grounds and resources available for the research such as time, manpower, funds and transportation. Other sampling methods that could have been used in this project are stratified random sampling, systematic random sampling and cluster random sampling. For this study, simple random sampling was used.

Simple random sampling is simple to accomplish and easy to administer. In its simplicity, the desired sample was achieved where the sampling units are selected by chance and for which there is a known, equal and unbiased chance of each unit being selected (Tull & Hawkins, 1993). Because simple random sampling is a fair way to select a sample, it is reasonable to generalize the results from the sample back to the original population from which the sample is drawn (Anyaegbunam et al., 1998). Simple random sampling is not the most statistically efficient method of sampling and its weakness is that one may not get a good representation of subgroups in a population. However, there were no subgroups I deemed important in this research, and therefore other methods were not applied.

It is important to outline the simplified random sampling technique in greater detail since it is the technique that was used in selecting the sample of farmers participating in this research. This is the simplest form of random sampling and at the same time regarded as highly reliable (Anyaegbunam et al., 1998). This was the reason for the choice of this method. After randomly selecting the participating farmers, I felt the sample population and the target population was similar as it constituted the young and old generation, widows, the poor and better resourced in the community.

- Objective: To select n units out of N such that each ${}_N C_n$ has an equal and unbiased chance of being selected.
- Procedure: A table of random numbers or a computer's random number generator is used to select the sample.

The starting point for simplified random sampling is to establish and ensure that the sample frame is organised and known. This is the total population that has a probability of being selected for the sample. In this case, the total number of farmers who were participating in the CA programme in Mazowe Chiweshe at the time of the study was 250. A decision had to be made on the number of farmers to be included in the final sample. For the study in Mazowe Chiweshe, I decided to use 25 farmers since this number would be reachable and possibly give the desired outcome, considering the time and other resources at my disposal. The sampling fraction is $f = n/N = 25/250 = 10$ percent.

Since the names of farmers participating in the CA project in Mazowe Chiweshe is known, a computer programme was then utilised. Many computer programmes can generate a series of random numbers. Names of all 250 farmers in Mazowe Chiweshe were randomly copied and pasted into a column in an EXCEL spread sheet. Then, in the column right next to it the function =RAND () which is EXCEL's way of putting a random number between 0 and 1 in the cells, was used. The next step was to sort both columns – the list of names as well as the random number – by the random numbers. This will rearrange the list in random order from the lowest to the highest random number. I then took the first 25 names in this sorted list as my sample.

2.5.2.2 Case Study Research Instruments

The instruments used in the case study were determined by the ethnographic approach that I took. For data collection, the researcher needs instruments which have such a high degree of accuracy that the data is valid and reliable. According to Nieuwenhuis (2009), the researcher is a very important data gathering instrument in qualitative researches where one has to prove credibility and trustworthiness by producing valid and reliable data. Other authors describe trustworthiness from the notion of dependability, applicability and confirmability and argue that validity will always precede reliability since data can only be reliable if it is valid (Lincoln & Guba, 1985).

Complementary data collection methods were used so that the degree of dependability could be trustworthy when an aspect is repeatedly coming from different sources. In the beginning I intended to use interviews, key informant interviews and focus-group discussions but in the field, because of time and financial constraints, I had to use only farmer interviews, key informant interviews and participant observation for data collection. The data gathering methods used are elaborated below.

a) Questionnaires

The researcher used questionnaires to gather the first round of information from farmers. Haralambos and Holborn define a questionnaire as a list of pre-set questions (2000). I felt this was going to be an effective way to 'solicit' relevant information from the interviewees. The questionnaire was chosen because it is flexible and potentially ensures objectivity. The questionnaire was divided into two parts whereby the farmers first complete their own information/administrative section and were later interviewed with open-ended questions. I first developed an initial questionnaire and took five copies to the research area to do a pre-test on conservation farmers not involved in the actual sample. My findings in pre-fielding were then incorporated in the final questionnaire where improvements were made. This was done to ensure that the questionnaires would be simple to administer, but also capturing the essentials for the study.

I carried out the interviews with the farmers while moving around in the community with the ZFAT field officer, on a motorbike. The answers from the questionnaires in conjunction with literature were then used to address all the research questions. The data was then measured against the SLA tools to assess the sustainability of the CA project at farmer level. Moser and Kalton state that a questionnaire can elicit information that lies deep within the respondent's mind (1980), hence my choice to use it as a data gathering tool. During questionnaire administration, the necessary etiquette was observed, especially the need to respect farmers and to get their full concentration. I usually visited farmers late in the afternoon to ensure they were done with their morning field work and other home chores. This was deliberately done to ensure that farmers would respond in a relaxed manner, without worrying about work disturbances. Some farmers were contacted well before a visit and if possible gave particular days and times when they would be free for the interviews.

b) Key Informant Interviews

Nieuwenhuis states that the use of qualitative interviews enables the researcher and the world to see the concept under study in the eyes of the interviewee (2009). The author further alleges that interviews are useful in obtaining the ideas, opinions, views, understandings and in some cases beliefs of those being interviewed. Following this argument, I interviewed some key players in the community whom I viewed as key informants. I interviewed a Councillor, who is a local government leader at ward level, two local Agricultural Technical and Extension Services in Zimbabwe (AGRITEX) Extension Officers who work for the government and a former Councillor who had vast knowledge of the area and the projects. Interviewing local leadership made sense in that the information they gave was important in assessing if the leaders are embracing conservation agriculture or not, which might affect adoption by other community members.

With these I chose to use semi-structured interviews that gave them pointers to what I really wanted to know. According to Maree, semi-structured interviews are defined as preset questions used to define a line of inquiry and to corroborate data which emerged from other sources (2009). My aim was to collect convincing data and have a deep understanding of the CA project and what it has achieved for the participant farmers. The key informants almost always explained on other aspects I did not ask on which they felt were relevant. I also had informal interviews with Mr Hungwe, the manager, and the ZFAT officer whom I travelled with around the ward. Most of the time I took notes during the interviews or wrote down the points discussed later. These key informant interviews were carried out in order to balance the information from farmers and any other information I had gathered in the research area. This helped during data analysis and triangulation of data gathered from farmers in the sample.

c) Observation

The other tool used during data collection was observation which was done as I interviewed farmers during house visits. Nieuwenhuis argues that observation is a systematic process where one records patterns and occurrences of objects and participants without questioning (2009). According to Nieuwenhuis, I played the role of an 'Observer as Participant' whereby I got into the situation only as an observer. I only focused on patterns or behaviours to understand the assumptions and values of the phenomenon and attempted to make sense of the social dynamics. In this sense, the researcher

remains uninvolved without influencing the dynamics (Maree, 2009). The most important aspect of this tool that made it relevant is that I developed a deeper understanding of the cultures and social norms of the community I did my research in and could better interpret their expressions.

When I visited the farmers, I tried to find their comfort zones so that for example we discussed while a woman is cooking in the kitchen or joined a male farmer shelling or bagging maize. I also took some photos of the farmers and of the infrastructure they have at their homes to aid my recall during write-up. I again wrote down some notes after informal discussions such that I could understand well some of the things I could have missed because of the generation gap between myself and other farmers. A personal experience in the study area where I stayed with Mr Kasetu, the ZFAT field officer, gave me an added dimension and an appreciation of what the farmers are doing on the ground. Being in the research area, though for a limited time, also made me understand the dynamics of rural life rather than just getting it from hearsay or literature. This improved the reliability of the information.

2.6 DATA SOURCES AND DATA ANALYSIS

This section speaks about the data sources for the research and also discusses the analysis of the data for drawing conclusions on the study.

2.6.1 Data Sources

Basically there are two broad categories of data, namely primary and secondary data. There is a distinct difference in the two data sources in that the former was sourced by the researcher specifically for the study. Secondary data would have been collected by other informants for other purposes but they contain information relevant to this study. According to Mouton (2001), secondary data were or are primary data for another study but can be utilised without investing the initial time and resources.

- a) **Primary Data** – Data for the study primarily came from farmers interviewed in Mazowe Chiweshe. These farmers were consulted through interviews and observation of their real progress in their communities. Part of the primary data was also obtained from key informants in the ward, AGRITEX officers, field officers from the ZFAT and local councillors.

- b) Secondary Data** – The ZFU and CFU also provided important information from their archives. They provided most of the trend data on farming for the smallholder sector in general, and the sector in the Mazowe Chiweshe area in particular. ZFU was the main target for provision of information on how they have commercialized and intended to improve farmers' livelihoods, with specific reference to the sustainable farming techniques which are being focused on. Most of this information was obtained from the ZFU Head Office, and a bit from the Mazowe District ZFU offices. ZFU was also a source of some crucial documents on the smallholder farming sector and CA in the country.

Journals on Zimbabwe's farming history available at the Harare office of the United Nations Development Programme (UNDP) were of much help to form a picture of Zimbabwean agriculture in general. These journals included information on current agricultural status in Zimbabwe and the place for sustainable farming techniques in the new-look Zimbabwe after the Global Political Agreement (GPA) of 2009.

Most of the statistics for trend analyses in the study utilised information from the Central Statistical Office (CSO) of Zimbabwe. The Zimbabwe National Crop Assessment Committee was also an important stakeholder consulted for current information and this is chaired by AGRITEX, a Department in the Ministry of Agriculture, Mechanisation and Irrigation (MAMID). The Ministry of Agriculture provided historical statistics, policy papers and blueprints for the Government which were useful for the study. The Food and Agriculture Organisation is a haven of information on Zimbabwean agriculture and has extensive and particular interest on promoting sustainable farming techniques in the smallholder farming sector. Since this is an international organisation, regional and global information was obtained for such regional and global comparisons.

2.6.2 Data Analysis

In qualitative studies, data collection and analysis are not separate processes (Yin, 1994), though data analysis and its interpretation is the ultimate goal of research. According to Nieuwenhuis (Maree, 2009), the processes are ongoing, cyclical and non-linear until findings are presented. The aim will be "to understand the various constitutive elements of the data through an inspection of the relationships between concepts, constructs and variables, and to see whether there are any

patterns or trends that can be identified or isolated, or to establish themes in the data” (Mouton, 2001:108). Following Mouton’s argument, I tried to link between the research questions following through the literature reviewed and the case study procedure in recombining the evidence to address the initial propositions of the study. In the processes, I managed to employ the criterion of saturation of data whereby during data gathering I reached a point where the continued collection of data added no new insights.

It was also important that I deal with errors that might have occurred in data gathering and capturing. There was a great possibility that some information would be missing on the questionnaire section that farmers completed on their own, hence need for data validation. Mouton argues that “it is imperative to have validation checks, which involves reliability analyses on questionnaire responses” (2001:109). This will help to deal with omitted data that can have a bearing on the trends being investigated. The analysed data can then be synthesized into one large coherent whole by relating findings to existing theoretical frameworks or models (Mouton, 2001) and in my case I used the SLA framework referred to in Chapter 3. According to Mouton (2001:108), “analysis involves ‘breaking up’ the data into manageable themes, patterns, trends and relationships”, which gave me the idea of using relevant information regarding the sustainable livelihoods of the farmers in the study area.

The interpretation was fairly simple, given that the questions asked to farmers were directly related to the vulnerability and capital assets elements in the selected SLA framework. I highly regarded the SLA framework as the sustainable livelihoods indicator at farmer level. The detailed discussion of the indicators is found in Section 3.5 where themes captured in the literature review directly informed the interview questions administered to sampled farmers during the research process. However, Mouton adds that there is a need to take into account rival explanations or interpretations of one’s data and showing what levels of support the data provide from the preferred interpretation (2001:109). The data analysis and interpretation will be given in the subsequent chapters.

2.6.3 Limitations and Possible Sources of Error

There were so many things I had planned to do for this research to come out with the desired information through the methodology I chose. However, when conducting the actual research in the field, I had to change some aspects to suit the resources available but at the same time try to meet

the set and clearly defined objectives. According to Marshall and Rossman, “the researcher considers the should-do-ability, do-ability, and what-to-do ability of the proposed research work and through systematic and sometimes collaborative strategies, information is gathered and then reflected on its meaning to arrive at and evaluate conclusions” (1999:22).

The biggest challenge I faced during the research period was inadequate time to visit the field and making of proper field observations. The organisation had other priority areas, and devoted more time to office work rather than being in the field. I was intending to be in the field much of the time and for the above reason and also financial constraints, I had to limit my interviewing time in the Chiweshe communal area to just two weeks. Since I was on unpaid internship and failed to get research funding, the finances were limited which in turn limited my travelling to the research area.

There are some other limitations to this study which should be noted such as the sample size of the farmers I used, the climate of the study area and a focus on only one project component. The area was chosen for logistical convenience and accessibility since I expected to save on time and resources for carrying out the study. The sample of farmers ultimately interviewed was 25, though in the first place I had planned to reach about 40 farmers. This means only ten percent of the potential respondents, totalling 250 farmers, was interviewed. The fact that I interviewed farmers only involved in the project may present a case whereby the adoption question was not well articulated since those who did not join the programme had their own reasons. However, during informal discussions I felt the organisation was too strict on selection. Many willing farmers were left out of the programme.

The climate of the study area can also not be a true representation of the SHF sector’s situation. The fact that the study was carried out in a high rainfall area (Region Two) can bring out positive results, yet the majority of SHFs reside in natural Regions Three to Five (Marongwe et al., 2011). The results could thus have been different if the study area was in a dry region. I also found it difficult to deal with the limited statistical data I wanted on yield levels for the period under study since the government struggled to release current data through the Central Statistical Office since 2004 and the majority of farmers did not have proper records. Other farmers could not correctly remember their yields over the years as they did not have proper records and there was need to standardise quantities measured in carts, tins and so forth. To help this situation, more yield and production data was collected from AGRITEX officers in the study area as a way of averting the limited

information. However, the actual numerical data on yields was not of much importance as long as farmers knew if the yields were lower than before or were increasing.

As the research used qualitative methods, possible sources of error could be found in the methodology used. There was room for judgemental and observational shortcomings. This might have limited the full discovery of facts in carrying out this research. Apart from what is heard and seen in questionnaire administration, the researcher has to be extra observant to be able to confirm some of the answers. This calls for a strong power of cognition and analysis which unfortunately can only be as far as the researcher can note.

On the whole though, I feel the limitations and possible sources of error in this research did not seriously undermine the validity and reliability of the information this thesis provides as long as the reach or ability of the findings to be generalised are not overstated. The farmers and key informants interviewed plus the secondary data consulted provided the necessary information to meet the objectives of the research.

CHAPTER THREE: LITERATURE REVIEW

3.1 INTRODUCTION

This chapter presents the first part of the literature review that introduces the global perspective of sustainability and then narrows it down to farmer level sustainability. I begin by giving an introduction to global agricultural approaches in order to understand the philosophies behind each of them and the need for sustainability. Much focus was given to sustainability and a detailed discussion on the sustainable livelihoods approach which will provide the assessment tools for the research, especially dealing with the main objective of assessing whether farmers participating in a CA project are now living a better life. Since this thesis is designed around literature review and a case study, I found it necessary to first have a literature that situates the study and provides background to the concept of sustainability. I then went on to discuss specifically tools used as an assessment framework which would directly help to address the main research objective on whether participant farmers have achieved a sustainable livelihood.

The review in this chapter was done to give background to the study which is based on the concept of sustainable development. Firstly, global agricultural approaches are briefly looked into, linking agriculture into the concept of SD in the following section and the polycrisis faced by the globe prompting people to consider alternatives to unsustainable approaches. The discussion on SD gives us an insight into ideas that were developed by proponents of sustainability to mitigate socio-economic and environmental problems. The sustainability concept is then discussed at small-scale farmer level in Section 3.5 in order to understand the interventions that can be made to assist SHFs to be sustainable. A framework of SLA which was developed by development agencies among others the DFID of UK, FAO and UNDP (Carney, Drinkwater, Rusinow, Neefjes, Wanmali & Singh, 1999) was adopted as assessment tool to measure if farmers' livelihoods have improved, thus setting the ground for answering the research questions that I posed in Subsection 1.3 of Chapter 1. The framework was developed when the agencies realised that there was a need to clarify the understanding of the fundamental principles behind the livelihoods approaches though each have varied emphasis on operations (Carney, et al., 1999).

After Chapter 3, Chapter 4 was utilised to introduce sustainable farming techniques with reference to CA which is being promoted by ZFAT in Mazowe Chiweshe. Chapter 4 was the second part of the

literature review used to set the scene for the case study in the research area. A brief account is given of global trends and experiences on the impacts of sustainable farming techniques in other parts of the world. Chapter 4 ends with a discussion on the Zimbabwean perspective of sustainable farming techniques and the challenges faced in introducing these techniques to farmers. The flow of literature from SLA to trends in Zimbabwe creates a link between the literature body on sustainability and questions asked in interviews.

3.2 INTRODUCTION TO GLOBAL AGRICULTURAL SYSTEMS

This research is based on agriculture and its associated problems leading to the concept of sustainability. I felt the need to first discuss what the agriculture systems are, to give a background of the situation on the ground. Agriculture has undergone many changes and advances since it began 10 000 years ago (Rosenberg, 2004). Globally there are two main agricultural approaches recognized since humans began the domestication of crops and animals (Rosenberg, 2006) which are conventional agriculture and the alternative agriculture systems sometimes referred to as agroecology by proponents like Altieri (1999; 2004). The former is argued to have started at the beginning of the 1900s. Around the 1930s agriculture practitioners began looking at alternatives (Giller, Beare, Lavelle, Izac & Swift, 1997), but before all this, farmers used traditional, non-mechanized agriculture. Traditional agriculture still exists, especially in Africa, though nowadays farmers have a choice between the conventional and the alternative routes.

To have an understanding of the agricultural approaches, it is important to have an overview of each of the approaches in the subsequent Subsections 3.2.1 and 3.2.2. All the systems have evolved in time but due to different approaches to life, the two branches were born. Rosenberg and Linders (2004) are of the opinion that conventional/industrial/modern agriculture has its origins in the 'developed' world. They added that "this is not to say that the so-called third world does not have an agricultural biography, but the reality is that scientific thinking and approach is a first world phenomenon". I agree with this view whereby the so-called modern, scientific agriculture has become so specialized working in monocultures of animals, vegetables, fruits or crops and much more oriented to economics than to man's inner life. I agree with the authors' argument that, if humans were constantly referring to inner life rather than economics, they would look for agricultural systems that work in harmony with nature.

3.2.1 Conventional agriculture

A brief review of conventional agriculture is hereby given. Conventional agriculture is also referred to as industrial agriculture and this has distinct characteristics that have been viewed as hindrances to sustainability (Altieri, 2007; Kate, 2008). Conventional agriculture has been built around an industrial model of increased production, economic and productive efficiency which has been made possible by controlling of nature and managing nature as a commodity as opposed to being a partner to humans (Rosenberg & Linders, 2004), making use of heavy machinery and relying on agrochemicals produced from non-renewable fossil fuels (Gliessman, 1998; Mader, 2002). The intensification just differs depending on the geographical area in question but the principles are more or less the same.

Due to our globalised world, conventional farming systems have spread to almost every corner of the globe. The philosophical underpinnings of industrial agriculture are often implicitly based on the following assumptions: humans are superior to nature and progress is measured in monetary terms and in terms of material consumption (Stauber, et al., 1995 in Gold, 1999; Rosenberg & Linders, 2004).

Practitioners of conventional agriculture share several characteristics: rapid technological innovation; large capital investments in order to apply production and management technology; large-scale farms; single row crops/monocultures grown continuously over many seasons; uniform high-yielding hybrid crops; extensive use of agrochemicals and external energy inputs; high labour efficiency, and dependency on the agribusiness system. In the case of livestock, most production comes from confined, concentrated systems (Gold, 1999; Rosset, 1999).

With this kind of thinking, industrial agriculture is heavily dependent on high external input technology (HEIT) where synthetic agriculture, Genetically Modified Organisms or GMO seeds and agrochemicals are highly trusted and recommended (Kate, 2008; Altieri, 2007). Many agree that this has led to an agriculture presently seen as a public problem encompassing the pollution of water, air, soils, environment and ecosystems (Menalled, et al., 2008; Hazell & Wood, 2008; Giller, et al., 1997). Agriculture has done more damage than good to the environment and also contributed to socio-economic imbalances (Swilling & Anneck, 2012) hence the need for change to more ecologically friendly systems that empower the people socially and economically (Gold, 1999; Altieri,

1999; Kate, 2008). It is Morand's view that a change to sustainable systems is a battle against cultural philosophies (2010) and Niemela, Young, Alard, Askasibar, Henle, Johnson, Kurttila, Larsson, Matouch, Nowicki, Paiva, Luigi, Smulders, Stevenson, Tartes and Watt (2005) had already cited how a paradigm shift to sustainable farming that is consistent with ecological realities would make a difference in biodiversity conservation and solving the problems associated with industrialized agriculture. Proponents of alternative/sustainable agriculture have been advocating for a new holistic version that does away with the practices of industrialised agriculture listed above.

3.2.2 Alternative agriculture

Alternative agriculture systems have their roots in environmental consciousness and an understanding of ecological aspects involved in the practices, such that the environment on the farmed land and its orientation into the greater ecosystem are harmonious and sustainable (Rosenberg & Linders, 2004). These authors add that sustainable agriculture is based on the deep understanding of the sphere of the living and the more we understand living processes, the easier we can see the connection between things in the web of life (Rosenberg & Linders, 2004; Macy & Young-Brown, 1998).

Alternative methods have been identified with different terminology in different parts of the globe but again with almost similar goals overall, shifting away from conventional agriculture. Rosenberg (2011) listed these alternatives as organic farming, nature (Kiyusei) farming, traditional farming, biological, biodynamic farming, integrated plant nutrient systems and no-till or conservation agriculture. To save the confusion, Altieri came up with the term agroecology to describe scientific approaches to alternative ways of farming (Altieri, 1999). Many people now use the term as an umbrella term to describe all of these different systems of alternative agriculture (Rosenberg, 2011).

Basically many proponents agree that, sustainable agriculture is "a way of practicing agriculture which seeks to optimize skills and technology to achieve long-term stability of the agricultural enterprise, environmental protection and consumer safety" (Altieri, 1999; Pretty & Hine, 2001; Greenberg, 2011). It is achieved through management strategies which help the producer select hybrids and varieties, soil conserving cultural practices, soil fertility programs and pest management programs that produce more whilst taking care of the natural environment around. With the different practices in farms, it can be noted that there are different levels of sustainable agriculture

ranging from those that aim to totally replicate nature like Fukuoka's 'do-nothing farming', to those that see the farm as a living system, to those that just try to replace synthetics with natural inputs but do not really change the overall philosophy of the way they farm. However, the goal of sustainable agriculture is to minimize adverse impacts to the immediate and off-farm environments while providing a sustained level of production and profit.

Today, alternative approaches commonly include: pest control strategies that are not harmful to natural systems, farmers, their neighbours, or consumers; crop rotations that mitigate weeds, disease, insect and other pest problems; providing of alternative sources of nutrients to feed the soil and keep soil covered most of the time; reducing the risk of water contamination by agricultural chemicals; increasing of soil and water conservation practices and strategic use of organic manures and increasing engagement of consumers and producers in a common cause (Menalled, et al., 2008; Rosenberg & Linders, 2004).

With the use of the above practices and other holistic management approaches, sustainable systems are thus not viewed as a single methodology but rather as a range of management and technical practices (Rosenberg, 2011). The alternative approaches tend to maintain their natural resource base and recover from disturbances and shocks, whilst managing pests and diseases through internal regulating mechanisms that rely on minimum artificial inputs or low external inputs technology (LEIT) (Gliessman, 1998; Altieri, 2007).

In recent developments, the concept of agricultural sustainability has grown from an initial focus on environmental aspects to include first economic and then broader social and political dimensions (Pretty, 2008). A close look at the definition of sustainable agriculture gives us a clue to what we need to achieve in the adoption of alternatives. As defined by Gliessman (1998), sustainable agriculture is a whole-systems approach that does not serve to supply food and fibre only but also balances environmental soundness, social equity and economic viability among all sectors of the public now and in the future. Inherent in this definition is the idea that sustainability must be extended not only globally, but indefinitely in time, and also to all living organisms, including humans.

This section introduced the two major approaches to agriculture and noted the differences inherent in them, especially the way the alternatives strictly encourage practices that are in harmony with nature. The most striking point is that the alternatives are more on the sustainability side and there

seems to be much hype on the issue of the former being unsustainable. This takes us back to the question of what sustainability is and what has prompted many to seek systems that are said to be sustainable (Green, 1998 in Gold, 1999). The foundation for sustainable agriculture ideas is laid in mitigating environmental harm caused by agriculture (Wezel, Bellon, Dore, Francis, Vallodid & David, 2009; Pretty, 2008) and the need to improve livelihoods and food security without depleting the natural resource base that supports life (Earles, 2005, Twomlow, et al., 2008).

3.3 THE CONCEPT OF SUSTAINABLE DEVELOPMENT

The core of this thesis revolves around sustainable development and the way smallholder farmers can improve their livelihoods through sustainable farming methods. The concept of sustainable development (SD) emerged from the need to integrate and balance environmental and economic concerns (Dresner, 2002). There were concerns that the economic systems in use (where agriculture is part of the economic subsystem) contribute to the strain on the environment's regenerative and assimilative capacities (Goodland & Daly, 1996). The Brundtland report of 1987, *Our Common Future*, defined Sustainable Development as "development that meets the needs of the present generations without compromising the ability of the future generations to meet their own needs" (WCED, 1987:1). After this report was released, there was an outcry over the vagueness of the definition with some criticizing it and reducing the term to meaninglessness (Hattingh, 2001; Dresner, 2002; Sachs, 1999). In accepting sustainable development, we need to acknowledge that it came as a promise to square-off the impasse between camps which advocate development that bridge the gaps of social injustice and those concerned with the over-exploitation of nature (Mebratu, 1998; Sachs, 1999).

Though SD is a contested concept, it is clear when one considers the polycrisis in the next section, that there is a need to transform the way we live on the planet. A polycrisis is a set of crises that tend to reinforce each other creating a vicious cycle (Swilling, 2008). A vague definition of SD was brought forward thus not being radical in nature and open to various interpretations since developmental agents have highly differing opinions on the pathway to follow (Hattingh, 2001). One of the most contested issues is centred around the need for developing countries to reach the same level of economic growth as developed countries, but with significantly less natural resources and without further damaging those resources for future generations (Swilling, 2008). Sachs calls for the need to re-evaluate the goals and values of societies such that a development model followed can

have intelligent self-limitations (1999). In my considered view and in support of Swilling's sentiments, the state of affairs of world development now do not allow us to first eradicate poverty and later follow sustainable development pathways but would rather couple the measures beginning from now (2008). What we need to do is to ensure that sustainable development delivers on equitably sharing resources at intra- and intergenerational levels while we do not further harm the disturbed systems but work on their restoration (Hattingh, 2001; Birkeland, 2002).

