

**EXPERIENCES WITH MECHANISATION – GOVERNMENT TRACTOR  
SERVICE PROVISION AND SMALL HOLDER FARMING IN NKANDLA AND  
IXOPO, KWAZULU-NATAL**

by  
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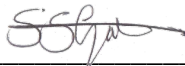
## **ABSTRACT**

This research explores the experiences that smallholder farmers have had when implementing the government's tractor services provision (*mechanisation*) programme. The objective was to understand the programme's contribution towards improving farming activities. A convenient respondent group of beneficiary farmers was drawn from the selected villages of Nkandla and Ixopo, in KwaZulu-Natal. Members of the government involved in the implementation of the programme were also purposefully engaged in the study. Semi-structured individual and focus group interviews, and observation in the field, were used as data collection tools. The findings suggest that the programme contributed towards an increase in ploughed land which enabled farmers to plant more cash and food crops. The challenges that were found, ranged from high input costs which meant partially planted fields, to ill-timed services coupled with frequent mechanical breakdowns and tyre punctures. This led to problems such as temporary interruptions of ploughing action, squabbling between people and conflict over servicing of farmers' sequence characterised by poor planning and management of the programme. The results of the study therefore recommend a gradual scaling-up of production potential through the classification and the evaluation of each farmers' unique capabilities. The introduction of an appropriate set of equipment a farmer can independently afford to obtain, to maintain and to sustain, is also recommended.

## DECLARATION

I, S'CELO S'DUDUZO GWALA, declare that:

- i. The research reported in this dissertation, unless where it is indicated otherwise, is my true original work;
- ii. This dissertation report has not been submitted to any other university or institution of higher learning for any degree or examination;
- iii. The dissertations contains no other person's data, graphs, tables, pictures or any type of information unless specifically acknowledged as being sourced from other persons;
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- v. The dissertation does not contain text, tables, graphs or any other information copied and pasted from the internet, unless correctly acknowledged and the source detailed in-text and in the references section.



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**As the candidate's supervisor I have approved this dissertation for submission**



\_\_\_\_\_  
**Dr Karen Caister**

\_\_\_\_\_  
2 May 2017

**Date**

## **DEDICATION AND ACKNOWLEDGEMENTS**

I dedicate this dissertation to my mother who did not get an opportunity to go to school but managed to raise us as a single parent. I also dedicate it to my only son whom I aspire to give the best education that life could offer. I wish to extend my sincere gratitude and appreciation to the following individuals and/or organisations:

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## **ABBREVIATIONS AND ACRONYMS**

AEOs –	Agricultural Extension Officers
AKIS-	Agricultural Knowledge and Information Systems
AMS-	Agricultural Mechanisation Strategy
ARC-	Agricultural Research Council
BEE/BBEE-	Black Economic Empowerment/Broad-Based Black Economic Empowerment
BRG-	Bio Resource Group
BRU-	Bio Resource Unit
CBD-	Central Business District
CTA-	The Technical Center for Agricultural and Rural Co-operation
DAFF-	Department of Agriculture, Forest and Fisheries
DAP-	Draft Animal Power
DARD-	Department of Agriculture and Rural Development
DFID-	Department For International Development
FAO-	Food and Agricultural Organisation
FGD-	Focus Group Discussion
GDP-	Gross Domestic Product
GoS-	Government of Swaziland
HOD-	Head of Department
HSSREC-	Humanities and Social Science Research Ethics Committee
HYVs-	High Yielding Varieties
IDP-	Integrated Development Plan
KZN-	KwaZulu Natal
KZNDARD-	KwaZulu Natal Department of Agriculture and Rural Development
MEC-	Member of Executive Committee
NCAM-	National Committee on Agricultural Mechanisation
NGOs-	Non Governmental Organisations
NPOs-	Non-Profit Organisations
OECD-	Organisation for Economic Co-operation and Development
SASAE-	South African Society of Agricultural Extension
SDF-	Spatial Development Framework
SKAB-	Skills, Knowledge, Attitude and Behaviour
SLA-	Sustainable Livelihoods Approach
SMS-	Subject Matter Specialist
SNL-	Swazi Nation Land
SSI-	Semi Structured Interview
STATSSA-	Statistics South Africa
THS-	Tractor Hire Services

# CHAPTER ONE: RESEARCH INTRODUCTION AND OVERVIEW

## 1.1. Introduction

The question for this research emanates from the real life experiences of the researcher's two and a half years of involvement with the KwaZulu Natal Department of Agriculture and Rural Development (KZNDARD); serving as an Assistant Extension Officer (AEO) based in the Nkandla local municipal office. The researcher observed the farmers' requests to have their land ploughed using the government owned tractor fleet. Each year when the service rendering had commenced, there were prevailing issues which jeopardized the smooth running of the programme. It appears that previous studies in this field, never delved into the conforming attributes of beneficiary farmers that operate under a mechanised farming system.

The Mechanisation Programme started in the 2010/2011 financial year through the national government's Department of Agriculture, Forestry and Fisheries (DAFF) and was mandated to all the nine Provinces of the Republic of South Africa (van Ransburg, 2015). Van Ransburg continued to say, the national department introduced the programme as a radical intervention to help develop large areas of underutilised, moderate to high potential land, through increased production. The respective provincial departments were then ordered to mechanise on behalf of farmers using government owned equipment- tractors and associated implements. The program operated for five years (ending 2016) and whether the outcomes have been realised, remains a question of interest (van Ransburg, 2015; KZNDARD, 2010). In KwaZulu-Natal, the relevant department<sup>1</sup> developed its own policy on how it was going to implement the programme. The purpose of the programme was to provide the relevant services which encompassed land preparation and production inputs to deprived, poor and less privileged communities to enhance their food crop production levels (KZNDARD, 2010). The intended outcomes were set to be poverty alleviation and promotion of food security, while at the same time creating vibrant agricultural communities.

The policy objectives were set out as follows (KZNDARD, 2010):

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<sup>1</sup> During this time period there was a re-structuring of the roles and responsibilities for this programme. Currently, the Department of Agriculture and Rural Development (DARD) is responsible for the programme.

- to release the capacity of fallow and or less utilised agricultural land for crop production;
- to supply agricultural mechanisation support equipment and plant production inputs to poor and less privileged households;
- to improve food crop production level and deter food insecurity and poverty; and
- to encourage equitable access to production resources and address previous inequalities.

Two models of assistance were implemented known as Model A and Model B.

MODEL A (comprehensive): included ploughing, planting and the supply of production inputs. The recipients of these services were identified as those farmers who were the most disadvantaged.

MODEL B (Limited) included ploughing and planting service only. The recipients of these services were those with working capital, but without the equipment available. Any service provision through model B was set to be conditional to confirmation that the beneficiary had adequate means to meet production input demands. Prior to the scheduling of services, the production input had to be secured.

The department set up to avail its own fleet of tractors or contracted service providers to render ploughing and planting services to underprivileged individuals. Such individuals may own, or have access to large tracts of agricultural land, within communal areas and have working capital, but they lack the mechanisation resources, to work the land. During the first year the department set out to provide a 100% subsidy, then to reduce its contribution by 25% each subsequent year until the fourth year when the subsidy support provision was set to cease. As the department reduced its subsidy, the beneficiaries were expected to raise the remaining 25% of costs. Where the department had contracted the service providers to render mechanisation services, it set out to enter into service level agreements with those service providers.

The policy stipulated that service provision would be limited to: a maximum of ten hectares (ha) per beneficiary and a maximum of 125 hectares (ha) for a group of farmers organised as a registered cooperative or other farmer formations. The targeted beneficiaries of the programme, according to the policy document, were said to be indigent, vulnerable and underprivileged people within communal areas; however, the policy was said to also accommodate farmers organised as cooperatives or any other form of farmer organisation. A finding of this research was that in reality, during implementation, the programme

responded to all the farmers interviewed and did not differentiate between the services offered.

## **1.2. Rationale and significance of the research**

Studies conducted worldwide and in the South African context hardly reveal mechanisation's best practices. They do reveal, however, that many government tractor schemes fail (Hittersay, 2013). In some instances, such as India's Green Revolution and the Sudan Gezira Scheme it has been confirmed that mechanisation programmes are successful only where they were coupled with irrigation and/or improved modern inputs, such as improved seed varieties, fertilizers and crop protection chemicals (FAO, 2008).

In South Africa there has been a shift in draft power from animals to tractors; with the increasing availability of tractors and the move towards large scale production (Starkey et al., 1995). One approach by the South African apartheid government that was aimed at indigenous farmers, was the quick establishment of homelands agricultural departments and parastatals and numerous farming projects (Hittersay, 2013). The government at the time bought a number of tractors and implements to work on farming projects, which were later regarded as inappropriate (Hittersay, 2013). Every one of these initiatives failed for various reasons (see section 2.10).

With the phasing out of the mechanisation programme, learning and reflection can inform future strategic agendas. This study, therefore, seeks to understand the importance of tractor services provision towards the improved farming activities of small-scale farmers. This study will contribute to the discourse concerned with the mechanisation strategies suitable for small-scale farmers. It will also help inform policy makers to better understand which farmers to target for which type and level of mechanisation and under what condition. The research also seeks to inform future endeavours of similar programmes with important considerations during planning and implementation and to help bring about better understanding of all the possible outcomes and impacts (intended and unintended) on small-scale crop production.

## **1.2. The problem statement**

A number of tractor services schemes or programmes have come and gone leaving behind little or no sustainable evidence of successful smallholder farmers. The recent experience appeared to follow the same pattern of previous similar programmes where tractors were hastily introduced to smallholder farmers and their use impeded for various reasons. One

reason for this as given by literature, has been the heavy financial drain on public funds and the inability to sustain expensive equipment (Mabuza et al., 2012; Molapo, 1983).

This research, therefore, explored the experiences of the programme and the main issues that emerged from the government officials involved and beneficiary farmers from the two villages, namely Nkandla and Ixopo, in the KwaZulu-Natal (KZN) Province of South Africa. It also examined how the programme influenced the farming patterns and various activities of the beneficiaries. The question that guided the inquiry was:

How has the tractor services provision contributed towards the overall improved farming activities of the small-scale farmers located in the rural villages of Nkandla and Ixopo?

### **1.3.The research objective**

The study's main objective was to determine the role played by the free tractor services provision towards improved farming activities of small-scale farmers in Nkandla and Ixopo rural villages of KwaZulu-Natal.

### **1.4.Sub-objectives**

In order to address the main objective of the research the following sub-objectives were also explored:

- the production process and different equipment concerned farmers used at different stages;
- the farmers' potential to produce a sellable surplus; and
- the farmers' potential to independently work expanded land areas.

### **1.5. Clarification of terms related to the research**

It is important to understand the concepts frequently used in this study as they have special connotations. This includes the following:

- *Farmers* in this research, refers to male and female individuals farming in a rural setting to both sell and consume the produce.
- *Small-scale/smallholder* are terms referring to those farmers in possession of, or having access to small pieces of land, where they grow food crops and or a couple of cash crops and a variety of livestock, relying almost entirely on household labour. They vary with regard to farm size, access to resources, livestock owned and non-agricultural activities as well as in their utilisation of external inputs and payment of

labour, the portion of sold food crops and also household expenditure patterns (OECD, 2015).

- *Mechanisation* is a term in this research that is attributed to the tractor services provision for small-scale farmers through the Department of Agriculture and Rural Development (DARD). However, broader definitions are supplied in the Chapter Two literature review.
- The term *tractor* refers to a standard (normal) farm tractor size, used for crop production purposes.

### **1.6.Ethical considerations**

The researcher obtained ethical clearance from the university's Humanities and Social Science Research Ethics Committee (HSSREC) (see Appendix 1.1). The reason for this is, since the mechanisation programme was a service provided by the government's provincial department of agriculture engaging with the programme beneficiaries, this can be perceived as threatening by the beneficiaries, therefore negotiations with gatekeepers of the programme and permission from the head office of the relevant department, was necessary (see Appendix 1.2). In addition, the dual governance nature (political and traditional) of rural areas required negotiations with significant leaders in the community, to obtain their support and acknowledgement. Hence, entrance to the community had to be legitimate and transparent. The beneficiary farmers were urged to give permission to participate in the study and to seek their perceptions. Confidentiality is always a concern and therefore a consent form (see Appendix 1.3) ensured the farmers' anonymity when reporting and voluntary participation was acknowledged. The ethical clearance form was also signed with the university to ensure that the participant's human rights would not be violated by the study.

### **1.7.Delimitations**

The study took place during the months of July/August when most of the farmers' land was lying fallow. The researcher did not address the surplus concept as intended by policy for improved food security and household income. This was partly because of no yield to observe or measure, nor much in the way of planted land areas, to witness. This aspect of the impact was therefore excluded from the study. The intention was not to look at household structures or single family farms as such, but to collect farmers' experiences on

tractor services provided and emergent issues thereof. The study did not address land properties such as soil depth, soil fertility, soil structure and texture, soil moisture retention, slope, erodibility and soil cover, due to its focus on the perceptions and experiences of farmers regarding the concerned programme.

### **1.8.Sequence of chapters**

Chapter One is an introduction and overview of the research which includes the background and significance of the study. This chapter also provides the research questions and the objectives of the study. Chapter Two is the literature review pertaining to small-holder mechanisation or government tractor schemes in relation to agricultural extension. This chapter starts by defining the important concepts relating to the study. These are the concepts of agricultural extension and agricultural mechanisation as understood by various authors in the field. It also addresses the history of agricultural extension, theory and practice worldwide as well as in the South African context. It further outlines some of the extension models applied and broader theories relevant to extension; namely food security, sustainable livelihoods and sustainable development, and technology transfer/appropriate technology. The study looks at the evolutionary path of agricultural mechanisation summarised in a diagram. Looking at the African continent, the study focuses on the agricultural mechanisation of different regions namely East, West and Central, North and Southern Africa where various countries experiences, are cited. The study also looks at the various agricultural mechanisation strategies for developing countries in Africa, including South Africa. Special focus is given to the South African agricultural mechanisation programme, past policies, previous attempts and today's policies and democratic government's attempts. Chapter Three provides the description of the research setting where the study was conducted. This chapter focuses on the state of South African agriculture in the concerned villages of Nkandla and Ixopo. Chapter Four outlines the research methodology. This chapter documents the field process, justification of tools employed during data collection and their critique. The penultimate chapter (Chapter Five) is concerned with the presentation and a discussion of results with regard to the field findings. The last chapter (Chapter Six) presents the final discussions and conclusions obtained from the study and all the recommendations for further research in this field.

# **CHAPTER TWO: AGRICULTURAL EXTENSION AND AGRICULTURAL MECHANISATION – A LITERATURE REVIEW**

## **2.1 Introduction**

This chapter provides a theoretical background of important concepts related to the study to provide an understanding of the concepts of agricultural extension as well as that of agricultural mechanisation. The definitions of these two concepts are supplied followed by a broadened understanding in relation to the development of smallholder farmers. The broader theories in development are also outlined, as they influence agricultural extension support services and agricultural development, of smallholder farmers. These are food security, sustainable livelihoods and sustainable development, technology transfer and appropriate technology theories. The focus on mechanisation is reviewed from an African continental perspective and narrowed down to the South African context. The comparison of animal with mechanical power in a South African context, is also included in this chapter. The line was drawn to not delve into the South African agricultural policy background due to changing political agendas associated with government. However, recent government speculations regarding the South African policy on extension are highlighted. In addition, the previous and the recent South African government interventions to mechanise smallholder farmers are also discussed with summative statements supplied at the end of the chapter.

## **2.2 Definition of Concepts**

### **2.2.1 Agricultural Extension defined**

The first agricultural extension service of a modern kind, according to Swanson et al. (1997), emanated from a potato blight crisis which occurred in Europe in 1845. According to Swanson et al., this led to the considerations being given to employing nomadic farm advisors and within ten years, the system grew rapidly and was formalised. Subsequently, the term “extension education” was coined following a letter by the new British viceroy appointed to Ireland in 1847 (Swanson et al., 1997). The term referred to organised methods and practises used to impart agricultural knowledge to rural farm folk in their respective residential areas (Swanson et al., 1997; van den Ban and Hawkins, 1996). Bolliger et al. (1992) defined extension as an interactive human encounter experience between the

extension worker and a farmer to build a better future together without presentation of any readymade solutions. Bembridge (1993:18) mentioned that extension is a “system” and a “process.” It is a non-formal educational system for rural adults’ relevant content derived from research and synthesised into practical principles and operational procedures. It is also a process to improve the living standards of rural people (Bembridge, 1993). The premise that extension is a non-formal education for “adults” might raise a concern that is it merely about adults, since much of the experiences of working with rural communities have proved that the majority of farmers in rural areas are mainly adults or of the middle age group. However, there are numerous initiatives such as the Four-H programme<sup>2</sup> that targets farm youth, extension advisory services on home economics for women and currently in the USA; they target urban farmers (United States Department of Agriculture (USDA), 2011).

According to van den Ban and Hawkins (1996) some countries which adopted the terminology of “extension” have lost the feature of educational activity. This allows extension to ensure achievement of improved agricultural production by stimulating farmers to utilise “modern” and “scientific” production technologies or knowledge produced by research. In conclusion, agricultural extension refers to a systematic process of imparting agricultural knowledge and innovation between research, extension practitioners and farmers in order to improve the livelihoods standard and ability to solve problems for those involved in agricultural activities.

According to Swanson et al. (1997) extension has threefold attributes. Firstly, as an agricultural field of study, it concerns educating people and understanding their conduct while being purposive in approach. Secondly, as a process it aims at assisting rural people to obtain new livelihoods and to improve existing livelihoods, which will in turn contribute to the betterment of their physical and psychological wellbeing. The success of such a process is often determined by the conditions of mutual understanding and trust, reverence and the relevance of the parties involved. Thirdly, as a service, agricultural extension enables public agricultural services providers, institutions of higher learning or aid agencies,

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<sup>2</sup>4-H is the premier youth development program of the U.S. Department of Agriculture (USDA). Originating in the early 1900’s as “four-square education,” the 4-H’s (head-heart-hands-health) seek to promote positive youth development, facilitate learning and engage youth in the work of their community through the Cooperative Extension Service to enhance the quality of life (USDA, 2011).

to be as useful as possible. The notion that the generic work of extension is to assist people resolve the challenges they face by employing scientific knowledge, is widely accepted today (Swanson et al., 1997).

### **2.2.2 Agricultural Mechanisation defined**

Technology has equipped human beings with great opportunities for growth and development in every sector. In the agricultural sector the expansion of mechanisation technology allows farmers to cope supplying food markets and in meeting the food demands for an ever-increasing population. Dixon and Dorset (2010) asserted that the agricultural output will have to increase by 70 percent if by 2050 an estimated world population of above nine billion is to be fed. This calls for highly innovative agricultural practices and optimal use of inputs or input resources in order to increase production and enhance productivity. Agricultural mechanisation, as one of the inputs, is of no exception. Historic literature about mechanisation of agriculture described the concept mainly about farm power and transportation (Obi and Chisango, 2011).

The Technical Center for Agricultural and Rural Co-operation (CTA) (1997) defined agricultural mechanisation, as the utilisation of tools, machines and associated implements to enhance the effectiveness of human time and labour. According to Verma (2006) agricultural mechanisation refers to the employment of improved farm tools and equipment of varied power sources to mitigate strain and drudgery experienced by human labour and draft animals. The aim is to also facilitate cropping intensity, ensure precision and timeliness of the various phases of crop production. The Food and Agricultural Organisation (FAO, 2008) defined the concept as the agricultural employment of mechanical technology and improved power especially to increase productivity and achieve the results that transcend human labour potential. This includes employment of various tractor sizes, muscle powered tools and implements, solar energy power, electric motors, engines of internalized combustion and other means of converting energy. Rijk (2012) mentioned that agricultural mechanisation encompasses the utilisation of tools, machines and implements for the purpose of agricultural land improvement, production and harvesting of crops, modification for storage, actual storage and on-farm processing. It involves three sources of power: these are mechanical, animal and human power.

The above definitions bring to light that agricultural mechanisation does not necessarily refer to the use of tractors or replacement of hand tools and animal powered implements with

tractors and other agricultural machines. The term also involves a number of other mechanical innovations used on agricultural land. In many developing countries, according to Mrema et al. (2008) agricultural mechanisation is perceived as the replacement of hand tools with mechanical power. Mechanisation is not synonymous with tractorisation<sup>3</sup> since muscle and mechanical power sources are considered to help each other at a household, farm or village level, with options regulated by local conditions (Obi and Chisango, 2011). Tractor power is just one of the alternatives and should not be confused with mechanisation (CTA, 1997). In sub-Saharan Africa, according to the CTA, some successful mechanisation interventions have used animal power. This means that animal traction can certainly be mechanised both on small and large farms and it is the power source that displays economic and environmental friendly attributes (Fowler, 1999). Tables 2.1 and 2.2 below summarize the levels of mechanisation and different types of farm power sources identified in the literature for later discussion. Figure 2.1 of Appendix 2.1A shows nine stages of the mechanisation adoption process and or labour productivity enhancing technology (after Rijk, 2012). Table 2.1 of Appendix 2.1B shows some historic generalisations with regard to mechanisation (after Binswanger, 1986). In conclusion, we can say that agricultural mechanisation refers to innovative manufacturing and the introduction of varied power options for use on agricultural land to facilitate and hasten time-bound activities, while reducing drudgery, limiting losses, and damages and the spoilage of an enterprise as well as improving production and productivity through a proper combination of different inputs.

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<sup>3</sup> Tractorisation “refers to the application of any size tractor (e.g. single-axle, 2-axle or track-type of any power rating) to activities associated with agriculture” (FAO, 1981: 04)

Table 2.1: Different types of agricultural mechanisation technology and their levels of sophistication (after Rijk, 2012 and FAO, 1981)

<b>Mechanisation type</b>	<b>Levels of sophistication</b>	<b>What is included?</b>
Hand tool technology	Simplest and most basic	The use of tools and simple implements using the human muscle as the main power source, e.g. hand hoe, gardening fork.
Draft animal technology	Intermediate	Implements, machines and equipment utilising animal (usually cattle, buffalo, horses, mules, donkeys or camels) muscles as the main power source, e.g. single share plough, single-axle tractor
Mechanical power technology	Highest technology level	A wide range of tractor sizes and self-propelled machines employed as movable power for cropland activities and transport, and immovable power for a variety of machines, engines or motors running on petrol, diesel or electricity to operate threshers, mills, pumps for irrigation, grinders and many machines that stay put. It also involves aircraft spraying of crop with protection chemicals and fertilisers, and self-propelled machines for production, harvesting and handling a wide variety of crops.

Table 2.2: Sources of farm power (after Srivastava, 2009)

<b>Mobile power</b>	<b>Stationary power</b>
<ul style="list-style-type: none"> <li>• Human (men, women, children)</li> <li>• Draft animal (bullocks, buffaloes, camels, horses and ponies, mules and donkeys)</li> <li>• Tractors</li> <li>• Power tillers</li> <li>• Self-propelled machines (combines, dozers, reapers, sprayers and so forth)</li> </ul>	<ul style="list-style-type: none"> <li>• Diesel/oil engines (for pump sets, threshers, sprayers and other stationary operations)</li> <li>• Electric motors (for pump sets, threshers, sprayers and other stationary operations)</li> </ul>

### 2.3 Extension Approaches

It is plausible to assert that no single agricultural extension model or approach is universally accepted and appropriate given the differences between nations and societies (Gaaya, 1995). A particular approach may work well in a certain community, but fail in another. This is based on the premise that people between and/or within communities, are guided by the

different local standards of behaviour and ethics, values, norms and customs, social and political agendas or interests, not excluding the economic and environmental pressures being sustained. This means that the socio-cultural, including demographics, and socio-economic environments have a noticeable influence on the performance of agricultural extension interventions and careful considerations for each are indispensable (see section 2.4.1). Among many approaches, the extension models compared here are *Linear/technology transfer*, *Advisory*, *Agricultural Knowledge and Information Systems (AKIS)*, *Facilitation/participatory* and *Agriflection/learning models*. These models were selected because of their relevance to the problem of the study. The interrelationship between two or more of the selected models means they can be used complementarily to address the identified research problem.