The concept of sustainability is thus useful in giving pointers of progressive development that transforms the economy and society leading to an improved quality of life. As far as agriculture is concerned, it is important to indicate issues that are perpetrating the polycrisis and deal with them putting up mitigatory measures. Some authors argue that agricultural production has shifted from just being technical to becoming more complex in the context of politics, environment, social set-up and economic issues (Altieri, 2007; Greenberg, 2011). Altieri then further argues that agricultural sustainability can then be achieved by an in-depth understanding of the relationship between agriculture, the global environment and the social setup (2007). Now systems have been put in place to address the problems faced, though globally role-players are not in agreement on the pathway to follow. Alternative agricultural systems have been developed to address the challenges initially created by conventional systems.

More often, discussions have been focused on the meaning of sustainability, but I am of the view that it is not the right time to argue about the definition but to try and understand the term so that we can try to mitigate the problems at hand. This is supported by Nitin Desai in Dresner (2002) who says that even if we try to define it, the value of any definition is simply the clue that it gives to the moral premises of the person who is giving the definition. Hattingh maintained that sustainable activities can be maintained indefinitely and sustainable development leads to a sustainable economy (2001). By adapting to changes, improving knowledge, technical efficiency and organisation, a sustainable system keeps the natural resource base intact and the environment stress-free but with significant development (Mebratu, 1998; Sachs, 1999; Hattingh, 2001). Birkeland added that humans need to move away from open-ended systems that create large amounts of waste and rather adopt ecological designs or intelligent designs that do not undermine global ecosystems support services (2002). All of these arguments show that there is a crisis looming which needs urgent attention. Swilling and Anneck refer to it as a polycrisis, which is discussed in detail in the next sections.

3.3.1 Polycrisis – a Rude Awakening

Ever since Rachel Carson's Silent Spring appeared in 1962, a burgeoning literature has substantiated the concern that the ecosphere, our life-support system, is being eroded at an accelerating pace. The list of threats to the life-support system in which we are embedded is overwhelming: deserts are encroaching on the ecologically productive areas at a rate of 6 million hectares per year; deforestation is rampant; soil oxidation and erosion exceeds formation; fisheries are collapsing; ground water is polluted; species are disappearing every day; industrial society has increased atmospheric CO₂ by 28 percent (Wackernagle & Rees, 1996:30).

We only have one earth which is our source of raw materials and our sink for the waste we generate. The trends given above are the result of over-exploitation or excessive waste generation (Swilling & Annecke, 2012; Wackernagle & Rees, 1996; Birkeland, 2002). Some are calling these trends a 'polycrisis': a multiple set of crises that tend to reinforce each other (Swilling, 2008). Agriculture has contributed to and is, in turn, affected by the polycrisis, creating a vicious circle. Worse still the world population is growing at an alarming rate estimated to reach 9.5 billion by 2050 (Brown, 2008), hence piling more pressure on the scarce resources. As part of the contemporary debate, documents have been publicized to give evidence that our footprint is negatively impacting on the earth (Swilling & Annecke, 2012). The subsections to follow will be a discussion on leading international reports on the major crises making up the polycrisis.

3.3.1.1 Ecosystem Degradation

To ensure on-going human survival on the planet, we need to protect the ecosystems that form the base of our life-supporting system. Ecosystems provide many services to the globe in addition to being a source of resources and a sink of waste, but humans tend to have overlooked this role (Wackernagle & Rees, 1996) despite warnings on biodiversity loss and climate change (Stern, 2007; Jamieson, 1992; Gardiner, 2006). The United Nations (UN) commissioned an assessment of the status of ecosystems and the way their usage would affect the well-being of humans. This produced a Millennium Ecosystem Assessment (MEA) report in 2005. The report was compiled by 1 360 experts from 95 countries and reviewed strategies for conservation and sustainable use of ecosystems (MEA, 2005).

The report defined the services provided by ecosystems which give us a broader picture of what we could be denying ourselves and the future generations if we continue to destroy these ecosystems (MEA, 2005). The MEA (2005) had this to report: anthropogenic activities, with agricultural activities included, have extensively depleted the genetic diversity in the ecosystems and in some instances, irreversible losses have been recorded, especially in areas where agricultural land has been expanded to create monocultural estates and agrochemicals extensively used in production. In the last 50 years, humans have manipulated ecosystems in a way that cannot be compared to any other era.

The objective of providing food for the poor and hungry global population is one of the critical Millennium Development Goals (MDGs) but might be hampered by an increase in ecosystems degradation in the 21st century (Brown, 2008). The MEA report hinted that there is need for a paradigm shift in the way agricultural systems operate and humans conduct themselves in dealing with the ecosystems for a positive development and restoration of the degraded ones (MEA, 2005). The above findings are alarming, especially with regards to the agricultural fraternity, given that agriculture depends much on the interaction of human beings and the natural environment. If the biota is depleted, pollinators decline causing a disturbance to bioprocesses. The disturbances have been known to impact negatively on every living organism and in human societies the poor are hard-hit since they are so vulnerable that they do not even have safety nets when disaster looms. The need for adaptation and mitigatory measures cannot be overemphasised, especially for the resource-poor whose agriculture has always depended on the relations between humans and the biota.

3.3.1.2 Climate Change

Climate change is defined as an alteration in temperature, wind patterns and precipitation of a specific area or planet between two different periods of time (IPCC, 2007). A document that outlined the realities of climate change was released in 2007 by the International Panel for Climate Change (IPCC) and many others that have been warning of its effects. Climate change is usually a result of changes in the absorption of sun energy by the earth's surface and atmosphere. Humans have been pointed out as culprits from industrialization and other activities that emit greenhouse gases. Human activities that release greenhouse gases (GHGs), especially burning of fossil fuels, release of aerosols

into the atmosphere, land disturbance and depletion of the stratosphere, are forcing climate change. Industrial processes tend to cascade climate change when fuels are burnt in industrialised agricultural production which is dependent on petrochemicals in a globalised economy (Swilling & Annecke, 2012).

If climate change continues at the current alarming rate (UNDP, 2008), human development will be impacted negatively. The IPCC (2007) warned that the impacts of climate change will depend on the level of adaptation, the rate of temperature change and the socio-economic development pathway. Poor communities are hard hit since they do not even have safety nets or if available, they are very weak. Food security is compromised due to recurrent droughts, floods, storms and extreme temperatures affecting the developing countries (IPCC, 2007), most especially in SSA, that already rely on food aid. Human settlements and water systems will be disrupted as is already happening in the Peruvian region where underground streams are drying up, causing the collapse of irrigated desert areas (IPCC, 2007).

It is imperative that humans change their development pathways or design systems to produce less GHG, especially in agricultural systems. The SHFs are already using less machinery but have also been enticed to follow the conventional systems that rely on heavy chemical use. This is not sustainable and tends to add to the woes facing the planet. More sustainable practices can be a better option that can deal with climate change by improved soil management practices that conserve soil moisture and promote storage of carbon in the soil.

3.3.1.3 Peak oil

Global oil consumption has been on the increase since the 1960s and this caused a sharp increase in prices to balance supply and demand (Skrebowski, 2011). At the same time, there have been predictions that this finite resource is quickly running out, hence the need to make transitions to sustainable energy resources. According to Grubb (2011), peak oil is the problem of energy resource depletion, or more specifically, the peak in global oil production. Oil is a finite, non-renewable resource, one that has powered phenomenal economic and population growth over the last century and a half. The rate of oil 'production', meaning extraction and refining (currently about 85 million barrels/day), has grown almost every year of the last century (Grubb, 2011; Skrebowski, 2011). The

peak in oil production means the end of cheap oil and not running out of oil per se (ASPO, 2008). For economies leveraged on ever increasing quantities of cheap oil, the consequences may be dire.

Our industrial societies and financial systems were built on the assumption of continual growth – growth based on ever more readily available cheap fossil fuels. Oil is so important that the peak will have vast implications across the realms of agriculture (Hall & Day, 2009), medicine, culture, transport and trade, economic stability and food production. Peak oil presents the potential for quite catastrophic upheavals, especially an increase in the world food prices, as biofuels will probably compete with food production (ASPO, 2008).

Without significant successful cultural reform, severe economic and social consequences seem inevitable. However, ultimately there are some possibilities: a chance to address many underlying societal problems, and the opportunity to return to simpler, healthier and more community oriented lifestyles. Agriculture being the focus, there is a need to implement techniques that do not rely on fossil fuels and the situation presents itself for uptake of alternative sustainable approaches to industrialized agriculture. It will be a wise move to adopt policies that promote renewable energies and use of agricultural systems that do not depend on heavy machinery and inorganic fertilisers. Doing away with machinery, inorganic fertilisers and agrochemicals present an opportunity for growth of the agro-ecological industry that encourages less soil disturbance and minimum-to-no use of oil-based agrochemicals.

3.3.1.4 Inequality and Poverty

The world over, the numbers of the poor are increasing at a growing rate signalling unequal sharing of scarce resources as well as injustice (Swilling & Anneck, 2012). According to estimates by the UNDP in the Human Development Report of 1998, the wealthiest 20 percent of the global population earns 82.7 percent of the total income of mankind. This report was a major eye opener to the way inequalities in resource access and consumption levels have been a major agent of poverty and food insecurity (Rogers, Jalal & Boyd, 2005). The small bracket of the rich is seen to control world trade, commercial lending, domestic savings and the means to agricultural production including land. By contrast, the share of the total global income of the poorest 20 percent is a mere 1.4 percent, with a contribution of only 1.0 percent to world trade and a statistically negligible 0.2 percent of commercial lending (Rogers, et al., 2005). These authors added that, in a study by the

Institute of Policy Studies of 2004, indications were that 497 billionaires in the world have a wealth greater than the combined wealth of the poorest half of humanity of over three billion people (2005). The wealth in the hands of the few has not trickled down to the poor as perceived but rather a widening gap has been witnessed.

To add to these statistics, the Human Development Report (HDR) of 1998 pointed out that the global income distribution and disparities drawn up by UNDP in 1992 had worsened. Policies like the United States of America (USA) Food and Farm Bill of 1970 which supports big corporations have had adverse effects on small farmers in the USA and the Global South as it nearly makes it impossible for them to make a living (Aziz, 2012). The policies brought mostly by neo-liberalism have not been fair to the majority while the rich and the middle men reap the benefits (Tansey, 2008; Lang & Heasman, 2004).

A key resolution to reducing poverty seems to be reducing consumption in the first world and increasing global cooperation. Current consumption patterns are damaging to our environmental resource base since our economic systems focus more on extraction than on restoration of natural resources. There is need for corrective measures especially in agriculture that can help to improve livelihoods of the poor and deal with equitability. Many sustainability proponents advocates policies and programmes based on principles of food sovereignty, the fair and democratic control over food, which is a key attribute of sustainable agriculture (Aziz, 2012; Greenberg, 2011, Pretty, 2008; Rosset; 2006). If we have to make a difference, governments are urged to continue funding for specific valuable programs, and fundamentally reconstruct policies that benefit family farmers, small producers and consumers, instead of investments by commercial systems in agribusiness giants.

3.3.1.5 Urbanization and the Challenge of Slums

In the wake of the polycrisis there are two issues that are closely linked. These are urbanization and the challenge of slums. There now seems a trend the world over of rural-urban migration in search of greener pastures and a better quality of life. These issues are informed by reports released by the UN in 2003 on the challenge of slums and then in 2006 on urban migration. The UN predicted a growth in population of about 8 billion people by 2030 and a rise to 9 billion by 2050 of which most will be living in cities (2006). Urbanisation has been fuelled by speculation that city life is better than rural life and most people are now abandoning the unproductive degraded lands heading for the

cities (Gliessman, 2007). As more people migrate to cities, labour in the agricultural sector of rural areas decline and food security is threatened with increased pressure from a more urban population to be fed.

Since the economies of most countries are declining, these migrating people often find themselves stuck in the unemployment pool and struggling to make ends meet in the city slums (Swilling & Annecke, 2012). With this trend, cities are estimated to be sheltering about one third of the world's population in slums (UN-HABITAT, 2003). Governments seem not to be enacting policies that would help improve the standards of living of the slum dwellers or those migrating to cities hence creating a vicious circle of poverty which they are running away from in the rural areas (Swilling & Annecke, 2012). The problems associated with this have been much pronounced in cities of the developing world where it is projected that in addition to those in slums now, an influx of more than two billion people over the next 30 years will be living in slums too (UN-HABITAT, 2003). To make ends meet, some indulge in crime or forced labour which is totally the opposite of what human development goals and poverty alleviation wants to achieve. As the gap in population between those producing food and those whose livelihoods are non-agricultural increase, there is a need to rethink anew the strategies to feed these masses. But Brown (2008) poses a question for us: At what consumption rate?

3.3.1.6 Agriculture and Soil Degradation

Agriculture has been topical in polycrisis discourse because the global economy largely depends on it and its policies affect almost everybody alike. This sector has its fair share of problems emerging from the way agriculture has been done since it started about 10 000 years ago, through its transformation, till where we are now (Rosenberg, 2006). The main document giving an overview of the status of agriculture is the *International Assessment of Agricultural Knowledge, Science and Technology for Development* (IAASTD) of 2008. The document gives an "assessment at international level of the role of agricultural knowledge, science and technology (AKST) in reducing hunger and poverty, improving rural livelihoods and facilitating environmentally, socially and economically sustainable development" (IAASTD, 2008:2). At a convention of 400 world agricultural experts, reports were reviewed and passed on to be reviewed by 30 government and 30 civil society representatives to produce a reliable and well represented global document.

This document and other papers from different authors show that almost half of the world's population derive their livelihoods from agriculture. The biggest challenge we are facing now is that the ecological footprint of industrial agriculture is too large to be ignored (IAASTD, 2008). Humans destroy soil through their activities of land clearing leading to erosion, siltation and ultimately hunger (Altieri, 1999; Mann, 2008; Kate, 2008; Rosenberg & Linders, 2004). Soil degradation and decline in soil health include salting, compaction, chemical contamination, water logging and erosion. The biggest cause for concern is that the rate of soil loss greatly exceeds soil formation rates with a record of five to ten ton loss per hectare per year in Africa and the Americas, and about 30 ton in Asia per annum. The rate of soil formation is approximately one ton/ha per year (Brown, 2008). The loss has been attributed to conventional methods of agriculture which most of the time leave soils bare or overturn it during ploughing, hence exposing it to erosion agents (Mann, 2008).

It is imperative that humans begin the restoration of soils and realise that if the current rate of soil degradation continue, food shortages will always prevail (Mann, 2008; Kate, 2008; Hine & Pretty, 2006). The soil degradation crisis is again linked to all the problems mentioned above. In 1937, the then American president, Roosevelt, warned that a nation which destroys its soil, destroys itself (Roosevelt, 1937 in Rosenberg, 2006). This calls for systems in agriculture that work on protecting agricultural land and soil fertility restoration rather than just mining of nutrients and degradation. Sustainable farming systems which are known to feed the soil might be an option as opposed to conventional agriculture that concentrates on feeding the plants (Rosenberg, 2006).

3.3.2 Conclusion

This section gave an overview of sustainable development and the major challenges facing the globe. Humanity seems to have invited trouble for itself and the unfortunate part is that all forms of life are going to suffer the consequences. The sustainability pathway followed since the WCED seems not to be preventing humanity from damaging the planetary support system or mitigating the scourge of poverty faced by many. This makes it impossible to apply a radical model of sustainable development hence the polycrisis is worsening and there seems to be an illusion that low income countries can reach the levels of affluence found in wealthy nations.

The current model of sustainable development is much more oriented towards “better engineering, integrated planning and more sophisticated models” which promise resource efficiency and

rationalization (Hattingh, 2001; Swilling, 2008). Rather, the authors above are of the view that we need to focus on structural changes in the economy, politics, institutions and individual lifestyles so as to ensure a fairer distribution of resources as well as stay within the carrying capacity of the ecological systems as advocated by Hattingh (2001). The problems faced today seem to have started in the fantasy of living a carefree life of overconsumption in a finite world where resources are limited. The harvesting of resources for industrial development created an unequal sharing of resources where many are living in severely poor conditions whilst only a few are filthy rich. Ecosystems are now degraded; climate change is looming, having a negative impact on agriculture and adding on to the threat posed to biodiversity. Agriculture is facing the same challenges as any other industry and also adds GHGs into the atmosphere, fuelling climate change.

In many areas, especially developing countries, modern agricultural practices have led to land degradation. The soils and waters of the world have been polluted, which now influence rural-urban migration since the land cannot sustain livelihoods anymore. This results in urban sprawl and slums are any eye-sore in our cities. Since the world population is growing and the majority becomes non-agricultural, the prevailing food system comes under scrutiny. Many are still hungry in Africa, Asia and South America though enough is being produced. Another approach to life or even changing consumption rates is needed with sustainable food production systems that can help mitigate or just adapt to the problems we face in the polycrisis.

3.4 IMPLICATIONS OF THE POLYCRISIS FOR AGRICULTURE AND THE NEED FOR CHANGE IN AGRICULTURE

The polycrisis discussed above has had many implications on the way agriculture is viewed worldwide especially with respect to the way a paradigm shift in agricultural systems can champion sustainable development (Swilling & Annecke, 2012). The section discussed the problems faced at world level which called for interventions at global level and a shift to radical sustainability. This study however focuses on smallholder farmers and sustainability needs to be discussed at a level understood by these farmers. SHFs in developing countries have a part to play given that they have to engage in polycrisis mitigatory practices and at the same time create safety nets in order to sustain their livelihoods. This section speaks into sustainability at global level as a recap of the sustainability subsection and then goes on to introduce sustainability at small scale farmer level leading to the SLA framework used as a livelihood assessment tool for the participant farmers.

The concept of sustainability is useful in agriculture in trying to use more environmentally, socially and economically viable systems. The systems are those that enhance the regenerative and assimilative functions of the global ecosystems. Socially and economically, concern by sustainability proponents have been about food sovereignty of communities and food security which has been threatened by the way our food systems are controlled by a few corporations (Rosset, 2006; Shiva, 1995; Tansey, 2008). We are living in a world with unbalanced global trade where farmers have no or very little control over their own food systems (Tansey, 2008). In Africa, agricultural development is lagging, though much investment is being poured in the sector (Pretty, 2008; IAASTD, 2008). Some authors argue that it is due to misplaced policies and lack of political will to make reforms that would benefit the current and the future generations (Pretty, 2008; Greenberg, 2011). It is further argued that a shift to sustainable practices can be a better option and this should be aided by policies and reforms of our systems or even redesigning of systems to adapt and put mitigatory measures in place. These policies and reforms are informed by the concept of sustainability which balances socio-economic and environmental issues.

3.4.1 Global Sustainability

Sustainability can be defined at any social and economic level depending on the activities of the community concerned and the way these activities affect development as well as the operations of the community. The last sections discussed problems humanity faces, which prompts us to think anew about the concept of sustainable development as a possible measure to mitigate such problems. The concept of SD is highly flexible to suit communities living in a different space and time, recognizing that each community is unique in its own way hence they need different sets of interventions. The world over, farmers have been attracted to join conventional agriculture and it is estimated now that 98 percent of the world's agricultural land is under industrial farming (Fresco, 2003). The industrial methods of production have worked well in other parts of the world and have managed to increase productivity especially during the Green Revolution (Kate, 2008; Borlaug, 2000) but also posed numerous problems affecting the environment and causing socio-economic imbalances, if not problems making it hard to meet even MDGs (Rogers, et al., 2005). An *International Assessment of Agriculture Knowledge, Science and Technology for Development* (IAASTD) document introduced in Subsection 3.3.1.6 reviewed the role of Agricultural Knowledge, Science and Technology (AKST) and also proceeds to discuss possible pathways in meeting the MDGs

through agriculture (2008). This document helps to bring to the fore the current state of agriculture and what it holds for the future.

People engage in agriculture primarily for food production and more recently for industrial raw materials. Any practices used especially to increase productivity or fasten growth were trying to adapt to the changes happening in the society, such as population growth and high product demand (Rosenberg, 2006). The IAASTD found that almost 40 percent of the world's population derive their livelihoods from agriculture with 70 percent of the poor living in rural areas especially in developing countries (2008). Agriculture, as shown by many authors and in the IAASTD also contributes a lot to ecosystem service disturbance since natural systems are removed to pave way for crops of choice (MEA, 2005; Altieri, 2004; IAASTD, 2008). The conventional system mostly used seems to have improved output and food security in some parts but without benefiting the whole populace evenly (Rosset, 1999). Many are still hungry especially in SSA and South Asia. In countries like India, the system left a trail of suicide cases (Shiva, 1995; Kate, 2011), land degradation, GHG emissions, agrochemical pollution of land and seascapes and loss of biodiversity (Brown, 2008; IAASTD, 2008). Some of these problems are news to the SHF communities because the media is awash with praises for conventional agriculture or the poor do not have access to forums where the problems are debated (Tansey, 2008).

We are no longer living in the times when we could eradicate poverty first and then clean up the mess because we have already pushed the source and sink to the limit (Swilling & Anneck, 2012). The polycrisis will have serious implications on SHFs, as was shown in the polycrisis section (Section 3.3.1). Climate change and degraded ecosystems are having and will continue to have serious impacts on agricultural productivity if we do not redesign our systems. SHFs will need to farm in ways that can adapt to climate change, move away from petrochemical dependence, mitigate further climate change and restore degraded land and ecosystems. The price of input is rising daily as oil prices shoot out of reach for many, especially peasants depending on agriculture for livelihoods (IAASTD, 2008). The methods recommended to small-scale farmers thus have to be affordable, soil fertility restoring and adaptive to climate change rather than ones that damage the environment.

Systems that are sustainable would enhance the multi-functionality of agriculture of not only producing farm commodities but also provide environmental services, cultural values and landscape amenities (IAASTD, 2008). Of late there has been mounting pressure from key stakeholders in the

agricultural fraternity that farmers should adopt ecologically friendly methods because the problems in the ecosystems are more threatening than ever (UNDP, 2009). The IAASTD even recommended that research should be directed towards agro-ecological approaches, though not as a silver bullet, but some countries find it too radical and rather feel it should recommend that the approaches be incorporated into industrial practices without side-lining the so-called conventional farming (2008). However, in many parts of the globe including SSA, non-governmental organisations and other organisations supporting smallholder farmers have initiated practices that embrace sustainability (Twomlow, et al., 2008, FAO, 2009).

3.4.2 Sustainability Defined at Small-Scale Farmer Level

This section further refines the concept of sustainability at farmer level. The research focused on small scale farming but with sustainable methods are the same at all levels, only differing with the scale of production. In a study of low external input farming methods as a more sustainable solution for small-scale farmers, Kelly proposed that all sustainable farmers should embrace methods that:

- i) protect and enhance ecosystems;
- ii) reduce carbon and GHG emissions;
- iii) allow future generations to meet their own needs;
- iv) promote equality and urban resilience and
- v) do not rely heavily on fossil fuels (2009).

The above recommendations were based on mitigating various aspects of the polycrisis discussed in Section 3.3.1 with a focus on agriculture that can help to guide us as to what makes the sector more sustainable. I agree that these are useful measures for adaptive agriculture that can feed the world as well as improving farmers' livelihoods and at the same time being ecologically friendly. It is then important to discuss a framework used as an assessment tool to measure if farmers practicing sustainable farming are achieving sustainable livelihoods in their communities. The next section discusses the SLA approach.

3.5 SUSTAINABLE LIVELIHOODS APPROACH (SLA)

This research was focused on small scale farmers mainly assessing whether individual farmers' lives were improved by being involved in the CA programme being implemented by ZFAT. I had to find a framework to measure against what farmers have achieved such that conclusions could be drawn on whether these farmers' livelihoods have become sustainable or not. The Sustainable Livelihoods Approach (SLA) was adopted as the tools for assessment and evaluation. The framework applies to rural communities where SHFs till the land for their livelihoods. Kelly (2009) also used the SLA to determine the guidelines for assessing which farming methods better promote sustainable livelihoods for small-scale farmers. However she relied mainly on the original work by Conway and Chambers (1991) and neglected to review more recent adaptations of the SLA between 1991 and the present. In this section, I will now provide my own interpretation of the SLA, including more recent uses of the tool. In my case, the tool will be used to assess if the livelihoods of small scale farmers in the Mazowe-Chiweshe area have been improved by the CA project being implemented. After interpreting the framework in line with the research objectives, I then discussed the way the assessment was done and also the questions that were developed for interviews with farmers.

“The livelihoods approach originates in the development of richer understandings of the dimensions of poverty, such as the sustainable human development approach, and the concept of capitals and capabilities of Amartya Sen. In some quarters, it is referred to as people-centred development (PCD)” (KHANYA – African Institute for Community Driven Development [KHANYA-AICDD], 2006:1). Livelihoods are defined as “people, their capabilities, assets and activities required for means of living. It is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets for both now and the future” (Conway & Chambers, 1991:2). This is a holistic approach which has been named in different ways but with principles that move away from the conventional way of developmental approaches (Carney, et al., 1999) which have proved singularly resistant to change.

The SLA moves away from “attributing problems of hunger and famine to production of enough food since in actual fact they are much more oriented to entitlement which is a question of commanding supplies” (Conway & Chambers, 1991:2). This is also agreed to by Rosset (1999) who said that food is in abundance but the problem is in sharing and accessing it. Conway and Chambers again argue that the idea of creating employment in the rural areas is not a panacea to poverty reduction since the

people are in a different setup and they seek to make ends meet through various activities rather than being formally employed. The ideas around formal employment seem to be exported as solutions from an 'industrial line of thinking' to rural areas where they do not apply (Serrat, 2008). Also, the poverty line is often mistakenly measured in terms of income or consumption, thus aiming for higher wages which is not in line with the poor's vision (Rogers, et al., 2005). Conway and Chambers conclude that conventional assessments of livelihoods (measured with standard routines and reflexes of earlier times) usually give a false indication for they are industrial imprints, and resembling reductionism for easy measurement using narrow conceptual bases applied top-down. The concepts and measures from the urban do not fit or capture the complex and diverse realities of most rural life hence accounting for the failure of conventional analysis to pick up or show the rural priorities of the poor and their many varied strategies to obtain a living.

3.5.1 History and Development of SLA

The SLA has been used by many development agencies though with variations in emphasis (Carney, et al., 1999), but the overall similarities in approach far outweigh the differences. In giving a brief history of the SLA, Carney, et al. (1999:47) viewed it as "an idea that emerged as an alternative poverty-reduction approach put forward as development agencies felt the need for new ways of practicing development that enable countries to move towards international development". The approach is thus made up of the best of the past practices in participatory development and configured into a new framework with basic principles that together enable more sustainable means of reducing poverty (Carney, et al., 1999). The most important steps in making this framework a reality was a forum convened in 1998 called the Inter-Agency Forum on Operationalizing Participatory Ways of Applying Sustainable Livelihoods Approaches (IAFOPW - SLA). The forum was built from the ideas of Chambers and Conway coined in the early 1990s that were being implemented by different developmental agencies. The forum then brought together experts from five developmental agencies to partner and collaborate in implementing the ideas of sustainable livelihoods and also learn from the experienced organisations.

The five organisations that came together for the conference were:

1. The Department for International Development of the United Kingdom (DFID).
2. The Food and Agriculture Organisation of the United Nations (FAO).
3. The International Fund for Agricultural Development (IFAD).

4. The United Nations Development Programme (UNDP).
5. The World Food Programme (WFP) (Carney, et al., 1999).

The aim was to share information and to elaborate a common framework out of the different approaches each was using. From the forum, ideas on the broad guiding principles aimed at supporting sustainable livelihoods and food security with a common goal of sustainable development emerged (Carney, et al., 1999). It became important to use participatory approaches, emphasizing macro-micro linkages, holistic understating of livelihood constraints and being people-centred. In this context, socio-economic issues are at the forefront in understanding poverty and the interventions that can improve livelihoods. The idea of the forum was to learn from the more experienced agencies on participation in projects and sharing experiences from the field (Carney, et al., 1999).

In my study, I felt the SLA framework developed by a group of developmental agencies would be more appropriate. A common framework developed by agencies was utilised as it captures all of the relevant principles. According to Murray, it has the strength of seeking to understand changing combinations of modes of livelihood in a dynamic and historical context (2001). The agencies emphasized the framework's importance as an analysis tool that can be useful in evaluating the progress of interventions on developmental issues hence my application on the case study of small-scale farmers in Mazowe Chiweshe. I also noted that, from Murray, the SLA approach implicitly recognises the necessity to investigate the relationships between different activities that constitute household livelihoods, which in turn require attention, both to intra-household and extra-household social relationships (2001). According to Carney, et al., the baseline to SLA was the recognition of limited achievements of development assistance which had been rolled out for decades (1999). I found it useful as its elements point out the issues affecting individual farmers who, through interviews, would tell how they have benefited or not. My research on this literature was guided by ancestry papers from other scholars who had earlier researched on similar topics.

3.5.2 Elements of Sustainable Livelihoods Approach

Within the SLA framework, there are elements and these can be easily interpreted on issues that affect livelihoods in a household, community, region or country. The elements which were later developed by the development agencies discussed in Section 3.5.1 were coined by Conway and

Chambers in terms of capital assets¹ and vulnerabilities but have been subject to change depending on the situation on the ground and the implementing agency (Goldman, Carnegie, Marumo, Kela, Ntonga & Mwale 2000; Carney, et al., 1999). The approach has many attributes based on principles shared by the collaborating development agencies which emphasise:

- A people-centred concept where policies are based on understanding the realities of struggles faced by the poor and their participation in determining interventions (Carney, et al., 1999; Murray, 2001). This revolves around the assets or capitals of the people and their vulnerabilities to stress and shocks.
- Recognizing multiple influences, multiple actors, different strategies, that is; the policies, institutions, processes and organisations which affect people at different levels to produce multiple outcomes.
- Understanding change, complexity of cause-and-effect relationships and iterative chains of events especially to do with livelihood strategies people adopt to achieve their desired outcomes.
- Firstly analysing strengths and building on everyone's inherent potential and positive aspects rather than merely addressing needs, thus enabling communities to recognize and define local resources capital and capacity for them to use.
- Bridging the gap between macro and micro levels.
- Committed to several different dimensions of environmental, social, economic and institutional sustainability (Murray, 2001; Goldman, et al., 2000; Conway & Chambers, 1991).

¹Capital assets:

Natural capital, social capital, human capital, physical capital and financial capital.

The agencies established that interventions can be done at four different levels as elaborated in the table below:

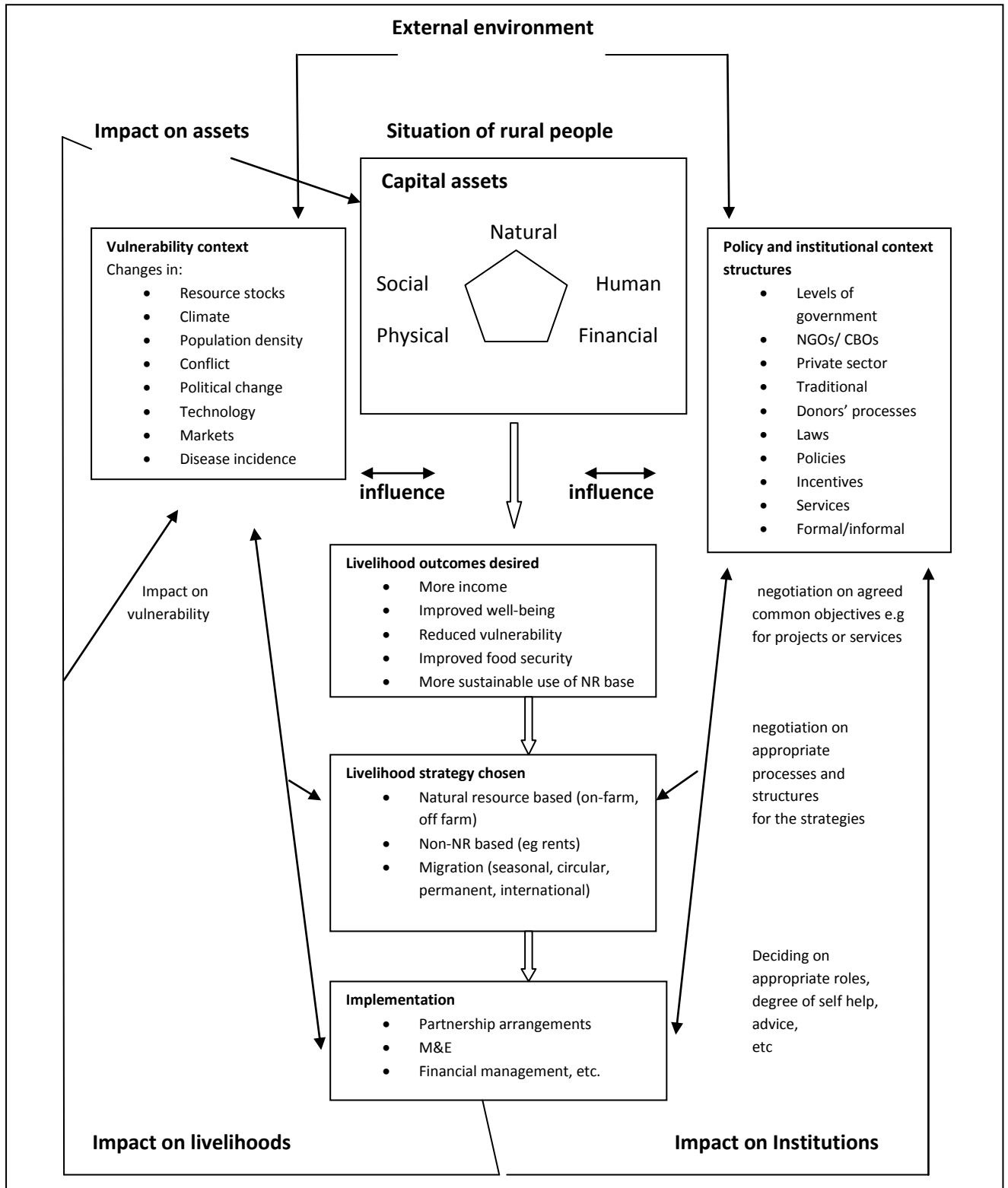
Table 1: SLA intervention levels

Level	Function	Unit
Micro	Community level – where people live	Household, community, ward
Lower meso	Lowest level of management and services	Local municipality
Upper meso	Intermediate level, which provides support to and supervision of the lower meso	District, province
Macro	Policy level	Region, province, country

Adapted from SLA Forum (Carney, et al., 1999).

At each level of practical intervention there are several implications of using the framework which has proved to be useful in structuring and analysing the development situation and the way policies and services are affecting the specific level (Carney, et al., 1999). However, of utmost importance in this research is using the SLA approach on evaluating CA programmes' impacts on livelihoods of the SHFs in the Mazowe Chiweshe area. This framework formed the basis for the questions that were asked to the farmers in order to understand how the project has impacted on their lives. According to my interpretation at the micro-level, this refers to vulnerability context and capital assets of the small-scale farmers. The farmers' livelihoods were thus assessed using the varied asset bases and the differing capacities and capabilities to respond to advantages, opportunities and shocks within the framework of sustainable agricultural project being promoted by ZFAT.

Figure 3: Sustainable Livelihoods Framework



Adapted from SLA Forum (Carney, et al., 1999).

In this research, the analysis was interpreted at household level to determine the assets these households have, preferred outcomes and strategies and the implementation of responses to the

intervention strategies. The diagram also clearly shows the external environment surrounding the community and illustrate how implementation of the project, in this case the sustainable farming techniques impacts on their assets, capabilities, again, on the vulnerability, and on the institutions and policies that do or do not address the community's needs and opportunities. However, the policy side was not looked into during the research as it was outside the scope of the research objectives. Rather, the policy side and institutional context is understood at leadership level in the communities hence viewed as externally controlled rather than an aspect the SHFs have direct control over.

For my thesis and interviews with farmers, the focus was on the vulnerabilities and capital assets of the participant farmers. Focusing on these made the research less complicated and more to the point. The table below shows the area of concern for farmer level assessment:

Table 2: Vulnerability context and capital assets

Vulnerability context	Capital Assets
<ul style="list-style-type: none"> • Changes in resource stocks • Climate change • Population density • Conflict • Political change • Technology • Markets • Disease incidences 	Human capital: the skills, knowledge, ability to labour and good health is important for the pursuit of different livelihood strategies.
	Physical capital: the basic infrastructure (transport, shelter, water, energy and communications), production equipment and means that enable people to pursue livelihoods.
	Social capital: the social resources (networks, group membership, relationships of trust, access to wider institutions and society) upon which people draw in pursuit of livelihoods.
	Financial capital: the financial resources (whether individual or group savings, supplies or credit, regular remittances or pensions) available to people and that provide them with different livelihood levels and options.
	Natural capital: the resource stocks from which resource flows that are useful for livelihoods are derived (e.g. water, land, wildlife, biodiversity, environmental resources).

Adapted from SLA Forum (Carney, et al., 1999).

The adopted framework was an improvement of Conway and Chamber's ideas and resonates well with their argument that SLA views environmental sustainability as concerning the external impact of livelihoods on other activities and social sustainability deals with outside pressures affecting aspects of the capital base (Carney, et al., 1999). The SLA framework used further divides environmental sustainability into local and global sustainability, whereby the former has to do with activities that maintain or enhance the local natural resource base (air, soils, river water and trees). The latter considers net positivity or negativity of livelihoods to the long term sustainability of other livelihoods via aspects such as GHGs, global warming and use of non-renewable resources. This fine division helped me to find interview questions that directly answer my research questions as farmers understood sustainability at their local level and context.

On the other hand, social sustainability is measured by the ability of households to obtain and hold on to adequate livelihoods. It is, however, important to note that in every society, the degree of adequacy varies with the specific situation the community faces (Murray, 2001; Carney, et al., 1999). The first level of social sustainability is reactive, which involves the avoidance of stresses or bouncing back from shocks. Stresses and shocks can be sudden or gradual; for example floods, which can hit suddenly, and declining yields or increases in input cost which are gradual (Conway & Chambers, 1991). I then tried to figure out if farmers are now producing enough to cushion them from hunger and provide food for their families till the next harvest. The second level of social sustainability is proactive where farmers are able to predict and adapt to or even exploit changes to their advantage. Small scale farmers in this instance can "improve their own networking for extension, experimentation and manage links with the wider economy ... this shows the family enterprise can manage risks and uncertainties that usually come with markets" (Conway & Chambers, 1991:12).

SLA makes the connection between people and the overall environment that influence the outcome of livelihoods strategies (Serrat, 2008). More importantly it brings attention to bear on the inherent potential of people in terms of their skill, social network, access to physical and financial resources and ability to influence core institutions (Serrat, 2008; Conway & Chambers, 1991; Kollmair & Gamper, 2002). For the poor communities to achieve sustainable development, two vicious circles that feed on themselves must be broken (Rogers, et al., 2005). Poverty usually cause resource depletion and degradation in perpetuity as the people harvest for sheer survival in a polluting and land degrading manner which in turn further entrench poverty. At the same time, development can lead to resource depletion and prospects can be shattered when it is hampered by factors such as climate change. The environmental problems then retard if not stop development since the

resources of the environment are also the resources for development. SLA recognizes that the vicious circle have to be broken if sustainability is to be met and at least have the people equitably meet their basic needs (Kollmair & Gamper, 2002; Conway & Chambers, 1991). The elements of SLA were thus utilised as a guide to which questions to ask of the farmers, for example by asking them about the assets they used to have and what they have added to their households owing to CA production and how they view their environment as compared to the previous years. Most of the questions revolved around the farmers' capital assets (human, physical, social, financial and natural capital) and their vulnerability to disasters. Information provided by the farmers during interviews and the literature reviewed was then used to assess if the farmers' livelihoods have improved as well as any gains as far as global and local sustainability (economic, social and environmental) is concerned.

3.5.3 Summary

This chapter was dedicated to a literature review that situates the study in the sustainability and livelihoods context, thus giving the basis from which arguments were developed. I began with giving an introduction to global agricultural systems and the problems these have presented, especially industrial agriculture. It was argued that the global problems which affect the poor most, forced humans to think in a new way about the economic systems in use where agriculture is a subsystem. This gave birth to the concept of sustainability, which is a developmental pathway that advocates development that meets the needs of the present generation without compromising the ability of the future generations to meet their own needs. The sustainability concept is however a disputed concept, but there is a global polycrisis (a multiple set of crises that tend to reinforce each other) which calls for explicit moral and ethical interpretation of the sustainability concept such that the level of application can be more focused.

I discussed some pointers of polycrisis as presented in various international reports focusing on the contribution of agriculture to the problems, the impact of the problems to agriculture sector and what should change in agriculture to address the problems. I then went on to discuss sustainability at global level and then at farmer level such that we understand how small-scale farmers can be involved in the push for sustainability. After setting the tone for level of applied research, I had to go into the specifics of the approach used to assess if farmers in Mazowe Chiweshe are attaining sustainable livelihoods by participating in CA projects. SLA was introduced and discussed on how it

was developed by agencies as an assessment tool to measure project achievements and in this case apply it at farmer level. This SLA tool blended with information from the farmers thus helped to determine if some of the project objectives have been met. Farmers provided information by answering interview questions I developed directly from the elements of the SLA. This study, as said before, assesses the impacts on farmers' livelihoods and the sustainability of a running conservation agriculture project. To blend into the way farmers adopt sustainable farming techniques, I felt the need to also discuss the global and Zimbabwean perspectives on sustainable farming techniques. This was included in the next chapter that reviewed the specifics of conservation agriculture as practiced in Zimbabwe and promoted by ZFAT projects.

CHAPTER FOUR: THE ZIMBABWEAN PERSPECTIVE OF SUSTAINABLE AGRICULTURAL FARMING TECHNIQUES

4.1 INTRODUCTION

This chapter is a continuation of the literature review that discusses the specifics of CA and how it has been practiced in Zimbabwe. It is necessary to look at the definition of CA as it is practiced in Zimbabwe. This will assist in the discussion on adoption of CA, its main drawbacks and the way these can be overcome. The chapter thus speaks into how CA was implemented as a response to concerns over the negative environmental impact of conventional agriculture and CA's potential to address food security and improve community livelihoods. This response has been viewed as an opportunity by development agents to help the poor make a living through this type of farming among other alternative approaches. Since Zimbabwean SHFs usually practise dry-land farming, CA seemed a better option amongst other alternatives. This review and the findings of the case study will thus be used to answer research questions ii, iii and iv².

4.1.1 Definition and background of CA

CA has been defined by FAO as a technique that aims to conserve, improve and make more efficient use of natural resources through integrated management of available soil, water and biological resources combined with low external inputs (FAO, 2009). Hobbs (2007) defined it as any tillage sequence that minimizes or reduces the loss of soil and water and operationally as a tillage and planting combination that leaves at least 30 percent or more mulch or crop residue on the surface; a distinguishing feature of conservation agriculture technique. It also aims at avoiding or minimizing soil loss in terms of soil crumb structure or ultimate soil degradation or soil movement due to erosion.

² Research questions:

- ii. What are the production trends of specific crops (maize & sugar beans) after adoption of sustainable farming techniques in Chiweshe as compared to when farmers used conventional agriculture?
- iii. What are the factors affecting adoption of sustainable farming techniques in Chiweshe?
- iv. What are the levels of adoption of sustainable farming techniques by SHF in the area?

In response to concerns about the perceived negative environmental impacts of conventional farming practices, whether for high or low input, farmers and other stakeholders in the USA, Brazil, Australia and Argentina developed revolutionary farming practices, usually labelled under the term conservation agriculture (ACT, 2008). All these movements share an emphasis on applying three main principles for managing agro-ecosystems: minimizing soil disturbance (from reduced tillage to no tillage at all), providing permanent soil cover (through crop residues, cover crops and agroforestry and diversified rotations) and the use of low external inputs technology (LEIT) that reduces operational costs to the farmers. CA in its various forms is widely accepted for its reduced production costs or soil improvements and increased as well as stabilized yields (Hobbs, 2007).

4.1.2 CA Adoption and its Benefits

Farmers consider many factors when adopting a farming system, especially the benefits and risks associated with something new. In promoting alternative agricultural systems, of which CA is one, benefits have been realised ranging from socio-economic to environmental gains (Hine & Pretty, 2006). In South America, there has been a steady adoption of CA and it was reported in Paraguay that up to 23 tonnes per hectare per year of soil was initially lost through conventional agriculture but this loss was significantly reduced by keeping soil covered most of the year when farmers adopted conservation agriculture. Not only did the farmers benefit from soil conservation but there was an added advantage in the reduction of 33 percent in tractor hours needed for crop production, leading to longer machine life and a national saving in fuel (ACT, 2008). In some communities, social integration has been seen to improve as farmers join hands to champion a technique they believe to improve their food sovereignty and livelihoods (Aziz, 2012).

However, there are still some barriers to the total adoption of the technology since tillage is sometimes seen as essential by farmers who are used to conventional methods of clearing the fields after harvest and residues continue to be burnt rather than being used as soil cover (FAO, 2009). Lampkin (2002), commenting on organic agriculture, also an alternative to conventional agriculture and almost similar to CA, pointed out that usually the benefits take time and in the initial transition years may present problems that influence farmers to leave the technology after a few years of adoption. I feel the same type of pressures also apply to conservation agriculture farmers.

Weeds are often a major initial problem that requires weed management over time to get them under control (Kornegay, 2010). Farmers would need to develop new crops or adapt old ones that create varying patterns of resource competition, allelopathic interference and soil disturbance that prevent proliferation of weeds (Wyse, 1994). Several years may be needed for all benefits to take hold but in the meantime farmers save on costs of production and time and usually get similar or better yields as compared to conventional systems (ACT, 2008). Brazil now has millions of farmers practicing CA after 30 years of pioneering work that proved that indeed the technology can be beneficial for both crop yields and the environment (ACT, 2008). It has been noted that CA farmers in Brazil are achieving yields as high as nine tonnes of maize per hectare and this could be a lesson to African farmers (ACT, 2008). In Africa, the CA yields have been generally low but at the same time, conventional agriculture in the African SHF sector is not achieving yields of one tonne per hectare, though with many inputs being applied, making CA a better option for the SHFs who cannot afford agrochemicals for conventional farming (ACT, 2008).

It has been argued that the successful and lasting introduction of CA practices require change not only on the side of farmers but also on stakeholders in the agriculture sector, notably agriculture administration, extension services, education and training institutions as well as farm service providers (ACT, 2008). Major challenges that farmers face when developing conservation agriculture practices are failure to access high quality advisory services and information (Asiabaka, 2001). Adoption of CA systems means learning anew, being patient, accepting setbacks and accepting trade-offs. Lampkin, again commenting on organic agriculture which falls under the umbrella of sustainable agriculture systems, argued that it is not only a change in the way farmers produces but a complete change in mindset. Consequently those pushing for the adoption of the sustainable farming practices require a high participatory and flexible approach and a great deal of innovation (Asiabaka, 2001; Altieri, 2004). They need to take the cue that the tendency is for farmers to use techniques they have known and practiced over years, some of the practices which would have been learnt from trained and trusted agricultural extension workers (Sims, Mkomwa, Steiner, Apina & Mzoba, 2005; Carolan, 2005).

4.1.3 CA and Polycrisis Mitigation

The polycrisis reviewed in Section 3.3.1 is a crisis springing from the way we designed our systems. It has been discussed that agriculture affects and is also in turn affected by the polycrisis. Birkeland

(2002) argues that it is high time we redesign our systems to work in harmony with nature. Alternative agriculture systems such as CA provide a farming system that mitigates many of the issues that face us. The need to address looming global crises like climate change, competing water demands and the use of more costly fossil fuels may be dealt with by applying tillage systems that use less non-renewable resources and saving on energy (Hobbs, 2007). Non-dependency on fossil fuels will reduce greenhouse gas emissions which have inherent warming effects on the atmosphere, effecting severe climatic events such as droughts and floods (FAO, 2009). A farming system that will ensure the sequestration or absorption of these gases would contribute to the reduction of global warming (ACT, 2008).

Agricultural soil management practices have grappled with nutrient balances in the soil, especially to do with carbon-nitrogen ratios, which affect uptake and utilization of nutrients by plants (Tittonell, 2012). Tilling of the land causes carbon to be released into the air and addition of inorganic fertilisers has been reported to increase chances of nitrogen volatilization. With respect to carbon sequestration, it is estimated that wide dissemination of CA could off-set as much as 16 percent of worldwide fossil fuel emissions (ACT, 2008). It is estimated that given that land under conservation agriculture in Brazil, the country can sequester about 12 million tonnes of carbon annually (ACT, 2008).

Agriculture also needs to feed the ever increasing population through systems that can produce high yields whilst keeping the soil productive. Conservation agriculture emphasises on minimal soil disturbance, permanent ground cover and rotation with an overall benefit of yields (Esteves, 2011), mainly because the crops retain moisture for a long period due to mulching. This farming system has low costs as inputs are precisely added to planting stations and promotion of stable soil aggregates as a result of minimum disturbance of the soil surface. Weeds have been shown to germinate less in well managed CA systems because the soil is less disturbed and weed seeds are not broadcast, meaning low competition for nutrients between weeds and crops, ensuring attainment of higher crop yields (Twomlow, et al., 2008).

The current population growth in an unequal world is a cause of concern (Swilling & Annecke, 2012) and the world needs farming methods that keep pace with the population (Brown, 2008). With the growing world population, the number of those who are hungry is increasing too, whereby about 800 million people are hungry (Pretty, 2008), 92 percent of this number chronically and 8 percent from extreme events (FAO, 2009). Communities are forced to migrate in search of jobs and a better

life. There is a need to provide food for the hungry and also to create jobs for the poor for them to have a sustainable livelihood. However, today such production increases must be accomplished sustainably, by minimizing negative environmental effects (Pretty, 2008; Kate, 2008; Rosenberg & Linders, 2004). An adherence to natural production systems is generally less harmful to the environment and equally important, providing increased income to help improve the livelihoods of those employed in agricultural sector (Earles, 2005; Sullivan, 2001; Menalled, et al., 2008). Increased income will thus help mitigate the problem of rural-urban migration as the unemployed are lured to the farms. When communities work for their own to produce and earn incomes, it is a move away from the conventional industrial thinking of working in industries for wages. In a way the communities are empowered.

4.2 THE ZIMBABWEAN PERSPECTIVE ON CA AND ITS PROMOTION

As the realisation that the globe is facing a polycrisis spreads, Zimbabwe has not been left behind on promoting sustainable agricultural systems. In Zimbabwe the most interesting thing is that sustainable techniques introduced by development agencies are dubbed ‘modern farming techniques’ (Hungwe, 2012). Alternatives have largely been promoted in Zimbabwe to help the SHF sector to revive their agriculture and boost food security (Dhewa, 2010; Marongwe, et al., 2011). The majority of black smallholder farmers in the rural areas are living in dire poverty and cannot afford machinery and chemicals, hence becoming ‘sustainable’ farmers by default; though they are usually taught conventional techniques by trained government extension officers. Most of these farmers in the rural areas are peasants who have been struggling to even feed their families but have agriculture as the main source of livelihoods. I hereby give an account of when and why it became necessary for Zimbabwe’s SHFs to turn to sustainable farming, especially to CA.

In Zimbabwe, CA was first implemented in the 1980s around the north-eastern parts (Marongwe, et al., 2011). The CA technology has evolved in time with many modifications from its earlier version to address low yields levels in the SHF sector. Donors and NGOs have been at the forefront of promoting CA to sustainably address the low productivity of farmers and improve their food security and overall cereal production (Dhewa, 2009; Marongwe, et al., 2011). “The recognition of positive impacts of CA on crop productivity generated in other parts of the world led to its intensive promotion by many NGOs in 2003” (Marongwe, et al., 2011:3).

In a bid to coordinate activities, a task force was formed in 2003 which is headed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the River of Life Church (Dhewa, 2009; Marongwe, et al., 2011). These two provide monitoring and training support to a partnership of at least 15 NGOs, FAO, international research centres and the government promoting conservation farming across 48 districts in Zimbabwe (Mazvimavi, Ndlovu, Marongwe, Tirivavi & Musitini, 2008; Marongwe, et al., 2011). Now the private sector is involved in supplying inputs and through the Union Project (now ZFAT), they have helped to initiate a market-oriented agricultural production system (Dhewa, 2009; Marongwe, et al., 2011). CA in Zimbabwe is being practiced by approximately 45 000 rural farming households (Gondo, 2008). Farmers practicing CA have exceeded conventional yields by between 10 and 100 percent, depending on input levels (Dhewa, 2009). NGOs promoting CA teach farmers how to implement the farming system, following some principles that ensure objectives of environmental protection and increased production are met. The next section discusses the principles which some authors describe as the drivers of successful CA practises in Zimbabwe (Marongwe, et al., 2011; Dhewa, 2009).