### **2.3.1 The Linear model: technology transfer**

The linear model according to Groot and Rolling (1998) comprises a number of connected institutions engaged in development. Fundamental research and applied research are carried out and extension workers transfer the results to farmers (Groot and Rolling, 1998). This model is more about the transfer of technology and the farmer is passive, as the intention is to carry out government policy. It is, therefore, constructed on a science-practice continuum, not in a two-way flow of information as in an REF (Research-Extension-Farmer) continuum (Groot and Rolling, 1998). Groot and Rolling went on to say, in this approach that the research is the origin of technological innovations. The linear model is top-down since the farmer is treated as merely an adopter and the recipient of technology and/or research results. The success or failure of the model is usually measured by the degree of technological adoption.

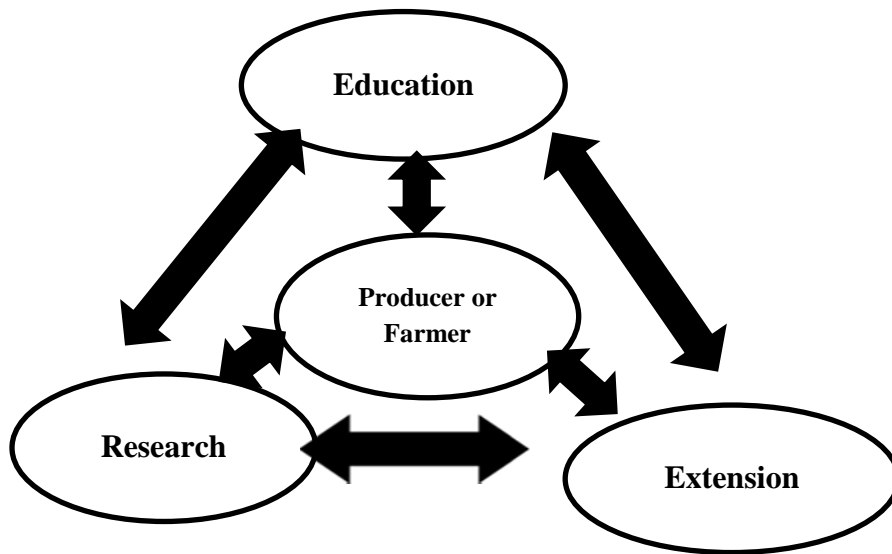
### **2.3.2 Advisory Model**

The advisory model comprises a team of highly specialised and mobile advisors supported by various experts, online computer services, and written information sources which the farmer uses (Groot and Rolling, 1998). In this model the farmers play an active role by asking questions about a particular problem. However, the farmer needs to know the specific kind of information s/he requires. This means that if the farmer has no clue of what he needs, the model would be inappropriate. This model differs from the linear model because

the farmer supposes to take the first initiative as an information seeker; whereas, with the linear model, the farmer is a passive adopter of technology.

### **2.3.3 AKIS Model**

The initial Agricultural Knowledge and Information Systems (AKIS) model (Figure 2.1) valued learning process as having threefold role players centred around one important participant which is a farmer or producer (Rolling, 1986; FAO and The World Bank, 2000). The AKIS concept was developed as a tool that connects people and the relevant institutions to encourage mutual learning in order to share and use agricultural technology, new information and knowledge (FAO and The World Bank, 2000). The continuous developments of AKIS model made the concept be redefined as an amalgamated cooperation of agricultural organisations and/or individuals through interconnectedness between them, as they are involved in various forms of knowledge and information management required for well informed decision making and problem solving in agriculture (The European Union Standing Committee on Agricultural Research, EU-SCAR, 201; Rolling and Engel, 1991). This model encourages farmers, agricultural educators and experts, researchers and extension workers, into collaborative learning and the sharing of information obtained from numerous sources for the betterment of farming and enhanced livelihoods (FAO and The World Bank, 2000). The noticeable element of AKIS, is the perception of the necessity of increasing influential power with regard to agricultural research and extension on innovative institutional arrangements (Berdegue and Escobar, 2001). This concept distinguishes between agricultural research and extension, and also between innovation and technological change (Anderson, 1997). Anderson (1997) also outlined that it is inappropriate to correlate the overall technological change influence to only extension and research, since the focus is also on innovation and supportive institutional arrangements (Berdegue and Escobar, 2001).



*Figure 2.1: AKIS model after FAO and The World Bank (2000)*

The fundamentals of AKIS perspective is that agricultural knowledge is a system made up of numerous role players concerned with agricultural know-how (Rolling, 2009). Rolling added that the research institutions, extension services and farmers together develop the technical knowledge the farmers employ in their farms. Other role players such as the Ministry of Agriculture, local government, NGOs, aid organisations, agricultural education institutions and universities are also involved in the AKIS (see Figure 2.2). The improved model recognises that as many actors as possible are involved in the agricultural knowledge system. Following the AKIS perspective, strengthening of linkages between actors in the knowledge system, appears to be the common concern, rather than support for research institutes and public extension services (Rolling, 2009). Rolling further mentioned that the view of agricultural knowledge as a system enabled the AKIS model to contemplate about the effectiveness of the role players in the development of agriculture. It is now acknowledged that policy makers and implementers started to recognise farmers as seriously considered role players in the governance of knowledge. The model shows that farmers' priorities and experiences are acknowledged as a valuable source for knowledge development (Rolling, 2009; EU- SCAR, 2012). The concept of Agricultural Knowledge

and *Information System* is now renamed the *Agricultural Knowledge and Innovation System*.

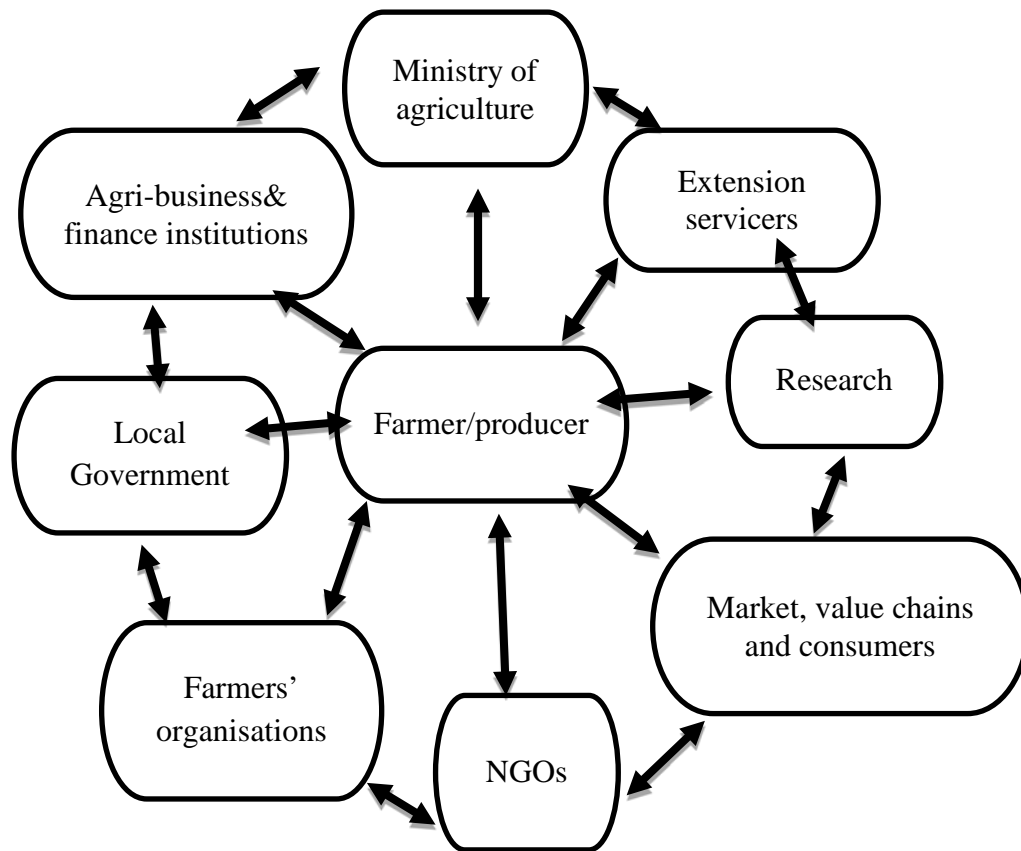


Figure 2.2: AKIS sees agricultural knowledge system as made up of many actors exchanging knowledge back and forth (after Rolling, 2009). (EU-SCAR, 2012).

### 2.3.4 Facilitation/Participatory Model

The facilitation model comprises a “loose network” of highly trained facilitators who are mobile, and able to visit learner groups on a regular basis (Groot and Rolling, 1998). It also comprises a network of trained farmers who can exchange experiences and stimulate each other to continue to learn (Groot and Rolling, 1998). This model involves the farmer throughout the problem-solving process with the extension worker playing a facilitative role. Thus, the model might sound attractive when dealing with smallholder farmers especially when the intention is “capacity building.” According to Worth (2008) the facilitation model is about creating tools for bringing about the visibility of processes and systems that impact on the farmers’ lives. The model requires that farmers must be able to meet at both local and district levels, and that written information can be exchanged among them (Groot and

Rolling, 1998). The emphasis of this model, is that farmers are regarded as experimenters and innovators and active participants in the changes affecting them (Groot and Rolling, 1998).

### **2.3.5 Agriflection: A Learning Model**

In this model, Worth (2006) is challenging the inter-relationship and partnership between farmers, extension agents, researchers and policy makers. This model contests old extension practices especially with regard to information, development and the adoption of technology (Worth, 2008). Traditionally, a research coupled with extension offered technology as a panacea for poverty alleviation and wealth creation was measured by the adoption. Whereas Worth (2006) argues that the solution towards promoting prosperity is beyond the development of the technology and adoption process. This is indicated by the lingering circumstances of abject poverty among rural farmers regardless of the attractive appeal of technology to alleviate poverty (Worth, 2006).

The Agriflection model suggests that farmers should be genuinely involved in a partnership with researchers, extension workers, funders and policy makers for the purpose of learning (Worth, 2006). The first learning curve, in this respect, is about what farmers do and why, and how they can benefit from the current systems when altered and made more profitable and sustainable. The second learning curve answers the question about who is in command of the resources and who is driving the learning. The final learning process is involved in identifying the learning that is required and the planning for how the extension facilitates that. In this approach, Worth asserted that farmers must be regarded as equal stakeholders in innovative research and the establishment of technologies directly impacting on productivity, profitability and sustainability of their farming systems. Worth (2006) went on to say, an inherent assumption in the Agriflection model, is that the role players, as partners, have the determination to learn through the process of investigation, absorption and the impartation of knowledge. This can be achieved individually on their own accord and collectively in their united engagements, since the goal is to promote mutual learning. The model is more about encouraging the learning desire and building skills for advancement (Blum, 2007). This model can be used in conjunction with the facilitation model as skills transfer is part of capacity building (Worth, 2008). The next section highlights some of the environmental factors affecting the success or failure of agricultural extension in any given situation.

## **2.4 Environmental Factors Affecting Extension Services**

### **2.4.1 The Political and Socio-cultural Environments**

The political environment influences agricultural extension and advisory services in different ways (Swanson et al., 1997). In numerous developing nations, smallholder agricultural development services are public goods; - meaning that little or no progress is possible without government involvement (Machethe, 2005). An effective extension requires sound government policy planning and implementation strategies due to the political impact on the mission of extension (Swanson et al., 1997). When agriculture is viewed as being among the major, primary economic sectors and has a strong support by the government, chances are extension favouring policies are most likely to be established and/or amended (Swanson et al., 1997). Swanson et al. added that despite that extension service providers must be objective in handling of information; the realities also require them to conform to the set policies of their government. However, extension organisation and extension workers must always circumvent political issues such as political intolerance, political conspiracy, injustice and unequal treatment resulting from political affiliations (FAO, 1993).

The socio-cultural condition is among the most important environments extension personnel operate under and must contend with every aspect of it. According to FAO (1993), the effectiveness of extension is highly correlated with the local community level of operation. Extension's strength is largely determined by the location of the extension worker at an accessible local level to farmers with ease of interaction and visibility of work. In this manner, the increased access between the farmer and the extension officer, allows a good opportunity for creating rapport, trust and friendship; meaning the official's access by farmers, is crucial both from a societal and geographical point of view (FAO, 1993). This denotes that the location of offices must not improve access for one client group or gender, at the expense of another. In this regard, the complexity involved requires careful attention, as there are many factors to consider.

The education process affects the values and attitudes of individuals and illiteracy is believed to be a factor in the attitudes of traditional farmers (Bembridge, 1993). Bembridge (1993) further mentioned that factors such as the resistance to change, focus on inter-personal relationships, hostility to authority, lack of innovation, fatalism and lack of inspiration have been attributed to lack of basic education among rural farmers. According to STATSSA

(2011) in South Africa, using a household's head as an agricultural practitioner, it was indicated that people engaged in agriculture had higher levels of no schooling (23%) as compared to 8.6% at a national level. The level of education and literacy, therefore, play a pivotal role in the delivery of extension support services (FAO, 1993). For example, illiterate farmers would require clear information that is easily understood in their own vernacular and more reliance on the advisor for information, than farmers who are able to access literature and electronic sources of information.

According to the FAO (1993), numerous claims have stressed hindrances to the adoption of technology as correlated to community attitude, traditions and societal implications. Rural development relies on a community developing a sense of social responsibility where effective leaders and organisations with strong social networks that support cooperative problem solving, demonstrate the ability to adapt beneficially to change (FAO, 1993). Ownership of the change process encourages communities to convince reluctant traditionalists more effectively than outsiders (FAO, 1993). The socio-cultural environment also reflects the way in which women are treated in a community, and also determines the way in which women are allowed to be targeted for extension programmes or from which they are exempted (FAO, 1993).

#### **2.4.2 The Economic Environment**

The varied economic environments extension workers operate under, also has an influence on the success or failure of extension support. According to FAO (1993) the two principal economic factors regarding the scope of extension practice and perception of public extension to farmers are:

- the profit opportunity available to the farmer by applying technologies brought to them; and
- the general economic environment in which nation's agriculture finds itself.

The incentive of economic returns for farmers plays a crucial role on the perception of new technologies and advisory service provided by extension personnel. The extension worker and farmers need to envision the improvement in a monetary state, but there seems to be a number of determinants. For example, a less paid extension worker, who is just doing it as a job, might not perform the duties effectively (FAO, 1993). Similarly, the farmer who does not see any economic improvement from the extension's recommendations, might be less motivated. Extension recommendations that find their most positive demonstration

responses of increased productivity, convinces farmers that such increases can mean a greater income or greater financial security for the family (FAO, 1993). However, more prosperous agriculture may mean a reduced level of enthusiasm in looking for help from extension services, by the farmers (FAO, 1993). For example, under good weather and better price conditions, the situation might prove that even relatively less successful farmers may appear lucrative. The opposite is witnessed under conditions of stressful events in the agricultural sector (FAO, 1993). This means the demand for extension may vary with seasonality, shocks and stresses encountered and other factors related to farm conditions, as can be seen in a sustainable livelihoods framework (see section 2.5.2).

### **2.4.3 The Agro-ecological Environment**

A deep understanding of agricultural ecosystems is also important to the extension service providers. This is crucial in raising consciousness about the renowned concern over “Global Warming” even to smallholder farmers in remote areas. According to Moyer (2010) weather patterns will shift due to climate change, which will result in changes to the amount of rainfall received by any particular region and subsequently water flowing through streams and rivers. Moyer (2010) predicted that by the year 2025 or later, we might expect regional wars over water. Moyer justified his statement by saying, in multiple countries in the world, water supply is from one major river with climate change, pollution and population growth putting a strain on the sources. A typical example is the Nile River flowing through five countries namely Uganda, Ethiopia, Sudan, Burundi and Egypt. Drought, according to Abberton (2008) is a significant environmental factor hindering crop production worldwide. The extended periods of summer droughts and variations in precipitation predicted by climate change models mean many regions will be severely affected by the water shortage (Abberton, 2008). Abberton went on to say, population growth, in this case, will demand that whatever amount of water is available, more of it will be used for both domestic and industrial purposes rather than to irrigate crops. This will give multiple advantages to crops showing attributes of water stress resistance, tolerance and/or water use efficiency (Abberton, 2008).

The concern, in this regard, is about ecologically sustainable agricultural practices and climate-smart agriculture which can, at the same time, be able to provide for the ever-growing population. The emphasis is on environmental preservation, whereas agriculture is seen to be greatly degrading it. Thus, most nations have developed and/or are still

developing research stations for crop varieties that are adapted to specific sites so that recommendations are based on ecological conditions (FAO, 1993). Extension services need to establish and retain the connections with those locale-specific proceedings in order to gain information relevant to many specific areas and suitable varieties for each (FAO, 1993).

#### **2.4.4 The Administrative/Organisational Environment**

The administrative and/or organisational conditions under which extension operates substantially influence its performance. Extension, according to Farrington et al. (2002: 13), has inherently been classified into three categories:

- The one that is rendered and financed by the private sector.
- The one that is financed and rendered by the state- government of the country.
- The one that is based on farmer-to-farmer knowledge, and often supported by NGOs.

All of the above categories of extension have their own distinct ways of operation. The public extension services often operate within a certain mandate. According to the Environmental and Development Trust (1995) good extension workers aspire to respond to the community's needs than to merely respond to government policy programmes; the two of which are usually in conflict. The public-sector-funded extension delivery has been considered to be top-down in approach and operation (Farrington et al., 2002). The public extension category is usually associated with various subsidy schemes and continues to experience shortages of funds and public servants staff in remote, unfriendly villages (Farrington et al., 2002). The third category in the above outlined is usually less progressive and less influential in the absence of local organisational support by NGOs or donor agencies (Farrington et al., 2002).

#### **2.4.5 The Infrastructural Condition**

The level of established infrastructure hampers extension service delivery in many ways. The condition of transport infrastructure, communication and market linkages, water schemes, electrification and so forth, affects both farmers' activities and extension support services (Swanson et al., 1997). The potential to mobilise people, inputs, produce and the flow of information all affect the performance of extension in relation to its impact on the farmers concerned (Swanson et al., 1997). In terms of transport, there might be the possibility that some areas cannot be reached by road transport and/or vehicles are in short supply (Swanson, et al., 1997). In either case, farmers under such conditions, can hardly be

reached with improved technologies and other developmental services. As a result, this tends to make extension inherently favour the road-side farmers and/or those accessible by road transport. With reference to communication, farmers' limited access to media (e.g. publications, radios, televisions, and computers) reduces the options available to extension for communicating messages (Swanson et al., 1997). This makes it difficult to maintain an uninterrupted two-way flow of information; again making extension favour those farmers who can personally access various forms of information at the exclusion of the illiterate ones or those with limited access to information sources. The challenge here is to explicitly convey information using modern technology to different groups of farmers without any exclusion. The next section outlines some of the world-views development theories influencing and motivating extension support services.

## **2.5 Broader Theories in Development Influencing Extension**

### **2.5.1 Food Security**

As one of the perceived outcomes of agricultural extension services, the understanding of the complexity of “food security” is of paramount importance. The most agreed on definition of the concept is the one supplied by the FAO (2006) after the World Food Summit in 1996. The concept was defined as the condition when all humanity has constant access to enough, safe and nutritious food at all times to satisfy their preferred dietary needs in order to thrive (FAO, 2006). Hence, the concept of food security encompasses four important aspects namely: food availability, food access, utilisation and stability. Availability of food is concerned about enough quantities of quality food being made available through domestic production or imports. Secondly, food access focuses on individuals' access to enough resources for obtaining appropriate food items for a nutritious diet. Whereas utilisation is concerned about the bodily use of food through having a balanced diet, sanitation, clean water and the health care necessary for mental and physical well-being. Stability refers to a population, household or individual having an uninterrupted access to adequate food throughout their lifetime; meaning there should not be a risk of losing access to food as a consequence of sudden shock (e.g. an economic or climate crisis) or cyclical events (seasonal food insecurities) (FAO, 2006). According to Du Toit (2011) the concept of food security or insecurity, is highly collated with poverty and the two are interrelated and to some extent, they influence one another. The concept is most often distinguished at a household, communal and national level in terms of measurements

and indication tools of food (in)security. The scholars of the concept tend to distinguish the food (in)security as being chronic, seasonal and occasional. The concept is seemingly more abstract than concrete and achieving its descriptive (narrative) goals under unstable economic situations is likely to remain a dream deferred.

### **2.5.2 Sustainable Livelihoods and Sustainable Development**

A **sustainable livelihoods** approach (SLA) to development draws on better understanding the complexity and different aspects of scrutinising poverty as correlated to various measurements from households to government levels and other systems that allows its holistic view (Farrington et al., 1999). Farrington et al. went on to say SLA puts emphasis on realising and developing assets of the poor communities to enable them to overcome livelihoods challenges. The SLA is based on the Sustainable Livelihoods Framework (see Figure 2.3 below) which according to Farrington et al. is an analytical tool for improved understanding of livelihoods and poverty. This framework views people as operating within a vulnerability context in which they have access to certain assets (Human, Natural, Financial, Physical and Social) or elements of poverty alleviation. These assets gain their meaning when useful role players are in place to influence people's livelihood strategies and how assets are being properly combined (Department For International Development (DFID), 1999). The framework, according to Farrington et al. (1999) supports the eradication of poverty by making improvement in the livelihoods of poor people a focal point of development endeavours; a livelihood includes people's potentials, assets and necessary activities to increase the means of survival. A livelihood is considered sustainable if it is able to bounce back from shocks and stresses and continuously improve its relevance without compromising its future use and the natural environment it relies on (Scoones, 1998; Chambers and Conway, 1992).

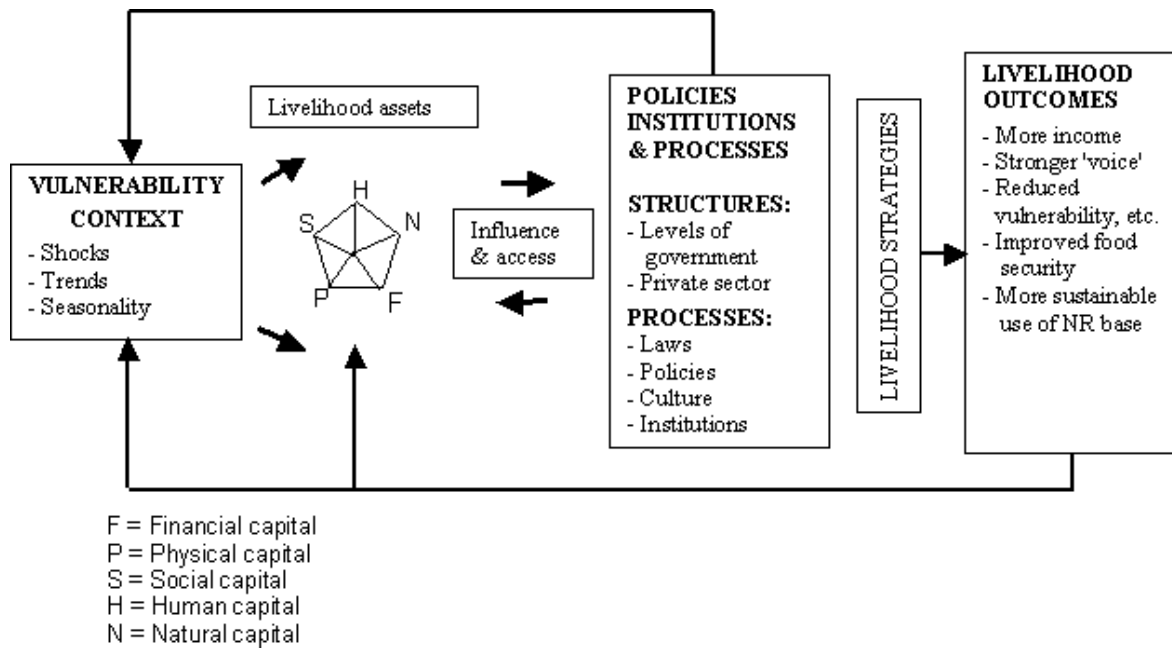


Figure 2.3: The DFID Sustainable Livelihoods Framework (SLA). Source: DFID (1999)

**Sustainable Development** on the other hand, is defined as the potential to achieve development that is characterised by indefinite impact while taking into consideration that the needs of the present generation are being met, without jeopardising posterity's ability to meet own needs (Kates et al., 2005). Kates et al. (2005) raised a question that "what is to be sustained?" The answer was coined under three categories namely: the nature; life support systems; and community- as well as intermediate categories for each such as earth, environment and cultures respectively. The most common emphasis was put on life support systems, which define nature or environment, as a source of services for the utilitarian life support of humankind. On the contrary, according to Kates et al. (2005) some literature valued nature for its intrinsic value rather than its utility for human beings. There were also parallel demands to sustain cultural diversity, including livelihoods, groups and places that constitute distinctive and threatened communities. Likewise, there were three quite distinct ideas about what should be developed; these being people, economy and society. Much of the early literature focused on economic development, with productive sectors providing employment, desired consumption and wealth (Kates et al., 2005). The attention has shifted to human development, including an emphasis on values and goals such as increased life expectancy, education, equity and opportunity. The identified calls to develop society emphasises the values of security and well-being of national states, regions, and institutions as well as the social capital of relationships and communal ties. In conclusion, sustainable

development implies linking what is to be sustained with what is to be developed (Kates et al., 2005).

### **2.5.3 Technology Transfer and Appropriate Technology**

Provided proper and relevant support such as good prices for their harvest, smallholder farmers are capable of raising production. However, nothing is attainable if technology transfer continues being top-down. The prerequisite rests with researchers to constantly stay in touch with farmers; understanding what problems they are grappling with, use that knowledge as their origins of research, and come-up with new technologies together. That is when the sustainable production of agriculture can be realised (Dixon and Dorset, 2010).

According to Ramanathan (1994) technology transfer refers to the process whereby technology is shifted from one possessor, usually regarded as a developer, to another, as an adopter. The transfer can be considered successful if the receiving entity, the transferee, can effectively utilise the transferred technology and eventually assimilate it (Ramanathan, 1994). The movement may involve physical assets, know-how, and technical knowledge (Bozeman, 2000). Technology transfer in some instances may be confined to relocating and exchanging personnel or the movement of specific set of capabilities (Lundquist, 2003; Osman-Gani, 1999). The concept has also been used to refer to the movement of technology from laboratory to industry, developed to developing countries, or from one application to another domain (Philips, 2002). It is somehow and in a restricted sense, where technology is considered as information, thus technology transfer is sometimes defined as the application of information into use (Gibson and Rogers, 1994). The definition of technology transfer as in the context of diffusion of innovation has led to the confusion between technology *transfer* and technology *diffusion* (Ramanathan, 1994). According to Ramanathan (1994), technology *diffusion* refers to the “spreading,” often passively within a specific technological population, of technological knowledge related to a specific innovation of interest to that population. Whereas technology *transfer*, is a pro-active process to disseminate or acquire knowledge, experience and related matters (Hameri, 1996). Furthermore, *transfer* is intentional and goal oriented, and also presupposes and involves agreement, unlike *diffusion* (Hameri, 1996; Ramanathan, 1991).

Jequier (1979) mentioned that “appropriate technology” refers to new types of technology which can be characterised by any one, or several of the following features:

- having reduced costs and capital investments
- being amenable to small-scale operations
- the ability to adapt to varying social and cultural situations
- little or no nature degradation
- a reduced cost of a final product; and
- they may also be of an intermediate level of sophistication and/or relatively easy to operate and maintain by unskilled people

There may be a number of additional criteria upon which “appropriateness” may also be judged and with many, it is inevitable that some may conflict with others (Eckaus, 1976). A given technology may meet one to several appropriateness criteria, but not others or fail to meet the most desired criterion, or may meet many but to varying degrees of wellness. The attributes that allow a particular technology to meet one criteria may inherently disqualify it from meeting another required criteria (Jequier, 1979). In addition, technology which meets a given criterion in one situation, may not meet that criterion in another situation. Similarly, a technology which meets a criterion at a particular moment might not meet the same criterion at another given moment, due to changed circumstances (Jequier, 1979). These assertions make it hard to firmly state what entirely constitutes a typical appropriate technology. This is because what constitutes appropriate technology varies with each unique circumstance and whether technology is appropriate is not merely determined by technology itself (Jequier, 1979). The next section focuses on agricultural extension in a South African context as understood by numerous observers in the field.

## **2.6 Agricultural Extension in South Africa**

### **2.6.1 Divergent South African Agriculture**

Given its history, South Africa has undergone much upheaval trying to curtail the consequences of the apartheid era. The country’s agricultural sector has also been through the cross-roads of change and is still being modified so to favour and compensate the victims of apartheid. A number of institutions which were previously involved in agricultural extension caused problems such as organisational overlapping, ethnic fragmentation, exclusion of the poorest of the poor, poor distribution of scarce manpower between institutions and regions and the total farmer population, and misappropriation of funds (Botha and Truernicht, 1997). Consequently, reorganisation of extension services was

needed. According to Duvel (2004) South African extension service has been through two noticeable changes: from white commercial farming and black subsistence farming to a combined service centred on previously disadvantaged farmers. This dualistic nature according to Duvel (2004), emanated from former government policy that portrayed ethnic prejudices and commercial farming favouritism. Thus, the democratic government continuously grapples to reduce the gap between the white commercial farmers and the black smallholder farmers, across the country. Consequently, a decentralisation policy was developed, leading to autonomy regarding agricultural management at provincial levels though with no improvements in the effectiveness and efficiency of extension delivery (Duvel, 2004). Most commercial farmers switched to privately provided services as a result of the department of agriculture's restructuring into provincial departments (Williams et al., 2008). The switch by commercial farmers was triggered by the premise that current provincial departments display many weaknesses in their ability to maintain support services for farmers (Williams et al., 2008).

It is therefore observed that there has been big differences between the extension work for white farmers and that for black farmers (Environmental and Development Trust, 1995). This segregation continuous to mark the service provision between white commercial and black smallholder farmers found in the country. This is because the majority of rural black farmers are less capable of accessing private extension services so as a result, they are reliant on government extension services (Ngomane et al., 2002). However, the public extension is not propelled to satisfy the needs of the resource poor smallholder farmers and to some provinces it has been suffocating (Williams et al., 2008; Ngomane et al., 2002). This means that the extension support system needs to be transformed in a manner that allows smallholder farmers to break the bondage of poverty and dependency from government. According to Botha and Treurnicht (1997), it is clear that state support of white commercial farmers is drying up and many challenges facing smallholder farmers in South Africa remain, despite the availability of public extension services.

### **2.6.2 The Future of Agricultural Extension in South Africa**

South African agricultural extension is still undergoing evolutionary changes so as to increase its efficacy. It is expected of government to indefinitely continue to render extension services without fully privatisation (DAFF, 2013). According to DAFF, government services will be rendered on cost-recovery bases to keep abreast of the

international trends and other state policies. As far as the concept of *cost-recovery* is concern, Botha and Treurnicht, (1997) indicated that pay-for-advice extension services might play a bigger role in the future. At the time, Botha and Treurnicht, (1997), identified that there is no Department of Agriculture (DoA) that charges commercial farmers for advice. Large scale producers will have to gradually move towards pay-for-advice extension services and from an early stage they will need to learn to do this, at low rates (Botha and Treurnicht, 1997).

The broadening of the concept of extension in South Africa has resulted in the adoption of a pluralistic strategy towards extension support services (DAFF, 2013). Following this strategy, the private sector, including NPOs and other agencies have been recognised as having a crucial role and, for some reasons, better equipped and placed to meet certain services' needs. Consequently, the state committed itself to provide incentives and funding opportunities for farmers and processors to cater for services where affordability might be a problem. The strategy also recognises farmers as important role players in the provision of extension services. The valued emphasis is on farmer-to-farmer extension through the sharing of local knowledge, experiences and local science (DAFF, 2013). Drawing from facilitation and learning-based extension, a pluralistic approach would mean a participatory and partnership based extension with two-way rather than one-way of engagement and would cease being instructional. Farmers and processors will be viewed as equal partners to be encouraged to fully cooperate in the learning process (DAFF, 2013). This relates back to the Agri-flection model highlighted earlier in the chapter.

It is also expected that the financially stable and market oriented producers will rely more on commodity specialised extension and advice; meaning an advisory context based on specialists, study groups and the sharing of research output having strong networks with industries, researchers and academic experts (DAFF, 2013). It is noticeable that such services will inherently be internet-based and coordinated by concerned firms/industries, or producer associations with services' costs recovered from producers through relevant agencies (DAFF, 2013). The next section focuses on the African countries' experiences with regard to the agricultural mechanisation of smallholder farmers.

## **2.7 Agricultural Mechanisation in Africa**

According to the Food and Agricultural Organisation -FAO (2000), one of the noticeable common elements that rural farming in many African countries still depends on, is hand tool

equipment, a system which has been used for centuries. The accepted view is that the situation needs to be changed, and the persisting concern is the way this change should be done (Obi and Chisango, 2011). That is, should African countries progressively and gradually go through the evolutionary path from hand tools through animal powered to mechanical-powered agricultural mechanisation as has been the case in other developing countries, or should African countries by-pass and skip the intermediate stage of animal powered mechanisation (Binswanger, 1986)? It is important to heed that the overall transitional costs from human to animal muscle power involves training animals, clearing and levelling of land, as well as feeding and caring for animals throughout the year (Pingali et al., 1987). The experiences of seven African countries namely Botswana, Ghana, Kenya, Nigeria, Swaziland, Tanzania and Zambia in agricultural mechanisation policy, show that the interventions that by-passed and skipped the intermediate phase did not yield positive results (FAO, 2000).

The common trend of post-independence policy in some African states was an abrupt emphasis on tractor usage and a desire to leapfrog animal traction (Pingali et al., 1987). Thus, a substantial proportion of government resources for mechanisation were channelled to the purchase and maintenance of tractors. Little was left for the promotion of animal draft power. The first shipment of tractors came to Africa around 1945, and the countries that began to encourage the use of tractors during the period 1945 to 1955 were called first generation tractor users (Pingali et al., 1987). Pingali et al. went on to say, the use of tractors in these first generation countries, namely Zimbabwe, Kenya, Zambia and Malawi, spread from colonial farms to private farms owned by native Africans. Countries that channelled their resources to the use of tractors between 1958 and 1970 were Tanzania, Ethiopia, Ghana and Cote d'Ivoire and these were called second generation tractor users, (Pingali, et al. 1987). In a number of these second generation countries, tractors were provided through cooperative farms, state farms, or tractor hire schemes<sup>4</sup> (THS) (Pingali, et al., 1987).

The endeavour to bypass animal-traction phase was abandoned in the late 1970s and some efforts were made to re-establish the utilisation of animal drawn equipment (Pingali et al., 1987). For example, when Tanzania became independent in 1961 a programme to

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<sup>4</sup>Tractor hire schemes- are government sponsored rental programmes for multi-farm use of equipment (Pingali, et al., 1987).

modernise agriculture was initiated. Government resources were channelled into the promotion of tractor cultivation through mechanised block-cultivation schemes<sup>5</sup>, village settlement schemes, contract hire schemes, and credit on favourable terms to large private farmers. These mechanisation schemes rapidly turned out to be a disaster (Pingali et al., 1987). Another typical example of a failed mechanisation programme is that of the government of Uganda. In 1965, the state owned a total of 489 tractors for its tractor hire scheme. The following years saw the scheme being abandoned due to lack of funds to subsidise the programme and heavy financial drains on government. The services were also plagued with ill-timed operations as recipients squabbled over service timing (Kienzle, et al., 2013). Critics attribute the unfruitfulness and failure of many Government sponsored tractorisation programmes in Africa as contributors to the decline of agricultural productivity and to growing unemployment as has been witnessed in Zimbabwe (Salokhe and Oida, 2003).

Though the use of tractors in sub-Saharan Africa indicated a decline in the past compared with other regions, but for post-independence Ghana, tractorisation may have accounted for production increases arising from bringing more land under cultivation (Ashburner and Kienzle, 2009; Nweke, 1978). The premise then, was that efficiency and tractor operations and/or ownership are highly collated, with tractor efficiency increasing as farm size expands to more than 20 hectares (ha) (Nweke, 1978). It has been shown that agricultural mechanisation led to an overall increase in the employment of human labour (Chatizwa and Khumalo, 1996). Mellor (1984) pointed out that the role of modern farm machinery in shortening land preparation time often enabled households to plant a second crop in one year, thus providing employment for labour that would have been redundant for almost the year-round. Carney (1998) asserted that the demand for non-farm labour requirements such as manufacturing, servicing, distribution, repair and maintenance as well as other embedded jobs increased due to mechanisation. Consequently, agricultural mechanisation has had a multiple featured history in the African policy terrain and remains a doubtful input in African agriculture specifically in the smallholder sector (FAO, 2008). The suitable power source for an agricultural operation is therefore determined by physical and economic

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<sup>5</sup> Block cultivation (or farming) schemes are group of farms being managed and operated as a single unit, often with mechanisation and other modern inputs” (Pingali *et al.*, 1987; 83)

conditions faced by farmers instead of the attractive appeal of modern machinery (Pingali et al., 1987). The sections below look at the mechanisation experience of the different regions of the African continent.

### **2.7.1 Mechanisation in East Africa**

Kienzle et al. (2013) noticed that with respect to agro-ecological zones in East Africa, as a physical determinant of mechanisation, Sudan's flat slopes are considered favourable for mechanisation of primary tillage operations; whereas the mountainous terrain of Burundi, Ethiopia, Rwanda and Uganda hinders expansion of mechanised farming. Assured markets have been attributed to the promotion of mechanisation in all the East African countries especially cotton production with draft animal power (DAP) and tractors in Tanzania, Uganda and Ethiopia (Kienzle et al., 2013). Small to medium-scale farmers have restricted access and/or potential to buy new machinery and thus are highly reliant on depreciating second hand equipment bought from large farms (Minister of Agriculture, Animal Industry and Fisheries -MAAIF, 2005).

Previously, numerous endeavours to hasten mechanisation in East Africa, as with the failed "Groundnut Scheme" in Tanzania, has been politically driven, rather than being sound commercial developments (Mkandawire and Bourenane, 1987). According to Mkandawire and Bourenane (1987), Tanzania witnessed a demotivating experience with regard to mechanised farming both before and after independence. Policy-makers did not realise the advantages brought with mechanisation and instead warned against the use of tractors due to foreign exchange constraints (Mkandawire and Bourenane, 1987). Other research conducted in some parts of the country revealed that mechanised farming systems can remarkably increase output per person and per hectare. Maize yields had shown an advantage with man-hour field time decreased by 92 percent (Mkandawire and Bourenane, 1987). However, during the 1990s and onwards, mechanisation faded away from priorities of many government policies in the region due to having suffered financial drains (Kienzle, et al., 2013; Mkandawire and Bourenane, 1997).

### **2.7.2 Mechanisation in West and Central Africa**

In various countries of the West and Central regions of Africa, tractors were introduced as early as 1948 and 1949; examples of which are Ghana and Sierra Leone respectively (Ashburner and Kienzle, 2009). Despite this, tractor usage continued to drop when

compared to other regions (Kienzle et al., 2013). According to Kienzle et al., there is often a lack of accuracy about what is known at government level and what is really happening at ground level- where real operations take place. For example, Fonteh (2010) reported that a census conducted in Ghana in the year 2014 uncovered that there were 1 736 operational units of tractors whereas government records showed there were 4 000 operational units of tractors. This is an indication of disinformation and lack of accountability between the different structures of government engaged in mechanisation.

In many regions the supply of agricultural machinery and equipment has historically relied on imports initially from Europe, then from North America, and recently from China, India and Vietnam (Ashburner and Kienzle, 2009). The West and Central Africa regions are without exception when it comes to importation of tractors (Kienzle et al., 2013). According to Kienzle et al.(2013), political figures have spearheaded the urgent need to overcome food insecurities which as a process thereof involved tractors being imported and/or assembled locally. It transpired that such politically motivated interventions were implemented hastily without proper planning and not supported with other necessary infrastructure, and support services of repairs and maintenance. For example, Mali imported 400 tractors from India in 2006 and, the concerns raised were a lack of spare parts and the availability of after sales services and initially there had also been no associated farm machinery (Ashburner and Kienzle, 2009). According to Kienzle et al., (2013) these interventions should be implemented on the basis of long-term collaborative efforts in order to succeed. Thence this should help to scale up smallholder subsistence to commercial agriculture and bring about food security and a generation of revenue from exports. One good example is that of Ghana when in the period 2004 – 2009 the state had a plan to import 4 000 tractors. From the years 2004-2006, 1000 tractors were imported and the balance of 3000 were imported by the end of 2009 (Kienzle et al., 2013). Kienzle et al. affirmed that this is one typical example in which the tractors were ordered and imported based on a clear plan regarding how they were to be used. Presumably, the success was owed to the support given by the private sector that committed to supply tractors and to provide necessary after sales service with service providers reaching out to smallholder farmers (Kienzle et al., 2013). According to Fonteh (2010) the major constrain of agricultural mechanisation in Mali and Ghana, is the poor access to mechanisation technologies due to their being expensive owing to the limited purchasing power of farmers and their poor access to credits. In addition, the high costs of obtaining tractors and hired-out services in some nations in these two regions compel small

to medium scale farmers to resort to imported second-hand or even old equipment (Kienzle et al., 2013). This case was considered similar to what occurred in the East African region.

### **2.7.3 Mechanisation in North Africa**

The North region of the African continent is characterised by vast land areas of arid and semi-arid terrain and irrigation is often necessary for agriculture (Kienzle et al., 2013). Kienzle et al. added that the majority of the region is affluent in petroleum resources with the oil economy over-shadowing that of the agricultural sector in various countries. The availability of these resources, facilitated the desired investments made in irrigation schemes, in some of the countries. For instance, Egyptian agriculture is almost entirely irrigated (Kienzle et al., 2013). In the region some agricultural areas are considered to be remote. This is where one can find traditional but intensive farming being practiced through manual labour and/or hired work animals, especially for soil preparation (tillage), routine transport activities and for lifting up water from the wells (Kienzle et al., 2013).

Availability of labour, increased levels of research, extension and training coupled with access to resources are significant elements that contributed to the past milestones of remarkable agricultural investments and the improved level of mechanisation found in the region (Kienzle, et al., 2013). Kienzle et al. (2013) went on to say that the regional limiting factor to increased agricultural mechanisation, is small landholdings. Generally speaking, open land of 100 hectares (ha) is obviously less difficult to manage, both in terms of machinery action and handling of materials, as compared to the same land divided up into 10 plots that then add-up to a 100 hectares (ha), with considerable distance in-between (Butterworth, 1984). Butterworth continued to say, that access is of significant importance in every farm area. For example, exactly how easy it is for farmers to get machines such as harvesters, mowers and other wider machineries to reach the action point, is critical to successful outcomes for farming. In addition, built infrastructure such as farm roads and gates may usually dictate the model and amicable width and height of the machine to be used (Butterworth, 1984). In North Africa, another issue of concern is the limited skills of operators and farmers which lead to the poor maintenance and operation of equipment and the adoption of unsuitable cropping practices (Kheyar et al., 2007). As a result, the farmer gets discouraged from investing in more suitable machineries or less keen to request services of a contractor who is an expert and hires out equipment (Kienzle et al., 2013). Hamza, (2005) noted that the after-sales service support infrastructure can be constrained in some

countries due to numerous tractor makes and models on offer. For instance, in 2004, more than 20 tractor brands were identified in Tunisia (UNIDO, 2005).

#### **2.7.4 Mechanisation in Southern Africa**

In most of the Southern African countries animal drawn tools and implements continue to be the main source of mechanised inputs when it comes to small landholdings (Obi and Chisango, 2011; Kienzle et al., 2013). According to Obi and Chisango (2011), in Zimbabwe the third phase of their Land Reform Programme led to the new category of farmers- the A2 farmers. These are small-scale commercial farmers who buy second-hand or pre-owned agricultural equipment often from previous commercial farmers. However, the A2 farmers are often short of the capital necessary to maintain tractors as they frequently break down (Obi and Chisango, 2011). Given the size of cultivated land area, A2 farmers depend on tractor power, but the country's tractor capability is insufficient to render the service to all of them (Kienzle et al., 2013). The average size of new A2 farms is 318 hectares (ha), while that of A1 family farms is 37 hectares (ha), including crop and grazing land (Scoones et al., 2011; 02). According to Kienzle, et al., the failure of the A2 farmers to prepare land on time, due to the shortage of tractors and machinery, has led to declined crop yields and falling agrarian productivity. In areas where late rainfall is received, the plausible farmers' worry to plant as early as possible, during the first rains of the season, is worsened by the lack of equipment. That denotes long waiting period which compels most of these farmers to resort to minimum tillage practices (FAO, 2000).

In Mozambique, according to The World Bank (2012), tractor hire service is in short supply. The World Bank went on to say that some commercial farmers render clientele ploughing services to small-scale farmers but only after they have done ploughing in their own fields. Thence land preparation is often delayed for most of farmers who heavily rely on tractor hire services which in turn distort their timeliness of planting and may consequently, reduce yields (The World Bank, 2012). Starkey et al. (1995) mentioned that the timeliness advantage of using a tractor is largely determined by its availability for the farmer. Starkey et al. added that for those farmers low down on the tractor operator's ploughing list, work animals might offer timely and less risky service. According to The World Bank (2012) certain development programmes in Mozambique such as USAID's AgriFuturo project have been issuing grants to finance selected farmers to purchase their own tractors for their own use and as an incentive to provide tillage services to nearby farmers. Government has

specifically targeted potential tractor hire service providers in its tractor support programmes namely Italian Aid, PAPA, and Zambezi Region Development Authority (GPZ). These private companies provide the required tractor hire service to their respective communities (The World Bank, 2012). Farmers associations and cooperatives also provide tractor hire services. Such farmers have benefited from donor programs or government subsidised programs to acquire agricultural machinery (The World Bank, 2012).