4.3 PRINCIPLES OF CA AND TECHNOLOGIES PROMOTED IN ZIMBABWE

In Zimbabwe the promotion of CA was institutionalized around 2003 (Dhewa, 2009). This commenced with the establishment of the Zimbabwe Conservation Agriculture Task Force (ZCATF) as explained in Section 4.2.1. The mandate of this task force is to monitor and disseminate information on CA activities in Zimbabwe. The task force gathers information on all NGOs and government efforts on conservation farming. This task force also laid out some principles which have to be followed by those implementing CA, so that activities are coordinated. CA promotes farming in a naturalized environment that allows recovery of environmental systems. These principles are aimed at increasing productivity by improving the management of agriculture, using available resources and technology (Marongwe, et al., 2011). This section will discuss the principles of CA used in Zimbabwe and then address the technologies promoted to meet objectives of CA. The discussion is based on literature gathered from Zimbabwean experiences from different NGOs that make up the CA taskforce.

CA promoters have mainly targeted resource-poor farmers who do not have livestock for draught power and also resources to buy agrochemicals (ZCATF, 2008). Nyagumbo noted that, "In Zimbabwe a number of CA techniques have been actively promoted and evaluated since the 1980s: no till tied ridging; mulch ripping; no till strip cropping; clean ripping; hand hoeing or zero till; tied furrows (for

semi-arid regions) and open furrow planting followed by mid-season tied ridging” (Nyagumbo, 1998:68). These have frequently been promoted in combination with mechanical structures such as graded contour ridges with cross tiers, and infiltration pits dug at intervals along contour ridge channels. In the next sub-section I will be discussing principles of CA.

4.3.1 Winter Weeding

Weeds compete for nutrients with crops and also tend to harbour pests and disease. Proponents of CA argue that as a principle, fields should be weed-free (ZCATF, 2008). Weeding is done soon after harvesting, before the weeds have set more seeds. Hand weeding is mostly used since it is easy to uproot the weeds owing to moist soils or using implements that do not disturb the soil. Hoes or machetes are used for shallow weeding, different from digging out weed roots as in conventional agriculture. If land is left unattended after harvest, the weed on the field has a greater chance of multiplication on the whole field before the next summer planting (Mazvimavi, et al., 2008:3). This is a major talking point between promoters and beneficiaries of CA with the latter complaining of labour constraints.

4.3.2 Digging Planting Basins

Seeds are placed precisely on holes/pits dug in a weed-free field. The planting stations are prepared in the dry season with specific recommended dimensions for each natural region (ZCATF, 2008). Basins capture water and retain moisture which enable germination of seeds. Seeds are placed in each basin at the appropriate seeding rate and covered with a clod of free soil (Gondo, 2008:6). Inputs are not broadcast but precisely placed in basins making sure manure or fertiliser is not wasted as it is only applied where it is wanted; on the crop basin. This is sometimes called precision application of variable agriculture inputs. The planting basins are prepared using hoes, jab planters or sticks which will be explained with the technologies of CA.

Figure 4: Farmers digging holes (planting stations) in the research area



Source: Profile pictures (Dhewa, 2010).

The planting basin is maintained by timely weeding in summer and winter, the application of manure and mineral basal and top dressing fertilizer, crop rotation and covering the soil with organic residues.

4.3.3 Application of crop residues

When the soil is left bare, it is exposed to many agents of erosion which washes away the normally nutrient-rich top soil. In CA, it is encouraged that crop residues must be applied on the soil surface to reduce soil erosion and conserve moisture for crops (Harford & Breton, 2009). Farmers are encouraged to use residues from previous crops as opposed to the traditional practise of burning or allowing animals to graze in the fields. "This is a major diversion from conventional agriculture that emphasises 'clean fields' – free of crop residue and other organic materials" (Gondo, 2008:8). The thinking under conventional systems is that residue causes poor germination, contains pests and diseases and interferes with operations such as planting and weeding. CA promotes the proper management of crop residues where they are placed carefully between rows during land preparation in the dry season.

4.3.4 Application of manure and inorganic fertilisers

Soil fertility is the basis for healthy plants and there is a need to replenish nutrients mined by plants during the growing season. In CA practices, it is understood that it is the soil that feeds the plant, hence the need for fertility amendments whereby both organic and inorganic fertilisers are used (Mazvimavi, et al., 2008; ZCATF, 2008). CA acknowledges the long term benefits of applying organic fertilisers, and these can be combined with small quantities of synthetic fertilisers for a bigger impact. Inorganic fertilizer is applied exactly in the planting basins and covered lightly with soil. When using precision application, it has been estimated that an equivalent to 80 kg per hectare is used as compared to 400 kg per hectare recommended in conventional systems (Harford & Breton, 2009). Inorganic fertiliser is applied twice with the first application at planting and the second after the first weeding at the amount of one level beer bottle lid per crop planting station. Application is done on moist soils and the rate per hectare is the same as for the basal fertilizer (Mazvimavi, et al., 2008:23).

4.3.5 Timely implementation

For a system to be effective, there is a need for timely implementation of operations, complemented by good management standards. In Zimbabwe, a farming calendar was established to ensure that operations and activities are conducted precisely and on time (ZCAFT, 2008). The calendar to be followed calls for:

- Preparing the land in good time.
- Planting soon after an effective rainfall event (called planting window) to take advantage of heat units.
- Weeding at appropriate times and intervals, during the winter usually two to three weeks after emergence, then at six weeks, and finally at the end of the rains.
- Effective pest and disease management before they spread too widely.

It has been argued that where CA has not produced results, it is largely because of lack of timeliness of operations (Twomlow, et al., 2008). Practitioners of CA have learnt not to jump critical stages in the early part of the season as this will cause more work and less yields later on.

4.3.6 Crop Rotation

Crop rotation has many uses in agriculture but conventional systems seem to trivialise it (Tittonel, 2012). CA sometimes promotes monocultures that rely on agrochemicals for weed and pest management (Kate, 2008). Rotating crops is one of the key principles of conservation farming whereby it helps in optimising plant nutrient use by synergy between different crop types (Mazvimavi, et al., 2008). The advantages of crop rotation include soil fertility improvement, control of weeds, pests and diseases, and producing different types of outputs, which reduce the risk of total crop failure in case of drought and disease outbreaks (Kate, 2008). Through rotations, peak labour times may be reduced and labour better distributed throughout the year, if planting and harvest times are different (Rosenberg, 2006). Crop rotations may balance the production of crop residues by alternating crops that produce few or short-lived residues with crops that produce a great quantity of durable residues. The residues is then utilised for mulching or green manuring purposes and sometimes as pest repellents. For the above discussed principles to be followed, certain technologies are used and they are discussed in the next subsection as practiced in Zimbabwe.

4.3.7 CA Technologies in Zimbabwe

The technologies used in CA in Zimbabwe are those that go hand in hand with the principles of the farming system. Most technologies ensure minimum soil disturbance and creation of planting stations/basins where seed and fertiliser are placed precisely to avoid wastage, hence saving money (Harford & Breton, 2009). Basin tillage and shallow planting furrows are most commonly used (Mazvimavi, et al., 2008). A hand hoe is used to dig the basins or pits and to create shallow furrows. The basins created are usually permanent and allow utilization of the same spot in future years. A pointed wooden stick can also be used to prick a hole through mulch and this method has the best minimum soil disturbance. The sticks for seeding holes can be made for free as compared to a tractor or oxen plough which might be expensive. Usually shallow furrows are created when planting sugar beans and other legumes. The method is also used for growing small grains (Mazvimavi, et al., 2008:16). This basin system is most promoted in Zimbabwe to mainly address the draught power shortages in the SHF sector and in case of drought where draught animals are still too weak at the end of a long dry winter. Some farmers use jab planters which are pushed into moist soil and opened

to release seed and fertiliser. The latter is quicker than the hoe or pointed stick methods. The job is also known to precisely place seed and fertiliser into planting stations.

Some farmers, who have draught power, make use of tine rippers, which are attachments fitted to the beam of the ordinary mouldboard plough, to prepare planting lines in an unploughed soil for households with draught power. This is likely to be adapted much more easily by these households. "The animal drawn ripper tine works a shallow depth of 10-15 cm and, after making the rip-line, seed and fertilizer are placed manually in the furrow and covered. They were designed to open furrows for moisture capture or to break the superficial compacted layers, but in conservation agriculture they work well to open planting furrows" (Mazvimavi, et al., 2008:17). This technology is still new and only filtering into the country. However, it is also easy to improvise with old mould board ploughs.

To cater for farmers who are practising CA on a large scale, direct seed planters were developed. These, also called Specialised No Till seeders, are meant for emerging commercial farmers with draught power. This technology is beyond the reach of smallholder farmers, and is generally used by the technologically more advanced farmer. "The direct planting seeder technology has helped the commercialization of conservation farming which would otherwise be difficult if done the labour-intensive way" (Mazvimavi, et al., 2008:17). With this technology it is possible to do a large hectareage under conservation agriculture. The direct seeders can also be tractor drawn.

4.4 UPTAKE OF CA IN ZIMBABWE

The post-land reform period has been critical in shaping the agricultural terrain of Zimbabwe (Marongwe, et al., 2011). Many SHFs have been producing for their families at subsistence level and were sometimes in need of food relief in drought years (Gondo, 2008). The most affected farmers are those in drier regions like Region Five of the agro-ecological zones of Zimbabwe.

According to ZCATF, it is imperative that farmers in dry regions and where natural fertility is low adopt cultural practices that improve fertility and ensure water availability to crops for extended periods (2008). For some farmers, though keen on practicing technologies that can improve their livelihoods, there are barriers attributed to critical inaccessibility of inputs (Marongwe, et al., 2011). There was a rise in the number of farmers taking part in CA projects when NGOs began promoting the system using demonstration plots and supply of inputs (Marongwe, et al., 2011). The supply of

inputs by NGOs has been criticized by some who believe it fuels dependency syndrome, but studies carried out by ICRISAT revealed that in the 2006/07 season, farmers supported under CA in Zimbabwe were still keen on the technology even when NGOs were no longer providing inputs (ICRISAT, 2009). This was attributed to the high yields attained under conservation farming as well as NGO support which came with inputs and technical extension support.

Farmers adopt technologies taking one step at a time and with packages like CA where certain principles are to be followed. It was observed that farmers initially adopt what they feel is the most relevant part and then follow additional principles at a later stage (Mazvimavi, et al., 2008: 16). This is particularly evident when CA targets households of varying resource endowments. According to Marongwe, et al., the most commonly adopted principles of conservation agriculture are manure application, top and basal fertilizer dressing and timely post planting weeding (2011). The least applied principles are crop residue application and crop rotation. The practice of winter weeding is limited, particularly in the first year of adoption. Adoption is generally assisted by effective extension support (ZCATF, 2008; Harford & Breton, 2009).

4.4.1 Determinants of CA Adoption

“The adoption of conservation agriculture in Zimbabwe is influenced by socio-economic factors such as gender, age, farming experience and resource base” (Gondo, 2008:14). The availability of labour can influence the adoption of CA practices. CA in some districts has been taken up by younger farmers and avoided by the old if they are not guaranteed of labour or some farmers just put very small proportions of their land under CA, citing labour constraints, mainly for weeding and basin preparation (Marongwe, et al., 2011).

In this era where some families take care of their members infected by HIV/AIDS (under home-based care programmes), they are least likely to take up conservation farming because of limited labour hours available for farming, as there is competition from the home-based care initiatives necessary (Gondo, 2008:15). The patients themselves cannot provide requisite labour during peak labour periods such as land preparation and the family might not farm at all.

The well-resourced farmers may not want to implement the no-till system because they have the draught power. Such farmers may also prioritize crop residues for livestock feed than for use as

mulch on conservation farming plots (Mazvimavi, et al., 2008). Leaving crop residue on the field as required under CA has not been easy for poor-resourced farmers without fencing. Animals stray in fields during off-season and graze the crop residue in the communal grazing system.

Crop rotation adoption has been slow, especially where there is no donor support, as seed for legumes is in general short supply in Zimbabwe (Hungwe, 2012). In rural Zimbabwe, farmers also place a bigger emphasis on staple or food security crops such as maize and small grains (Gondo, 2008:4). "Access to inputs also influences adoption of CA principles in the smallholder farming sector" (Gwaringa, 2009:3). For NGOs with input support programmes, conservation agriculture has been adopted intensively. The limited inputs available in rural areas do not allow farmers to expand areas under conservation farming.

Weeding problems have also influenced the adoption of CA principles. "Because of the no-till approach, weed development in the first year seems overwhelming and farmers feel it is laborious to do hand weeding. However, in Zimbabwe use of organic herbicides is being encouraged as well as light weeding which minimally disturbs the soil" (Gondo, 2008:18).

Extension approaches also play a part in ensuring that the CA technique is adopted by a community. "In some areas NGOs tended to promote conservation agriculture without involving the field extension staff of government, AGRITEX" (Gondo, 2008:16). These officers are generally trained on conventional agriculture and would still need training on CA. A few NGOs incorporated the training of AGRITEX staff in their implementation budgets (ZCATF, 2008). In Zimbabwe the widely used extension methods are the Extension Agent System, Lead Farmer System and the Combined Extension and Lead Farmer System. In the first system, trained extension staff gives advice to farmers and support them in the implementation of CA interventions (Gondo, 2008). This assumes that extension workers should be well versed in conservation agriculture to be able to impart the 'specialized' knowledge required. The NGOs can also make use of farmers chosen on merit and successful implementation to train other farmers with monitoring of extension officers (ZCATF, 2008). With experiences in the field, some organisations are combining the two systems above as it has been proven by extensionists that farmers learn more from each other than from extension agents using principles of adult learning (Gondo, 2008:24). They tend to believe and trust each other's practical experiences more than messages brought by outsiders. It is therefore the extension workers' task to ensure that they coach some farmers to be good examples to their peers.

4.4.2 Setting a Mindset

For farmers to adopt a certain system, there is a need for them to be prepared for what to expect including the risks and benefits involved. Farmers have their own socio-cultural beliefs which could have evolved in time, owing to systems they have been using. When a new system goes against these beliefs, resistance in adoption can be met, hence the need to explain some principles that create a clear focus and the objective thereof (Gondo, 2008; ZCATF; 2008). It is imperative that the community itself as well as the existing structures within the community are incorporated into the extension programme (ZCATF, 2008).

CA involves a change in the whole production system, hence it is not a simple technology that can be understood with a brief exposure. Farmers have to be taught the principles and techniques of how to prepare land, control weeds, the quantities and methods of application of the inputs and sometimes how to assist technologically advanced farmers with calibration of farm implements, the time of planting/planting window, use and management of crop residues, crop rotations and even which crops to grow/enterprise selection (ZCATF, 2008:5). Farmers have to be aware that benefits accumulate over time with improvements in the practices of CA, especially on land management (Gondo, 2008).

For the successful implementation of a system, it is not just farmers who have to change their way of thinking but a whole host of other farming sector stakeholders (Gwaringa, 2009). There is need for commitment to turn around the downward trend in agricultural production and pass the message on through various supporting acts (Mazvimavi, et al., 2008; ZCATF, 2008). In general, one can expect that farmers need to be supported for years, especially with respect to information, training, and advice for them to be able to continue on their own in a sustainable way (ZCATF, 2008:5).

The need for continuous research cannot be overemphasized. This research should also incorporate farmer knowledge as the farmers learn through their field experiences. Farmers are sometimes ridiculed for trying new things like CA, only to be later approached to lead other farmers in the lead extension models (ZCATF, 2008). Farmers in the same community implementing CA can support and help each other to resist the pressure to return to conventional farming methods. Extension agents' commitments are, however, important as they should frequently and substantially support the farmers, be it through encouragement or reminding them of the principles and reasons for these methods (Gondo, 2008; ZCATF, 2008).

4.4.3 Training and Role of Extension Officers

The key element in extension and promotion of CA is that farmers conduct their own field studies and experiments. Extension agents, be they from NGOs or government, are primarily facilitators, not teachers (ZCATF, 2008). Extension officers, after initial training exercises in the various components of CA, offer help, guidance and encouragement as and when required. For this support to be credible and acceptable to farmers, extension agents must have a good understanding of the principles of CA and must know how to manage the particular CA technologies that they are transferring (ZCATF, 2008). CA knowledge cannot be obtained by attending one training course. It is essential to engage in regular follow-ups to refresh and discuss the principles and practice of CA (Gondo, 2008).

There are organised CA training sessions and it is vital that the same people attend all courses to ensure staff continuity, provided host organisations are committed (ZCATF, 2008). Additional on-the-job training is also available to CA projects through ICRISAT throughout the cropping season (ZCATF, 2008). Specific sessions can be organized upon request during the season for trainees who may not have attended the first or second sessions (Gondo, 2008).

Stakeholders of CA programmes should aim at being as practical as possible thus implementing the 'learning-by-doing' concept (ZCATF, 2008:6). It is essential that both change agents and farmers have opportunities to try out the various components of the CA package being promoted, so that they can learn and understand the skills and knowledge required. Under CA, farmers change the timing of their farm operations and rip their fields to absorb the rain and plant on time, which provides good seed germination. Farmers themselves make excellent extension workers. They have practical experience and credibility, and with a little support they can train fellow farmers in CA, organize farmer groups, and arrange activities such as field days and field visits (ZCATF, 2008). However, farmer facilitators should not be seen as an alternative to regular extension support but rather complement and reinforce the work of extension staff (ZCATF, 2008:8; Mazvimavi, et al., 2008). There have been positive outcomes in the implementation of CA with stakeholders showing commitment, but there are still many challenges.

4.5 BARRIERS TO IMPLEMENTATION OF CA IN ZIMBABWE

Implementation of CA has not been an easy path in Zimbabwe (Gwaringa, 2009; Marongwe, et al., 2011). This section discusses the challenges and barriers to the implementation of CA and goes on to look at possible ways of overcoming the barriers, tapping from experiences of NGOs in the field. Some barriers are practices which farmers are used to doing, where they need a change of attitude for adoption CA. This goes back to understanding the socio-cultural values of a community, the community mind-set as well as attitudes towards implementation of the programmes.

4.5.1 Barriers

Barriers to CA implementation can be traced at various levels from the institutional organisation of promoters, governmental policies and at grassroots (farmer) level. The research was done at farmer level hence much discussed here are challenges found when dealing with farmers in the communities. Farmers in Zimbabwe are used to principles of conventional farming, the main dominant component being ploughing the fields, using draught power and to some it has been a disadvantage as they had to wait for others to finish before they get draught power to plough (Dhewa, 2009). They were made to believe that ploughing is essential for crop production because it makes the soil soft and enables roots to penetrate easily, when in fact the opposite is true. This misconception has been emphasised by conventionally trained extension workers (Gwaringa, 2009).

In principle, CA encourages farmers to cover land to curb erosion and also help retention of soil moisture. However, farmers are used to burning crop residues and weeds in the fields after cattle have grazed it or use fire to manage pastureland (Gwaringa, 2009). The burning is reinforced by the notion that a clean field is the basis for good farming and the belief that organic matter should be ploughed into the soil (Harford & Breton, 2009). In fact, mulch on the soil surface allows more rain to infiltrate the soil, and promotes fertility better. The traditional farmer sees mulch as dirty left on the field (Gwaringa, 2009). Conventional extensionists even argue against CA which encourages farmers to leave crop stalks in the field. They argue that residues retain diseases and pests but these can be controlled. Crop residue adds on to soil organic matter.

Communal farmers are basically subsistence producers who only sell the surplus (Gwaringa, 2009). In Zimbabwe, people prioritise growing maize over any other crop even when the conditions are not

well suited for it, since it is the staple food. Other more drought resistant crops may provide better yields especially in drought-prone areas (Shetto, 2007). Introduction of CA-input packages with other crops are resisted because farmers want to always try their luck with maize which brings direct and palatable food security. Any other crop that does not give direct value to the farmers is shunned. This has been explained also in terms of land ownership terms where farmers are not willing to do long-term projects. When land is communally owned, in other countries, individual farmers may have little or no incentive to improve it. They may not care about making sure they preserve it as recommended under CA (Harford & Breton, 2009; Gondo, 2008). However, in Zimbabwe, this may be contestable since many communal farmers in the rural areas, such as the research area, are not knowledgeable about land tenure systems. They usually have usufruct rights to land and have been farming on the lands for generations and regard the land as belonging to them. Land tenure is an economic and political issue as well as a cultural and social one.

In rural communities where cattle are allowed free-range grazing during off-season, it is believed to be socially unacceptable not to permit communal grazing in the fields. It is also difficult to keep animals off a farmer's field unless they fence it off (Gwaringa, 2009). Most smallholder farmers cannot afford decent fences for their conservation agriculture plots. Fencing off the fields might require access to credit and financial constraints are a huge barrier. Farmers are accustomed to buying external inputs, even though the success of CA relies more on positive attitudes, knowledge and precise management of available resources (Gondo, 2008). Many farmers, especially in the communal lands and resettlement areas, have no collateral in the form of secure of tenure, which disqualifies them from accessing credit for inputs (Harford & Breton, 2009). The successful CA programmes in Zimbabwe have been those with full input support from donors (Marongwe, et al., 2011; Mazvimavi, et al., 2008). The technique works well if one has a total package which includes adequate inputs.

When farmers have access to inputs and relevant knowledge, CA emphasises high levels of precision and timeliness which may be new to farmers. A strict adherence to principles and timing of operations might give the impression that CA is burdensome or difficult to implement (Harford & Breton, 2009). Most farmers want easy farming techniques and paying attention to detail is sometimes regarded as extra labour (Gondo, 2008). It is the young farmers who usually take up new ideas as compared to older farmers who do not easily let go of ingrained habits and attitudes. It takes time to change attitudes (Mazvimavi, et al., 2008). Some farmers take up the practices but are not so keen to implement the good management and some do not have adequate labour. However,

some farmers, especially vulnerable groups, lack self-confidence. They think their poverty situation is inescapable, and therefore they do not attempt to get involved in the CA programmes.

The barriers discussed here are not the only ones and it is important to note how this research was dealing at micro-level. Therefore there was no need to look at all external influences. In search of the review of the Zimbabwe CA situation, it was discovered that ways have been suggested to overcome the barriers. These are discussed in the next subsection.

4.5.2 Overcoming Barriers

Over the years since NGOs have started promoting CA in Zimbabwe, efforts have been made to increase adoption of the technique in the rural communities (Mazvimavi, et al., 2008; Marongwe, et al., 2011). Overcoming the challenges faced as discussed in Subsection 4.5.1 have proved to be an uphill task, but the following techniques have been proving to work to get optimum results and mitigating low adoption of conservation agriculture from studies in Zimbabwe (ZCATF, 2009; Gwaringa, 2009).

The rallying point in SD interventions is taking time to listen to the community, in order to appreciate the community's challenges and their opinions (Harford & Breton, 2009). Engaging community to gather information on the problems farmers are facing, ensures evaluation if CA can be part of the panacea. Communities feel a sense of belonging and acceptance when they are consulted on possible answers to their problems. It is thus important for extensionists to help the community to envision the benefits of CA through discussions and consultations rather than imposing interventions (Gwaringa, 2009). Discussions serve as awareness campaigns on benefits to environmental and socio-economic issues. It is important for extension agents to proffer alternative solutions to problems and barriers discussed by the communities. Communities might have their ingrained habits but these can be overcome by jointly exploring solutions. The discussions are an important indication of willingness by farmers to participate or not and helps in planning the way forward (ZCATF, 2008).

Discovery of evidence of the clear benefits through experimentation and demonstration lies at the heart of CA programmes. Promoters and extension personnel can set up demonstration plots to show farmers the benefits of CA, such as the investment of a small amount of labour and inputs to achieve high returns (Harford & Breton, 2009). A farmer would be persuaded by a formula that

ensures they can feed their family better (Mazvimavi, et al., 2008:16) and enjoy benefits for a long time. These benefits should provide solutions to actual problems a farmer faces.

Operation time in the fields is the farmer's time to experiment and this should have to be encouraged. Farmers should be allowed to experiment with a variety of crops and not only stick to crops with seed inputs supplied (Dhewa, 2009). As a complimentary practice to rotation, intercropping is encouraged, trying different crop combinations. CA is quite knowledge-intensive because farmers will be learning to adopt a new range of practices and management techniques (ZCATF, 2008). A farmer-centred learning process is required, which involves reflection and discovery in the farmer's own context.

Most farmers learn best from their peers (ZCATF, 2008). Farmer exchanges benefit all participants. People who share information develop the confidence and skills to teach their new-found skills and learn from their experience, while visiting farmers can ask questions and share concerns (Mazvimavi, et al., 2008). A CA programme would best provide as many opportunities as possible for farmers to exchange their knowledge and experiences. The exchange visits allow participatory sharing and socialisation. The core principles of participatory approaches and adult learning include visualization, exchange, sharing and discovery, leading to action. Participatory methods can be used to raise awareness of CA with activities such as community drama to promote the concepts in an entertaining way (ZCAT, 2008).

Some farmers can be willing to participate in a programme but without any inputs and it is very important that the development agency work around such issues, in a way that do not cause problems in the future (Gondo, 2008; ZCATF, 2008). Input delivery can be used as a stepping stone to own production, guarding against creating a dependency syndrome (ZCATF, 2008). Inputs procurement has been difficult for rural farmers (Gwaringa, 2009). NGOs may have to improvise on input delivery systems like supplying the inputs to the farmers or not supplying the inputs at all and encouraging the farmers to source their own. Else, inputs can be supplied on a credit basis that is repaid from the profits of the harvest (ZCATF, 2008). Most farmers end up barter trading part of inputs to transporters to get inputs to the farms. Whatever system development agencies use should be trustworthy to farmers such that it does not look like a deceptive way to lure them to the programme and they should be able to continue when inputs are no longer supplied. Approach will have to vary from community to community such that interventions will be beneficial in the short and long term.

Farmers need encouragement to grow their food sustainably. The basis of agriculture in the rural areas is food security. CA programmes can ensure that farmers are food secure and when there is a surplus, it can be sold to provide other services for the family (ZCATF; 2008). Agriculture value chains can be created to provide ready markets for the produce. According to Dhewa, farmers are concerned about being able to send their children to school and break the poverty cycle (2009). Providing the family with the basics of food, medicine and education entails that farmers go beyond subsistence farming to make a profit. Development agencies have to instil the concept of sustainable farming as a business. Farmers can thus push to make optimum profits to keep them in the business. According to ZCATF, making a profit also provides a farmer with enormous self-worth and is the key to their release from the poverty trap (2008:13).

The barriers and ways to overcome them were discussed at farmer level. Development agencies make interventions to help farmers make a breakthrough and achieve sustainable livelihoods. Strong synergies between the relevant stakeholders and everyone involved are then needed to make interventions like CA a success.