In Swaziland farm mechanisation services are mainly delivered by the government leasing out tractors to farmers at subsidised charges (Kienzle, et al., 2013). Apart from using tractors for land preparation, Swazi farmers have been using draft animals (mainly oxen) for quite a number of years past (Mabuza, et al., 2012). Mabuza et al. went on to say, the Government of Swaziland (GoS) introduced Tractor Hire Services (THS) in 1974 with hire pools in 20 centres nationwide. The aim was to increase the food production level and rural consumption for farmers who could not afford to hire the services offered by the private sector (Mabuza et al., 2012; Kienzle et al., 2013). Irrespective of these endeavours, the unit number of tractors was regarded to be low as farmers complained about delayed soil ploughing and that the tractors are usually not available when required (GoS, 2007). In supporting this view, Kienzle et al., (2013) asserted that most smallholder farmers failed to get the services early enough and resorted to the use of animal power. Consequently, the national government recognised that managing the THS was not economically feasible since its subsidisation could no longer be sustained by the already meagre public funds (Mabuza et al., 2012). Mabuza et al. further asserted that government hire charges<sup>6</sup> in nominal terms had been constant for quite a long period and despite being 48 percent lower than the private sector charges, they were, however, far below the break-even point.

The impotence of government in financing the regular service requirements, procurement of fuel, and permanent employment of tractor operators, has therefore yielded a negative impact on the sustainability of the programme and on food production in the rural areas (GoS, 2005). It is due to this demise, that the National Agricultural Summit held in 2007 proposed the privatization of THS in order to deliver the best and most opportune services to farmers (Mabuza et al., 2012). In order to develop a strategy that combined both tractors

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<sup>6</sup> According to Mabuza *et al.*, (2013) government tractors charge 130 Emalangeni (E) (national currency) per hour compared to the average of E250 charges by private operators.

and draft animals, the programme implementers pointed out factors that motivate a farmers' decision on the use of alternative technologies for land preparation (Mabuza et al., 2012). Mabuza et al. (2012) provided three reasons that influence the farmers' choices between the usage of tractors and animal draft power. These are namely: (i) household income or wealth; (ii) size of land area to be cultivated and (iii) the number of draft animal owned by a particular household. One might possibly add terrain or slope of the land, land accessibility (by road or footpath) and the physical natural appearance of the land surface (and underneath the surface). Thus, an understanding of the economic role of these elements in Swaziland farming context, would therefore help policy makers decide which type of farmers to target either for tractorisation or use of draft animals (Mabuza et al., 2012). According to Kienzle et al. (2013; 34-35), some of the discovered operational dysfunctional elements regarding the THS in the SNL are:

- poor management which jeopardised performance due to lack of supervision;
- highly centralized repairs and maintenance;
- a lack of preventative and routine maintenance systems in place;
- a lack of operators' motivation to perform and upskill themselves since were on full employment; and
- the tractor pools were less monitored and annual targets per tractor were unclear resulting in each pool avoiding the routine tractor management duties.

## **2.8 Discussion Regarding Mechanisation in Africa**

The previous endeavours of many African governments and donors that aimed to fast-track the use of mechanical inputs yielded mixed results (FAO, 2008). This, according to FAO (2008) was largely because Africa rarely put emphasis on investment for other necessary infrastructure like irrigation systems and modern inputs for improved production. This justifies the fact that mechanisation by itself cannot improve crop production because it is merely one of the various inputs needed in the production process. The FAO (2008) also asserted that the main concern owing to the unsatisfactory interventions for mechanisation, was disintegrated approaches. That is an approach where each functional group or stakeholder independently implements their own programme or plan of action, instead of an integrated approach. According to Kienzle et al. (2013) this can be attached to poor planning by government agencies, overreliance on unpredictable or unsuitable once-off aid-in-kind for many mechanisation inputs. Another contributing factor to failure was a lack of proper

coordination by highly-influential role players in the mechanisation- that is private sector and government agents (Kienzle, et al., 2013). In a number of African states, government-managed and operated mechanisation schemes had been unsuccessful and were later abandoned (Kienzle et al., 2013). Kienzle et al., (2013) continued to say although mechanisation is a significant factor in enhancing farm productivity, it has not been backed by other relevant programmes important to developing smallholder farming. The development planners need to understand that there is a continuous shortage of youth and active labourers within rural African agriculture, due to ongoing rural-urban migration by people (Kienzle, et al., 2013).

Looking at the drivers of mechanisation, Pingali, (2007) challenged the assertion by Jaleta et al. (2014). Jaleta et al. mentioned that agricultural mechanisation was driven by the intensification of a crop production system that created bottlenecks in farm power, particularly in land preparation, harvesting and threshing operations. Pingali (2007), stated that youth migration from agriculture to service and manufacturing sectors could also be another driver for mechanisation due to labour scarcity and also the increasing wages in other sectors. The pay rise in other sectors attracts people away from agriculture and so the agricultural sector has to adjust accordingly in order to maintain labour in farm operations. If this trend keeps increasing, there will be a point where mechanisation is more feasible than the use of farm labour (Pingali, 2007). There might be a number of drivers for mechanisation, but in a rural smallholder farming, labour productivity may take priority before intensification of crop production. The underperformance of many programmes meant to improve productivity, has been associated with low levels of mechanisation and a declining labour force (Kienzle et al., 2013). This is evident because the likely justification for improving a farm's degree of mechanisation is to increase labour productivity; that is to enhance a farm's yield per worker, thereby achieving a higher output and/or better income per man per hour of work done (Holtkamp, 1990). According to Holtkamp (1990), this could become a necessity following an increase in land productivity (yield per hectare), an expansion of the farm's hectares (ha), or a decline in the number of available manpower on a farm. Holtkamp went on to say, in order to obtain high output, the farmer substitutes capital in place of scarce and or expensive manual labour. By contrast, biological, chemical and technical advances such as high yielding varieties (HYVs), chemical fertilisers, crop protection chemicals, modified tillage methods and the introduction of irrigation, serve to improve land productivity (yield per hectare) therefore compensate for a shortage of arable

land (Holtkamp, 1990). Many benefits in labour and land productivity have been achieved through such intensification measures (Holtkamp, 1990). At a farm level, anticipated yield increases are rarely stated as a motive for scaling-up mechanisation (Holtkamp, 1990). The obvious reasons often mentioned, are the wish to achieve a lighter workload, mobility and prestige, while demonstrating the farm's economic efficiency (Holtkamp, 1990).

In many African countries, according to the Technical Centre for Agricultural and Rural Co-operation-CTA (1997) the state had a monopoly in the provision of mechanisation inputs and services; that is mechanisation being controlled and/or dominated by a single powerful stakeholder. Tractor schemes were subsidised and generally failed due to low operational profitability and poor management (CTA, 1997). However, according to FAO (2008) some mechanisation schemes have been successful, especially when coupled with irrigation. The example supplied by FAO is that of the Gezira scheme in Sudan dating back to 1924. In this case, steam was the motor power before combustion engines took over a couple of years later. "By the 1970's, in the same country about 100 000 tenant farmers were cropping 760 000 hectares (ha) of land with the assistance of mechanised cultivation services provided by the scheme on contract" (FAO, 2008; 08).

According to Pingali et al., (1987), a tractor hire scheme is likely to be successful if the farming system is of sufficient intensity that warrants ploughing with tractors. According to Pingali et al., the endeavour to introduce tractor services to unsuitable land such as forest and bush fallow, is bound to fail due to a high density of stumps, rocks, which will then lead to high operating and repair costs. Pingali et al. (1987) went on to say the operation to which a tractor is suited, ploughing is time-bound as well as synchronic. This means it needs to be accomplished within a short period and within a particular region at the same time, on all farms. Rental markets, according to Pingali et al. are not usually successful under such circumstances because of the harsh conflict over sequencing by farmers, to be serviced. There seems to be no acceptable managerial solution regarding this problem (Pingali et al., 1987). In addition, Pingali et al. mentions that public hire schemes suffer from a variety of problems related to poor management. Firstly, there is a high amount of non-productive working time spent and fuel consumed due to multi-farm use travel. Secondly, concerning publicly open tractor hire services, usually, the starting of active planting season finds many tractors still dysfunctional or with some defects. Lastly, at high-activity season period when the machines ought to be in an uninterrupted daily action, public hire services are usually

interrupted; usually by a lack of incentives when operators strictly adhere to the official eight-hour day, even if the work demands extra hours. Some farmers, as a result, tend to opt for private rental operators when such are available locally, regardless of the higher unit costs of their services (Pingali et al., 1987).

## **2.9 A Plausible Agricultural Mechanisation Strategy<sup>7</sup> for Developing Countries in Africa (Including South Africa)**

The national governments are the main role players in the public mechanisation programme for smallholder farmers. They hold mandates to develop an appropriate and detailed Agricultural Mechanisation Strategy (AMS). This does not necessarily mean other numerous role players should not be engaged in the development of AMS. The main objective of the strategy is to basically establish government policy, and promote an institutional milieu whereby producers are allowed to decide on equipment and farm power suitable for individually preferred needs with sustainable delivery and support systems (Rijk, 2012). Rijk outlined that AMS encompasses manual, draft animal and machinery power, the utilisation of tools, implements, machinery, their supply and their maintenance. The punctuality of delivery, utilisation and maintenance of such tools, implements and mechanical technology is of vital importance. This is because of the dependence and heavy reliance of agriculture on climatic conditions and seasonal changes. Thus, the strategy according to Rijk (2012) should cover timely importation and domestic manufacturing of sufficient agricultural tools, machinery and associated equipment. This should also cover constant repairs and upkeep, necessary trainings and extension support services for improving the health of draft animals, breeding and feeding programmes. Certainly, the promotion and/or facilitation of financial resources needed to acquire draft animals and machinery is indispensable (Rijk, 2012). In addition, especially in terms of animals, feeding and stress or shock relief support programmes should not be overlooked as they also need to be in place and budgeted for.

The AMS policy also needs to be adjusted according to specific situations should the need arise. There are many other government policies which influence the availability of agricultural mechanisation inputs and determine the effectiveness of this sub-sector (Clarke,

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<sup>7</sup> The content of this heading heavily relies on Rijk (2002)

2000). Such policies, Clarke continues, are those which affect privatization and how the market operates. The government established policies are meant to achieve specific objectives and to put in place strategies that define how policies will be implemented (Rijk, 2012). The concern is whether governmental policy objectives are in line with the expectations and needs of the beneficiaries and those affected.

According to Rijk (2012), the emphasis is placed on market freedom and recognition that the private sector is the crucial sector when it comes to successful economic development. Thence AMS formulation stresses the creation of the most conducive conditions to the effective and the efficient adoption of appropriate farm tools, implements and machinery (Rijk, 2012). The term “appropriate” in this regard is of paramount importance. This is because improved farm tools, implements and machinery have been around for decades if not centuries but they failed on their own, to increase agricultural productivity and change the lives of the rural poor for the better. African governments have encouraged farmers to utilise agricultural machinery technology through many development programmes and incentive measures (FAO, 2011). However, according to FAO (2011) the positive effect of agricultural machinery on farming is still less than what was expected. This means that a high number of people living below the poverty line continues to persist indefinitely, if not escalating, regardless of many agricultural development initiatives. The persistent food insecurity among many African countries remains a challenge that emanates from food shortages and famine (Kimenyi, 2013). In general, it can be observed that governments and donors have adopted a relatively slow approach to encourage mechanisation without properly reviewing the entire agricultural engineering sector (FAO, 2011). Thus the transfer and adoption processes should be reviewed and strategised according to area specific needs and circumstances. In a dynamic environment, conditions change over time and therefore an AMS will need to be regularly defined, revised and adjusted and should be dynamic and flexible (Rijk, 2012). The recommendations towards AMS which emanated from a round table meeting in 2011 by the FAO (2011) and other representatives from various African countries are as follows:

- the establishment of a National Committee on Agricultural Mechanisation (NCAM);
- the creation of an enabling environment to increase the utilisation of tractors and other farm equipment;
- an increasing investment in agricultural mechanisation by both private and public sectors;

- the building capacity for the beneficiaries and role players;
- the development of an agreement on a code of practice for agricultural machinery suppliers, and;
- the creation of a regional agricultural mechanisation networks in Africa.





The formulation of an AMS requires comprehensive knowledge of many aspects of agriculture in its broadest sense (Rijk, 2012; Clarke, 2000). An AMS according to Rijk (2012) will depend a lot on a particular country's economic attributes, its degree of development and the type of agricultural sector it has. Table 2.3 below shows a typical mechanisation strategy that might be adopted and adjusted by developing countries in the African continent. Rural development programmes must consider the future needs of agricultural mechanisation. For example, the design of irrigation and drainage systems and the field size and layout must take into account the access by different machines. In addition, the layout of supportive infrastructure must take into account the access of machines to fields; for instance the width and strength of bridges must be amenable to the movement of agricultural machines and implements (Rijk, 2012). These examples explain why a holistic approach and multidisciplinary input in strategy formulation is necessary (Rijk, 2012). As far as “sustainable development” is concerned, the strategy must also consider sustainability of land and environment.

The strategy should further embrace a gradual scaling-up of farmers using different sets of equipment under different projects and/or programmes. Tools such as the jab planter, animal-drawn planters, wheel hoes and many others, are ideal for smallholder farming in a remote village depending on the land size. Table 2.4 below highlights the anticipated scaling-up process that can be attributed to an individual farmer's potential and the resources at hand. The emphasis is on engaging the end-user throughout the development, adoption and utilisation of equipment and to let the farmers decide what best serves their purposes.

Table 2.3: Typical Agricultural Mechanisation Strategy (after Rijk, 2012).

<b>Modes of Mechanisation</b>	<b>Timeous support and services</b>
manual, draft animal	<ul style="list-style-type: none"> <li>• Improvement of draft animal health services, breeding and feeding support programmes</li> <li>• Material and design transfer (prototypes of, e.g. wheel hoes, 2 wheel walk-type tractor, animal drawn technology) followed by compatibility checks to local conditions</li> <li>• Enhancement, promotion and/or facilitation of financial systems for the purchase of draft animals and equipment</li> </ul>
Machinery, implements, tools	<ul style="list-style-type: none"> <li>• Material and design transfer (e.g. small 4wheel tractor) followed by compatibility checks to local conditions.</li> <li>• Domestic manufacturing</li> <li>• Importation of balance needed</li> <li>• Regular maintenance established</li> </ul>

Table 2.4: Power options for small-scale farmers

Power type	Typical land size (ha)	Typical personal capabilities/skills	Typical example one	Typical example two
Improved hand-tools (e.g. wheel hoe)	>0.5	Basic knowledge to maintain/operate metal tools	 <p>Wheeled-ripper (source: <a href="http://whizbanggardening.blogspot.co.za/">http://whizbanggardening.blogspot.co.za/</a> )</p>	 <p>Wheel-hoe with different fittings (source: <a href="http://whizbanggardening.blogspot.co.za/">http://whizbanggardening.blogspot.co.za/</a> )</p>
Improved draft power	0.5-1	Able to harness and care for animals, calibration knowledge and ability to fix the equipment	 <p>Draft-power planter (source: sanat.org.za)</p>	 <p>Draft-power boom sprayer (source: sanat.org.za)</p>

Smaller tractor models	1-2	Have some basic mechanical and calibration knowledge, and ability to fix the equipment	 <p>Small tractor model (source: Researcher's observation, 2015)</p>	 <p>Small tractor model (source: Researcher's observation, 2015)</p>
Medium(normal) tractor models	2-5	Have some strong mechanical and calibration knowledge, and ability to fix the equipment	 <p>Medium tractor model mounted with a planter (source: sanat.org.za)</p>	 <p>Medium tractor model mounted with a planter (source: sanat.org.za)</p>
Larger tractor models	5<	Have sound mechanical knowledge, calibration knowledge and ability to fix the equipment	 <p>Large tractor model mounted with reversible mouldboard plough (source: <a href="http://agrireview.com/tag/plough/">http://agrireview.com/tag/plough/.</a>)</p>	 <p>Large tractor model mounted with lime-spreader (source: <a href="http://agrireview.com/tag/plough">http://agrireview.com/tag/plough</a>)</p>

## **2.10 Tractor versus Animal Draft Power in South Africa**

Animal traction in South Africa was utilised by native people ages before the arrival of Europeans in 1652 (Simalenga and Joubert, 1997). Ever since, it has had a crucial contribution towards growth and development of agriculture in the country. According to Fowler (1999), the indigenous people of the country used oxen for back-packing, riding and war until the early European settlers introduced (in the mid-1600s) other activities. Oxen, horses and later donkeys or mules were then used to pull transport carts and wagons and ploughs for cultivating fields (Fowler, 1999; Simalenga and Joubert, 1997). In the cities mules and horses were used to pull carts whereas oxen were used to pull heavy laden wagons (Simalenga and Joubert, 1997). During the 20<sup>th</sup> century, farmers began to depend more on fossil fuels for large-scale farming, mining and transportation power (Simalenga and Joubert, 1997; Fowler, 1997). Early in the century, steam engines were the preferred source of draft power over animal power (Fowler, 1999).

According to Simalenga and Joubert (1997), from 1960 to 1980 the utilisation of animal traction dropped among commercial farmers and was replaced almost altogether by tractor-powered mechanisation. For smallholder farmers and rural communities, however, animal power continued to be a valued source of livelihood irrespective of the introduction of government subsidised tractor schemes. Fowler (1999) asserted that early in the 1950s when South African government officials and farmers turned to tractorisation which came to dominate the country, the introduction and development of animal power equipment literally stopped. Thus, animal draft was nearly dumped and denigrated altogether by officials and educators, especially with increased government pressure to destock communal areas. This was a mandate to cull old and unproductive animals (such as oxen and donkeys) and to buy up old tractors and to use subsidised fleets. Consequently, the use of animal draft power among smallholder farmers gradually declined, Fowler elucidated. This, according to Fowler, was worsened by resettlement policies and the drought that struck the country during those years. According to Simalenga and Joubert (1997; 02) a particular survey indicated that “at least 400 000 smallholder farmers still utilised animal traction.” Given the modern technological advances and attractiveness of tractors in agriculture, after almost 20 years this figure might have dropped even further. However, due to increases in oil prices, the weak rand and failure of tractor schemes, animal traction has started to be reconsidered as a complement to tractor power (Simalenga and Joubert, 1997). Historically, oxen were the major work animals and they continued to be popular in various parts of the country notably

in KwaZulu-Natal, Transkei, Ciskei and KwaNgwanase (Starkey et al, 1995). However, Starkey went on to say that due to the drought, inadequate grazing land and pasture degradation in many smallholder farmers' areas, the trend shifted to the increasing use of donkeys, particularly in the Northern Province. There is, therefore, a necessity for state intervention in terms of a clearly defined policy about animal traction as well as training, research, development and extension in animal traction (Starkey et al, 1995). According to Simalenga and Joubert, (1997) animal draft power technology is a suitable, cost effective and a sustainable option that continues to be utilised in some parts of Southern Africa. Simalenga and Joubert (1997) mentioned that animal traction has many benefits as compared to tractor usage. Among others are: it is affordable and sustainable since it is always available and timely; it improves soil fertility by providing manure from draft animals; and it provides a friendly power for cultivation and transportation, since the animals can be also be handled by both women and children.

The effectiveness of tractors to shorten ploughing time on large areas cannot be underestimated (Starkey et al., 1995). However, tractors are expensive and economically recommended for use only on large farms with high net incomes. Starkey et al. added that most farms on which tractors are economically viable, are more than 100 hectares (ha) in size, though it depends a lot on production levels. By contrast, most farmland areas of smallholder farmers are less than 10 hectares (ha) and a lot are less than two hectares (ha). This is far below the size at which tractor ownership can be economically justified (Starkey et al., 1995). Despite their lack of economic viability on small farms, tractors appear to be popular and are associated with having a high status in the community (Starkey et al., 1995). In addition, Starkey et al. (1995) unveiled another factor that has masked the uneconomic nature of using tractors in many smallholder farming systems in the country. This is the system of migratory labour which enables wage-earners to send money to pay for tractor services that could not be possible from farm income. Notably, bankruptcies among tractor owners have remained low since commercial credits are unobtainable due to the lack of ownership of land and/or both land and tractor, Starkey added. Thus, unprofitable investments have been achieved through savings or 'soft' public sector loans, and have not therefore been publicly destructive.

A number of privately owned tractors in the smallholder farming have been bought as second-hands and with non-agricultural income, mostly from failed public tractor schemes or formerly subsidised large scale farmers (Starkey et al., 1995). Starkey et al, added that,

the privately owned tractors tend to be unsustainable and capital depleting, even when hired-out. According to Starkey et al. the areas where some success with private tractor hire was achieved, appears to have specific economic exceptions. These included profitable cropping systems with good rainfall and/or irrigation of fertile soil, large individual farm areas (e.g. sugarcane farms) or land that is consolidated (or not badly fragmented) and with nearby infrastructural support (Starkey et al., 1995). Such circumstances are uncommon and a rare sight in many smallholder farming systems. According to Starkey et al., subsidised tractor schemes are fading away from the political agenda and some lessons need to be learnt. Funded tractor schemes compete against non-funded animal draft power and this automatically marginalises households or farmers that still rely on animal power to work their land. Secondly, smallholder farmers are indirectly discouraged from using draft animals and subsidised tractors services fail, as is usually the case. It is not easy to re-establish animal traction power. This is not merely because of the skills that vanished during years of animal redundancy and often dwindling animal numbers, but farmers also resent the move 'backwards' from tractors to animals. In addition, harnessing equipment might have long been forgotten and/or not in a usable condition. In some cases, farmers reported that when tractor services fail, fields remain fallow for a long time, and historically, animal traction was seen as the only viable option (Starkey et al., 1995).

Starkey et al. (1995) made it clear that tractors are inefficient for small-scale farming systems where small and scattered pieces of land have to be cultivated in remote areas. This leads to an unreasonable amount of tractor time being spent on travelling, turning and awaiting inputs. The high costs associated with such operational "inefficiency" cannot be justified by the resulting yields, especially in risk prone areas. According to Starkey et al. (1995), the poor intrinsic profitability of smallholder tractorisation is reflected by the unavailability of successful tractor entrepreneurs operating in the remote rural sectors. This is in sheer contrast to the entrepreneurial success in South Africa of privately-owned taxis, road transport, retailing and so forth. Fleets of hire tractors have not been established in any of the smallholder areas in South Africa, whereas taxi, bus, bakkie and truck fleets have. The question is what are the underlying reasons for such trends with regard to tractorisation in the rural settings of South Africa? The answer lies chiefly in good economic returns which means that tractor hire service have little or no economic viability given their low economic returns.

Certainly, tractors allow large areas to be cultivated, which is a great advantage mainly to those with large tracts of land and to whom availability is not an issue. According to Starkey et al. (1995), there seem to be no conclusive advantage or disadvantage for using tractors and animals in relation to yields. Much is determined by soils, rainfall, spacing, timing and other operations, Starkey added. Importantly, especially from an environmentalist point of view, tractors are more likely to have more detrimental ecological effects, than draft animals (Starkey et al., 1995). Starkey et al., added that:

“For every R100 spent on tractor hire, most is exported from the rural areas. For every R100 spent on the hire of draft animals, most remains within the community” (1995:26).

Starkey et al., (1995:26) concluded by saying that in South Africa the second-hand supply from government is less likely to continue. Most of these schemes are being, or have been phased-out or have disappeared. Thus government tractors are rarely likely to be available in the near future and draft animals may continue to have a crucial role to play. Another conclusion reached, was that tractors do not eliminate the utilisation of draft-animals for some operations such as seeding, weeding and transport. Certainly, if farmers tend to abandon animal traction altogether due to tractor ploughing services, many farming families may lose an important livelihood. Lastly, in many parts of the country, a number of farmers regard tractors and animal power to be complementary with the need varying according to the kind of activity needed to be done (Starkey et al., 1995: 26). The following section covers the recent initiative by the South African democratic government to mechanise smallholder farmers in the country.