4.6 CONCLUSION

CA is not a new concept in Zimbabwe. Development agencies have been helping communities with relief materials including food, especially in drought prone areas. Now the focus seems to have shifted to not giving hand-outs but providing interventions for farmers to help themselves. NGOs in Zimbabwe introduced CA such that farmers can manage resources and farm in an environmentally friendly manner whilst producing enough for their households. This chapter gave a review on describing how CA has been operationalised and started, by providing a definition and the background. I went on to look at the adoption of CA and the benefits to areas such as South America where it has been operational for quite a long time. These benefits are related to the way CA has solved the problems SHFs were and some are still facing.

A Zimbabwean perspective of CA and how it has been promoted, especially the effort put by NGOs in reviving agriculture, was discussed. The principles used in CA were looked into as well as how they are used by farmers with the technologies available. These principles of CA relate much to what technologies farmers use as they experiment in their fields. As CA is introduced to communities, there are challenges faced and this affects adoption of the technology by farmers. I looked into the

determinants of technology adoption such as extension and preparing farmers' mind-sets for a new system. Lastly I looked at barriers to implementation of CA. Most of the information was based on the research done specifically in Zimbabwe and the experiences shared by NGOs working with farmers who presented some ways they can think to overcome the barriers. This chapter was setting the ground for the case study and helped in the answering of Research Questions ii, iii and iv, which focus on the factors affecting adoption in Mazowe Chiweshe, as well as the levels of adoption thereof. The next chapter goes on to discuss the findings of the case study.

CHAPTER FIVE: FINDINGS AND DISCUSSION

5.1 INTRODUCTION

This chapter presents the research results which are a product of questionnaire interviews, key informant interviews and the review of secondary data. This section begins with a profile of the study area, Mazowe Chiweshe (Ward 4), where I interviewed SHFs in the communal areas. The findings begin with an area profile as given by an insider, Mr John Gombiro (a former councillor). Mr John Gombiro served as a councillor for about 10 years from 1988 to 1998. I felt the need to write this up, because I discovered many things which I had assumed knowledge of. Being physically in the area gave me a clearer picture because of the observations and things I discovered through talking to the farmers.

After the profile, I go on to give accounts of the farmers' responses to questionnaires and then the interviews with the current councillor and the AGRITEX officers. The latter were key informants and this was meant to balance and validate data from other key sources. The profile serves to give background on the farmers whom I found to be living in very poor conditions. Most are worried about food security more than anything else and trying to find means to educate their children, as the opportunity to get educated and get a good job are highly regarded in these communities.

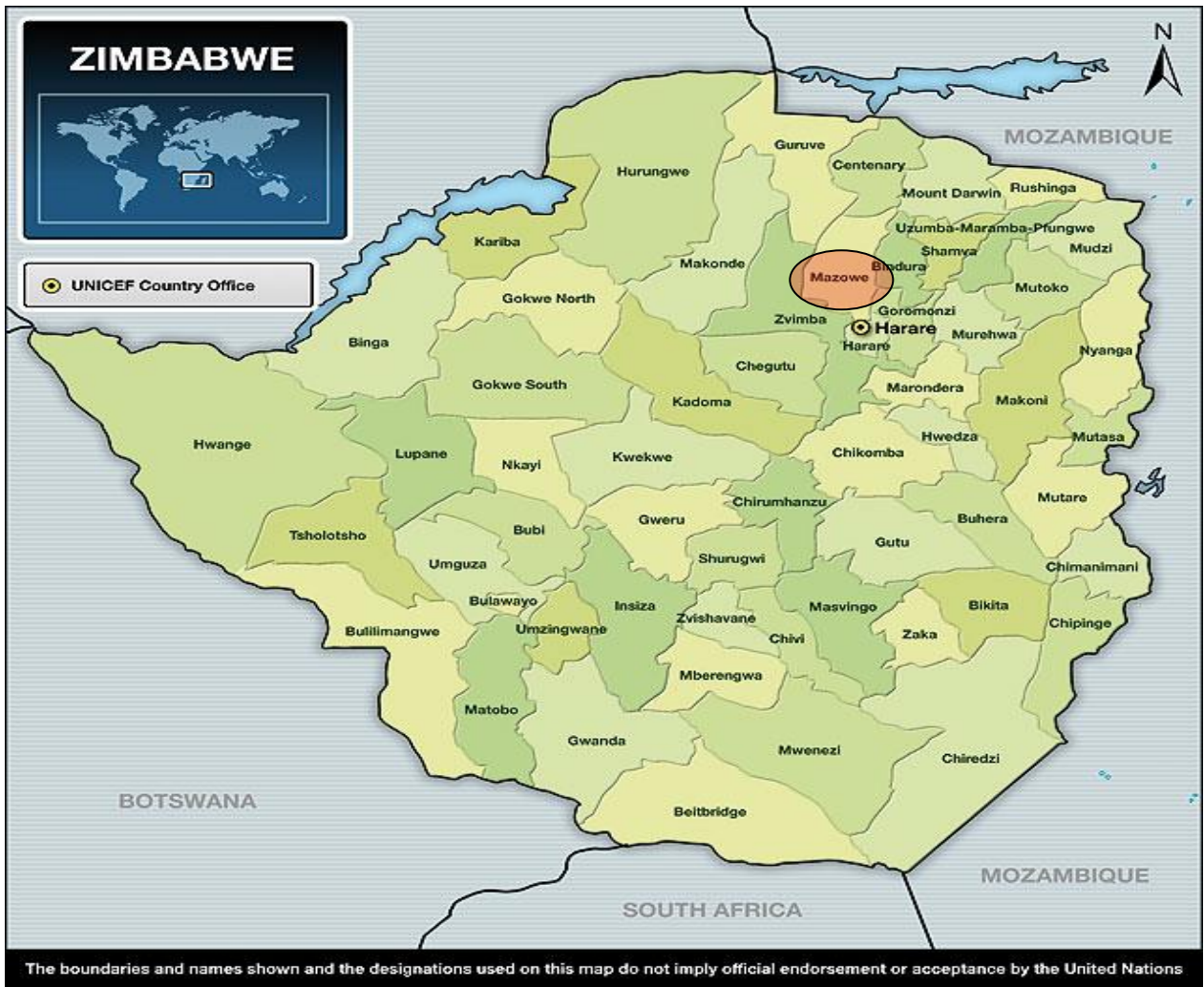
The community people were very free to discuss with me and I considered myself lucky to meet some farmers outside those in the sample of interviewees. I managed to have informal discussions with them and also asked about any information pertaining the way they live and their views about the CA project. This information was useful in the write up of the research as it helped me reflect on some issues discussed with participants and try to make sense out of some things I was not familiar with. It also helped me understand some of the cultural beliefs and social norms of the community and how I would appeal to them as a friend rather than a total stranger. I would want to believe that these farmers were giving their honest opinions because from the time I arrived, the ZFAT Extension Officer introduced me as his colleague and the farmers gave me a warm welcome. This relationship was very crucial given the volatile political situation that normally prevails in many of Zimbabwe's rural communities. People do not usually talk to strangers or give their honest opinion for fear of being labelled as anti-government or belonging to a certain political group. The community had to know the discussions were purely on the CA project and their Extension Officer

whom they had lived with for years would not put them in a precarious situation. On the other note I also realised that the farmers wanted to be close to me and have their views known so that if I have any influence at management level, their views would be known.

5.1.1 Mazowe Chiweshe (Ward 4) Area Profile

The case study was carried out in Mazowe Chiweshe, Ward 4, where I interviewed small-scale communal farmers who are involved in the CA project being implemented by ZFAT. The study area was briefly introduced in Chapter 1, Section 1.6.1, but now a more detailed description of the area and the way the people are living will be given. This is just one area in which ZFAT has a project among many other districts around the country. The area is in Mashonaland Central Province in the Mazowe district. The main research area, Ward 4, is about 120 kilometres away from Harare, the capital city. This distance means the area is closely linked to the city where ‘everything’ happens, such as administration, marketing and operations directed from the NGOs’ head offices. The area is accessible by road from the capital city, though right inside the communal areas there are still only gravel roads. Below is a Zimbabwean map showing the Mazowe district in Mashonaland Central Province (in the north, just above Harare, the capital).

Figure 5: Zimbabwean Map Showing Research Area



Source: UNICEF (2010).

Mazowe district in general is a valley with many farms and large estates around, and communal farmers living in reserves around the farms. This kind of living was designed during the colonial era when white settlers took land and made the blacks around the farms their labourers (Gombiro, 2012). Though the country had a land redistribution programme, not so many communal farmers benefitted the Mazowe area as the farms were deemed of national importance for they exported citrus fruits, tobacco and flowers. The communal farmers displaced back in the early 1900s are still living in the peripheries where the soils are not that fertile as compared to the farms. In Ward 4 they have generally all types of soils but mainly sandy loam soils (Gombiro, 2012) which have a low water retention capacity and fertility level. These farmers have been living on subsistence farming and

government food aid in times of droughts and also support from family members who work in the farms or in towns (Gombiro, 2012).

Chiweshe Ward 4 is of political importance to the province in general as it is one of the areas where the liberation struggle started (Ngirande, 2012). Besides the fact that Wards are named in numbers, they also named it Tafirenyika, meaning 'we are dying for this country'. The area has been dogged by political controversies and many decisions seem to be informed by the politics of the province, down to the district and the ward level where people make decisions and choices influenced by political opinions (Gombiro, 2012). Though the populace in this area is well known for supporting the ruling party which spearheaded the land reform programme, communal farmers did not benefit much from the land redistribution programme and many are still tilling the infertile, old soils in the communal areas. Some were retrenched from the farms and joined those in the communal areas hence putting pressure on the scarce resources like land. Mr Gombiro attributed this to inconsiderate decisions and actions by politicians, whereby political leaders grab resources and the communities do not benefit much or make decisions for vote buying without fulfilling their promises (2012).

Mazowe Chiweshe, Ward 4, has 15 villages with an average of 75 households per village (Kasetu, 2012). The area has three primary and one secondary school which cater for all the school-going children in this area with a radius of about eight kilometres. Because of this, quite a number cannot read or write. Actually, there was only one primary school before independence and many people were not able to walk to school (Gombiro, 2012). In the old, patriarchal society, culturally, men were preferred to be sent to school and get educated over women, and this affected the literacy rate of women above 40 years creating huge gender imbalances. According to Mr Gombiro, now women below the age of 40 are able to read and write, therefore he estimates the literacy rate of women in the area at around 60 percent. His view is that men were motivated to go to school to learn to write letters to their women. Therefore associating with school was important. To men it was an incentive to get exposed to women. Mr Gombiro estimates that the literacy rate in men stands around 85-90 percent. Mr Gombiro's estimate was not far off: the 2012 Census shows a male literacy rate of 97 percent in males over 15 years of age. However, the literacy rate for women over 15 years is 95 percent, meaning Mr Gombiro's perception in this regard was not correct (ZIMSTAT 2012).

In the rural areas, people are exposed to many health hazards and there is a need for health facilities. Maintaining their health can be aided by eating a balanced diet. Ward 4 does not have a

single clinic and Mr Gombiro explained that from the time he was a Councillor, they have been battling to build one. People travel between 11 and 16 kilometres to get to the nearest clinic and use cattle-drawn scotch carts most of the time since not so many automated vehicles can be found in the area. Communal farmers cannot really afford medical help if they have not sold their produce or obtained help from family members who are formally employed. However, the government has been putting in efforts to supply medication for free. Unfortunately, because of the economic meltdown, this provision has since ceased. The community has to work hard to obtain fees for medication and many people struggle to get along (Gombiro, 2012).

In the informal discussions, I realised that this area has more women than men; approximately at a ratio of 60 to 40 with many women being widows. Nobody offered an explanation of why this is so but it explained why so many more women are involved in the CA projects than men. I later consulted the 2012 Census results and confirmed that in Mazowe district there are about 116 255 males as compared to the 117 195 females (ZIMSTAT, 2012). I tried to think around the demographics and I concluded that maybe men have been migrating to find work in towns and farms and because of the high HIV/AIDS rate in Zimbabwe, many of the migrating men could have fallen victims. This opinion was reinforced by Miles' claims that in the aftermath of the economic meltdown, without proper medical facilities, HIV has been wreaking havoc, leaving many widows and orphans (2010). Of the 15 villages in this ward, some villages contain ex-farm workers and more often these have made agreements with a village head whom they pay for a household (HH) to get a field (Gombiro, 2012). The arrival of these ex-farm workers boosted agriculture in some villages as they had vast knowledge and experience in farming, though many were used to conventional farming. According to Mr Kasetu, the ZFAT extension agent in the area, ex-farm workers are often more keen on taking up projects than those who have always stayed in the villages (2012).

As pointed out earlier on, livelihoods have been based on subsistence farming and the arrival of the NGOs helped SHFs to shift to think of farming as a business to sustain themselves (Hungwe, 2012). But what we need to understand is that this community is very poor, as is confirmed by the current Councillor, Mr Ngirande. Mr Ngirande (2012) said that through the government food aid schemes he used to feed widows and orphans, but now they seem to be able to produce on their own using the CA basin system. In discussions with Mr Gombiro, he indicated that after the NGOs intervened, about 80 percent of those fortunate to get input supply are doing well in terms of productivity and are more food secure than before (Gombiro, 2012). The Councillor, Mr Ngirande, concurred with these sentiments (Ngirande, 2012).

We tried to measure the poverty levels according to Mr Gombiro's understanding and he had this to say: "The first level is food security and then affording to send a child to a boarding school" (Gombiro, 2012). He said that many families had not been able to feed themselves and relied heavily on government handouts. This was seconded by Mr Ngirande who added that some people were used to working in fields of other families who were better off, to supplement their food. Now a sizeable number of those known to be very poor are producing on their own (Ngirande, 2012). Given the scenario, farmers who have surplus sell for extra cash but not many are able to pay the fees for boarding schools. Rural schools (which are far away though a walking distance by rural standards) cost around R450 per term. Paying these fees is a big challenge (Gombiro, 2012). The rural schools are heavily affected by political activities, as sometimes parents go to political gatherings and children are left at home affecting children's learning activities. Girls are the most vulnerable given the distances they have to walk to school and often many get married before they even finish school (Gombiro, 2012). The education quality is also very low because the schools are poorly resourced (if any books are available), the teachers' commitment is also questionable and the levels of discipline are very low (Gombiro, 2012). This has created a vicious cycle of poverty as the dreams of the parents to have their kids educated and get formally employed are shattered.

The schools' pass rates are very low and at one point the former Councillor initiated the community to build a Technical College to cater for those who could do practical subjects, agriculture included. The then Member of Parliament ordered it to be destroyed because he was not part of the project (Gombiro, 2012). The bad influence of politics in the constituency has led to low levels of development as politicians try to gain political mileage by promising communities development they never deliver on when in office (Gombiro, 2012). Mr Gombiro has vast knowledge on sustainability and was involved in many environmental and developmental projects including an organic and agroforestry irrigation scheme which used to export vegetables to Europe. After economic restrictions were imposed on Zimbabwe by EU nations, contracts were terminated (Gombiro, 2012). The irrigation scheme was managed by a communal committee and had its communal farmers as the members. It was a great source of livelihoods. Since the agroforestry and organic irrigation project, there wasn't any significant project to help develop the community until the CA projects initiated by NGOs.

We also took time to discuss on issues related to climate change and the way farmers conduct their farming in the area. From the informal discussions, I realised that not many community members

understood the concept of climate change. What was interesting was that some had their own explanations which had to do with traditional beliefs but with the realisation that the rain season has shortened or shifted. Mr Gombiro said that people are not aware that climate change is caused by humanity's unsustainable practices. Zimbabwe, especially in the northern parts, receives convectional rainfall, which is helped much by forests or plantations. Now, after the land reform programme, forests and plantations are increasingly being destroyed. Mr Gombiro reiterated that people should not cry foul when our country turns into a desert because we are destroying nature and sometimes it is out of arrogance. The wind patterns and seasons are shifting for worse and we seem not to take heed. He actually came up with an awareness statement that, "when using the axe, one has to plant in order to cut again later" (2012).

Many farmers and Mr Gombiro agree that adoption of CA reduces the area committed to land cultivation since a small portion can produce enough to feed the family and have surplus to sell. The areas left can then be used for other projects like cattle grazing and plantations for reforestation. They agree on the notion of redesigning our systems and using systems that reclaim degraded agriculture land, if we are to leave healthy soils and a better environment for future generations. Besides CA, farmers can be encouraged to practice agroforestry whereby they plant fertility trees and trees in between crops. These are methods which are profitable to the farmers but without destroying the environment. This model proved to be working at the irrigation scheme but Mr Gombiro cried foul over how hierarchies in the government system derail progress when 'big officials' do not (sometimes) listen to the 'small brains'.

My discussions with the former Councillor gave me a clear picture of what kind of community I was doing my research in. The information he gave also made me realise how farmers in the rural area have an understanding of the environment around them, meaning they have valuable knowledge. Mr Gombiro finished with these words, "I am leaving you a critical challenge: to influence a change, to influence other people to have what can sustain the world. Even God did not create the world like this but we are destroying it. We need not to have myopic visions but think of what we will leave for our children" (Gombiro, 2012). This interview took us almost two days as I visited Mr Gombiro late in the afternoons to do our discussions at his place of residence which was near the school I resided.

Below are pictures of myself and Mr Gombiro, who is giving a profile of the area and explaining sustainability during our discussions.

Figure 6: Discussion with a former Councillor (Mr John Gombiro)



Photos taken by T. Kasetu (ZFAT Extension Officer).

5.1.2 The Scope of the Project

After outlining the profile of the study area, I feel it is necessary to have a recap of the scope and scale of the project. This will discuss how ZFAT, the development agency behind this CA project, has intervened to stabilise agricultural productivity for communal farmers, given the situation discussed

in the last section. FAO is supporting the improvement of food security and commercialization of communal farming in Zimbabwe through cooperation with farmers' unions in Zimbabwe through their joint technical organisation, ZFAT. The project's objectives are to improve food security and livelihoods, and to increase and stabilize production for Zimbabwe's rural households, through advanced land use and management practices (Harford & Breton, 2009).

ZFAT seeks to achieve this objective through various interventions such as encouraging SHFs to adopt improved farming practices, including CA, SHF capacity building training, agricultural inputs provision, credit schemes and supporting farmers' unions in providing additional extension services. The implementation of the project is under way with about 3 000 beneficiaries around the country. This includes the 250 beneficiaries in Mazowe Chiweshe (Hungwe, 2012). The main targets were the poor, widows and orphans who are deemed most vulnerable in the communities. The organisation roped in the private sector to provide inputs whereby each farmer was expected to receive inputs for one hectare, broken down into 1/3 maize, 1/3 cash crop and 1/3 legume crop (Dhewa, 2009). The inputs are provided to farmers on a microcredit basis for them to return in the form of grain when they harvest. ZFAT created a reliable market for the produce which they buy at very competitive prices. The NGO acts as the go-between and promoter so that the private sector does not claim anything from farmers directly, but farmers are required to pay back in grain through the NGO and then keep the surplus for own use.

The organisation has extension officers who train farmers in CA, contract farming and other technical crop management courses. Farmer training is mainly centred on demonstration plots and is intended to be as practical as possible. Farmers usually meet on a weekly basis at demonstration sites where they learn about various crop management practices at each crop growth stage. In addition, extension staff visit the farmers twice a week to discuss various farming issues as they unfold in the field (Dhewa, 2009). ZFAT also enlist the services of consultants who provide technical backup to the farmers at the demonstration plots and in the fields. These also provide further training on contract farming, budgeting, composting and marketing.

To sum up, the focus is on advocating environmentally friendly farming practices such as CA, water harvesting techniques, woodlot plantations and the use of renewable energy. Awareness campaigns on climate change are undertaken and counter-mechanisms promoted. Use of natural pest control methods is also promoted (Hungwe, 2012).

Expected key results and effectiveness are centred on the specific objectives and the various activities listed above. The expected benefits that will be accrued from the project are as follows:

- Functional and effective farmers' groups and associations at grass root level are established whose membership are confident, motivated and self-reliant, and who are able to articulate their needs and defend their interests.
- Effective extension services provided to members.
- Increasing crop quantities and quality livestock production.
- Improved access by lower level farmers' associations to national policy dialogue platforms.
- Improved policy environment.
- Improved collaboration between ZFU and CFU in dealing with farming issues (Harford & Breton, 2009).

ZFAT adopted the concept that it is better to start small and allow growth over time, building on each season's success. According to the manager, Mr Hungwe, it is important that the CA project is approached cautiously as farmers who had bad initial experiences will be averse to change in the future and are often very vocal in speaking out against the technology (2012). The management made use of a strategic plan to set a good mind-set such that farmers and extension agents become familiar and confident with all the facets of the CA technology. The project started small and the number of farmers increased every year (ZCATF, 2008; Dhewa, 2010). It was envisioned that programs that try to reach too many farmers without effective contact/support, learning and mutual knowledge development will not be successful (Gwaringa, 2008; Mazvimavi, et al., 2008).

5.2 FARMER INTERVIEWS

In this section I compiled the data collected from the farmers through questionnaires and interviews. These are the farmers who were sampled from the whole group and it should be noted that I did not interview farmers outside the project. The initial plan was to interview about 40 farmers to have a good representation of the population but because of time and financial constraints, I ended up with 25 farmers out of the total 250 CA project participants. These farmers were randomly sampled and it was mere coincidence that I had at least one farmer from each of the 15 villages making up Ward 4.

The interviews were focusing mainly on income-generating activities, crop production trends and adoption of CA and whether the livelihoods of the farmers have improved or not. Sometimes I had to ask the farmers in Shona (the local language) and then translate their answers to English for my writing. Although I am not an expert in Shona language, I was able to do the interviews in a way that could easily be understood by the farmers since I am Shona speaking. I observed cultural etiquette when approaching the farmers. Those who can write were left to do their own writing whilst I took some notes. I then gave each interviewee a ballpoint pen which we had used to complete the questionnaire. In Shona culture giving a gift (no matter how small), is highly regarded as a token of appreciation and a sign of friendliness. I also took some time to pose for photos with the farmers and their families.

I was introduced to the farmers by the ZFAT extension officer as cited earlier on in Chapter 2 and the interviews went according to plan. The responses were very positive and according to my own assessment, the farmers were very open to voice their opinions. Some were very comfortable even giving extra information which they felt can make the project better. I however discovered some things I had overlooked prior to my visit to the area. The farmers in this area have many livelihood activities but most live on farming of maize, groundnuts, round nuts and vegetables from small gardens at riverbanks. The government has not been repairing boreholes in the area and almost every household have a water-well at the homestead. Some now have gardens at their backyards. Some were trying the commercial crops like tobacco but usually on a contract basis as they had to get inputs from private companies. The CA project was also introduced back in 2007 but many of the farmers were second year or first year recipients of inputs from ZFAT. All the farmers that were interviewed have not fully converted to CA and they still have bigger portions where they practice conventional agriculture although many had recorded better yields on the CA plots.

During one of my informal discussions, I discovered that it is not only ZFAT which has CA projects in the area but that it was the 'pioneer' organisation. This was confirmed by Mr Kasetu who further alleged that some farmers who are now with other organisations still think that it is the ZFAT programme. I tried to obtain more information about the other organisations and found out they were only two; an NGO called Sustainable Agriculture Trust (SAT) and O'Neam Meats (a private company). I found it interesting that one extension agent was with ZFAT when the organisation launched the programme and is now with the private company but the farmers were not aware of this. For interest's sake I once asked one farmer where they are getting the inputs for the CA plot,

and she answered that the extension officers sourced for her. It showed me that some farmers do not really care where the inputs are sourced, their main worry is to get them.

The farmer interviews were done using questionnaires and the following sub-section discusses the information provided by the farmers. The questionnaires started with demographic information and this helped a lot in understanding the dynamics in the adoption trends of CA technology. I acquired an idea from Gibbs (2007) that starting with demographic questions help respondents get started comfortably.

5.2.1 Demographics and Research Sample Sex Frequency

I realised there was a trend in the demographics that followed a certain pattern in almost all districts the organisation was working in. This could be attributed to the selection criteria of participants in the projects. The sample that was interviewed had 56 percent female-headed and 44 percent male-headed households. The plan of the organisation was to target more of the disadvantaged households hence there are many widowed women in the programme. I also made an assumption that this could also have been caused by the statistics. I was told by Mr Gombiro that the ratio of women to men is 60 to 40. Generally there are more women than men at a ratio of 54:46 in Zimbabwe according to the Zimbabwe National Population Census of 2012 (Central Statistical Office – CSO, 2012). However, I felt there was a coincidental gender imbalance although the sample was selected randomly. This is shown in the table below.

Table 3: Sample Sex Frequency Table

SEX	FREQUENCY	PERCENTAGE
FEMALE	14	56%
MALE	11	44%
TOTAL	25	100%

This scenario was almost the same as in the research done in Domboshava at the end of the term where the age distribution and the sample revealed that the bigger percentage (60 percent) of those engaged in conservation agriculture are above 50 years of age (Dhewa, 2010), and of that larger

group, 75 percent are women above 50 years. In that research again, those under 39 years of age were all males and they made out 20 percent of the total sample participating in the study (Dhewa, 2010). I believe the trend is caused by the selection criteria of farmers by the organisation.

5.2.2 Comparison of CA and Conventional Agriculture Implementation

The farmers in Mazowe Chiweshe are not fully practising CA on all their plots. Most seem to only dedicate a piece of land which matches the inputs they would have gotten from the NGO. The inputs are normally for a hectare for which enterprises under CA are recommended to put a cash crop, maize and a legume, as indicated in Section 5.1.2. The farmers then use the rest of the land for conventional agriculture. Farmers have been practicing conventional agriculture with advice from government extension officers (Harford & Breton, 2009). I realised that many farmers cannot afford or used not to afford inputs (seed and fertilisers) on their own and therefore would opt to get into the project to get support but still use conventional tillage on other portions of their land. The table below shows the total number of family members involved in the two types of farming. The table below reveals that the number of family members involved in CA is the same as those involved in conventional agriculture.

Table 4: Mazowe Chiweshe CA and Conventional Agriculture Implementation Comparison

FARMING TYPE	Family Members Involved
Conservation Agriculture	70
Conventional Farming	70

Family members tend to help each other on both conventional and CA plots. The table shows that the number of household or family members in both farming systems is exactly the same. This might be attributed to working together in the family or showing equal preference for the two agricultural techniques. Just like in Domboshava (Dhewa, 2010) it was found that family members tend to work together on all plots though usually one member would be registered with ZFAT for inputs supply.