### **2.11 Previous Mechanisation Attempt for Smallholder Farmers in South Africa**

According to Oettle et al. (1998) during apartheid era there were seldom any signs of even the vaguest endeavour by governing authorities to encourage the development of African tribes into self-sufficient communities. According to Molapo (1983), the majority of farmers who made enough fortunes from other sectors such as mining and industries self-mechanised their farming by acquiring tractors, irrigation sets and ploughs to replace manual tools. Molapo added that, at first the self-mechanisation strategy appeared productive and time saving. However, over time, the substantial financing requirements for mechanisation

pushed a number of farmers out of farming. As many moved out of farming, they joined the ranks of the working class in the cities (Molapo, 1983).

According to Hittersay (2013), the eagerness of the apartheid government to show the world community that South Africa's separate development is feasible, drove it towards the creation of the homelands departments of agriculture and numerous farming projects. The Transkei (which today forms part of the Eastern Cape Province) for instance, received 1 100 tractors and implements directly from an Austrian manufacturer. Meanwhile, in Bizana and Butterworth 300 UK and Italian tractors and maintenance workshops were made available by the then relevant department for the government that rendered free primary tillage services to indigenous farmers. Such interventions failed to yield positive results due to a number of reasons (Hittersay, 2013). Among the many reasons, Hittersay (2013) revealed the following: (i) tribal leaders intervened and distorted the service provision activities through unequal treatment and allocation of tractors, (ii) poor management and the exclusion of remote beneficiaries; (iii) tractor operators were denied working beyond an eight-hour day, though the work demanded this and they were usually absent after receiving their month-end payments and sometimes they rendered services to benefit themselves because of no supervision; and (iv) extension officers had no experience to set or calibrate farm machinery.

According to Oettle et al. (1998), a shortage of mechanical skills and finances among rural farmers led to a decline in the units of fully operational tractors and this has contributed to the farmers' reluctance to pay market prices for ploughing services. Furthermore, rural farmers today grapple with pre-owned tractor market whereas smaller models are considered not only rare but also expensive (Oettle et al., 1998). Oettle, et al., continued to say some large-scale farmers have drifted towards minimum and/or zero tillage practices to cut on tillage costs, mitigate damage of soil structure, and to retain soil moisture. Such practices are considered to be rare among smallholder farmers (Oettle et al., 1998). Animal traction continues to offer affordable and sustainable option for many smallholder farmers (Oettle et al., 1998; Starkey et al., 1995). According to Starkey et al. (1995), many farmers often perceive animal draft power as outdated and the majority are keen to own a tractor. The only farmers who are vigilant are those who inherently suffered capital depletion due to buying a tractor, (Starkey et al, 1995). As much as tractors are increasingly being used, it is inevitable to also talk about draft-power animals since the two usually complement one another in rural farming systems (Starkey et al., 1995).

## **2.12 Democratic Government and Mechanisation Programme in South Africa**

The South African democratic government recently embarked on the mechanisation programme aimed at stimulating and enhancing production by smallholder farmers with a special focus on rural areas and the former homelands (DAFF, 2011/12 yearbook). According to Hittersay (2013) the then Minister publicly announced that R50 million per province will be spent on the mechanisation programme of small-scale and emerging farmers across the country. Since then, a large number of tractor units and implements were distributed to provinces, however the success of such initiatives is hard to establish, Hittersay stated. Following an unsatisfactory maintenance and performance of the programme, Hittersay (2013) and Erasmus (2013) revealed that the department had no set policy on how tractors would be managed. The following was said:

“The tools for measuring the sustainability of the programme were inadequate and that the systems for verifying claimed figures of units distributed needed to be strengthened” (Hittersay, 2013:27).

Hittersay also mentioned that the programme mirrored that of previous mechanisation programmes in South Africa and the continent at large.

According to Erasmus citing one committee member who said:

“the mechanisation programme is being implemented haphazardly, with some provinces drafting their own policies and others having no policy at all.” (2013:17)

DAFF only had a draft policy in place for its mechanisation programme. Erasmus went on to say the draft policy did not prescribe exactly how the provinces should support poor communities, but left the distribution and allocation of tractors and other equipment to the discretion of the provinces. The DAFF committee members were shocked to hear that in some provinces tractors were standing idle, gathering dust and rust, due to various problems such as non-registration, while others were used for the benefit of individuals instead of the whole communities (Joubert, 2012). According to Joubert, (2012), irregular expenditure at the KwaZulu-Natal (KZN) Department of Agriculture and Rural Development (DARD) were revealed, with dumped, unused agricultural equipment and inputs worth over R5 million discovered at one of the department’s local office. The KZN DARD spokesperson cited by Joubert, uttered that:

“we suspect it’s the tip of an iceberg, as there are over 70 extension offices around the province.”

Joubert (2012) added that:

“the department received other reports of rotting and decaying equipment in some of the local offices.”

One scenario was also pointed out by Hittersay with reference to farmers in Bushbuckridge, in Mpumalanga province. Where, in February 2011 the beneficiaries of the Masibuyel’ eMasimini (let us go back to the fields) project complained that the tractor drivers were demanding bribes of up to R200 to plough the fields of non-beneficiary smallholders, while the intended beneficiaries waited for up to two months to have their fields ploughed. Months down the line, many issues were reported, among others were: lack of a service provider to ensure the availability of tractors to farmers; less than 10 percent of the planned 80 000 hectares (ha) was ploughed; fallow land ploughed regardless of ownership merely to try and meet the target; and a lack of mentorship for farmers thus farmers were found to be growing inappropriate crops. In some cases, provincial departments of agriculture entrusted the municipalities with roll-out tasks for their own mechanisation programmes. This seemingly has led to redundant tractors left in warehouses and/or office yards being stripped for spare parts (Hittersay, 2013). The Kwanalu President Brian Aitken cited by Erasmus (2012) said:

“we are horrified at this waste of money. The mechanisation programme is an embarrassment.”

Aitken concluded by saying:

it was not unexpected when one considers the lack of skills, capacity and credibility in the department. If the department wanted to sort out agriculture, it had to include commercial farmers on the ground.

According to Erasmus (2012) DAFF would have been well advised to establish why previous free-of-charge mechanisation programmes for smallholders have failed in this country and all over Africa. Certainly, one reason could be that “something for nothing is worth nothing,” Erasmus added. The recipient does not own the item or service, so cannot question the quality of services rendered, such as the minimum depth or quality of ploughing, or whether the machinery is being looked after properly. The reality according to Erasmus, is that a smallholder under tribal authority cannot operate a tractor and implements economically, without providing mechanisation contracting services to others. Erasmus (2013:27) continued to say, there are constraints to providing these contracting

services which include the following: (i) free or heavily subsidised government mechanisation services imposes unfair competition; (ii) extended travel distances on poor roads to provide the service; (iii) long drives to fill-up fuel or service the tractor; (iv) working with small, irregular-shaped plots which may be next to hazards such as dongas; (v) mismatching tractors and implements; (vi) the need to frequently change, load and offload implements required to accomplish different tasks; (vii) deterioration of a tractor and implements owing to poor planning and no consideration given to keeping records of services, diesel and oil consumption and parts replaced. The government tractor units also suffered from many of the above constraints.

### **2.13 Summary**

In many African countries (SA included) government's tractor-hire schemes or free of charge tractor services usually cannot be sustained by the public funds available thus they disappear from the political agenda. The common trend is that smallholder farmers purchase second-hand old tractors and machinery from commercial farmers. Those who cannot afford to do so rely on government's free services and/or muscle power using animals and humans to work their land. The lack of financial resources to buy new machineries or to maintain the existing ones, is prevalent among smallholder farmers. When government tractor services fail, the option is to revert to hand tools and/or animal draft power which is still widely used in many developing countries. Encouragement of innovation among smallholder farmers based on what they have, instead of what they lack, might help reduce dependence on government services. The top-down approach to technology transfer continues to put small-scale farmers in a disadvantaged position of being passive and dependent. An improved smallholder farming system can be achieved, if farmers are proactive in developing their own technologies suited for their own needs and use. As a result, a bottom-up approach is urgently needed. It should not be ignored that varied power options complement each other in a smallholder farming system, with each choice dependent on availability, accessibility and economic utilisation.

The role of extension to successful mechanisation interventions toward smallholder farmers, is not yet appreciated. This is based on the conviction that many extension personnel lack the appropriate agricultural mechanisation skills and the know-how information needed, to mechanise farms. It is not uncommon, that the expertise needed at ground level where real field operations take place, is distant from the farmers. Continuous human (farmers)

development is indispensable, thus bringing such skills and expertise closer to the farmers, is a pre-requisite for the successful mechanisation. Modern agricultural inputs (tractors, implements and machineries included) are continuously improved to suite changing conditions over time, therefore farmers need a much closer contact with the feeders of the updated information. The greatest concern facing extension, is clarity as to whether to develop people through agriculture, or to develop agriculture through people. Perhaps a satisfactory conviction lies in the fact that extension is educational in nature and only 'the people' can learn to practice developed agriculture. This says it is better to develop people (in an educational rather than material sense where material sense could be the manifestation of human development) through agriculture. Otherwise resource poor farmers are more likely to perform inappropriate agricultural practices degrading the environment at the expense of future generations.

## **CHAPTER THREE: RESEARCH SETTING**

### **3.1 Introduction**

An overview of the South African Agricultural sector regarding exclusion of rural areas and small-scale farmers and the political agenda to rectify this has, already been provided in the literature review. Since the focus of this inquiry is to probe the experiences of farmers with the public mechanisation programme, it is therefore important to understand the research areas where beneficiaries reside. The generic treatment of the nature of smallholders' farming potential and consideration that they all operate under common conditions (in terms of institutional and infrastructural support, market access, input or service supplies) could be misleading. Understanding the nature of smallholder farming (or farming activities) for the respondents is important to get a deeper insight into the existing circumstances under which the programme was implemented. How those existing circumstances might have had an impact on the failure or success of the programme, is also important to understand. This chapter, therefore focuses on such varied living conditions where the respondents are smallholder farmers, who mostly rely on public goods and services to operate their farming practices.

### **3.2 Research Setting: The State of Agricultural Sector in South Africa**

The two villages where the study was conducted are located in the Province of KwaZulu-Natal in the Republic of South Africa. The total land area in South Africa consists of 122.3 million hectares (ha) with 2.76 million hectares (ha) being cultivated land of which the majority is used for commercial purposes (Nieuwoudt and Groenewald, 2003; AgriSETA, 2010). AgriSETA (2010) noted a decline in the number of commercial farming enterprises in many provinces countrywide and KwaZulu-Natal was no exception. The country has a formalised sector, historically dominated by white commercial farmers occupying the majority of agricultural land and a number of alienated smallholder farmers (see definition in chapter one) sharing the remainder of the land (AgriSETA, 2010). AgriSETA went on to say, the latter belongs to the informal sector and has been targeted for development initiatives utilising mechanisation as a means to promote high production output and food security. In the years since the advent of democracy, the sector has undergone many changes including the entrance of black commercial farmers and the advent of emerging farmers (Nieuwoudt and Groenewald, 2003). The emerging farmers according to AgriSETA (2010) consist of three categories. Firstly, there are those struggling to shift from subsistence to

commercial farming operations. Secondly there are those who benefited from government's land reform programme and have aspired to grow a commercial enterprise on the allocated land. Thirdly, are those who took advantage of Black Economic Empowerment (BEE, now called BBBEE- Broad-Based Black Economic Empowerment) funding to acquire a portion in a farm in order to make a profit. This category of emerging farmers is neither established commercial farming nor subsistence in essence, but it is among government's focal points of development (AgriSETA, 2010).

The commercial agricultural sector in the country is subdivided into field cropping (field crops such as maize, sugar and beans), horticulture (fruit and vegetable crops), livestock production (dairy, beef, pig and poultry), mixed farming and forestry (Kienzle et al., 2013). Kienzle et al. added that agriculture's contribution to the GDP as in 2005–2007 was three percent dropping from 9.1 percent in 1965. Recent statistics revealed that the agriculture industry continued to have a disappointing negative economic growth, posting its sixth consecutive quarter of economic decline (STATSSA, 2016). During November 2015, amid unprecedented stressful drought conditions in South Africa, in 23 years, STATSSA published disappointing figures that showed a decline in gross domestic product (GDP) regarding agricultural activity. The real value of the agriculture industry has fallen from R77,8 billion in the fourth quarter of 2014 to R66,7 billion in the second quarter of 2016 (STATSSA, 2016). The ownership of agricultural equipment (tractors included) is still dominated by white commercial farmers who have a potential to import high-technology units (Simalenga, 2003; Kienzle et al., 2013). Tractorisation by many smallholder farmers continues to be unaffordable and uneconomical with the main fallback option being animal draft power, which is environmentally friendly and appropriate, given their farming systems and holdings (Simalenga et al., 2000).

Previously, the government attempted to encourage the utilisation of mechanical power for agricultural production and transportation, this did not yield positive sustainable results (Dibbits and Wanders, 1998). Today there are a number of national government departments and spheres engaged in the challenges of the agricultural sector in the country (AgriSETA, 2010). Among many is the National Department of Agriculture (DAFF) which is responsible for agricultural policy and support; the Department of Rural Development and Land Reform responsible for Land Reform and land claims settlements; the Department of Economic Development responsible for economic planning; the National Treasury Department responsible for macro-economic policy; the Department of Trade and Industry

responsible for industrial strategy (The 2010/2011 – 2012/2013 Industrial Policy Action Plan (IPAP)); the Department of Water Affairs responsible for the management of water supply; the Department of Labour responsible for Labour market policy; the Department of Higher Education and Training responsible for Human Resource Development and skills planning and SETAs (Skills Education Training Authorities); the Agricultural Research Council (ARC) which is an autonomous statutory body that provides research to DAFF and the provincial departments of agriculture. There are also a number of Non-Governmental Organisations (NGOs) concerned with Agricultural and Rural Development in the country (AgriSETA, 2010). The next two sections take a close look at the two rural villages in the country that were used as the research areas.

### **3.3 Nkandla Local Municipality Area (KZN286<sup>8</sup>)**

The Nkandla Local Municipal Area is one of the six local municipalities under uThungulu (recently renamed King Cetshwayo) District Municipality<sup>9</sup> in the KwaZulu-Natal Province (Urban-Econ, 2012). Much of the district is characterised by rural land areas and Nkandla is no exception. Out of the total uThungulu district area of 8 215 square kilometres, the majority (64%) is tribally owned and is therefore under communal, rather than private ownership (uThungulu Municipality, 2011). The map (Figure 3.1, Appendix 3.1A) shows part of the KwaZulu-Natal province and the area boundary and its proximity to the neighbouring towns that residents also use for shopping purposes and to also access public services. Some of the neighbouring towns such as Eshowe, Empangeni, Richards bay and Melmoth belong under the same district municipality with Nkandla whereas others, such as Nqutu, Msinga, Dundee and Ulundi belong to different districts. The area is linked to the nearest towns namely Eshowe, Empangeni, Richard bay, Ulundi, Nqutu and Melmoth, through tarred roads.

#### **3.3.1 Demographics and economy of Nkandla Local Municipality**

Nkandla is among the poorest of local municipalities under uThungulu district (Nkandla Local Municipality Integrated Development Plan (IDP), 2015/16). A large percentage

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<sup>8</sup> Municipal Demarcation Board Code

<sup>9</sup> UThungulu is one of eleven District Municipalities in KZN which comprises of Umhlathuze, uMlalazi, Mfolozi formerly Mbonambi, Ntambanana, Mthonjaneni and Nkandla local Municipalities (Urban-Econ, 2012).

(93%) of the population stays in Tribal Authority areas (Nkandla Local Municipality, 2015). The overall population of the area, according to STATSSA (2011) was 114 416 with a population density of 62.61 per square kilometre (km<sup>2</sup>). According to STATSSA (2011) the number of households as of 2011 census was 22 463 with a household density of 12.29 per square kilometre (km<sup>2</sup>). The average estimated household size was 4.9 (or 5) members with more than half (63.1 %) of the total households being female-headed and 1% child headed. Gender distribution, as of 2011 census, consisted of 63 770 females (55.74%) and 60 647 males (44.27%) with the dominant population group being Black Africans (99.57%) and other groups such as Whites, Coloureds, Asians (and other) sharing the remaining percentage (STATSSA, 2011).

The age groupings consisted of 40.3% young (0–14 years old), 53.6 % of working age (15–64 years old) and 6.1 % elderly (65 years old and above) (STATSSA, 2011). According to the Status Quo Report (Nkandla Local Municipality, 2011) and the Nkandla website, the area is characterised by a high level of unemployment and a low level of development. The unemployment rate in the area during 2011 was sitting at 43.9% with the youth taking a large share of the percentage (STATSSA, 2011). The schooling of the population aged 20 and above, varied markedly. Those with no formal schooling were estimated to form 29.1% of the population; those with matric formed 21.2% of the population and those with higher education made up about 4.8% of the population (STATSSA, 2011). The Nkandla municipal area consists of 14 wards with ward five (5) forming the urban node that offers economic activities and government services (Nkandla Local Municipality, 2015/16). The main economic activities in the region are retail, subsistence agriculture and/or semi-commercial (or informal) agricultural trading, including livestock trading (Nkandla Local Municipality, 2015/16). The number of agricultural households by 2011 was considered to be 13 343 (STATSSA, 2011). A large proportion of the local population rely chiefly on government social grants and migrant remittances to survive, with a significant population percentage having no income (Nkandla Local Municipality, 2015/16; STATSSA, 2011). The formal agricultural economic activities (which exclude smallholder farmers concerned) are based on state owned timber production estates, privately owned estates producing tea<sup>10</sup> and

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<sup>10</sup>Ntingwe Tea was initiated in 1990 by Ithala Bank. The estate has the capacity to employ 1 200 full time workers and additional seasonal pickers. The tea is also sold as a specialty tea in the United Kingdom and the United States (source:<http://nqolobanetech.co.za/nkandla/index.php/natural-sites/ntingwe-tea-estate>)

herbs for making essential oils.<sup>11</sup>Nkandla town is the only urban centre available within the local municipality dominated by rural land use (Nkandla Local Municipality, 2011; Nkandla Municipal website; STATSSA, 2011).

### **3.3.2 Infrastructure**

Nkandla is a remote area distant from major economic corridors of the province and economic development hubs of the country (Nkandla Local Municipality, 2015/16). The area is located about 35 kilometres (km) north-west of Eshowe and 75 km south-west of Ulundi and covers about 1 827.58 square kilometres (km<sup>2</sup>) of land (Nkandla Municipal Website; STATSSA, 2011). It is characterised by poor roads condition with only tarred access roads (R34, P226, P50/2, P50/3 and P15) from Melmoth, Eshowe, Kranskop and Nquthu (Zitholele Consulting, 2007; Nkandla Local Municipality, 2015/16). These tarred roads stretch far beyond the local town and are under the jurisdiction of the KZN Department of Transport. The area has no national routes and/or major provincial routes passing through the municipal boundary (Nkandla Local Municipality, 2015/16). The tarred roads inside the local town and gravel ones leading to residential areas are under the Municipality's control and responsibility but their maintenance is unsatisfactory since the area has a huge backlog in this regard (Zitholele Consulting, 2007). Figure 3.1 shows the local CDB and nature of the roads within the municipal area. All of the observed bridge-crossings found in the area are single-lane (see Figure 3.2). The other observed roads infrastructural conditions were gravel roads of inconsistent widths and surface appearances and the bridges had a narrow width (see Figure 3.3). Such road conditions may impinge the movement and the ability to cross over of tractors mounted with wide agricultural equipment designed for field use. According to Zitholele Consulting (2007), telecommunication and electrification is still lagging behind with disparities between deep rural parts and those closer to the town, the latter being superior. The backlogs in some areas have been attributed to crime where solar panels were stolen, and as a result of this Telkom blacklisted those areas. This has resulted in a limited signal despite many people owning cell phones. Information services are important including telephones and post offices- however there is inequality of access to operational ones, since many were vandalised, possibly by residents.

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<sup>11</sup>The project formed a trust called Ikusasaletu which took over the management with the help of a private mentor (Nkandla Municipal website)



*Figure 3.1: Nkandla local town and its surroundings (source: Google Earth)*



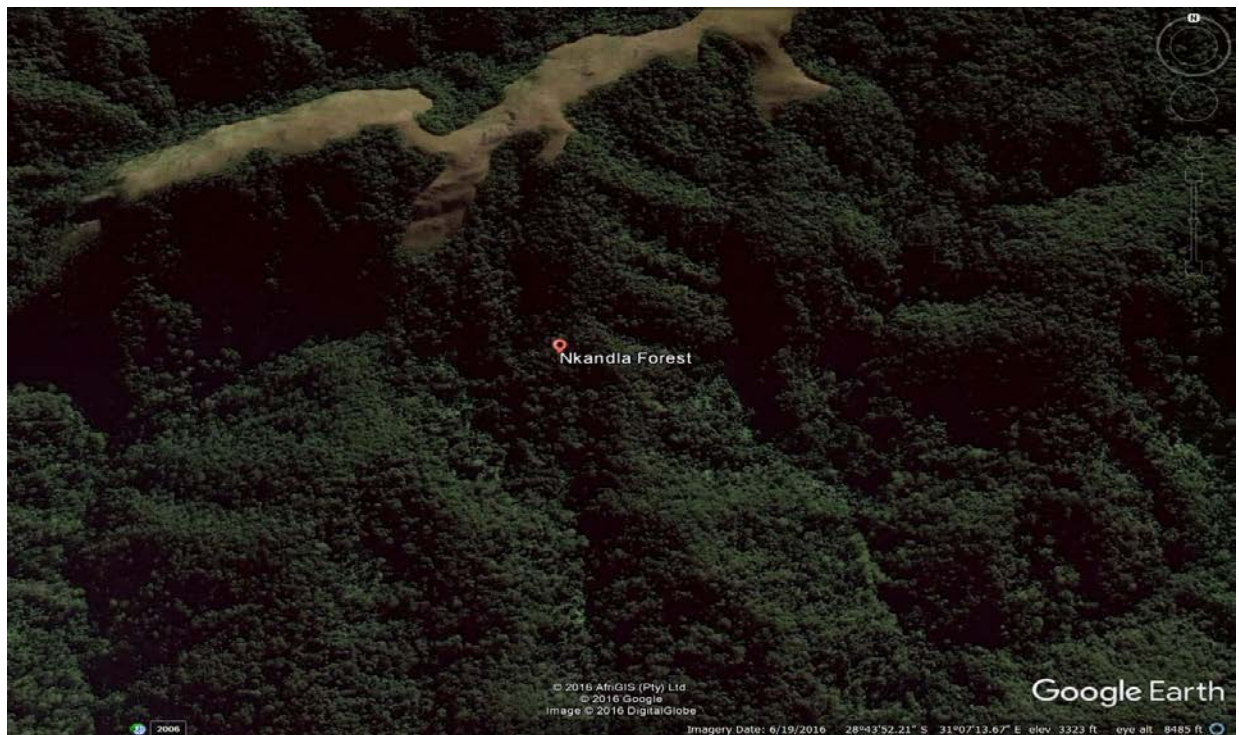
*Figure 3.2: The single lane Bridge in the upper Mhlathuze River connecting the area to one of the nearest towns (source: Google Earth).*



*Figure 3.3: The tarred road (back and forth town) cut-off point (shown by an arrow) merges with gravel road junction and these roads extend far beyond this point (source: Google Earth).*

### 3.3.3 Natural environment

Nkandla is an area of breath-taking mountainous views (Urban-Econ, 2012). The area has a wealth of undisturbed natural forests (refer to Figure 3.4 below) that boast many indigenous plants and animals. The forest is under the supervision of Ezemvelo KZN Wildlife (Zululand Regional Office based in Eshowe) (Inqolobanetech, 2016). With reference to Bio-resource Groups (BRGs)<sup>12</sup>the Nkandla area falls under BRG3: Moist Coast Hinterland Ngongoni Veld (Camp, 1997). The usable Bio-resource Unit (BRU)<sup>13</sup> area (ha) in Nkandla is about 78 210 hectares (ha) (Status Quo Final Report, 2011). BRG 3 according to Camp (1997) and is fragmented by many rivers and valleys. Water supply is reasonably good, with a few major rivers (such as Nsuze, Mhlathuze and Tugela Rivers) supplying the area.



*Figure 3.4: Nkandla indigenous forest (source: Google Earth)*

<sup>12</sup> BRG is defined as a specific vegetation type characterized by an interplay of climate, altitude and soil factors and consists of one or more BRUs (Camp, 1997).

<sup>13</sup> BRU is defined as an ecological demarcated area within which environmental factors such as soil type, climate, altitude, vegetation and to a lesser degree, terrain display a sufficient degree of homogeneity to permit uniform recommendations of land use practices and production techniques can be defined for each unit (Camp, 1997). **Note:** The parameters apply to the Bio-resource Unit (BRU) as a whole and may not necessarily reflect localized conditions of any particular farm or area within the BRU.

Soils are generally acidic with much of the steep slopes showing signs of continuous soil erosion (Camp, 1997; Researcher's observation, 2015). Under normal natural conditions "the mean annual rainfall ranges from 800mm to 1160 mm, with zero to two ecological dry months with occasional droughts as a climatic hazard" (Camp, 1997; 09). The mean annual temperature is 17.9 degrees Celsius (°C) with occasional light frost. The dominant natural vegetation pattern under this BRG is a secondary grassland dominated by unpalatable Nongongi grass, *Aristida junciformis*. Bush-filled valleys are found at lower altitudes which graduate into the Coastal Hinterland Thornveld (pg. 10). Indigenous burning coupled with selective overgrazing has led to a poor quality pastures. Poor quality pastures mean less fit animals that are not suitable to use for draft power (Camp, 1997). This has, as a result reduced the reliance on animal draft power for land use purpose and increased the reliance on tractors.

### **3.4 UBuhlebezwe (Ixopo) Municipal Area (KZN434)**

UBuhlebezwe local Municipality is located within the Harry Gwala (formerly called Sisonke) District Municipality (DC43) (uBuhlebezwe municipal website). The Harry Gwala District Municipality covers an area of 10 547 km<sup>2</sup> situated south of KwaZulu-Natal Province (uBuhlebezwe Municipal website). The district is an area subdivided into five local municipalities namely Ingwe, KwaSani, UMzimkhulu, Greater Kokstad and uBuhlebezwe (uBuhlebezwe Municipal website). The main administrative centre of the district municipality is Ixopo town located approximately 85 kilometres southeast of Pietermaritzburg (see Figure 3.2 Appendix 3.1B). The district is acknowledged for its progressive farming activities and Ixopo is no exception (uBuhlebezwe Municipal website). This places agriculture among the most important employment sectors in the district, in addition to construction and small-scale manufacturing (Sineke, 2012). According to the Municipal website, the undisturbed natural environment has high eco-tourism and adventure-tourism potential.

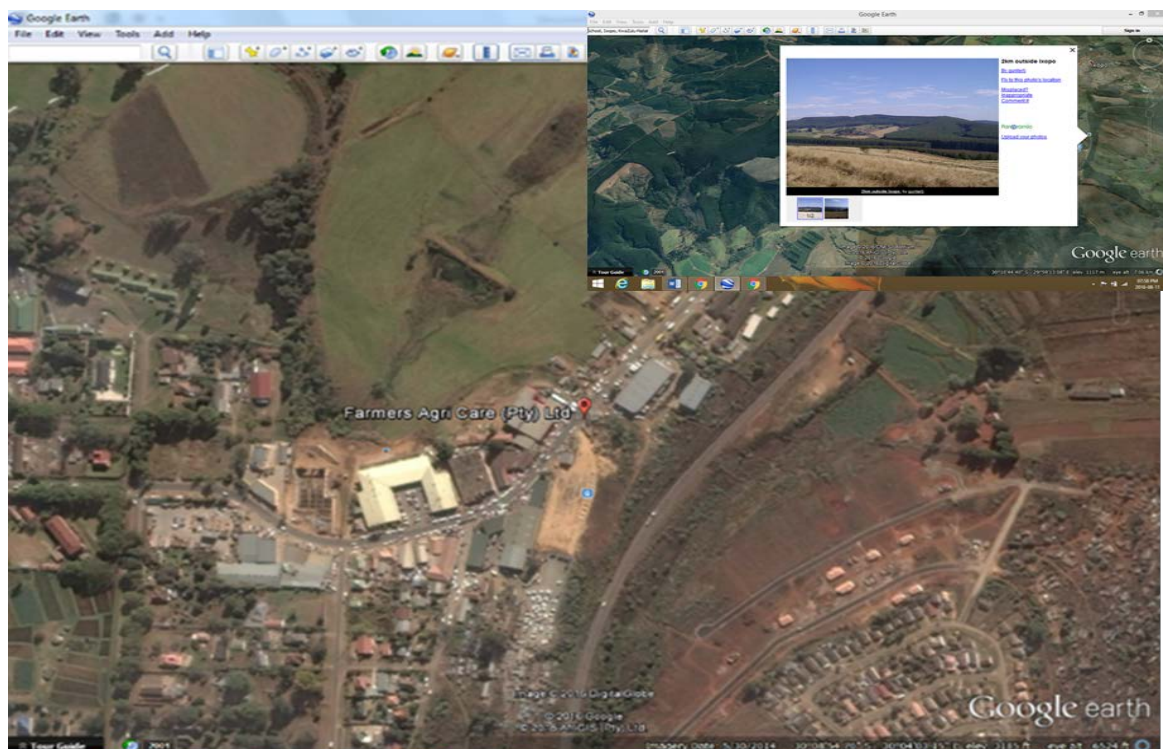
#### **3.4.1 Demographics and economy of uBuhlebezwe Local Municipality**

UBuhlebezwe local municipality covers an area of approximately 1604.03 km<sup>2</sup> (STATSSA, 2011; Sineke, 2012). The overall population of the area, according to STATSSA (2011) was 101 691 with a population density of 63.4 per square kilometre (km<sup>2</sup>). The number of households was considered to be 23 487 with a household density of 14.64 per square kilometre (km<sup>2</sup>). The average estimated household size was 4.1 (or 4) members with 57.2

% of the total households being female-headed. Gender distribution, as of 2011 census, consisted of 54 445 females (53.54%) and 47 246 males (46.6 %) with majority of the population being Black Africans (97.54 %) and the groups such as Whites, Coloureds, Asians (and other) sharing the remaining percentage (STATSSA, 2011).

The age groupings consisted of 37.4 % young people (0–14 years old), 57.4 % of working age (15-64 years old) and 5.3 % elderly (65 years old and above) (STATSSA, 2011). The unemployment rate in the area was at 34% with the youth taking a large proportion (STATSSA, 2011). The schooling of the population aged 20 and above differed considerably. Those with no formal schooling formed 15.9 % of the population; those with matric made up 21.2 % of the population and those with higher education formed about 4.3 % of the population (STATSSA, 2011). The area consists of 12 local wards with a number of residents living in rural villages found across the municipal area, particularly in Traditional Authority areas (uBuhlebezwe Municipal website). All the 12 wards are rely on Ixopo town to access public services and to address family needs, thus confirming its importance as a focal point for a number of activities (uBuhlebezwe Municipal website). Access to basic services varies between urban and rural areas with the latter being poorly provided. The importance of Ixopo, according to Sineke (2012) in the socio-economic development is justified by it being selected as the seat of the Harry Gwala District Council (Sineke, 2012). The area is located amidst formal agricultural economic regions within the province and is renowned for good agricultural potential. Figure 3.5 below shows the support of agricultural activities through availability of agricultural retail stores and workshops. According to Power Rush Trading (2013) report the majority of land in the municipality is either private or state owned with most of the agricultural land owned by commercial farmers with farm sizes ranging from 250 to 2 500 hectares (ha) per farmer. By contrast, the cropland cultivated by emerging farmers ranges from three to 20 hectares (ha) per household. Seemingly, land availability is not uniform throughout the farming communities with some areas having limited land while other have more than is cultivated (Power Rush Trading, 2013). The number of farming households as of 2011 census was sitting at 13 343 with subsistence agriculture showing some importance in the context of sub-regional development (STATSSA, 2011; uBuhlebezwe Municipal website). The white commercial farmers dominate agriculture in the area living side by side with black subsistence, semi-commercial and emerging farmers. The latter groups of farmers in the municipality are high in numbers but have the lowest agricultural output (Power Rush

Trading, 2013). The formal agriculture industry in the municipal area encompasses members of the High Flats Farmers Association, Ixopo agricultural Society members, Masonite, Mondi (and Mondi/Shanduka), Sappi and individual private timber and game farmers (uBuhlebezwe Municipal website). Commercial farmers are engaged in a variety of agricultural activities such as crops cultivation, livestock rearing, timber production and game farming (Power Rush Trading, 2013). Figure 3.6 shows some of the established farm areas found in Ixopo.



*Figure 3.5: Agricultural retailers and workshops are found in the local town (main picture), the insert (top right) shows timber plantations two kilometres outside Ixopo town (source: Google Earth, 2016).*

The crops commercially produced in the area are sugarcane, maize, pastures, potatoes, tomatoes, cabbage, and citrus fruits (Power Rush Trading, 2013). According to Power Rush Trading (2013), some farmers practice game farming and these farms are used mainly for commercial game hunting and to a limited extent for eco-tourism in the form of walks, birding and game viewing. Mainly Sappi, Mondi, Mondi/Shanduka, Masonite, NTC and some private farmers, are producers of timber. Masonite primarily produces pulp for Masonite paper with the main market being the Masonite factory at Estcourt. Masonite undertakes swap agreements with other timber companies in the Estcourt area as a means of reducing transport costs for taking wood to the factory. There are however other small mills

in uBuhlebezwe municipality that buy timber from individual timber growers. Most crops and vegetables are sold locally and sugarcane is sold to an Illovo mill on the south coast (Power Rush Trading, 2013).



*Figure 3.6: Ixopo has a number of established commercial farms, the roads leading to the farms and residential areas are gravel (source: Google Earth, 2016).*

The area has a number of farmers' associations including those of emerging farmers (Power Rush Trading, 2013). According to the Municipal website, the key purpose of such associations is to form a united front to address agricultural related issues faced by members. Emerging farmers within the uBuhlebezwe Municipality are either individual farmers or groups of farmers (Power Rush Trading, 2013). The means to obtain agricultural land is through two main land acquisition systems. The most common one is through traditional leadership, where land is allocated to individuals or groups of individuals, for a specific agricultural purpose. The second method, is where government purchases and allocates land to communities. Individual efforts to purchase land also occur, but only to a very limited extent. The area has an active land reform programme (funded by the Department of Land

Affairs) and coordinated by the district based committee (Power Rush Trading, 2013, uBuhlebezwe Municipal website).

### **3.4.2 Infrastructure**

According to Sineke (2012) Ubuhlebezwe Municipality is perfectly situated amid four major provincial routes, meaning it has strong north-south and east-west linkages within the region (see Figure 3.7 below). This is through the regional route R56 that links Ubuhlebezwe to areas such as Pietermaritzburg to the north and Kokstad to the south and the road R61 which provides regional access and linkages within the South Coast tourism region, from the east and the Drakensburg, to the west (Sineke, 2012). The route R56 is acknowledged as a primary corridor within the Ubuhlebezwe municipality's Spatial Development Framework (SDF), but is also of importance on a provincial scale, where it is identified as an agricultural activity corridor, which links with other important nodes, i.e. Kokstad/ Umzimkhulu/ Msunduzi secondary corridor. The R612 on the other hand, provides east-west linkages and is another primary corridor in terms of the SDF. On a provincial level, the Port Shepstone/ St Faiths/ Ixopo corridor is identified as a secondary agricultural provincial priority corridor linking the Southern Drakensberg with the South Coast. Ixopo is identified as a third order node at a provincial level. The roads that run through and among the rural villages are made of gravel and are often without bridged river crossings. Eskom supplies electricity to the municipality, then the municipality redistributes it within the area, but most of the households in rural areas have inadequate access to electricity (Power Rush Trading, 2013). In addition, the water is sourced mainly from Ixopo dam. According to Power Rush Trading and uBuhlebezwe Municipal website, as of 2013, 36 % of the total population have access to piped water in one form or another, but this figure most probably has increased since then. By contrast, there are still communities that rely on water from springs, streams and rivers (uBuhlebezwe Municipal website). The visited communities on the outskirts of town have unequal access to resources and infrastructure. The tele-communication services- such as postage and the telephone- are available in the local town with the majority of the population owning a cell phone (uBuhlebezwe Municipal website, Researcher's observations, 2015).



*Figure 3.7: R56 at Ixopo linking the area with the nearest towns and developed urban cities such as Pietermaritzburg (source: Google Earth).*

### **3.4.3 Natural environment**

According to Camp (1997), Ixopo (Ubuhlebezwe local municipality) within the Harry Gwala district municipality falls under BRG 12- The moist, tall grassveld covers about 407 991 hectares (ha) in extent. The mean annual rainfall range of this BRG is 712mm to 805mm, and the mean annual temperature is 17.1 degrees Celsius (°C) (Camp, 1997; 39). Camp went on to say, frosts are moderate with occasional severity. The area is considered to have a temperate climate receiving much rainfall in summer with a reported winter snow in the nearby peak areas (Isibuko se-Africa Development Planners, 2010). According to a similar source, from 2010 backwards, the mean annual rainfall, as recorded by SAPPI at their nearby district office over the past twenty years, was sitting at 831mm. The natural environment shows that Ixopo has fairly good soils, terrain and rainfall that together provides good agricultural potential (uBuhlebezwe Municipal website; Isibuko se-Africa

Development Planners, 2010). The available natural forests, as opposed to timber plantations, are found in some of the remote areas (see Figure 3.8 below). The agricultural impact of the natural forests is that they harbour animals that are considered pests by farmers, such as monkeys, boars and other wild animals that may prey on livestock or destroy crops. However, natural forests also serve as a resource for fencing posts and wooden harnessing material, for animal draft power.



*Figure 3.8: One of the natural forests observed in an area called kwa-Nokweja (source: Researcher's observation, 2015)*

Soils within the area differ markedly with respect to the underlying geomorphology (Isibuko se-Africa Development Planners, 2010). Generally, topography within the municipal area shows suitability for development though steep slopes which are found in some remote areas of the municipality (Isibuko se-Africa Development Planners, 2010; Researcher's observations, 2015). The biggest river found in the area is the Umzimkhulu River, which passes alongside the area serving as both a water source and a boundary. Since rainfall is not always enough and on time, irrigation is an important part of crop production in the area.

### **3.5 Conclusion**

The villages where this study was conducted are distant from each other; with one lying north and the other south-west of the province. This means there is a high variation in terms of climate, ecotopes, flora and fauna, water sources, market access, infrastructural and institutional support. The economic activities found in each area are also different with Ixopo having a higher economic potential as compared to that of Nkandla. This can be attributed to the fact that Ixopo has high formal agricultural economic activities (and other commercial activities) compared to Nkandla. Secondly, it has strong linkages to the economic regions and is situated close to the important development nodes of the province, with good road access. Given the above facts, Ixopo has a higher development potential as compared to Nkandla. The tourism sector also grants Ixopo an economic advantage over Nkandla since it is situated at the corridor of tourism destinations namely the Drakensburg Mountains and the South coast. Due to heavy competition between black smallholder farmers and white commercial farmers, agricultural land might be in higher demand and scarce in Ixopo, as compared to Nkandla. Whereas, in Nkandla, land might be plenty (with much steep slopes) but farming may prove less attractive since market opportunities are limited due to the lack of a supportive infrastructure and other prerequisite for commercial farming.

The steepness of land in many parts of Nkandla as compared to Ixopo, limits its availability and the possible crops that could be cultivated in the area. The abundance of an undisturbed natural environment in Nkandla as compared to Ixopo, grants the area an opportunity for nature conservation activities. However, natural bush canopies have some negative impacts on farming, through the proliferation of animal pests. In addition, alien invasive plants could be established easily (especially through birds and animal droppings) and invade nearby agricultural areas and reduce land available for farming. The nature of the condition of the roads put Nkandla at an agricultural economic disadvantage, as compared to Ixopo. Long distance travel on gravel roads with uneven and rocky surfaces is discouragement enough to practice commercial farming thus eliminating opportunities for any formal marketable agricultural enterprise. The nature of the bridge-crossings (width and strength) needs to be re-considered and redeveloped to accommodate the shipping of agricultural machines and implements, especially the ones found in Nkandla.

## **CHAPTER FOUR: THE RESEARCH METHOD**

### **4.1 Introduction**

The research setting has already been presented in the previous chapter. This chapter, therefore, reports the process and methods followed to carry out the research. Furthermore, it provides justification and reflection on the tools employed to collect data. The study utilised an empirical data collection process targeting internal role players in the programme. The main research question to be answered was about the role played by the free tractor services provision in improving the farming activities of smallholder farmers. The research sub-questions were about the production processes and different equipment that concerned farmers use, at different stages of production; the farmers' potential to produce cash crops and the farmers' potential to independently work expanded land areas. The chapter is separated into two sections. The first section documents the research process and the second section is the justification for and reflection on the method used. A brief summary is supplied at the end of the chapter.

### **4.2 The Research Process**

The study was naturalistic in approach and followed a qualitative data collection process. The Appendices 1.1, 1.2 and 1.3 show evidence for ethical process followed as part of the naturalistic inquiry. The approach is based on the researcher's observation and informal interviewing with readily available methods that need no special equipment or facilities (Arthur et al., 2012). The approach extends practices that are regarded as a usual part of social life (e.g. discussion and conversation) and that require no special training or resources. Following this approach, the researcher developed questionnaires that guided the engagement of the respondents. The approach in this study engaged with people over issues in real life situations. The inquiry mode followed an unstructured technique of data collection process. Below is an outline on how the study's respondents were identified as part of the study process.

#### **4.2.1 Identification of the research respondents**

The research respondents were identified and selected using purposive and convenient sampling. According to Silverman (2010), purposive sampling enables the researcher to select respondents who demonstrate characteristics the researcher is interested in; that is information-rich cases related to the phenomenon of the research interest. With this approach, according to Marshall (1996) the researcher actively selects the most productive sample to answer the research questions. The first respondent identified was the Programme Coordinator with the decision informed by the researcher's previous affiliation with the concerned department. This respondent was identified as a key informant through the researcher's personal visit to the head office of the department. The researcher initially met with the coordinator to exchange contact details in order to set-up the appointment for an interview. Thereafter, the researcher communicated with the coordinator until the final appointment date was set. The coordinator suggested that the researcher should also interview the Mechanisation Assistants in the districts and/or local offices, to gather more insight into what was happening at a ground level regarding the programme; meaning that the mechanisation assistants were identified through the mechanisation coordinator- this is known as snowballing.

The public Agricultural Extension Officers (AEOs) for the concerned department from the local offices of the two villages, were also targeted as respondents. The AEOs were targeted because of their direct contact with programme's beneficiary farmers. The identification of the AEOs was also guided by the researcher's previous affiliation with the concerned department. Thence, a convenient respondent group of AEOs was drawn from both villages as were actively involved in the programme's implementation process. Possibly the AEOs had more insight about beneficiary farmers and their combined experiences of the programme. The views expressed were therefore more likely to be dissimilar to that of the mechanisation coordinator, but more similar to that of the mechanisation assistants.

The potential beneficiary farmers from the two villages were identified through AEOs who served them. The researcher engaged with the AEOs in person who had helped with the farmers' identification process and provided contact details. The farmers were therefore contacted and appointed according to the list provided by AEOs. The survey was conducted in July/August 2015 when most of the farmers' fields were lying fallow or covered with crop residues, except for those who also planted winter vegetable crops. The next section outlines how the researcher heeded ethical procedure and the consent of the respondents.

#### **4.2.2 Ethical considerations and obtaining consent**

The information about ethical considerations has already been provided in Chapter One. This section will therefore highlight the important activities that were necessary for data collection process. Table 4.1 in Appendix 4.1 highlights important events prior to the field work and also mentions different stakeholders involved and their locations at the time. Furthermore, it provides information on how each activity was accomplished and the exact dates, when it was undertaken. A number of consultations to firstly request the respondents to engage in the study and then to make appointments, were necessary. Many of the consultations were made telephonically and via e-mails. The managers of the two local offices were contacted so as to be made aware of the research to be conducted in the areas under which they work. The contact numbers were obtained from the departmental diary for the year 2014. Upon consulting the Ixopo local office, the receptionist mentioned that the researcher needed recognition (in a form of a letter) from the head office in order to engage with the local offices and their clients- the beneficiary farmers. The supplied reason was that the research might include confidential information regarding government programmes and farmers, so the head office had to be aware.

The researcher managed to get the acknowledgement letter after a number of consultations with Senior Managers from the head and regional (Hilton) offices of the concerned department. This was the key to proceed with data collection surveys which commenced with the Programme Coordinator, followed by Extension Officers, Mechanisation Assistants and then beneficiary Farmers. At the beginning of each interview, the researcher read the consent form (Appendix 1.3) to the respondents and asked for a signature, as a symbol to agree to participate. In the case of the respondents who were willing and able to read, the researcher presented the letter to read and sign. The next sub-section outlines the entrance process to the two villages, where the study was conducted.

#### **4.2.3 Making contacts- Nkandla**

The researcher visited the village after a number of telephone conversations with the officials concerned. The first day in the area was a working day (Monday) and the arrival time was at 13:00 midday. Upon arrival in the village, the researcher went straight to the local office of agriculture to bring his presence to the attention of the officials and to make necessary arrangements. On the same day an informal conversation was held with a few AEOs (and an Assistant Manager) who were in the office, at that time. The aim was to get

a list of local beneficiary farmers, to participate in the research and to set appointments both with AEOs and Farmers. The list of 20 farmers (in case of unavailable respondents since the target was 15 farmers) was compiled and contact numbers were provided. On the following day, an appointment to meet with the AEOs was arranged. In the process, three farmers per ward and/or traditional area were identified by the AEOs and each was phoned for an appointment. In the first week, six farmers were interviewed and a focus group discussion was held with seven AEOs. The farmers' appointments were made at the end of each day, for the next day, or the day after the next. The farmers' sequence of visits was based on their availability and the convenient time slots making sure that the farmers with close proximity were visited on the same day. The mechanisation assistant (who is also an AEO by profession) was interviewed separately during the first week as well. In the second week, nine farmers were interviewed. Making contacts was easy, since the researcher knew almost everyone in the office and was familiar with the area and its people. Two weeks were spent in the research area.