5.2.3 Main Sources of Livelihoods

To establish the participant farmers' sources of livelihoods, I tried to ask the farmers questions that made it easy for them to understand what was meant by livelihoods. I felt a question on the main source of incomes for the HH would be most appropriate. In a preliminary questionnaire, I had made a provision for the farmers to list their main sources of income. I got this idea from the research done in Domboshava and felt it was also proper to use it for my study in Mazowe Chiweshe. The Domboshava farmers had diverse sources of livelihoods but it should be noted that this could also be true for the participant farmers. Out of 13 livelihood options provided in the questionnaire, 6 came out since respondents were asked to list three main sources of livelihood. CA emerged as the top most source of livelihood from the participant farmers, and this cannot be generalised to the whole community. It was interesting to find that some people are utilising skills they have learned during CA training sessions to earn a living. Farmers are taught life skills such as composting and budgeting which is now used by many youths to generate capital to start own projects besides those funded by the NGO. The table below shows the general picture of the sources of livelihoods for Mazowe Chiweshe farmers as given by the sample farmers in this study.

Table 5: Sources of Livelihoods in Mazowe Chiweshe

Source of livelihood	Number of Respondents	Percentage of total respondents
Conservation Agriculture	19	76%
Petty Trade	17	68%
Gardening	17	68%
Conventional Agriculture	15	60%
Informal Employment	2	8%
Irrigation	1	4%

The scenario given above applies to the farmers practicing CA under the ZFAT programme and this cannot be said to be true for the whole populace given that some households do not practice CA at

all. This trend has been shifting since the introduction of CA under the Farming as a Business (FAB)-model (captured in the scope of the project) by ZFAT (Gombiro, 2012; Ngirande, 2012). Farmers who are practicing CA recorded better yields and they are selling the surpluses to get income for other projects or income generating activities.

5.2.4 Mazowe Chiweshe Maize and Sugar Bean Yield Results

In this study, production trends were a good indication of progress or failure since one of the objectives of ZFAT was revival of agriculture. Sustainable agriculture entails being profitable (Menalled, et al., 2008) and in this, high productivity means farmers can have enough to eat as well as surplus to sell. To get the yield trends in the area, the research focused on maize (the main cereal crop and staple food) and sugar beans (a vegetable and legume used in crop rotation). Farmers are provided with seed for these crops among other inputs and this section discusses the average yield results for Mazowe Chiweshe farmers. Initially I wanted to review yields from the 2006/07 to the 2010/11 farming seasons but the farmers did not have updated records for all those years. I then used the sketchy records from farmers and some secondary data to reach my conclusions.

5.2.4.1 Maize Yield Results

Farmers who participated in the research indicated that the maize yields under CA were increasing and were much better than in their conventional plots. Upon harvesting they would put the produce in different storage rooms and many claimed that the CA produce was more compared to the conventional per given area. They however did not have properly written records but it could be observed that many have surplus grains in their storage facilities. Some farmers did not have records at all but at least could remember how difficult or easy it was for them to find food depending on the harvest they got. After joining CA, they were no longer working in other families' fields for food and they had food for many months till the next season. The records sought after were mainly for the CA plots. To validate these claims, I found useful some secondary data from projects evaluation by Dengu and Vhudzijena (2010) who compiled maize productivity levels for CA plots in the season 2009/2010 from data provided by field officers. The table below shows the yield levels for farmers taking part in the ZFAT CA project, including the farmers in Mazowe Chiweshe.

Table 6: Maize productivity (t/Ha) levels under CA for the 2009/2010 farming season

Yield levels (tonnes/Ha)	5	4	3	2	1.5	1	0.5	Total
Number of farmers	600	331	460	110	65	200	227	2043
% of total	29.36	16.2	22.51	5.38	3.18	9.79	13.56	

Source: Dengu and Vhudzijena (2010).

Communal farmers in Zimbabwe have been producing less than a tonne per hectare on conventional farming (Harford & Breton, 2009). The above data shows that in the CA programme some project beneficiaries have managed to increase maize yields to one tonne or even five tonnes per hectare. This increase was also realised by some farmers in the sample of farmers interviewed in Mazowe Chiweshe. About 69 percent of the sampled farmers said that their CA yields have been increasing and better off compared to their conventional plots. This made me to wonder why they are not changing wholly to CA, but as Gwaringa (2008) says, it is not easy for farmers to change the ways they are used to.

5.2.4.2 Mazowe Chiweshe Sugar Bean Average Yield

The other crop that was looked at is sugar beans. This is a legume used for rotational purposes. It is consumed by the locals and is also a cash crop. ZFAT decided on using this on rotation since it can benefit the soils and also the farmers on food security. The crop is easy to grow and can tolerate low rainfall so that in times of drought, farmers do not have a total crop failure. Some farmers who had grown the crop for more than one season presented a case whereby their yield have increased significantly. The recent yield was always better than the previous years. Those who had one season were happy to have diversified their meals and realised some money from produce they sold. They however did not have records at hand and those who had grown sugar beans for the first time had nothing to compare with. Again some secondary data was sorted to find how farmers were performing and it was shown that from the Zimbabwe National Crop Assessment Committee (managed by AGRITEX), yield averages from the CA projects have been exceeding national averages for the past five seasons (Ministry of Agriculture, 2012).

5.2.5 Adoption of CA Principles in Mazowe Chiweshe

CA is basically centred on principles of minimum soil disturbance, mulching to cover ground and crop rotation (ZCATF, 2008; Harford & Breton, 2009). Some farmers cited that they were not practicing all the principles and had their own reasons for that. The reason most cited was that of labour constraints and in literature it was argued that farmers experimented and left out what they felt did not help much (ZCATF, 2008). All hundred percent (100%) of the farmers interviewed were implementing the minimum soil disturbance and mulching principles of CA. Only 20 percent were also implementing crop rotation and quite a number preferred intercropping. These trends are presented below in Table 7.

Table 7: CA Principles Adoption

Principle	Number of farmers Implementing	Percentage of sampled farmers
Minimum tillage	25	100%
Mulch	25	100%
Intercropping	13	52%
Crop Rotation	5	20%

5.2.6 Agents for CA Introduction

CA has been introduced to farmers through various agents but the research showed that, in Mazowe Chiweshe, efforts have been championed by NGOs. AGRITEX, which is the government arm for research and extension, did not play an active role on introducing sustainable farming techniques. Farmers also contributed a great deal in spreading the word to others in the community. Some farmers stated that they got interested in joining the CA project after seeing already participating farmers getting higher yields compared to conventional plots and that the soil quality of their fields have improved. However, NGOs were the most popular agent on introducing CA in the area. This is shown in Table 8.

Table 8: Agents for CA Introduction in the Project Area

Agent for Introducing CA	Number of farmers	Percentage of sample
NGO	18	72%
OTHER FARMERS	7	28%
AGRITEX	0	0%

The other agents such as AGRITEX were not a source of CA information though these officers now help in disseminating information and giving crop management advice given that government itself is now involved in CA projects. I found it interesting that one village farmer said he got the idea from a white farmer who lives on a farm nearby but was very sceptical as to why the white farmer is not doing it himself. Rather the village farmer waited until the NGO introduced the techniques at a community meeting. The village farmer openly confessed that he rather wanted to copy the conventional methods used at the white farmer's farm but he could not afford inputs and mechanisation level.

5.2.7 Reasons for CA Adoption

This section speaks to the findings around the reasons given by farmers for adoption of CA techniques. When the NGO introduced CA, farmers were selected according to their willingness and commitment to the programme. The organisation started off with a low number, taking an incremental approach. Farmers in Chiweshe are very poor as discussed in Section 5.1.2. The idea was to initially select the poorest of the poor. Many could not afford the hybrid seeds and fertilisers for conventional agriculture and their yields were very low, making them food insecure. When CA was introduced, many farmers saw it as an opportunity to replenish their poor soils and take good care of it. In the first place, they were not convinced that it was going to yield more but 'experimented' with the inputs provided by the NGO. The farmers did not cite any concern for the broader environment as a reason for changing to CA but rather they are now seeing the benefits to the environment. The soil fertility is improving and erosion has largely been curbed. They are taught to replace trees they have cut and many are now growing trees at field borders. The research results revealed that 88 percent of the farmers adopted CA for its good yields, while 68 percent adopted it as a good farming method that restored soil fertility and kept soil moisture for a long time. Of the

sample, 12 percent indicated that they were attracted by NGO support. This phenomenon is hereby presented in Table 9.

Table 9: Reasons for CA Adoption

REASON	Number of Respondents	Percentage of sample
Good yields	22	88%
Good farming method	17	68%
NGO support	3	12%
Lack of draught power	0	0

Of the sampled farmers, no one indicated lack of draught power as a reason for adoption of the CA technique. But I observed that some HH do not even have cattle, which is a 'prestigious' possession in African culture. This could be because farmers have always been helping each other with draught animals, which is the norm in a communal setup. This, however, is a disadvantage to those who do not own cattle as they have to wait for the better resourced farmers to finish ploughing their own fields first before they could be assisted with ploughing. Late planting would prove costly as farmers miss key but short planting window since the rain season seems to have shortened in Zimbabwe (Ministry of Agriculture, 2012).

The farmers I interviewed gave me the impression that the CA techniques were embraced by the majority of the community's population. They argued, however, that the scale of the programme could not cater for all the farmers who would want to join. This was confirmed by sentiments by the current councillor and some farmers I met in the village as I visited some interviewees. I actually met some who came to the ZFAT officer to ask when the programme is co-opting more farmers. For some reasons, there are farmers who are not practising CA and those practising are not fully converted. Farmers said they would not fully convert for the fear of the unknown and also that they cannot just leave the practices they were used to.

In informal discussions, I found that when the programme was introduced, it targeted the poor and initially it was snubbed by the better resourced. This was a case of stereotyping and social stratification, where the better resourced farmers felt that they would have lowered themselves and lose dignity in the process (Hungwe, 2012; Kasetu, 2012; Ngirande, 2012). It is an African cultural

belief that a 'real' man should have cattle and hence use them for farming (Gombiro, 2012). So, some farmers felt they cannot dig planting holes (which is laborious) when they have cattle which cut the labour hours. However, I noted that many of the not so poor are joining the programme, like the former councillor and others I met in the village. Farmers are now realising the advantages of CA and seeing how others are farming 'successfully' using the technique.

5.2.8 Feelings around Success

During the interviews, farmers were also asked on issues pertaining to their success in agriculture in general. There were different perceptions about success ranging from having good yields, being able to feed the family all year round and also acquiring household goods. Some farmers stated that they really had nothing before joining the project and rather used to work in other farmers' fields to get food. Now they have been able to work in their own fields to produce their own food and also sell the surplus to afford school fees for their children. Almost all the farmers interviewed indicated that they measured their success by the grain they now have given the cheap production means they use. From what farmers stated, I got the impression that, as the years progressed, the yields in the CA plots had been increasing and never were they below that of conventional plots for these farmers. I felt the other reason for not fully converting could be their mind-set, which believes in conventional agriculture as promoted by AGRITEX officers they have been working with for quite a long time.

The farmers indicated that they were happy with the CA project which made it easy for them to repay their input loans and are left with some food for the family. In this community, farmers have not been taking farming loans since they do not have collateral properties. Some tried contract farming with tobacco companies but have not been as successful as almost all the money would be finished when paying back for the inputs. The farmers were evaluating and talked in terms of profit margins because they have been learning this in budgeting courses. Since CA production is done usually with hoes, some farmers said this has given their cattle a good rest and they are fetching more at the market. It showed that these farmers were also 'thinking outside the CA box' and seeing the benefits associated with this type of farming. On adoption of CA, many farmers talked about it being a good farming system with the benefits of improving their soil fertility and this was success to many. It meant they are no longer worried about buying fertilisers.

The community being poor as it is and given the economic meltdown in the country the farmers had hit hard times, but conditions are getting better for them. There were several farmers who had left uncompleted work (such as unfinished buildings) who stated that they are now able to finish using proceeds from the CA project. I met three farmers who are now finishing building their houses for they can now afford to buy building material. These were success stories among the CA participants in the community. Some farmers were now considering electrifying their homesteads and are buying solar panels, an inspiration they got from lessons during CA meeting about using renewable energy.

There was a unique group of farmers, I realised, to whom success did not mean any material gain. These were mostly the older generation who said they were happy to go back to the basics of farming in harmony with nature. Mr Gombiro was one such farmer who applauded the interventions of CA in bridging the knowledge which had been eroded by modern thinking. I realised that the old generation felt happy that CA was reviving their culture of taking care of the environment which provides the resources they depended on. To them, the environment meant the economy and conserving it was of the utmost importance.

Below are pictures of assets acquired and projects being finished by farmers using proceeds from the CA project. In this community, these are shining examples of farmers who feel very successful.

Figure 7: Success stories by the CA Farmers

The photos presented below were taken during the interviews and farmers were very happy to showcase how their lives have improved since they got involved in the CA projects.

Figure 7a: A successful widow who now affords to pay for her children's fees and has food all year round. To the right is the grain storage facility she has recently constructed.



Figure 7b: A female farmer who constructed a house with corrugated iron sheets from the proceeds of CA.



Figure 7c: A young boy shows off solar panels bought by the family to electrify the family house.



Figure 7d: A house which had been put on hold for years and is now being finished



Photos taken by T. Kasetu and F. Masunda.

5.3 INTERVIEW WITH THE WARD COUNCILLOR

One of the key informants in my study was the current ward councillor who is a very important figure in the society. The councillor's name is Mr Ngirande who holds a very important leadership and political position. He played the role of a key informant together with AGRITEX officers and Mr Gombiro who supplied the area profile. We had a lengthy discussion which helped me to compare and validate the findings in my data analysis. The councillor is a very busy man but he gave me time to interview him and we met at his field where he was preparing seedbeds for his tobacco crop. During the interview, I discovered that Mr Ngirande is not even in the CA project but he knew a lot about it as NGOs goes through the leadership when they approach the communities. He was quick to point out that he embraces the technology though he himself uses his tractors for farming and he is wholly conventional. He has been one of the very few who are able to get loans from banks because of his asset base. Below is a photo of myself and Mr Ngirande in his field during the interview.

Figure 8: Interview with the Councillor (Mr Ngirande)



Photo taken by T. Kasetu.

Mr Ngirande started with describing the poverty levels in the community and how some bank back in the 1980s just after independence tried to intervene with loan schemes. This did not work because the interest rates were too high. Farmers did not have collateral and offered their cattle when they could not pay back. It was a disaster (Ngirande, 2012), as farmer livelihoods (cattle – the pride of an African man) were forcibly taken using the messengers of courts.

Recently around 2005, he said, the NGOs prepared a memorandum of understanding with farmers to help them out of the poverty. He explained the input supply scheme as he understood it and the way farmers are taught through field demonstrations and short courses. The councillor was very elaborate on this which he felt goes in hand with the government plans of having development from the grassroots, thus from ward level to district, to the provincial and then to the national level. He was quick to point out that leaders embrace the technologies which are proving to improve food security in the area.

According to him, farmers have benefited from the demonstrations as now there is reduced burning of stocks which meant they were using this for composting and saving on money for fertilisers. He said he had observed that the fertility in CA plots has improved a lot and they have managed to reduce erosion and at the same time increase yields. The councillor said he used to feed widows and orphans but now many have joined the CA project and can produce their own food. He again believed the project has helped to keep the young generation busy thus working in the fields and no longer have time to indulge in unscrupulous activities like stock theft which has reduced significantly.

Mr Ngirande feels it is high time the projects are up-scaled to help many more farmers who are willing to get on the CA bandwagon. The NGOs and donor programmes are stepping stones and when knowledge is imparted to communities, people can work on their own (Ngirande, 2012). In this area, he said the problem was lack of co-operation between NGOs and AGRITEX officers with the latter feeling the former were taking over their role of extension. The councillor, however, feels the communities do not trust the government branch (AGRITEX) whom they have accused of corruption. Cases have been reported to the councillor of inputs which are allocated to other people who are not part of the programmes. In a bid to rectify this, the councillor called for a meeting but the AGRITEX officers were not cooperative as they did not even arrive for the meeting. The councillor just said they knew they were going to be exposed. I felt that this was a case of communication breakdown which they can solve amicably.

The other thing of importance I realised was that the community have influence on their leaders. The community actually sent the councillor to the District Administrator (DA) to complain about the AGRITEX scenario. Mr Ngirande finished off by saying if only the AGRITEX officers were cooperative, the projects could be doing well surpassing the current levels and would have spread to many farmers in the area because as it is, the NGO officers are not able to reach all areas alone. To make matters worse, the AGRITEX officers rarely responded to people's problems. He also applauded the NGO's approach whereby they teach people first before demonstrating in the fields and also gave farmers a chance to experiment in their own fields. He also said this was the most sustainable project in the recent community development efforts he has witnessed. He was happy the CA programme is helping to develop the community as well as imparting knowledge on farmers on other issues besides farming. The councillor particularly pointed at social integration as farmers form working groups. He said he was also considering joining the CA project and lead by example though he will be using tractor drawn implements since he has large tracts of land.

5.4 INTERVIEW WITH AGRITEX OFFICERS

A few days after interviewing some farmers and the Councillor, I organized a meeting with the AGRITEX officers whom I had also earmarked as key informants. During the interview with the ward councillor, I felt the push to 'address' the issues raised on cooperation between NGOs and the AGRITEX officers. When the councillor raised the issues, I felt there was only communication breakdown and I needed to have AGRITEX's side of the story and their perception about the CA project. I prepared some open ended questions which helped us to get to the point. I met two female AGRITEX officers on a Thursday, but they were at home since it was after working hours. The officers jointly participated in the interview. The most senior officer (Officer 1) had been in the area for about eight years. Her junior (Officer 2) had joined AGRITEX at the beginning of 2012 and was fairly new in the area. During the interview, the senior officer did much of the talking with little interjections from the other one. I was writing down the answers they gave to the already prepared questions. Below is the interview:

- Fanuel For how long have you been employed as officers?
- Officer 1 I have been employed for eight years and Banda has only one year experience. [The officers trained on conventional agriculture from government colleges and according to them, people do not appreciate it if an officer does not have demonstration plots. Banda added that farmers want to be taught by someone who is also practicing what he/she preaches and they always check if the demonstration plots are maintained.]
- Fanuel What is your take on CA?
- Officer 1 CA is the future. The principles used are proving to be yielding more. Soils are too old and thus need minimum disturbance.
- Fanuel Has the government been supporting any CA initiatives?
- Officer 1 AGRITEX officers have been going for refresher courses. Since 2010, AGRITEX officers have been giving extension advice on CA and organic agriculture. We have been spreading the word of CA though we do not give inputs like NGOs. However, we have realised CA has been taken as a technology for the poor and women take the projects more seriously than men.
- Fanuel Do you think CA can feed the community?
- Officer 1 Yes, farmers are having good yields and we have witnessed a farmer producing two tonnes on 0.4 hectare land. When that small piece can produce enough for an average family of five, up-scaling mean the whole community can be taken care of.
- Fanuel Does CA promote or enhance ecosystems in the communal area?
- Officer 1 Yes, CA does not disturb soil organisms and reduced chemical use is important. Tilling on small portions allows biodiversity corridors in the communal lands.
- Fanuel Do the farmers in the area rely on fossil fuels?
- Officer 1 Most farmers do not have machinery/tractors so they have been relying on cattle for draught power. A few who uses tractors, would have hired.
- Fanuel Does the CA projects in your view promote equality [gender equality; bridging the gap between the poor and the rich]?
- Officer 1 People's lives are now better off since they engaged in the CA projects. (She even tried to compare it with the years before CA was introduced and the situation at hand in the community.) We project that in the future, things will be changing for the better of all.

Fanuel Sustainability entails development that meets the current generation's need without compromising the ability of the future generations to also meet their needs. In your view, does a CA project protect the needs of the future generations?

Officer 1 Yes it does. It is protecting natural resources in the community, for example soils. CA is improving the soil structures, fertility, texture and water retention capacity. This is for the good of the future generations. Reduced leaching, erosion and rectifying soil caps and pans means we are protecting our interests as well as the futures'. They will also harvest from an unpolluted environment.

Fanuel Do you want to add any information?

Officer 1 Many farmers have embraced this technology which suppresses weeds by mulching and they are encouraged to fence off their CA projects. The problem is that this is communal land and one cannot deny other people access to grazing land during off season. The farmers opt to just leave the stocks in the field but cattle grazing is a big issue.

We decided to move around in my car and took photos of cattle grazing in a farmer's CA plot.

Figure 9: Cattle grazing on the stocks supposed to be used as mulch



Photo taken by F. Masunda.

The officers commented that the number of cattle per family seems to be increasing and the government needs to control this. However we agreed that this could be problematic since farmers will see this as a move to reduce their asset base and resist as they did during the Rhodesian/Ian Smith regime, which made the government of the day very unpopular. They also said some farmers still believe in clearing their fields and burning crop residues, which is against CA principles.

We continued with the interview as I tried to get more information on sustainability at small scale farmer level:

Fanuel Does CA enhance global assets? [I further explained on the concept] Global assets entails net positivity or negativity of livelihoods to the long term sustainability of other livelihoods through aspects such as GHGs, global warming and the use of non-renewable resources.

Officer 1 Yes it does but we must understand that most farmers are worried about food security and besides, many do not fully understand the concept yet even if they know it at all. (I felt she answered this according to her understanding and not to what farmers really perceive).

Fanuel Does CA projects enhance local assets?

Officer 2 We believe it does. Improvement of soil fertility, protection of water bodies and leaving more space for other livelihood activities is of great importance. Besides soils, livelihoods are improving as indicated earlier.

Fanuel Do the projects have a net beneficial impact on others' livelihoods?

Officer 1 Of course, the farmers are learning a lot from neighbours. The issue is on lead farmers and mentored farmers who are a source of inspiration to others. The infrastructure like roads and market places being planned on, are a net benefit to the community as a whole. Erosion is also controlled for the good of the whole community.

Fanuel Is CA improving the ability of SHF to cope with stress and shocks?

Officer 1 Yes we believe so. CA conserves moisture and collects litter which decomposes to organic matter and helps improve soil fertility. This improves yields and farmers have more in their granaries to sustain them in times of drought.

Fanuel Does CA allow farmers to take advantage of changes in surroundings?

- Officer 2 Yes it does. Farmers now have more time for other home chores because of the improved and timely calendar. In cases of rainfall delay, farmers are more prepared by digging basins in time.
- Fanuel Do you see CA providing for the future?
- Officer 1 We are in no doubt that it can provide for the future. Yields are improving, soil fertility is improving and it has helped to reclaim degraded lands. Farmers only need training and demonstrations in the fields. The government can help with soil sampling since NGOs are already providing other services and this can help deal with non-responsive soils. There is need for cooperation within the agricultural sector rather than playing the blame game.
- Fanuel Do you have anything to say on adoption trends?
- Officer 1 We have a great feeling that many farmers were lured by the provision of inputs which was a great incentive to them. It is however important that the farmers later understood the concept and those without draught power were also at an advantage. [I interjected to ask how other farmers and more men could be convinced to join the project].
- There is need for awareness campaigns that explain the concept of sustainability and climate change better. Use of demonstrations and lead farmers helps a lot as farmers want to learn from their colleagues.
- Fanuel Are you facing any challenges in trying to take the CA concepts to farmers?
- Officer 1 The biggest challenge is that we don't have resources. To begin with, we don't have transport and the government last gave us motorbikes two years ago and they have since broken down. A ward has 1 500 households and it is difficult to get hold of every farmer since we cannot walk the whole ward with some villages more than 15 kilometres away from where we live. It has been difficult for us to visit all farmers if they do not come to training sessions at central points. However, the farmers seem not to trust us and feel we are not delivering inputs meant for them. Let alone, the government does not have an input plan like NGOs and sometimes it is politicians who seem to put spanners to our programmes and wait till farmers need food aid.

After this interview we had a discussion about concerns raised by farmers and the councillor to which they gave their side of the story. They refuted the claims that they did not support CA implementation and said they were on good working terms with the NGO extension workers. They again pointed to the problem of resources of which farmers did not believe them. I advised them to

seek audience with the leadership and also to look for possible areas of cooperation with the NGOs and work together for the better of the community.

After compiling data from interviews and observations, I interpreted them according to my analysis in line with the research objectives. The interpretation of the findings is given in the next section.

5.5 INTERPRETATION OF FINDINGS

In this section, the data interpretation is hereby presented based on analysis of data I got from the interviews I conducted in Mazowe Chiweshe, formally and informally, and also on observations I made. The literature review on sustainable development, sustainable livelihoods approach and conservation agriculture as practiced in Zimbabwe, informed these interpretations. As I collected my data, I took heed of Gibbs' comments that "in qualitative research, there is no separation of data collection and data analysis" (2007). Data analysis started as I collected data during interviewing, taking field notes and the observations I made which made me consider reversing the order of my questions in this presentation.

This section thus presents the interpretation starting with Question iv on levels of adoption, then goes on to discuss on the factors affecting adoption (Question iii) and then the yields farmers are getting from the CA plots (Question ii). All of these question build up to the main question which was trying to find out if the CA project has improved the livelihoods of participant farmers. In the literature review in Chapter 2, the SLA framework was discussed as the assessment tool for improvement of farmers' livelihoods. Findings from the case study in Mazowe Chiweshe were pitted against the framework and came to a conclusion that the lives of the sample farmers have been improved by the CA project. It is however important to note that my sample of farmers was very small to generalise these conclusions to the whole of the 250 participants in the ZFAT project.

5.5.1 Agents for CA Introduction and Levels of Adoption

In Mazowe Chiweshe, NGOs played a big part in introducing the CA techniques to farmers. Although AGRITEX is the main extension arm of government to spearhead agriculture in communal areas, no farmers in the sample interviewed had been introduced to CA by this agent.

In Africa, NGOs have been in the forefront of promoting CA as underlined in a UNDP Working Paper (2009) introduced in Chapter 4. In Zimbabwe, farmers would be selected to join if they showed willingness and commitment within the set criteria of choosing the poor and vulnerable in the community (Dhewa, 2010). Studies done by ICRISAT in 2009 revealed that over 90 percent of those supported in previous seasons or still on donor funded programmes were keen on continuing. In Mazowe Chiweshe other farmers joined after seeing the output of participant farmers. Farmers said that the levels of adoption were very high in this area but the scale of the project could not cater for more willing farmers. These claims were supported by AGRITEX and ZFAT extension officers. The way CA was introduced, according to Mazvimavi, et al. (2008), helped to reach only a few targeted farmers. This points to the weakness that if CA is not promoted by government it can take longer to filter through to more farmers. Though the farmer willingness, commitment and adoption levels are high, the scale and resources of NGOs are sometimes too low to cater for a larger group.

In Zimbabwe it has already been stressed that levels of adoption are usually low because of poor extension support (ZCATF, 2009). However, this study confirmed findings in other regions of Zimbabwe that show that households do not necessarily leave conventional agriculture. They rather divide their plots and family members tend to help each other on both CA and conventional plots. The fact that the same number of family members working on the CA plots were also working on conventional agriculture seems to confirm that while CA is an acceptable technology, farmers do not abandon conventional agriculture on their other portion of land not supported by donors. Farmers tend to apply portions of CA as highlighted by Derpsch (2005) to experiment and change later. Sims, et al. (2005) also underscores that smallholder farmers are risk averse and therefore reluctant to change the well-known conventional practices even if they are aware of shortcomings and realise the benefits of proposed new practices.