#### **4.2.4 Making contacts- Ixopo**

After leaving Nkandla village, the Ixopo local office of agriculture was contacted prior to the actual visit in the area. This was done to notify the office manager and extension officers of the researcher's visit. It was also done to request a meeting for a focus group discussion with AEOs and to help with the identification of beneficiary farmers. Upon arrival in the village, the researcher also went straight to the local office of agriculture, to bring his presence to the officials' attention and to make the necessary arrangements. Opportunistically, on the first day of arrival, one AEO was going out to meet with a small group of farmers which comprised some of the beneficiary farmers. Thence the local manager asked the concerned AEO to go along with the researcher to meet that particular group of farmers. In that meeting the AEO introduced the researcher to the group which consisted of seven farmers and explained his intention. The AEO asked the farmers to provide the researcher with their contact numbers and they corresponded. One of the farmers present was the local *Induna*<sup>14</sup>. Over the next few days the researcher contacted

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<sup>14</sup>In a South African traditional leadership, *Induna* (Zulu pronoun) is the right-hand man and representative of the Chief (*iNkosi*) in that designated traditional community/village/sub-village since the Chief cannot be in every area every time.

other AEOs to help with farmers' identification process to reach the targeted number of respondents.

Three beneficiary farmers were selected per ward and/or traditional area. During the first week the researcher managed to interview nine beneficiary farmers. In the second week six beneficiary farmers were interviewed and a focus group discussion was held with twelve AEOs (together with their Manager). The number of officials who attended the focus group discussion was higher than that of the previous research area. This was because the officials had a staff meeting prior to meeting with the researcher. The mechanisation assistant was also interviewed separately on the second week in the area. In the second week nine farmers were interviewed. The sequence of farmers' visits was also determined by one or two of the following factors: availability; convenient time slots and proximity to each other. Two weeks were also spent in the area.

#### **4.2.5 Data collection tools employed**

The researcher employed a number of tools to collect data. These included semi-structured interviews, focus group discussions, direct observations, guided field observation walks, the use of handheld devices and planting-to-harvest calendar season. The flow-diagram below (Figure 4.1) summarises the interviewing process followed by the researcher during data collection. The description of each tool and how it was applied in the study is outlined below.

##### *4.2.5.1 Semi-structured Interviews*

A semi-structured interview (SSI) refers to purposeful, usually face-to-face interaction between a researcher as an interviewer and the respondents (interviewee) in order to gain perspectives on the research topic (Arthur et al., 2012; Mack et al., 2011; Creswel, 2009). According to Mack et al. (2011) the researcher interacts with respondents by posing open-ended questions in an unbiased manner, and listens carefully to the responses and asks follow-up questions and probes related to responses. In addition, the researcher needs not lead the respondents with respect to any preconceived convictions nor to encourage respondents to provide particular answers by signalling approval or disapproval of what they say. In the process, according to Arthur et al. (2012) the researcher strives to learn what interviewees know about a topic, to discover and record the respondents' experiences, thoughts and feeling and what connotative meaning is associated with responses. In this

study, semi-structured individual interviews were held with beneficiary Farmers, the Programme Coordinator, and Mechanisation Assistants. During these interviews the respondents were asked open-ended questions with the researcher facilitating the process and taking notes of the responses. The Programme Coordinator was interviewed in his office a month before visiting the two rural areas concerned (see Appendix 4.2). The two Mechanisation Assistants (one from each local office) were interviewed separately from AEOs but using a similar questionnaire (refer to Appendix 4.3). The beneficiary farmers were interviewed from their homes and interviewing was continued during guided field observation walks as informal conversations (see Appendix 4.4). To complete each interview took about one hour to an hour and the half. The data sheet and codes for closed-ended questions is shown in Appendix 4.5A. The responses for the open-ended farmers' interviews are recorded in Appendix 4.5B.

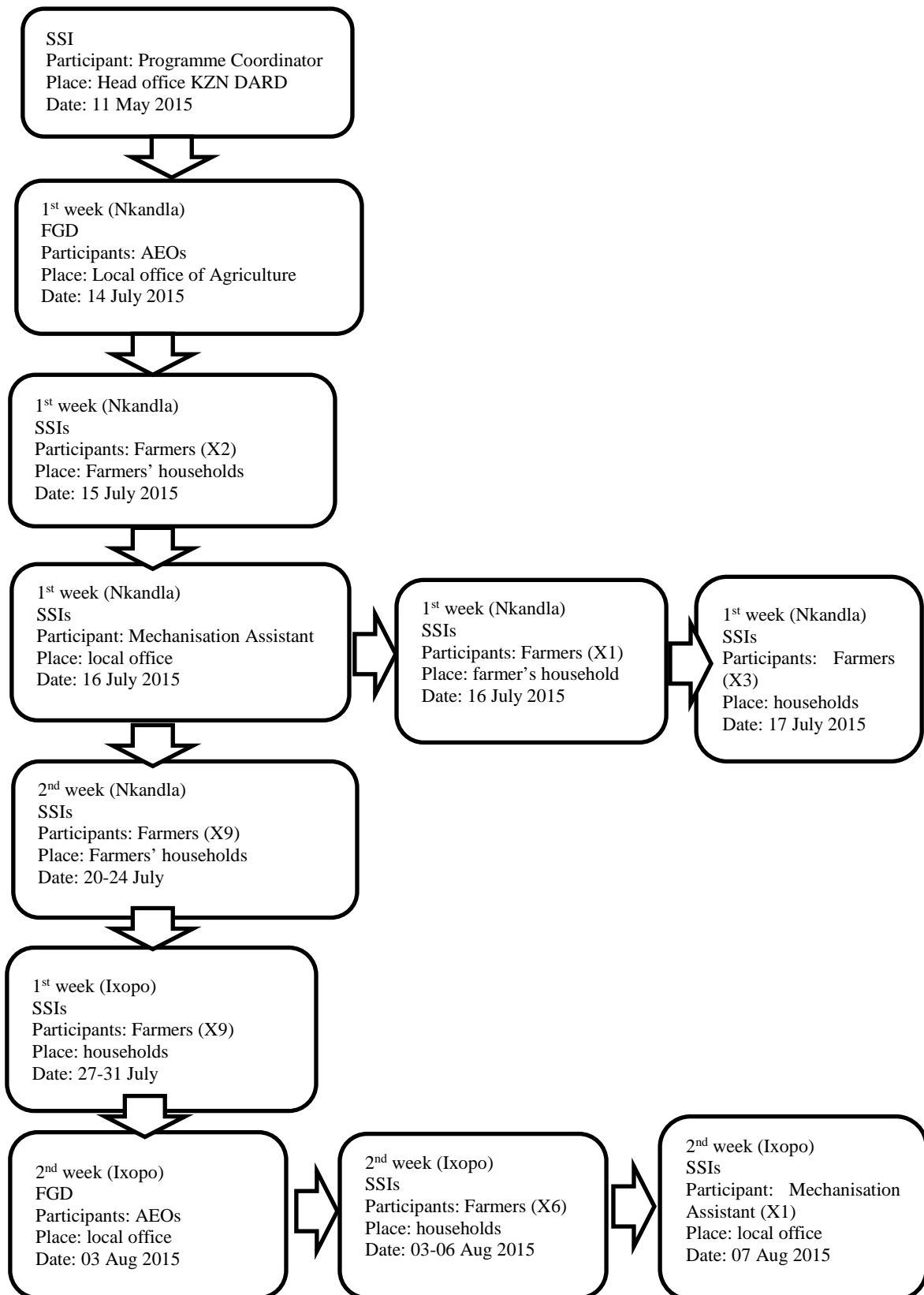
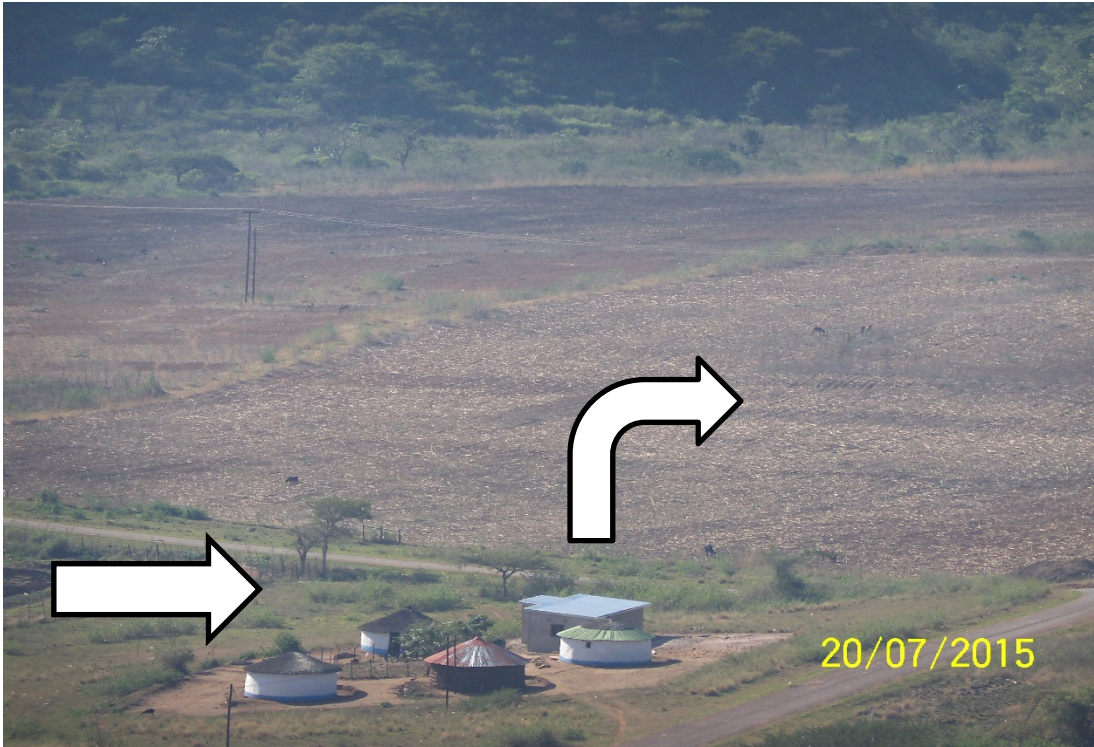


Figure 4.1: The flow diagram of data collection interviewing process

#### *4.2.5.2 Guided field observation walks*

The guided field observation walks conducted in the study as a data collection tool resembled direct observation rather than a transect walk. Thus, the supplied definition follows that of a direct observation given in the sub-section 4.2.5.4. According to Mercado (2006) a guided field walk is when the researcher accompanied by local informants takes a walk tour through areas of interest. The aim of the tour is to observe, listen and to identify different zones and conditions and to pose questions that help workout problems and possible solutions.

In this study, field walks were useful to obtain field data from eye witnessed observations in addition to reliance on the information provided by farmers. Out of 30 visited farmers, the researcher conducted 27 guided field observation walks. The examples below (Figures 4.2 and 4.3) depict the activity trail and further breakdown is presented in Appendices 4.6A and 4.6B, Figures 4.1 and 4.2 respectively. Accompanied and guided by the farmer, starting from the household, the researcher walked to, in and around the field to make observations. The aim was to measure the land area (since other farmers did not know the actual size of the land), take field coordinates, make observations on slope, physical surface appearance and to take pictures. Direct observations and informal dialogues were part of the activity. The observations included whether the land was properly fenced in or not, availability and/or proximity of water sources (including irrigation methods), what was/were the last crop(s) planted and so forth. This activity was important because the farmer only relied on lead questions asked by the researcher without knowing other aspects of particular importance to the study. Thus, such walks enabled the researcher to uncover much of the realities experienced by the concerned farmers since they elicited important dialogues. For example, seeing livestock in the field may elicit a question of why they are there, and the farmer may provide a reason of either the land is not properly fenced or were deliberately introduced to feed on crop residues.



*Figure 4.2: Beneficiary farmers 'household interviews' were followed by 'field observation walks' (Nkandla example)*



*Figure 4.3: Beneficiary farmers 'household interviews' were followed by 'field observation walks' (Ixopo example)*

#### *4.2.5.3 Focus Group discussions*

A focus group discussion (FGD) refers to an organised discussion between the researcher (s) and a selected group of respondents on a given research topic (Arthur et al., 2012; Mack et al., 2011). According to Kibombo and Kanyesiye, (2005) the focus group is used to gather opinions of a specific group of respondents in research. In the process, the researcher leads the discussion by posing open-ended questions to the respondents while recording (taping) and or taking notes of the responses (Mack et al., 2011). The recommended number of respondents in a group may vary between seven to twelve or eight to ten with a maximum of twelve people (Mack et al., 2011; Kibombo and Kanyesiye, 2005). According to Mack et al. (2011) the main advantage of focus groups is the ability to obtain many views on a topic and to gain a large amount of information in a relatively short time. Kibombo and Kanyesiye (2005) mentioned that it is advisable to select group respondents from a similar social setting, sex, age group, power differentiation and so forth. For example, too many power differentiations may dictate that some respondents will not speak or even be upset by the remarks from more powerful others (Arthur et al., 2012).

In this study, two FGDs were held with AEOs from each local office of the concerned department. The FGDs were held in the presence of the office Managers. The researcher introduced the research topic to the respondents and mentioned there were lead questions to complete the discussion. In order to develop trust and credibility, the researcher presented the attendants with an acknowledgement letter from the department's head office. A consent letter was also presented and the researcher read it out and asked one of the respondents to sign on behalf of the whole group. Following that, open-ended questions were posed for open discussion and everyone was free to reply, while the researcher noted the responses (see Appendix 4.3). The first FGD consisted of seven respondents and the second one had 11. Each discussion took one hour to an hour and a half to complete. The discussions were ended-off with words of gratitude to the respondents.

#### *4.2.5.4 Direct observations*

Observation refers to a data collection technique that encompasses carefully selecting, watching and recording behaviour and characteristics of living beings or objects of relevance to the study (Kibombo and Kanyesiye, 2005). According to Arthur et al. (2012) observation is when the researcher collects information based on the five senses though emphasis is on what can be seen and heard. Arthur et al. added that the tool is rarely a stand-alone method

of data collection since it is usually dependent on the basic information provided by other tools for initial observation. Observation can supply more accurate information pertaining to people's behaviour than surveys and can be a primary source of information (Kibombo and Kanyesiye, 2005). For example, the status of physical objects such as farming equipment was observed to provide information about different methods of field operations. Observation during naturalistic research can only take place in the setting where people are based in their own familiar places (Arthur et al., 2012). This means the researcher must go to the places where people work, play, worship or conduct a number of other daily life activities.

In this study, field observation of farmer practices was employed as one of the data collection tools. The observations were part of the interviewing process and so were the guided field walks. Such observations were recorded as images taken with a digital camera. These were then synthesised in relation to the SSIs in order to confirm what farmers mentioned during the interviews. For example, when farmers mentioned that harvested grains, specifically maize and beans, were being stored and/or grounded, the researcher asked to see the storage and/or grinding facilities. Again, when asking questions about livestock ownership, especially cattle, the researcher looked around for a kraal<sup>15</sup>. The Figures 4.3, 4.4 and 4.5 in Appendix 4.7 show the observed physical assets, facilities and equipment farmers used to support their farming and related activities as a livelihood strategy. Using a digital camera the researcher took photos of these observations. For instance, photographs taken were of old worn-down or dysfunctional tractors and associated implements, land surface appearance, water sources, weighing facilities, stored grains, stashed crop residues, harnessing implements and so forth. Similarly, with the field observation walks, direct observations, for example eye witnesses elicited important dialogues to gain more information not covered in the semi-structured interview questionnaires. This tool was also useful to confirm some of the information supplied by the farmer. For example, as a means of weighing and processing harvest, the researcher asked to see the stored grain himself, either in sacks or barrels and milling facilities then asked to take photos of such facilities.

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<sup>15</sup> In a traditional African village, this is an area in a household surrounded by a fence in which animals are kept, usually as their sleeping place- e.g. a cattle kraal.

#### *4.2.5.5 Hand-held devices (GPS and digital camera)*

The researcher used a GPS device to measure and record the sizes of farmers' croplands in hectares (ha). The land sizes are recorded in the data set table in Appendix 4.5A- first row column eight. The table shows coded Data Set mainly for close-ended questions. Consideration of actual landholdings for farmers was important to compare the average to a justifiable land size suitable for use by a tractor. The data pertaining to land sizes was also important to relate to the farmers' productivity on the accessible land. That is to say, how much land can a single farmer operate successfully and when during the production phase, is extra labour needed. The data was recorded on each corresponding questionnaire to be used to report the findings. In addition, the researcher also used a digital camera to take photos of croplands appearance and objects relevant to the research. The data was important to document physical assets farmers have and how they are used to assist farming activities and related tasks. The photographs were downloaded into a computer for use during the presentation of results.

#### **4.2.6 Analysis process**

The research data collected was initially transcribed into field notes interviews for electronic documentation and analysis. The worded responses were interpreted verbatim and analysed using content analysis for connotative meaning. Content analysis is a process of identifying keywords, themes, concepts and meanings within the text, which could assist in the understanding and interpretation of raw data (Burns 2000; Nieuwenhuis 2007). Content analysis allows the identification of patterns where selected information was grouped and crystallised into thematic representations using common responses. The emergent themes were then grouped and developed into important categories. Content analysis was followed by the coding of close-ended questions. The researcher counted the 'yes' or 'no' responses from transcribed farmers' questionnaires. What was counted was transferred into a spreadsheet using numeric codes one (1) as a yes and zero (0) as a no (see the respondent log sheet in Appendix 4.5 A). The coded data was then transferred to SPSS to produce statistical values such as frequencies, mean, median and the mode tables. These are shown in Table 1-16, Appendix 5.1 and graphically represented in Appendix 5.6. The summary of the analysis process was as follows:

- Transcribing of responses
- Verbatim interpretation and content analysis

- Identification of patterns and emergent themes
- Emergent themes developed into important categories
- Themes and categories analysed against the literature
- Coding of close-ended questions
- Coded data entered into a spreadsheet and transferred into SPSS
- Statistical values were produced for further interpretation and comparison

#### **4.2.7 Communication of results**

The results were communicated through a thesis report to the concerned discipline. The research findings were also presented in a conference for the South African Society of Agricultural Extension (SASAE) as a poster in June 2016. In addition the researcher was expected to share the findings with the funder and produce a policy brief document aimed for the attention of the concerned department. The researcher also planned to share the results with the respondents by attending farmers and or information days, to present the research findings.

#### **4.2.8 Truth value and validity**

The researcher took into consideration the legitimacy and truth value of data collected through *validation* and *triangulation*. By definition, *validity* refers to whether the findings are really about what they say they are about (Bryman 2004; Silverman 2010). Member *validation* was used to verify data obtained from the respondents. Member *validation* is when the researcher conveys research findings from the former to the next participant(s) to confirm or deny certain information (Bryman, 2004). *Triangulation* on the other hand, refers to the use of more than one method or data source in order to verify data obtained from a particular method (Guba 1981; Bryman 2004). Looking at the situation or issues from different perspectives enabled the researcher to affirm the credibility of the data collected. The researcher achieved this by engaging with the government officials as internal informants and farmers as members of the general public and recipients of programme services. The researcher had a semi-structured interview with the programme Coordinator then with the mechanisation assistants, to provide departmental perspectives on the programme. Then a focus group discussion with the AEOs was also held to verify some of the information from the programme coordinator and assistants. In this manner, the issues around mechanisation were looked at from three different stakeholder perspectives. Some

of the information shared by AEOs was validated by engaging with beneficiary farmers either by denial or confirmation of certain statements made. In addition, farmer-to-famer validation of certain remarks was a strategy the researcher used to determine the truth value of data collected. To cater for consistency in data collection, the researcher engaged with the same number of farmers from both areas (15 each), using similar survey questions. In addition, the officials engaged in the study were of the similar designation- all were AEOs. The equitable time allowed in each area of data collection also ensured consistence. In terms of the ability to confirm the information gathered, all the farmers drawn were operating under rural settings with most having similar circumstances in terms of farming operations. This meant their experiences in terms of government services support were more likely to be similar or insignificantly different. The two groups of AEOs selected were both operating at a local (ground) level having a direct personal contact with the farmers served. This means the information provided by these groups emanated from first-hand experiences of working and dealing with farmers and the issues concerned. In addition, the interviewed mechanisation assistants were also operating at the same level as AEOs having similar experiences in terms of the government programme concerned. The researcher's frame of reference upon reporting the findings, was guided by formal academic writing principles. The researcher's rural background and being used to rural daily life, made understanding of hard vernacular concepts easy to translate and relate to the context of the study. The researcher having served under the government as an assistant agricultural extension officer managed to engage much easily with farmers. The next section focuses on the data collection tools employed during the actual field work.

#### **4.3 Reflection on and Justification for Methods**

The research method allowed flexibility and was more appropriate to explore the nature of a problem or phenomenon with less quantification. The tools employed were selected mainly because of their detailed inquiry nature and ease application by a sole researcher. The reflections on tools employed and their fitness for study purpose are presented below. Due to the descriptive nature of the research and the amount of time it took to complete one interview session, 30 farmers were considered as a reasonable and manageable sample size. In addition, given the rural setting and physical ground distance that had to be travelled from one farmer to another, targeting 15 distant apart individuals was considered as optimal.

#### **4.3.1 Semi-structured interviews (SSIs)**

Semi-structured interviews were employed due to their exploratory nature allowing the researcher to probe the opinions and perspectives of the respondents throughout the data collection process. The interviewing and the informality of conversation was suitable, because of its easy application to different individuals and the fact it allowed for engagement with all the respondents. Due to the informality of the process, the respondents were free to share their perceptions and a lot of information was obtained. However, the long questionnaires worried many respondents and made them complain about all the time consumed. Thus, to make the respondents feel at ease, the researcher had to reassure them by saying: “don’t get alarmed by the thickness of papers, some questions will be skipped if are not applicable to you.” It was therefore important to quicken the interview sessions without compromising the quality of data collected. The important skill the researcher learnt was to be quick with the interviewing procedure, while retaining the quality of collected data required to answer the overall research question.

It was not uncommon with farmers to be over-interested over a particular question-thus spending some time on one question instead of answering what was being asked and move on. This tendency made farmers deviate from the question itself and they ended up ‘unwittingly’ answering a question still to be asked. In this case, the researcher played a facilitative role and asked the farmer to hold the thought for subsequent questions. This needed to be done politely lest the participant feel uncomfortable to talk freely. Otherwise researcher’s flexibility to quickly jump into the unwittingly answered (subsequent) question was indispensable.

Of significance, is that asking more of the “whether” and “why” questions would have helped the researcher understand the farmers’ priorities when making decisions. Thus the researcher would have had evidence providing deeper insight into why farmers chose one option over the other. For example, whether feeding the family comes before, or after, selling the produce, was unclear. Secondly, the understanding of the determinants of producing a sellable surplus crop, from the farmers’ perspectives, was not gained; therefore flexible thinking is important to formulate additional questions that will help gain a deeper insight into the matter, instead of sticking to the list at hand. An additional tool (as a quick version) such as priority ranking, is necessary to understand the farmers’ priorities in terms of decisions making and satisfaction of needs. Thence, the lesson learnt is that the choice of data collection tools need not to be bound to only the pre-selected tools, since the

situations in the field determine the process. Collecting explicit data necessary to answer the research question depends on how quickly and how strategically minded the researcher is, when introducing a new tool during the actual data collection process.

Audio recording of SSIs can create silent gaps during the session when the respondent takes time to retrieve and the researcher to transcribe information. Since talking is faster than writing, noting the response while the interviewee awaits the next question, automatically creates silent gaps. To avoid this, the researcher should pause the audio recorder when transcribing, or while the participant retrieves the memory. Again, knowing the sequence of questions after a few interviews, the researcher used to ask the next question, while noting the response of the previous one. The important skill learned in this case, was to transcribe quickly and to juggle between verbal interviewing and recording.