5.5.2 Factors Affecting CA Adoption

The third research objective was to understand the factors affecting CA adoption in Mazowe Chiweshe. The question around this objective was tackled by asking the interviewees about their reasons for adoption and the principles they are using most. The research showed that most farmers who joined in the first place were lured by input incentives and the will to experiment on the 'new' technology introduced by the NGO. In the sample, 88 percent of the farmers adopted CA for its good yields, while 68 percent adopted it because it was a 'good' farming method. The last group pointed

to the goodness in terms of environmental benefit and improvement of soil fertility. Interview results also showed that 12 percent adopted CA because of donor support. This point was also reiterated by AGRITEX officers who felt almost 50 percent of farmers join for the sake of input support and rather get to understand the concept of sustainability later. The current councillor, Mr Ngirande, had a different view: farmers already understand the concept and rather see the project as a stepping stone to improve their livelihoods and at the same time prove that if adequately supported, they can do well and will not have to wait for government relief or hand-outs.

Inputs provision has been suggested by proponents as a measure for overcoming barriers in the implementation of CA in Zimbabwe (Gondo, 2008). The support is in the form of fertilisers, seed and herbicides and through extension. It has been argued that farmers who join for the sake of input support are likely to quit if the NGO working in the area departs (Sims, et al., 2005). It is also arguably common in Africa for farmers to anticipate incentives for new technology as underlined by Derpsch (2005). Shetto (2007) also confirms Derpsch's concerns when he presents that it is not sure whether farmers implement CA for inputs or because the technology is a good method. However many farmers in Mazowe Chiweshe, including the ones who converted due to NGO support, said they now realise the benefits to the environment and improvement in their livelihoods hence are willing to continue with CA even after NGOs pull out. Some said even if they don't get support now, they have already put other land to CA on unsupported plots because they have acquired the necessary knowledge to produce and it is working for them.

Under this theme, it was also researched if farmers are using all principles of CA as they are taught by extension officers. The three main principles of CA according to Sims, et al. (2005), are minimal soil disturbance, mulching and crop rotation. Farmers are also encouraged to use intercropping to take advantage of plants that can grow together to save space and increase diversity at the same time. In Mazowe Chiweshe, 100 percent of the farmers were implementing the first two principles, and only 5 percent were implementing the full range, including crop rotation. This was also because the respondents included some who had recently joined the project (some were in their first and some in their second year). Those in the first year had not had an opportunity to implement crop rotation, and a few indicated that sometimes they do not put mulch because of labour constraints and because they preferred not cut stalks after harvest. Those with labour constraints, especially for hand land preparation and weeding, noted it as a constraint to spread CA beyond 1 hectare.

The issue of inputs provision led some farmers to not even attempt to use their own seed. Most of the respondents were seemingly waiting for the NGO to give them a legume to interchange with maize. They did not seem to be knowledgeable of the efficacy of other legumes traditionally grown in the area such as groundnuts and round nuts. They thus would grow maize through and through. This could confirm Derpsch's theory that most smallholder farmers lack land and they emphasise on the staple crop (maize) for their subsistence (2005). The role of extension is thus helpful in setting the right mindset in farmers and helps them make decisions such as leaving some land aside for legume production and perhaps forfeit some maize production to pave way for other crops that can do well in the area. With more understanding, improved knowledge and capacity, farmers can have a focused and derived demand of inputs since they know what they want to achieve.

5.5.3 Mazowe Chiweshe Average Yields

In a society where agriculture has been a source of livelihoods for decades, productivity always matters to feed the community. World over, crop productivity has been a cause for concern and the Mazowe Chiweshe community is no exception. To get the yield trends in the area, the research focused on maize (the main cereal crop and staple food) and sugar beans (a vegetable, cash crop and legume used in the rotation). According to Menalled, et al. (2008), a farming system can only be sustainable if it is productive and profitable and in the process protecting the environment the crops are grown on.

From the data collected from the farmers and key informants, I concluded that there is a clear upward progression in the yield of CA plots from the season the participant farmers began practicing it to the 2010/11 seasons. The secondary data I accessed showed that ZFAT CA projects effectively used conservation techniques to introduce smallholder farmers to a more diversified crop menu (cash, legume, staple) and in the process enhanced farmer cropping choices (Dhewa, 2009; 2010). There was ample evidence from the sample farmers that CA increased the productivity for them. From the interviews with Ward Councillors, AGRITEX officers and ZFAT officers, I feel that this improved productivity is likely to have been experienced by the majority of participant farmers.

Interviewees indicated that their maize yields were a bit low in the first years of practice, but almost doubled over the following two years. The organic amendments to the soil will probably be paying off as fertility is increasing each year, improving the yields. This confirms Shetto's assertion that CA can achieve good results even under harsh climatic conditions especially given the climate change

scenario in the country (2007). Some secondary data for the national average CA plots presented in Table 6 showed that farmers were now getting more than 3.5 tonnes per hectare and this is enough to feed the family and have surplus to sell. This underlines the high productivity that comes with CA as propounded by authors like Gondo (2008).

The farmers in Chiweshe had not kept proper records for their yields though a few indicated that they are now keeping records, after attending budgeting and record keeping courses provided by the NGO. Some have not been used to record keeping and did not even know its importance until it was emphasized by extension officers. The sample farmers interviewed indicated that just like maize yields, sugar bean yields are improving each year. The study conducted on CA farmers in Domboshava found that the average sugar bean yields topped the 400 kg mark, up to 540kgs per hectare in the previous two seasons leading to the 2009/10 season (Dhewa, 2010). According to Dhewa, in the Domboshava area where farmers have been practicing CA for a longer time, averages were always above the national averages for the measured years (2010). This shows a big impact of CA on yields as emphasised by Gondo (2008). Sometimes farmers use retained seed when the NGO do not deliver seed for the new season which could compromise yields due to the poor quality of the uncertified seed. The NGO however encouraged good post-harvest seed storage techniques to preserve seed for use. This is supported by Mazvimavi, et al. (2008), who stresses the need for quality seed for any farming technology to succeed. These authors however further argues that, when farmers use retained seed, there is need for extension support to help with cultural or management practices to help farmers grow the bean crop (legume) optimally. Mazvimavi, et al. underscores the importance of extension on the adoption and impact of sustainable farming techniques (2008), especially on working with farmers to increase their productivity.

5.5.4 Environmental protection

Agricultural production cannot be divorced from the question of environmental protection as it is affected by the environment and vice versa. The CA project in Chiweshe has helped farmers understand the need for a farming system that supports environmental protection but at the same time producing enough for their sustainable livelihoods. According to Pezzoli (1997), for any production to be sustainable, the answer lies in promotion of technology together with social learning for change bringing patterns of production that do not strain the environment. This in turn cultivates intragenerational and intergenerational equities in the process.

Farmers who participated in the research showed some interest and knowledge on how they are supposed to take care of the environment around them. This included minimum or no continued destruction of forests and measures that limit overharvesting of resources. Some farmers have even engaged in reforestation programmes thus planting trees around their fields which also serve as windshields. One of the farmers, Mr Gombiro stated that farmers had a habit of clearing bushes around their fields with the view that they harbour insects and animals that destroy crops. This has since changed as they have been taught that these animals are part of the web of life where humans have no right to reduce biodiversity richness except to satisfy their needs. In this view, I felt the need for informing the communities how SD can be viewed not in terms of their productivity only but systematic integration with economic, social, cultural, political and ecological factors. According to Blewitt (2008), there is always need for checks and balances on connection and relations between system elements in this case ecological elements and human society.

Some farmers in their response, viewed environmental protection as one of the successes of the CA project. They were happy their actions would also benefit the future generations. The protection of soils against erosion, less use of agrochemicals that pollute the land and rivers as well as limited GHG emissions was a success to them. I however felt, at the level of community understanding, the complexity of ecology would be beyond their scope but they exhibited some knowledge on the prevailing limits and thresholds in relation to the amount of stress their local environment can handle as inflicted by human activities. In this context, crop productivity is a critical economic growth component which has to be sustained continuously. This is achieved by guarding against depletion of environmental stocks since natural resources are finite and carrying capacity of the ecosystems is limited. The environmental aspect is also critical in the sense that changes in resource stocks can be a source of conflict as people jostle for a few left. The situation in this community can be argued to have been helped by community by-laws and a framework within the NGO sphere of influence whereby caution and prudence is highly regarded. Decision making is also thus left in the hands of the community where ethical decisions are expected helped by political leadership that makeshift for limited knowledge.

5.5.5 CA Project and Livelihoods Improvement

The first question, which is also the main question for this thesis, seeks to assess if the livelihoods of farmers participating in the CA project has improved. In trying to find information on this subject,

which seemed personal and sometimes could have been uncomfortable for farmers to divulge, I tried to be very observant and cautious not to make an error of judgment. While a farmer completed the questionnaire, I looked around to see if what we discussed was really true and sometimes took photos and made short notes.

I started by asking the farmers about their main sources of livelihood and I found out that since agriculture is a main activity in the community, it has its sub-activities farmers prefer to be stand-alone activities as they get income from these. For the sampled farmers, conservation agriculture topped the list on sources of livelihoods (76 percent), followed by petty trade (68 percent) and gardening (68 percent). Indeed the Mazowe Chiweshe area has gardening as a common activity, but, for those under the ZFAT-funded project in the area, CA was the first priority. Conventional agriculture was only prioritized by 60 percent of the sample who also doubled as CA practitioners. This was probably because all of the respondents were engaged in CA projects under the NGO. Validation was done through interviews with the Ward Councillors and extension officers who said that this shift was as a result of the project. In Mr Gombiro's words, those who benefited from the CA input scheme and are following the principles of CA are 'sitting pretty' (2012).

Improvement of farmers' livelihoods and sustainability of the project goes hand in hand. From the literature review which had arguments based on sustainable development, it was established that the world is facing a polycrisis as discussed in Section 3.3.1. To help this situation, methods recommended to SHFs have to be cheaper, soil fertility restoring and adaptive to climate change rather than the ones that damage the environment that supports the farmers (IAASTD, 2008; Kate, 2008; MEA, 2005; Altieri, 2004). The authors referred to above also agree that for a system to be sustainable, it should be enhancing the multifunctionality of agriculture of not only producing commodities but also provide environmental services, cultural values and landscape amenities.

Sustainable development as viewed in line with this thesis tries to balance the three pillars, namely social, economic and environment. To assess if these are promoted by the CA project in Mazowe Chiweshe, a community of smallholder farmers, a SLA framework was developed such that assessment is narrowed down to sustainability levels at small-scale farmers' level. Economic and environmental pillars were scrutinised in productivity levels as well as the ways the environment is responding to practices of CA. Social sustainability thus had to be assessed according to the two levels given by Conway and Chambers in 1991. The first level is reactive which involves the avoidance of stresses or bouncing back from shocks. In my understanding of this impoverished

community, I felt this would relate to the alleviation of poverty and droughts that threaten food security. Conway and Chambers refer to the second level as proactive, where farmers are able to predict and adapt to or even exploit changes to their advantages (1991). Farmers stated that they have been food secure since they began the CA project though some areas have been recording low levels of production owing to erratic rainfall received in the country.

Sustainability entails balancing the environmental, social and economic pillars of the community. Sustainable livelihoods are likely to be achieved when a project like CA enhances all pillars which complete the web of life. Farmers in this case improve own networking to extension, experimentation and managing links with the wider economy for profitability. They also manage risks and uncertainties that are in the imperfect markets (Serrat, 2008; Kollmair & Gamper, 2002). Above all, the inherent potential of people would have been unlocked (in this case feeding themselves; according to interviews and Ngirande, 2012) in terms of skills, social network, access to physical and financial resources and ability to influence core institutions. To assess if all this or if some aspects had been achieved by the CA project, I referred back to the SLA framework which provides assessment tools in accordance to vulnerabilities and capital assets the farmers have managed to acquire. According to the information I gathered from the 25 sample farmers and the different sources of evidence, I drew up the conclusions shown in the table below. The ticks show areas that contribute to farmer livelihoods that have improved because of CA interventions.

Table 10: Livelihoods Improvement According to Vulnerability Context and Capital Assets

Vulnerability context	Yes	No	Capital Assets	Yes	NO
• Changes in resource stocks	✓		Human capital: the skills, knowledge, ability to labour and good health important for the pursuit of different livelihood strategies	✓	
• Climate change	✓				
• Population density		✓	Physical capital: the basic infrastructure (transport, shelter, water, energy and communications), production equipment and means that enable people to pursue livelihoods	✓	
• Conflict	n/a				
• Political change	n/a				
• Technology	✓		Social capital: the social resources	✓	

• Markets	✓		(networks, group membership, relationships of trust, access to wider institutions and society) upon which people draw in pursuit of livelihoods		
• Disease incidences	✓				
			Financial capital: the financial resources (whether savings, supplies or credit, regular remittances or pensions) available to people and that provide them with different livelihood options	✓	
			Natural capital: the resource stocks from which resource flows that are useful for livelihoods are derived (e.g water, land, wildlife, biodiversity, environmental resources)	✓	

Adapted from Carney, et al. (1999).

This study was done at a micro-level, thus at the functional level of the community where people live. The unit of assessment was a ward. The table above narrates the vulnerability and capital assets the Mazowe Chiweshe community have accumulated according to the evidence I gathered during the case study. According to Carney, et al., interventions of this sort thrive to promote livelihoods (1999). The authors further argue that “promotion in this context improves the resilience of households; especially with programmes that focus on savings and credit, crop diversification and marketing, health promotion, institutional development, personal empowerment and community involvement in service delivery activities” (Carney, et al., 1999:48). The CA project as a livelihood promotion strategy has long term benefits that involve participatory methodologies and an empowerment philosophy. Since the farmers are empowered to produce on their own, they can try to solve some of the inherent problems they face in the community, which then lowers their vulnerability. The introduced CA technologies helped the farmers to increase productivity hence helping in widening their resource base and cushion themselves from the scourge of hunger. Climate change is a global phenomenon which affects agriculture activities at any level and the CA interventions help farmers with mitigatory practices. Temperatures are reportedly higher and rainfall patterns are now unpredictable (MEA, 2005) but the CA farmers are managing to produce by using techniques that are sustainable (protecting and enhancing ecosystems; reducing GHG emissions; not relying on fossil fuels and thus allowing future generations to meet own demands). I felt the participant farmers have managed to create safety nets in the face of a polycrisis at community level.

Farmers interviewed in the research area shared their stories and give information on personal achievements brought about by their involvement in the CA project. This was interpreted in the context of capital assets as given by Conway and Chambers (1991). Farmers have acquired different life skills associated with agriculture including ability of developing skilled labour and good health, which is important for the pursuit of livelihood strategies, in this case working in the fields. This could have been brought about by producing diversified crops for a healthy diet and skills that are utilised to source incomes. According to community leaders like Mr Ngirande and Mr Gombero, there is a significant improvement on physical capital in Mazowe Chiweshe (2012). Farmers have been empowered to build on the basic infrastructure that enables them to develop. CA projects also managed to rebuild social networks through encouraging farmers to work together helping many to realise their potentials and restoring confidence that they can be accepted as part of the entire community. Financial capital has also been enhanced by high production trends enabling farmers to provide services for their families. Lastly, the community is building on natural capital, whereby resource stocks are conserved for the benefit of the whole populace and future generations. The accumulative advantages of building on these capitals help communities improve livelihoods (Carney, et al., 1999; Serrat, 2008). In terms of capital assets, I felt these have been enhanced and definitely improved the lives of farmers in my sample. However, from the interviews with Ward Councillors, AGRITEX officers and informal discussions, I also feel the benefits are likely to be spread to the rest of the group in this project.

5.6 CONCLUSION

The information gathered for this research led me to feel that the CA project has significantly contributed to the livelihoods of SHFs, especially those I interviewed in Mazowe Chiweshe. The sample farmers gave their views on the project ranging from levels of adoption, factors affecting their adoption, the average yields from their CA plots and the way they see their livelihoods being improved by participating in this project. I felt the farmers are happy to be engaged in this project and many are willing to join as they are motivated by what they see others achieve.

From my own interpretation of the results, I felt farmers in the sample have developed a new sense of purpose and have achieved a sustainable livelihoods objective. This could be also true for the rest of the group, with reference to the information I gathered from the ward Councillor, Mr Ngirande. The project has managed to improve food security and livelihoods and stabilize production for the

poor SHF in Chiweshe through advanced land use and management practices that are environmentally friendly (Ngirande, 2012; Gombiro, 2012). My reference point was sustainable development and mitigation of polycrisis which the farmers might not have realised but in a way they are playing their part. The overall conclusions drawn from the research will be discussed in the next chapter which covers the summary, conclusion and recommendations of this thesis.

CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The previous chapter focused on the data presentation, analysis and interpretation, while this chapter will provide a summary of the whole research. My findings started with the last question to build up the interpretation for the first question, which was the main objective of the research. However, in this chapter I begin with this first question, going down to the fourth. I then present my conclusions on the whole research as well as the recommendations. I begin with the thesis summary.

6.2 THESIS SUMMARY

The topic for the study was “assessing the impact of sustainable farming techniques on smallholder farm enterprises in Zimbabwe”. The farming technique which was focused on was conservation agriculture (CA), which is being implemented in Mazowe Chiweshe through a project by an NGO called ZFAT. Two crops were covered in the study, namely maize and sugar beans. The sample for the interviewees was 25, which was 10% of the whole group participating in the research.

The study originated from the background of poor rural farmers who survive mainly on agriculture and I wanted to assess if CA project intervention being applied is improving their livelihoods. I also felt the problems facing the world are hitting the poor hard and there is need for awareness to how they can turn their fortunes around through sustainability thinking. I was imagining how developmental projects can help fighting inequality, climate change, environmental degradation towards helping to feed a growing world population where food shortages is severe. Projects have been implemented the world over to try and mitigate these problems. In Zimbabwe, NGOs came up with initiatives to improve agricultural production in the country, following years of economic decline. ZFAT is part of the NGOs which became involved in implementing sustainable farming techniques in rural areas.

The objective of the CA project by ZFAT was to improve food security and livelihoods, increasing and stabilizing production for the Mazowe Chiweshe and other rural Zimbabwean households through

advanced land use and management practices. The organisation wanted to achieve this through training and capacity building of SHFs, thus unlocking the full potential of communal areas in poverty reduction and addressing inequalities through sustainable agriculture. A number of projects had been applied in the past, sometimes achieving the objectives and some without positive results (UNDP, 2009). I took the opportunity to assess the sustainability of the project at farmer level, investigating if the CA project has improved the livelihoods of those involved. The investigations also included yield levels, factors affecting adoption and levels of adoption of sustainable techniques in this community.

A comprehensive literature review on sustainability and tools of assessment where developed through a SLA framework, was done in Chapter 2. Sustainability was looked at from the perspective of the polycrisis facing the world (Swilling & Anneck, 2012) and how sustainable farming techniques like CA can mitigate these problems. An assessment was only done at micro-level that investigated improvement of farmers' livelihoods in the context of the SLA's vulnerability and capital assets context as given by Conway and Chambers (1991) and later developed by development agencies. Literature also reviewed CA as practiced in Zimbabwe and the factors which could be affecting uptake of technique. This was carried out under the literature review in Chapter 4, where many views from other Zimbabwean researchers were given. This chapter was setting the basis of a case study in the Mazowe Chiweshe area where farmers and key informants were interviewed to reach some conclusions pertaining improvement of farmers' livelihoods, sustainability and adoption of CA in the area. The results of the case study and the process of assessing the benefits/disadvantages of CA was analysed through trend analysis of evidence gathered in my qualitative research.

6.3 SUMMARY OF FINDINGS

In the light of the above, the research aimed at investigating if CA projects had helped participant farmers achieve more sustainable livelihoods in Mazowe Chiweshe communal area. This was expressed through answering Research Question i and also built on by answering the three other research questions that investigated average yields for CA farmers, factors affecting adoption of sustainable techniques and the levels of adoption in the area. The literature reviews and case studies complimented each other in answering these questions where a production trend of specific crops (maize and sugar beans) was assessed on plots under CA (Research Question ii). The case study with support from Chapter 4's literature review also informed Research Question iii, about the factors

affecting adoption or lack of it for the sustainable farming techniques. Lastly Research Question iv looked into the levels of adoption of sustainable farming techniques in the Mazowe Chiweshe area.

Doing a case study research in Mazowe Chiweshe made me recognise the realities of poverty in the area. However, the leadership in this area pointed out that conditions are actually getting better and an increased number of the poor households are now able to fend for themselves owing to the CA project. Poverty in the rural areas is measured by the assets a household has, which are mostly livestock and the ability to send children to school (Gombiro, 2012). Farmers engaging in this project have been able to increase their incomes and are now living better by rural standards, in Mr Gombiro's view. These families are now able to feed themselves and also afford other basic commodities they do not produce themselves. One farmer confessed, "we are now better people in the community as a result of knowledge acquired in the CA project. Before joining the project, our family used to spend the rest of the year working for other people to get food but now we are successful producers".

Many farmers revealed that they engage in the projects to fend for their families and look after each other by providing basic amenities. The young generation who have not made it on the scholarly front are joining CA projects as they have realised that farming sustainably has many advantages. According to Mr Ngirande, in this era where unemployment rates are high, CA projects are a way out for the rural areas (2012). Keeping these school leavers busy has reduced the rate of urban migration in this area as the young are now farming to earn a living (Kasetu, 2012; Gombiro, 2012). I felt in a way this is reducing the problem of rural-urban migration and in turn reducing slums in Zimbabwe.

A big ratio of farmers in the study indicated that their soil fertility is improving under CA and that they were willing to do away with conventional farming. These are farmers who have realised that CA is a good farming method and who would even continue without NGO support. Though many farmers did not really rely on draught power or machinery for their farming, they have significantly reduced reliance on fossil fuels since CA encourages low external input farming and low usage of agrochemicals. No tillage also helps in carbon sequestration as the land is not opened up (Derpsch, 2005). All the land which is not being used now has helped to improve the ecosystems which were being degraded. However much damage had already been done, owing to the pressure on the land from the overpopulated rural areas.

The effects of climate change are being felt, especially the changing and shifting of the rainy season (ZCATF, 2009). Farmers who did not have draught power and had to wait for others to finish or work other farmers' fields, have been handed a new lease of life by this project. The yields have been so low due to climate change (Dhewa, 2010), but now farmers are realising better yields on a small portion of land. They have also realised that they can use crop residues for mulching and composting rather than burning them, which added to GHG emissions.

The most interesting thing is that farmers, especially the older generation, are happy to revert to principles they have understood to be the best way of living in harmony with nature. According to the farmers, land-use knowledge, skills and living sustainably depends on taking care of the environment and this had been the culture until conventional farming was introduced. CA is actually reviving the old practices under which farmers shared the benefits and costs of resource use and environmental conservation among different communities and interest groups, including both rich and poor, and between their generation and those who would come after them. Because of the comments I received from different respondents during the study in Mazowe Chiweshe, I felt the community in general believes that life is part of one great interdependent system, which influences and depends on the various components of the earth, but of late cultural changes have resulted in bad consequences whereby nature is destroyed. Engaging in CA and sharing knowledge has influenced farmers to manage their lifestyles so as not to threaten the survival of other species or eliminate the benefits to be enjoyed by future generations. To me, this is sustainability.

6.3.1 Research Question I

Have sustainable farming techniques (SFT) helped achieve more sustainable livelihoods for the participant farmers?

This question was tackled through assessing what the farmers have achieved through the CA project. The assessments were done against the backdrop of global sustainability trends and a polycrisis which is affected by and in return affects the way we are living. The literature reviewed pointed out that sustainable farming methods can present a solution (though not a silver bullet) to this crisis, owing to its philosophy of working in harmony with nature. Defining sustainability at SHFs refined the concept and gave more insight on the SLA which was then used as a sustainability assessment tool. The SLA tools which focuses on capital assets and capabilities helped to inform the questions

asked from farmers during the interviews. The questions on sustainability were guided by the following principles, which were also explained at farmer level in Kelly (2009)'s research. I then used the same principles in the context of capital assets and vulnerability:

- i. Techniques should protect and enhance ecosystems;
- ii. practices should reduce carbon and GHG emissions;
- iii. techniques used should allow future generations to meet their own needs;
- iv. the project should promote equality and urban resilience and
- v. should not heavily rely on fossil fuels.

During the interviews, a few farmers seemed to understand the concepts of sustainability at global scale but had ideas about sustainable livelihoods and the benefits to their environment, especially the soil and pollution of water and the air. Questions were thus directed by the five capitals within the SLA concept, which entails what skills and knowledge have been acquired (human capital), the basic infrastructure and means developed to enable people to pursue livelihoods (physical capital), social resources and networks drawn in pursuit of livelihoods (social capital), the financial resources acquired (financial capital) and lastly the environmental resource stocks from which livelihoods are derived (natural capital). Their responses to this was analysed and evaluated according to the vulnerability context to assess if farmers are now able to avoid stresses and bounce back from shocks, and if there has been any improvement in their capital assets.

The sample of farmers I interviewed was very small, making it difficult to make generalisations about the whole group of 250 farmers, but I felt that the livelihoods of the interviewees had definitely improved. However, what did help were the interviews with ward councillors, government extension officers and the CA project officers, as well as some previous project research documents to back up my conclusion that it could be benefiting the whole group of farmers involved. The participant farmers are contributing to sustainability for global and local causes, though many did not realise how much they were contributing to global polycrisis mitigation. I learned that according to the farmers, at the centre of their socio-economic activities is the land, regarded not only as a productive resource, but also as a link between the dead and the living, the present and the past. Actually, it is the belief of the community that land and the environment at large binds the people together and hence should be looked after well. These sentiments gave me the feeling that some community members were now understanding the concept of taking care of the environment in order to leave behind a legacy of sound environmental management, skilful extraction of resources

from the environment and ploughing back to the same environment for the benefit of future generations.

6.3.2 Research Question II

What are the production trends for the specific crops (maize and sugar beans) after adoption of sustainable farming techniques in Chiweshe as compared to when farmers used conventional agriculture?

With the ever increasing human population, the need to make sure these mouths are well fed cannot be overemphasised. The big question remains: "How?" The world is in need of systems that produce more and at the same time keep the soils fertile and improve farmers' ability to avoid or cope with stresses and shocks. The question of production trends can be looked at from both the financial and economic perspectives of input affordability and returns per dollar invested. The yields per unit area are also considered as to what needs to be invested to feed the household up until the next season. The CA project came up with a micro-loan scheme whereby farmers are supplied with inputs and can pay back in the form of grain. They can do whatever they want with the surplus.

Farmers in Mazowe Chiweshe indicated that during the first years, CA yields were a bit lower but comparable to conventional plots. A significant CA plot yields increase was realised in the third year, and they were much greater as compared to conventional plots. The farmers now have enough to feed their families even after paying back input loans organised by the NGO. In research done in another area before this, CA yields showed an upward trend and later surpassed that of conventional plots (Dhewa, 2010). Farmers interviewed in Mazowe Chiweshe stated that their CA yields surpassed conventional plot yields though they did not have proper records. Authors like Shiva (1995), Altieri (2004; 2006) and Pretty and Hine (2001) argued that sustainable techniques guarantees sustainable yields as soils are protected and regenerated. The yields are also enhanced by crop rotations and intercropping which then contribute to food security as farmers reduce outright crop failures. When farmers produce at low cost, in an environmentally friendly manner and at the same time, this is sustainable agriculture.

6.3.3 Research Question III

What are the factors affecting adoption of sustainable farming techniques in Chiweshe?

This question was developed to investigate the factors leading to adoption of CA principles. This was clearly linked to agents of change and extension methods being used to have farmer buy-in. It was established that NGOs have played a significant role in introducing sustainable techniques to the SHFs. Though the government has an extension arm (AGRITEX), it has done virtually nothing in introducing CA but is now playing a part in giving advice. This might be due to a lack of resources and that the government had not realised the benefits, but later got involved to support NGOs. During the research it was also found that farmers spread the word in the communities about their activities and how it might help others. A significant number joined the project because of the success stories they had heard from other farmers.

To understand ways to overcome barriers to adoption and obtain the farmer opinion, farmers were asked what factors really motivated them to change the way they farm and adopt CA principles. Many farmers agreed that they felt it was a good farming method that was improving the soil fertility and producing good yields. A few said that they initially wanted input support, but later realised that the benefits went beyond input support to good yields and sustainable livelihoods. No farmers adopted the techniques owing to lack of draught power. Though many did not have cattle, they did not cite it as a reason for adoption.

Above all, the farmers did not think about sustainability in the first place but would seem to understand the concept after elaborations. They expressed their desire for their children to inherit fertile lands that can produce enough. Extension played a significant role in influencing farmers to adopt CA and there were calls by the community for the government to step up efforts in complimenting NGO efforts by up-scaling the projects to cater for more farmers.

6.3.4 Research Question IV

What are the levels of adoption of sustainable farming techniques by SHF in the area?

This question was very wide ranging. It was touching on the percentage population that embraced CA as compared to conventional farming, per household. This would lead to conclusions on the adoption levels for the whole population in the community. It was found that all family members are involved in both CA and conventional and also that no household is wholly conventional or wholly CA. They are involved in both. It was thus concluded that according to farmers I interviewed, farmers have not fully converted to CA because they feel there is no superior system, but all approaches should be regarded in terms of what can be realistically achieved. I also felt that since this sector is known to be risk averse (ACT, 2008), it is fears of the unknown in the long run that makes them want to use both systems. They now tend to just try all the systems at hand.

The question went on further to look at the principles of CA adopted by farmers in the area. According to authors like Twomlow, et al. (2008), CA has three main principles, which are minimum soil disturbance, mulching and crop rotation. On adoption of CA principles, farmers adopted almost all and also added intercropping, which they were used to in their traditional farming systems. Crop rotation was not done by beginners but they had plans to do it in the coming seasons. Many farmers however complained about mulching, which they said is labour intensive and was destroyed by livestock in the free range community grazing system.

These are the questions which had to be answered as provided in Chapter 1 of the thesis. The above questions were all addressed in the literature review (Chapter 3 and Chapter 4) and then complimented by a case study in which results/data are presented, analysed and interpreted in Chapter 5. The data is a culmination of a case study through questionnaire interviews, key informant interviews, participant observation and review of secondary data. These ethnographic tools are outlined in detail under Chapter 2, which dealt with the research design and methodology.

The main assumption investigated and put to test was the unproven assertion (in Mazowe Chiweshe) that sustainable farming techniques such as CA lead to increased productivity and better or improved livelihoods. Over all, the research confirmed, for the sampled farmers, the assumption that sustainable farming techniques lead to better livelihoods and increased productivity as the conclusions in this chapter will reveal.

6.4 CONCLUSIONS

Following the study processes outlined in the summary of this chapter, the following conclusions were drawn. During the course of the research, I came across some things which, I felt, need to be reflected on though they are not directly related to the original thesis objectives. These are included herein.

6.4.1 CA has improved the Livelihoods of SHFs

The interviewed SHFs in Mazowe Chiweshe gave me the impression that their livelihoods improved and they are benefitted hugely by using CA. Success stories were told by farmers and this was validated by the interviews with key informants. It would be difficult to generalise my findings to cut across the whole community but through the research, I found evidence that SHFs in Chiweshe, especially those involved in the CA project, had their livelihoods improved. The CA project brought hope and renewed their confidence in farming as an enterprise that can mitigate poverty and at the same time enhance environmental protection. Livelihoods have been improved in terms of capital assets and building the capacity of farmers to avoid stresses like droughts. The project has not only been restricted to agricultural management, but also unlocked the skills in the population. Participant farmers have been taught budgeting and composting skills which has seen some youths earning a living through selling compost to other farmers and doing budgets for others for a fee. Farmers are also now earning more from their proceeds and building infrastructures and taking care of their family members.

6.4.2 Yields

The Mazowe Chiweshe community has traditionally been experiencing food security problems and some farmers used to live on government hand-outs or from working in other farmers' fields. After they joined the CA project, they can now tend their own fields though they do not have cattle for draught power. These farmers and others in the project have increased yields by following the principles of CA which encourages LEIT. The farmers started low but they have been increasing progressively, boosting food security. Farmers are also earning more income from selling produce hence they have been able to buy other household goods and pay their children's school fees with less difficulties as stated in sub-section 5.2.8. More yields mean they can use the income for their

building projects, sending children to school and taking care of medical bills as well as buying what they cannot produce.

6.4.3 Factors Affecting Adoption

There have been numerous factors affecting the adoption of CA in Mazowe Chiweshe. However the most popular was that farmers know it is producing better yields and it is generally a good farming practice that improves soil fertility and enhances environmental protection. Some farmers, as much as AGRITEX officers thought, were lured by input incentives. But this seemed not to be a problem as the NGO's selection criteria was to have those who could not afford inputs for themselves in the first place. The farmers are now seeing the advantages of CA and are willing to continue even without input support. Of the sampled farmers, none gave possession of draught power as a reason for adoption of CA though it could be noticed that some households did not have draught power.

6.4.4 Level of Adoption

The levels of adoption were not so easy to determine, but farmers seem to not really find any system more superior than the other between CA and conventional agriculture. This conclusion was reached from the point that of the sampled farmers, no household is fully conventional or practicing CA alone. Within the household, family members would help each other to tend both plots. However, it was hard to understand why farmers would prefer to continue with conventional farming if CA is producing more, to which they answered that they were used to conventional farming and it was not so easy to just let go of a system they had been using for years. Some indicated that men culturally pride themselves in using cattle and that is why more women joined the project as compared to men. This question was also related to the third question in that most farmers would refer to the adoption of CA principles and how they are constrained by labour and sometimes a lack of seed.

6.4.5 Extension

The extension staff from the NGO played a key role in promoting CA in the area and ensuring adoption of the system by farmers. The methods used were a bit effective as the level of adoption seems to be increasing from year one to date. The NGO also made use of various methods to spread

the word, for example using lead farmers who are trained to be leading examples and teach fellow farmers. There was a significant number of farmers who said that they adopted CA after learning from other farmers, hence confirming Gondo's arguments that farmers tend to believe messages they receive from other local farmers over those received from technical 'outsiders' (2008). However, it should be noted that inculcating CA and other sustainable farming principles in farmers experiencing the technologies for the first time is not an easy task and if the sustainable agriculture techniques are to be successfully implemented, other extension services from the government and even the private sector need to step up efforts and complement the NGO efforts.

6.4.6 Incentives

Most beneficiaries are attracted by the free inputs that normally go with new technology (Harford & Breton, 2009). When I interviewed AGRITEX officers in Mazowe Chiweshe, I could sense some disapproval on the way NGOs are using input as an incentive for farmers to join the project. These officers felt that when the input scheme ended, farmers would also discontinue with the CA. I beg to differ and I might be wrong in my thinking, which I take from the way I saw things according to the farmers' adoption. Farmers also in the interviews stated that they were willing to continue even when NGO no longer provided inputs as they can use stored seed from previous harvests or buy their own when need be. Though some joined because of inputs, they tend to have realised more gains that come with farming sustainably and are continuing with the technology. I concluded that incentives such as inputs support play a significant role in introducing new technology in an area. Some farmers in the ward wanted to join the project to kick-start their farming because they felt they could not just start farming sustainably without input support. Though this is subjective, it is my considered view that NGOs have proved incentives work.

6.4.7 Government Support

The government has so far played a virtually insignificant role in promoting CA in Mazowe Chiweshe. Given that the communal people are used to working with AGRITEX officers, it would have been easy to spread CA if the government had played an active role (Ngirande, 2012). It is possible for governments to support new technologies (Dhewa, 2010). However, some positive steps are now being taken as the Zimbabwean government has stepped up efforts to support the CA projects around the country. Now extension agents are being sent for refresher courses on sustainable

farming. Through the Ministry of Environmental Management, there are calls for greening the economy in every sector, including agriculture.

6.4.8 Selective Implementation

Farmers have a tendency to choose what they think works for them when they are doing the practical work in the field. When I interviewed some farmers, I felt they chose not to use some principles, not because of resource or time limits, but because they wanted to experiment. In practice, farmers choose the principles which they find useful. The success of the techniques hinges on meticulous extension to guide the farmer to engage in experimental learning to prove for themselves the efficacy of the sustainable farming techniques.

6.4.9 Capacity Building

ZFAT has played a significant role in capacity building in the Mazowe Chiweshe community. There were farmers who did not know anywhere to start, but now their potential to feed themselves was unlocked and this helps in the development of the area (Gombiro, 2012). Mr Kasetu, the area extension officer, indicated that there are functional and effective farmers' groups at this grassroots level which were established by the organisation. These farmers organise demonstration plots and field days which help to showcase the good results of CA. The members are very confident, motivated and self-reliant, enabling them to articulate their needs and defend their interests. UP, in another study, had recommended the need to build the capacity of government extension workers for effective promulgation of new techniques since this is not included in colleges and university curricula (Hungwe, 2012). According to ZCATF, there are refresher courses which are meant for every stakeholder interested in promoting the sustainable agriculture cause. This has been applauded by many researchers in Zimbabwe as it helps to set the right mind-set across the board.

6.4.10 Inputs Procurement and Marketing

The project should be applauded for helping farmers to procure inputs for the revival of their agriculture. The NGO supporting the CA project introduced an input loan scheme which makes it easy for farmers to acquire inputs at the beginning of the season without any problems and pay it

back in the form of grain. As I understand the programme, farmers are then paid very competent prices by these input suppliers, such that the programme continues. ZFAT created the model from the understanding that for the sustainable farming techniques to succeed there is a need to address input procurement and financing (Dengu & Bvudzijena, 2010) and equally important is the need to have reliable markets for produce. The NGO also plays a very important role in ensuring that there are no contractual conflicts as farmers are paid their dues in time and the farmers pay back the loans just after harvesting.

6.4.11 Economy and Efficiency

CA is a cheaper and much more efficient farming technique that ensures high yields (Derpsch, 2005). Farmers who have been able to make good use of composting have achieved better yields without applying much fertiliser and they are happy with the fertility improvements in their fields. Time invested and the timeliness of operations which ensures good yields at the end of the season proves CA to be cheaper. Farmers were happy with the courses where they are especially taught precision application of inputs which makes them use less per hectare. However, sometimes the timely management for optimisation of yields makes farmers think that CA is too complicated.

6.4.12 Exorbitant Implement Prices

There are some farmers who would want to use animal-drawn or tractor-drawn implements rather than hoes. The importation of CA implements into Zimbabwe from Brazil seems to be increasing the cost of the implements (Gondo, 2008) and hence put it out of reach of many farmers. Plans should be put in place to have these implements manufactured locally. This will boost local industry and also create employment.

6.4.13 Land Size and Ownership

Land size dedicated to the CA operations is also a limitation to expansion of technology (Dhewa, 2010). In Zimbabwe, usually the land size for communal farmers is less than 3 hectares and when the project began inputs were only provided for 1 hectare of land or less (ZCATF, 2008). Although CA is a high yielding technology it could have a bigger impact if it was implemented on bigger portions of

land. Farmers are eager to expand if the support is guaranteed but it seems the capacity of NGOs cannot go beyond this (Dengu & Vudzijena, 2010). The other issue which is very controversial in Zimbabwe is that of land ownership. In the communal lands, it is all state land and there is no security of ownership. Some farmers are not eager to protect or develop land that is leased from the government. The case was different in the Mazowe Chiweshe community as I found that there was hardly a farmer who knew about land tenure security in the communal area. The reason for underdevelopment here, although this was not something I specifically asked about in the interviews, is likely poverty. Only the Councillors had some knowledge about tenure security but it seems it is not communicated to the masses. Therefore they feel that their land is secure.

6.4.14 Private Sector Involvement

There is limited private sector involvement in communal agriculture in general and sustainable agriculture in particular (Dhewa, 2010). The private sector can chip in with input support and affordable loans and also be involved in extension and market linkages. In the beginning, ZFAT had plans to involve the private sector in the programme but they seem to have hit a snag as not so many companies are keen on investing in agriculture in Zimbabwe (Hungwe, 2012). This seems to have been exacerbated by the liquidity crunch that has rocked Zimbabwe since the introduction of the multi-currency system and this affected the farmers (Dhewa, 2010).

6.5 RECOMMENDATIONS

Based on the conclusions outlined in this chapter, some recommendations were proffered. The study focused on the micro-level, that is the community level, hence recommendations are much to do with small-scale farmers' conversion to farming methods which are more sustainable, such as CA.

According to this research and the conclusions made from the interviews of a small group of farmers, I would want to add a voice to the debate of whether sustainable agriculture can increase productivity and improve livelihoods for small-scale farmers. From my findings, I would recommend that proponents of sustainable farming and governments should find ways of promoting the spread of techniques such as CA. In Zimbabwe, NGOs have played the critical role of introducing this farming system and it is now left for other stakeholders to make use of this stepping stone and push for up-scaling of the technologies.

During the writing of this paper, the Ministry of Agriculture in Zimbabwe started having awareness campaigns to promote uptake of CA in communal areas, which is a positive move. It is high time the farmers take advantage of the promotions to take measures that help mitigate poverty, inequalities, and urbanisation, and adapt to climate change.

This technique has worked for the poor and they have been able to boost their food security from small portions of land. It will be much better to encourage expansion of CA plots such that farmers can realise much bigger yields and have surplus to contribute to the food security of the country, since Zimbabwe has some areas which are having droughts each year. These droughts are attributed to climate change and it is better for farmers to take heed and apply adaptive agricultural methods.

Sustainability is the 'buzz word' of the moment and I feel it is high time proponents of sustainable farming in Zimbabwe spread these technologies under this theme. As it stands, NGOs have been able to introduce CA as a technology for the poor, which was a good thing in the beginning as those who adopted the technology have been able to move up the ladder from working for others to producing for themselves. What needs to be done now is to create the right mind-set among farmers and players in the agriculture fraternity that alternative systems are not only for the poor but for greening the economy as a sustainability measure for the whole country and the globe at large. Everybody needs to play a part in the efforts for a sustainable world and mitigation of the polycrisis. However, it is my belief that not so many people are familiar with this concept and there is a good chance that even some agriculturalists do not know the alternative side as our curricula is biased towards conventional systems. A very good example is myself, as I only got to know about sustainable farming technologies after enrolling for the Sustainable Development Planning degree, after having studied Agronomy as a first degree.

The government can also play a critical role in advancing research on implements that can be used at a large scale. The literature I have showed that our implements are coming from abroad and seem to be very expensive. Rather it will be better to produce these locally and sell the idea to those farmers who do not want the laborious basin system but prefer to use mechanical implements which might save on labour hours.

Promotion of sustainable agriculture can begin from schools where students can be educated on the negatives of conventional agriculture, especially the long term impact on the environment. This can be a good rallying point, given that the negative impacts are already being felt on society, health and the environment. Stakeholders that stand for sustainable agriculture can capitalise on this collapse

and create awareness with the communities through public lectures or by fusing this into the curricula.

NGOs can still play a part in mobilising farmers and consumers to stand for health foods from sustainable systems that also champion food sovereignty to shack off the monopolising of markets by corporations. This would also help promote the rights of the poor to a fair share of the resources in an already unequal world.

The role of the state comes into play again in seeing to it that agriculture is regulated to do away with policies that subsidise unsustainable systems. There is, rather, a need for measures that prevent pollution and at the same time promote and reward sustainable farming practices. Government has shown that it has the power to also make the market fairer and this is the time farmers should capitalise on to produce profitably for the local markets.

NGOs used an incentive system to kick-start the CA movement and the government can chip in with more on the input side as well as funding of on-farm research. This can help farmers renew their confidence when they are also seen as disseminators of information. Farmers also need to be included in decision making forums for them to feel ownership of projects through a participatory approach which do not only show recognition but respect for their views and equality.

Lastly, those who have been promoting sustainable farming initiatives need to continue and try to find areas of cooperation so that the movements can have a say in the world with a united voice. The sustainable farming movement can be championed by mounting pressure on governments and corporations that would change when they realise that there are already structures in place that work. Although the above recommendations were issued, I felt there are further areas of research related to this thesis and these are discussed in the next sub-section.

6.6 AREAS FOR FURTHER RESEARCH

This research was exploratory as I had to gather information from participants to assess their livelihoods earned by being involved in a CA project. The theme was embedded in a social setting that required skill to unravel what some participants would view as too personal to divulge to a researcher. In unlocking this information, I realised within my research context and other related topics, there are several areas that require further study.

- The thesis provided an overview of livelihoods within a communal setup. I assessed livelihoods using the SLA model with capitals as pointers but there were some (e.g. physical capital) which are linked to politics and conflict that I did not dig into. Future studies could

consider these political aspects that seem to affect decisions and further affect how resources are distributed and how communities relate.

- Farmers have been introduced to alternative farming methods and it would be interesting to assess how innovative have they been in terms of applying their own technologies and also integrating their own farming knowledge for productivity and profit maximisation with their small pieces of land.
- There is a need to evaluate if the introduction of other systems like organic farming and biological farming can be of more help. There are other areas in Zimbabwe where these approaches have been introduced and a comparative study would be interesting.
- Technology adoption is an important aspect when a system is being introduced and hence need to investigate technology adoption trends in isolation. This can be based on traditional models of categorisation to analyse and give current statistics on early adopters, early majority, late majority and laggards.
- After adoption of principles and elements of promotion of a farming technique or system, there is need to investigate and evaluate the long term influences of the system on the environment (fauna, flora and microbial diversity).
- This research was qualitative in nature, so a quantitative approach could be used to substantiate potentially relevant trends. This could help to highlight certain issues like the amount of external inputs required as related to outputs pitted against sustainability principles.
- The need for a detailed research on understanding of sustainability by individuals in the community cannot be overemphasised. This can be further used to measure the effectiveness of educational and promotional strategies on this subject.
- The policy side needs further research especially how stakeholders can integrate efforts between themselves (e.g. government and NGOs working together) and create action plans for smooth takeover and broader rollout of successful pilot projects.

The research was successful with limited resources and produced some useful information that can be used as a baseline for further research on issues pointed out above. I noticed that social setups are highly affected by politics and economic situations that are unique to each community. I thus argue that there is a need to assess issues uniquely in each community. This is in light with literature used in this thesis whereby most was from other continents. Having a locally initiated and oriented

research can help understand how even personal and local beliefs have a bearing on advancing systems in the subject matter, in this case sustainability. Communities can then be assessed to evaluate whether their uptake or changes in behaviours are positively changing towards the desired outcomes as influenced by local or external influences/beliefs.

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APPENDIX A: QUESTIONNAIRES

My name is Fanuel Masunda, a student at Stellenbosch University in South Africa. I am carrying out a research project for my Master's thesis which is focusing on the smallholder farmers in Chiweshe community. I am trying to assess whether the Conservation Agriculture project has improved the lives of the farmers involved in the project. I thus would like to interview farmers taking part in the project, asking questions about the project and their farming as well as more personal questions about their lives. The farmers were randomly selected from the pool of 250 farmers taking part in the project but those selected have the choice not to participate. If they do take part, they can choose not to answer certain questions that they feel are too personal. No one will know what answers one person gave as all answers will be summarized together. The information will be used only for the research, hence farmers need not to worry about personal information appearing with names in any other discussions or printed documentation. The participation in the project will not be compromised by the answers the participants give. I kindly request you to answer all questions truthfully and I thank you for taking time to answer these questions:

Q 1: Individual Farmer Questionnaire

Conservation & Organic Agriculture Impact Assessment Survey Questionnaire			
Section A: Site and Location			
A1 Respondent's Name	A2 Village Name	A3 Ward Name	A4 Ward Number
A5. Total Arable Land (Acres/Hectares) (Owned + Accessed)			
Section B: Demographics (<i>write the appropriate response in the space provided</i>)			
B1. Sex of HH Head (1 = Male 2 = Female)			
B2. Marital Status of HH Head 1=Single/never married 2= Married 3= Divorced/ Separated 4= Widowed			
B3. Number of people in the HH			
B4. How many household members are involved in conservation agricultural / OA			

activities?	
B5. How many household members are involved in conventional agricultural activities?	

Section C: Main income generating activities

(Rank the top 3 in bringing in the most money – 1 being the first up to 3 for the least)

List of activities	Rank	Livelihood Activity	Rank	Livelihood Activity	Rank
1 = Dry Land conventional Farming		6 = Informal employment		11 = Petty Trade	
2 = Conservation agriculture		7 = Fishing		10 = Small business	
3 = Irrigated Farming		8 = Formal Mining		12 = Livestock	
4 = Gardening		9 = Informal mining		13 = Other (specify)	
5 = Formal employment		10 = Informal mining		14 = Other (specify)	

C2. Have the conservation project increased your income levels?

C3. Have you ever taken a loan for farming? If yes, specify where it came from.

C4. Do you have any outstanding loans?

C5. After you joined the project, have you ever found it difficult to repay the loans?

C6. What assets did you have before the conservation project (livestock, scotch carts, wheel barrows, bicycle)?

C7. Can you afford inputs without NGO support?

C8. Do you see yourself continuing after the NGO has pulled out?

Section D: Crop Productivity Trends

Conservation Agriculture & OA PLOT

Section D: Crop Productivity Trends			
Conservation Agriculture & OA PLOT			
CROP	D1. Yield trends for the past five years (indicate N/A when it was not practised)		D2. Inputs sources Use keys below for source 1 = Purchases, 2 = Government Programmes, 3 = Retained, 4 NGOs, 5 = Gifts/Remittances 6= Other, specify
	Area planted in hectares	Yield levels in 50 kg bags and season (eg 2 000 kg in 2001/2002)	
MAIZE			
SUGAR BEANS			
CONVENTIONAL PLOT			
CROP	D3. Yield trends for the past five years (indicate N/A when it was not practised)		D4. Inputs sources Use keys below for source 1 = Purchases, 2 = Government Programmes, 3 = Retained, 4 NGOs, 5 = Gifts/Remittances 6= Other, specify
	Area planted in hectares	Yield levels in 50 kg bags and season (eg 2 000 kg in 2001/2002)	
MAIZE			

SUGAR BEANS			

Section E : Conservation Agriculture Adoption

E1 In which seasons did the HH practise CA (indicate 0 = No when not practising, and 1= Yes when practising)

Before 2006 (state year)	2006/07	2007/08	2008/09	2009/10	2010/11

E1.2 Which principles has the household been practising? **(Circle all that apply)**

1= minimum soil disturbance (basins/ripper lines) 2= mulching/ crop cover 3= crop rotation

If some of the principles are not adopted, why? Indicate principle number and state reason

.....

E1.3 Who introduced CA /OA to the household? **(Circle all that apply)** 1 = NGO, 2 = Agritex, 3 = Other farmers, 4 = Other, specify

What was your perception about CA technology when it was introduced to you?

E1.4 If the HH is still practising CA in 2011/12, indicate why? **(Circle all that apply and rank)**

1 = Still receiving support from NGO 2 = Good farming method 3 = Lack of draught power 4 = Good yields 5= Other, Specify

Are there any other benefits of CA realised to date?

E1.5 If, at any point, the HH discontinued practising CA, indicate why? **(Circle all that apply)**

1 = No longer receiving input support from NGO 2 = Labour intensive 3 = No benefit 4 = Other, Specify

E1.6 What do you think is the most attracting factor to farming using CA?

E1.7 What type of tillage does the household use for land preparations (rank in terms of area tilled, 1 being the one used to till the most area) **(Top 3)**

Tillage type	Rank	Tillage type	Rank	Tillage type	Rank
1. Animal drawn		3. Hand hoe furrow		5. Planting basins	
2. Ripper tines		4. Tractor plough		6. Other specify	

E1.8 Is the household willing to continue with CA in future without support? Yes or No

If NO, state reason;

E 1.9 Are you practising CA on other unsupported plots? 0=no 1=yes

If yes; what is the total size of the plot/s? acres/ha (tick appropriate)

Section F: Sustainability and livelihoods improvement

F1 Do you see your life improving since joining the project?(more income, assets issues)

F2 Are you now able to seek medical attention for family members?

F3 Do you have adequate food all year round?

F4 Can you now afford to send more children to school?

F5 Have you been able to build a house or any infrastructure from your proceeds?

F6 Do you have enough water supply for the household; that is for drinking, for livestock and for the fields?

F7 Do you go to church or any social groupings? (Have you increased friends in social circle?)

F8 Do you have secure land tenure? ... aren't there any fears of losing the land due to relocation by Government or any other authorities?

F9 Did you have any significant assets before joining the project? Which assets have you acquired from the proceeds of the CA project?

F10 Are there any training programmes for farmers by the CA agencies?

F11 What other life skills have you acquired in the projects?

F12 Who else besides ZFAT is supporting your projects?

F13 Have you as a community have any influence to get support from government?

F14 Do community members still migrate to towns to get jobs leaving or selling their fields?

F16 Do you use any machinery which runs on oil, diesel or petrol on your farm?

F17 Do you have small wild animals around?

F18 Do you consider yourself successful as a conservation farmer?

F19 What can be done to help farmers become more successful and how can others be convinced to adopt sustainable techniques?