Since the study engaged with a number of elders, SSIs were useful for conversational communication. It is normal for older people to be more comfortable with face to face, verbal rather than written communication, meaning SSI was suitable to engage with them, and when the list of questions and time permits are strictly adhered to, a large volume of information can be obtained. To save time, it is better for the researcher not to try and transcribe every response during the interview, but rather to do so, at a later stage using the recordings. In this regard interviews might take less time than expected.

#### **4.3.2 Focus group discussions**

Due to limited time and setting of the office environment, the round-table discussion was most appropriate because of a limited open space. The approach helped the researcher gather many factual points from the extension officers gathered together as the respondents complemented each other's experiences of the programme. The experience the researcher had with this tool is that some respondents tend to be quiet with a few dominant speakers. The researcher perceived face saving and careful wording, as an issue for an open dialogue due to power differentiation among the group respondents. This was the case where AEOs were interviewed in the presence of their office managers. This was confirmed by Arthur et al. (2012) in the description of focus group statements highlighted above. It is therefore better to interview general staff separate from their seniors or managers, in order to allow an open discussion free from carefully wording and face saving. However, the busy schedules of the respondents did not permit separate interviews, so the emergent strategy was to bring the available officials into a representatives group. The merit of having a focus group

discussion, is that the researcher can get many different views on the topic within a short time, since the respondents complement each other.

The focus group held after a staff meeting had its advantages and disadvantages. The advantage was the high number of attendants which meant many perspectives were to be obtained. By contrast, the disadvantage was limited participation and attention probably due to exhaustion after a staff meeting. The lesson learnt in this regard, was the importance of proper planning for *ad hoc* schedules with the research respondents, rather than opportunistic encounters. Though time is a limiting factor, through patience and persistence, it is possible have a meeting with an undisturbed schedule and good attendance.

#### **4.3.3 Guided field observation walks**

The walks were not applicable to all the interviewed farmers. The reason for the missed walks was unfavourable (rainy) weather condition. The walks, coupled with direct observations, allowed the researcher to personally see what was not mentioned in an interview, but considered of particular importance to the study; for instance, the land's physical appearance, the vegetation cover, the nearby wetland or river, the physical infrastructure and so forth. Consequently, a number of valuable study elements were discovered through such walks which SSIs omitted- especially with regard to the accessible natural resources. In this regard, the walks initiated an informative and useful dialogue which detailed various important issues such as the challenges faced with irrigation water sources and the poorly versus properly fenced croplands. The limitation of the tool, was its reliance on the weather condition, since such walks are less easy for all concerned when conducted on a rainy or on an extremely hot day. Under difficult climactic conditions, the fields that are accessible by roads are more likely to be reached, as compared to those accessible by footpaths. However, that also depends on the nature of the road used.

#### **4.3.4 Direct observations**

The direct observations by the researcher helped to identify objects/assets of interest which the researcher did not have time to collect during interviewing process. Since interviewing can be long and tedious, a farmer may only be concerned with getting it completed and less aware of relevant objects to the research. Examples of these are: harnessing facilities; grain measuring containers; crops and crop residues storage facilities; worn-down tractors and so forth. Most farmers were unaware of what the researcher wanted to see and document (take

photographs of) for the study purpose, so direct observations (sometimes opportunistically or co-incidentally) helped to add value by providing visible evidences of what farmers had. Observations also initiated useful and informative dialogues between the researcher and the farmer. The researcher had to know and be selective about what to observe and about what to start a dialogue about. Deciding what to observe was a proactive, stealthy process the researcher had to accomplish within a short period of time. Thence observational skills and good eye sight became crucial in this regard. Information about the weather condition for each day was also observed (from the television a day before and sky viewing in the morning) since it affected the turn-out of farmers, activities to perform, and the researcher's mobility due to gravel roads. The weather condition also affected what was there to observe. For example, livestock is generally out of sight on a rainy and cold day, meaning the researcher was less likely to eye-witness any during such a day. In addition, observation of three of the farmers' croplands, was not conducted, due to rainy weather. In this regard, the research had to only rely on the information provided by the farmer.

#### **4.3.5 The use of Hand-held devices**

The researcher used the GPS, digital camera and the audio recorder to help with the documentation of data collected. The researcher selected these tools because of familiarity and availability. The tools were convenient because of the quick capturing and storage of data that can be accessed at any time. The tools also helped refresh the researcher's memory on information collected through other tools such as SSIs, guided field observation walks and direct observations. Thence this was not a stand-alone method of data collection but one that allowed the researcher to have concrete evidence of the information collected, using the other tools. That is to say, the tools provided evidence confirming what the farmers said and what the researcher observed, recorded and documented.

#### **4.4 Summary**

The observation of all the protocols, gatekeepers and all the affected stakeholders was an important lesson learned. In a naturalistic inquiry, obtaining respondents' consent is of paramount importance for ethical reasons. It was therefore important, to bring every data collection activity to the respondents' attention, for their consent and awareness. For example, when the researcher conducted activities such as audio recording, taking photographs and measurements, it was important to alert the respondents and to explain why the particular activity was done. The tools employed during data collection were mostly

appropriate because of their exploratory nature and capacity to gather deep insights and multiple views on the topic. However, lengthy questionnaires made the researcher realise the importance of keeping the list of questions as short as possible, without compromising the aim of answering the research question. Proper planning was acknowledged as an important element for the application of each research tool and its effectiveness in data collection. That is to say, the researcher needed to plan in advance how the research tool would be employed and to set the necessary conditions for its effectiveness in gathering quality data.

Engaging with the respondents taught the researcher manners of approach and good communication skills. In the process, the researcher also learnt to persevere, to be persistent and patient with the processes and protocols involved in implementing the naturalistic research method. The process of analysing and handling qualitative data can be confusing for a novice researcher. The lessons learnt during the analysis process was the importance of creative thinking and the ability to identify patterns from the data collected. In this regard the research gained some creativity and critical thinking skills that are necessary to handle and analyse qualitative data.

# CHAPTER FIVE: PRESENTATION AND DISCUSSION OF THE FINDING

## 5.1 Introduction

This chapter is a presentation of the field findings, outlining the background information of the respondents and the important themes identified, regarding the mechanisation programme. The findings are summarised in a table form and further described in context. Most respondents whose views are hereby expressed were of (or close to) an ageing population. According to Joubert and Bradshaw (2006) population ageing refers to older people of 60 years and above. The sizes of land accessible and other assets possessed by the concerned farmers, are also explained in the chapter. The main programme challenges are outlined and were identified by the respondents. This chapter also presents the discussion of the findings both comparing to and contrasting with, what is known about smallholder mechanisation programmes. Concluding summative statements are presented at the end of the chapter.

## 5.2 Demographic information for the interviewed farmers

The respondents' gender distribution consisted of 20 males and 10 females out of 30 farmers; meaning more than fifty percent were males (see Table 5.1 below). Out of 20 male and 10 female farmers, half of each came from both visited areas. That is, 10 males and five females from each village. This distribution was determined by the farmers' voluntary availability, rather than sampling strategy. The average age was 56 years with a minimum of 28 years of age and a maximum of 72 years of age. The comparison with respect to age, showed that Nkandla village had farmers that were mainly elderly with ages ranging from 50 to 71 years old (see Tables 5.3 and 5.4 below). The Ixopo village had two of the youngest farmers aged 28 and 33 years of age respectively, with the oldest farmer being approximately 72 years of age. This meant that the youngest and the oldest farmer, came from Ixopo rural village (see Appendix 4.5A). However, in general, this group of respondents represented an older farming group. Table 5.2 below summarise the age and the education level of the total respondent farmers.

Table 5.1: Gender distribution of the respondent farmers (n=30) from Appendix 4.5A

<b>Gender</b>	<b>Total</b>
Males	20
Females	10

The education level varied markedly, with an average of standard seven (STD 7/Grade 9 in modern terms) between a minimum of zero (no formal education) and a maximum of standard ten (STD 10/Grade 12 in modern terms). Out of nine farmers who completed standard ten, six of them were from the Ixopo village and three from Nkandla village. Looking at the second highest schooling level (STD 9) the farmers completed, the trend looked the same with four farmers from Ixopo and one from Nkandla (see Appendix 4.5A again). In terms of the lowest level of education, both areas had one respondent with no formal education among the 15 interviewed. Finding out about the farmers' formal schooling was important because education level influences the numeracy and or literacy level, ability to receive, conceive and deliver information, of an individual. To a greater extent, it plays a role in whether a farmer can independently read and write or learn. This is important for example when it comes to reading the operator's manuals for mechanisation equipment, as pertaining to this study, and for business communication purposes. The generic assumption, therefore, will be that farmers with low levels of education might need extra attention or help when it comes to formal trading, as compared to those with higher levels of education.

Table 5.2: Demographic information of the respondent farmers (n=30) from Appendix 4.5A and Appendix 5.1, Table 16

	<b>Range</b>	<b>Mean</b>	<b>Median</b>	<b>Mode</b>
Age (years)	28-72	56	59	63
Education level (STD)	00-10	7	8	10

Table 5.3: Demographic characteristics of Nkandla village respondent farmers (n=15) from Appendix 4.5A and Appendix 5.1, Table 16

	<b>Range</b>	<b>Mean</b>	<b>Median</b>	<b>Mode</b>
Age (years)	50-71	59.6	60	59/60
Education level (STD)	0-10	5	5	2

Table 5.4: Demographic characteristics of Ixopo village respondent farmers (n=15) from Appendix 4.5A and Appendix 5.1, Table 16

	<b>Range</b>	<b>Mean</b>	<b>Median</b>	<b>Mode</b>
Age (years)	28-72	52.2	56	64
Education level (STD)	0-10	7	9	10

The significance of the above values is found in how they affect the resources available and capacity to make use of the commercialization agenda that the mechanisation programme offers. Age variation for instance, influences mobility (activeness), level and type of

education, sources or level of income, and the knowledge and experiences of an individual farmer. Gender composition shows how mechanised farming in a rural setting is likely to favour the male farmers over the female farmers. This is based on the generic assumption that men are more active in mechanic and driving activities, as compared to women.

### 5.3 Land and other resources

The average land area accessible to the concerned farmers was 6.5 hectares (ha) with a minimum of half a hectare (0.5 ha) and a maximum of 60 hectares (ha), fragmented into two 30 hectares (ha) spaces worked as a collective. Table 5.5 below shows differences in landholdings regarding the respondents from the two villages. Nkandla village farmers showed access to more land than Ixopo village farmers, with a range of 1.1 to 60 hectares (ha) and 0.5 to 20 hectares (ha) respectively. Farmers with the smallest landholdings were therefore from Ixopo and those with the largest landholdings were from Nkandla, though these landholdings were somewhat spread about. A variation in land areas gives a comparison baseline on what is either the economical or the uneconomical use of a tractor. From the results of this, conclusions may be drawn about what kind of structures, processes and energy may be used to manage the land successfully in the future. For instance, the following questions may be answered. Should land areas be re-arranged (if possible) or should alternative draft power be considered? This trend however cannot be used on its own, to make a generalisation and or conclusion about the farmers' landholdings in the two villages, given the limited sampling criteria used.

Table 5.5: Land holdings for the Respondent farmers (n=30) from Appendix 4.5 from Appendix 4.5A and Appendix 5.1, Table 16

<b>Land size (ha)</b>	<b>Range</b>	<b>Mean</b>	<b>Median</b>	<b>Mode</b>
Land distribution for Respondents	0.5-60	6.5	3.2	2
Land size Nkandla respondents	1.1-60	8.9	3.5	2
Land size Ixopo respondents	0.5-20	4.08	2	0.5

The additional resources relevant for farming purposes at the disposal of each farmer showed variation in terms of availability and accessibility. The farmers from Nkandla showed a large ownership of livestock as compared to Ixopo farmers. See Table 5.6 below extracted from transcribed farmers' questionnaires. The livestock owned was reared mainly under communal grazing pastures with kraals and handling facilities situated within a household.

The large scale ownership of livestock meant Nkandla farmers had more of their land areas fenced, as compared to farmers from Ixopo.

Table 5.6: Summary of livestock ownership (cattle) comparing the two villages (from Appendix 4.5A & 4.5B)

<b>No. Of cattle</b>	<b>Sum</b>	<b>Average</b>
Nkandla	152	10.13
Ixopo	114	7.6
Total	266	13.5

Some of the farmers (40%) owned motor vehicles and 23 % owned farm tractors (refer to Appendix 4.5A and Figure 4.4 in Appendix 4.7). The farmers' self-owned tractors differed in terms of functionality and condition, meaning some were functioning whereas others were completely worn-down. The Figure 4.4 and 4.5 in Appendix 4.7 shows farmers livelihoods and some of the farmers self-owned tractors observed. According to Starkey et al. (1995) a number of privately owned tractors in the smallholder farming have been bought with non-agricultural income, and even when hired-out, they tend to be unsustainable and capital depleting. The unequal access to a number of resources can be attributed to differing sources of income. Farmers who had already reached retirement age were receiving government pension grants. A few once had (or currently have) formal employment or they have grown-up children with formal and/or informal employment. This implies that it is possible that the farming inputs, including tractors, were often bought using non-farming income. Table 5.7 below further compares the two study villages in terms of farmers' resources relevant to farming practices.

The sources of water were mainly rivers and streams, while other farmers had communal stand pipes and/or household taps. The stand pipes and/or household water taps are limited to household chores water usage and were not for irrigation purposes. According to FAO (2008) some mechanisation schemes have been successful, especially when coupled with irrigation. However, many of the respondents participating in this research, lacked irrigation. The support obtained from irrigation systems was considered by the farmers, as a responsibility of the Department of Agriculture. The local departmental offices including the Office of Agriculture, food and non-food retail stores, including mechanical workshops and agricultural product retail stores, are situated in the local towns. These resources are located a time consuming distance away from many of the farmers. Many farmers rely on public transport to reach the local business centres and the various areas of support needed to accomplish farming practices which include purchasing inputs and access to government

services. This means that a farmers' degree of long distance travel to reach high resource areas, will affect farming practices adversely, in one way or another. For example, ordered farming inputs that need a motor vehicle for transportation may take time to be delivered to a remote farmer, as compared to one that is closer to the local town. This is obviously because of a physical distance difference between farmers and purchase points. In the following sections the presentation and discussion of the emergent themes concerning the programme are supplied.

Table 5.7: Summary of resources at the disposal of farmers relevant to production, management, marketing and finance

<b>Framework from literature to identify the discrepancy</b>	<b>What the farmers have in Ixopo</b>	<b>What the farmers have in Nkandla</b>	<b>Gap (discrepancy) between what is and what has been determined as “should be”</b>
Production (timeous land preparation, enough doses of fertiliser, high yielding variety seeds, pest and weed control measures)	Self-owned Tractors (13%) and reliance on government tractor services	Self-owned Tractors (33%) and reliance on government tractor services	Limited versus unlimited access to a tractor for ploughing
	Draft-power animals (small quantity)	Draft-power animals (large quantity)	Abandonment versus preservation of draft-power animals
	Seeds and fertilisers accessed mainly through government and self-purchases	Seeds and fertilisers accessed mainly through government and self-purchases	Limited seeds and fertilisers versus enough to plant the whole field
	Fencing of landholdings: 60% fenced; 40 % not fenced	Fencing of landholdings: 80% fenced; 20% not fenced	Properly versus poorly fenced (or unfenced) croplands
Potable water (established irrigation systems)	Water for production: few streams and rivers	Water for production: many streams and rivers	Minority with irrigation systems versus the majority without
Marketing (sellable quantities, storage, reliable market, transportation)	Low yields, small or no proper storage facilities	Low yields, small or no proper storage facilities	Lack of and/or inaccessible formal markets and proper storage facilities versus availability/accessibility
	Farm vehicle ownership (e.g. bakkie) (53%);	Farm vehicle ownership (e.g. bakkie) (27%);	Bakkie owners contrary to those with limited (hired) access to transport for market.
	Market: pension points, local	Pension points, local community, local	Potential to supply supermarkets against

	community, local shops and supermarkets	shops and supermarkets	those without or with limited potential.
Finance: reliable sources of income and credits	Social safety nets (old-aged pension fund), self-employment, farming, formal/informal employment, Remittances (money sent home by migrant workers)	Social safety nets (old-aged pension fund), self-employment, remittances, farming	Limited access to credits versus unlimited access
Social kinship relationships	Extended families, friends and relatives, social organisations (e.g. stokvels)	Extended families, friends and relatives, social organisations	

#### **5.4 Descriptive presentation of emergent themes**

The data obtained from probing questions and open ended questions given to respondents were used to develop the main themes regarding their experiences with the programme. Thus the themes were developed and noted from the most common replies to particular questions. The full detail of farmers' responses is supplied in Appendix 4.5B. The transcribed data from farmers' interviews revealed their perceptions and the related issues as far as the programme was concerned. Table 5.8 below highlights these emergent themes, as well as the associated farmers' remarks and the perceived implications.

##### **5.4.1 Theme one: the programme was helpful**

The majority of the farmers found the programme useful in their farming activities. The farmers outlined a number of reasons as to why they considered the programme helpful. These included expanded croplands, free mechanised ploughing services made available, savings from privately-owned tractor hire services and the ability to plant both food and cash crops in order to feed families and earn an income. Each of these is further described below.

Table 5.8: Farmers’ programme observation remarks, emergent themes and implications from the interviews

<b>Farmers observations</b>	<b>Emergent theme</b>	<b>Programme implications from farmers comments</b>
Free ploughing services and inputs	The programme was helpful	Encouragement to work the land
Expanded crop lands		Cash crops created sources of income
Savings from private tractor-hire service		Cash to use on other inputs
New farming method (no till)	The programme was efficient	Opportunity for advancement to modern sustainable agricultural practises
Misuse of services	Programme inefficacy	Bypass some committed farmers & frequent breakdowns
limited services- ploughing only		More labour demand to create proper seedbeds- disking and tilting the soil; Partially planted fields
Wasteful expenditure		Unfruitful services
Limited time (days) for service rendering		Services were received by a few farmers and missed by many others
Delayed services and supplies (i.e. ploughing & inputs)		Delayed planting
Poor management of the programme		Unfruitful services; Poor service delivery
Insufficient farming inputs		Unfruitful services; Poor service delivery

#### 5.4.1.1 Expanded croplands

Many farmers mentioned that prior to the initiation of the programme, their fields laid fallow and since the commencement of government’s tractor services aid, they managed to work rested and /or underutilised land. The programme enabled farmers to work on expanded croplands rather than smaller plots, thereby putting more land under cultivation, as was anticipated. This was helpful for a farmer who did not own a tractor and associated implements and who could not afford to purchase any tractors or who had to constantly hire privately-owned tractors available in the village. Table 5.9 below is as example used to assess a farmer’s affordability of different inputs.

Table 5.9: Summary example of affordable and unaffordable inputs by a farmer (see Appendix 4.5B Q18)

<b>Affordable inputs</b>	<b>Unaffordable inputs</b>
Seeds	Tractor hire
Fertilisers	Irrigation (water) system
Chemicals (herbicides and pesticides)	Fencing

As land sizes expanded, an individual farmer was less capable of practically working the land. This was shown by the farmers’ need to employ additional labour to accomplish field activities (see section 5.4.3.4 under theme three). Farmers were therefore encouraged by the department officials to work as farmers’ organisations. This simultaneously benefited many individuals or households from government services issued under the programme. The concerted effort allowed shared labour among members, common learning and learning from each other. The question is how much land one farmer can practically manage effectively? The answer depends much on the resources at the farmer’s disposal and the affordability of inputs by an individual farmer and the management decisions that are taken. Since some of the farmers had croplands that are spread over an area, using a tractor shortened and quickened land preparation time, with a greatly reduced level of effort. This is obviously because a tractor can move faster between separate fields and it ploughs a lot quicker than muscle power. A negative element of this, is the total amount of time spent and the fuel consumed moving the tractor from one field to the next. However, this negative economic element was not of farmers’ concern since the operational costs were subsidised by the government.

#### *5.4.1.2 Free mechanised ploughing services*

Having interviewed all 30 farmers, they each affirmed that the programme was helpful since it made land preparation using mechanised power available, free of charge. Notwithstanding, 76 percent of the farmers concerned mentioned that they had hired privately-owned tractor services in the past, though complaints of this being expensive, were common. Farmers who owned neither draft animals nor farm tractor asserted that their fields lay fallow indefinitely in the absence of the programme. Of significance is that when the farmers were all asked: “do you wish the programme to be continued or re-initiated in the near future?” They all answered with a definite “yes, because it is helpful” outlining the reasons covered under this theme.

#### *5.4.1.3 Savings from privately-owned tractor hire services*

Since privately owned tractor hire services were deemed expensive, all the farmers found it financially beneficial to use government tractor services. This was supported by the fact that even the privileged farmers who owned their own tractors, still went ahead and made use of the free government services. The ploughing service charges for privately-owned tractor hire services varied. For example, some tractor owners charged R1 000 per hectare, while others charged an amount, by just observing the size of the land. The money saved from not paying for land preparation, was often used to purchase other farming inputs. The savings for the indigent farmers who entirely relied on free government services and input handouts were in the form of less intensive labour and less time spent in the field preparing the land, than in a monetary form. This was supported by one farmer who often used draft power when he said “it takes me a week to prepare and plant one hectare (ha) when using animals but with a tractor it takes two days” (FN24).

#### *5.4.1.4 Planting both food and cash crops*

The farmers mentioned that as far as the programme was concerned, they managed to plant both food and cash crops on the same piece of land. Even though many did not have a formal market, it transpired that beans were the most profitable (given a good harvest) crop followed by maize, potatoes and other vegetables such as cabbage and tomato (see table 5.9 below). Such cash crops were often sold directly to the members of the village, also at pension points and with a few having the potential to supply local food retailers. Pension-points are designated communal gathering spots mostly found in rural areas where old-aged, social and disability grants are issued on a monthly basis by mobile government officials from the South African Social Security Agency (SASSA). This inherently creates competitive and free market points where anyone is allowed to trade. Table 5.10 below shows the different prices of crops in terms of measuring units used by the farmers. Figure 5.1 below shows some of the measuring units used by farmers. Price ranges are influenced by seasonality (out of season more expensive), who the buyer is (cheaper prices for larger quantities) and trending market prices (usually less to make it more attractive). Part of the harvest is also consumed within a household as the way to enhance food availability.

Table 5.10: Possible prices for some of the crops farmers grow and measuring units used (source: farmers' estimates as of July/August, 2015)

Enterprise	Measuring unit	Common units used (see pictures below)	Price per unit
Beans	50 kg	Sack e.g. re-used mealie meal bag	R500 – 800 each
	25 kg	Sack e.g. re-used bag	R450 –500 each
	10 kg	Sack e.g. re-used mealie meal bag	R100 –150 each
	5 kg	Sack e.g. re-used bag	R100 each
	2 kg	Sack bag	R35 each
	2 to 20 litre barrels	Barrels/buckets	R50/2 litre
			R70 –90/5 litre
R150 –160/10 litre			
Maize	80kg	Sack e.g. re-used maize meal bag	R200 (yellow maize)
	50kg	Sack e.g. re-used maize meal bag	R120 –160
	10 kg	Sack/bag e.g. re-used	R45
	5 kg	Sack/bag e.g. re-used maize meal bag	R30
	2 to 20 litre buckets	Buckets	R70 – 80/20 litre
R30/5 litre			
Potatoes	10kg bag	Normal potato bag, re-used	R30–40 each



Figure 5.1: A 20 litre bucket (left) and 50kg sacks (right) that farmers used to measure the harvest

#### 5.4.2 Theme two: programme was effective

Some of the respondents mentioned that the programme was effective toward improving the farming activities of the farmers. This was confirmed by one farmer who outlined a change in the way they farm through adoption of a no-till method. This case was singled-out as it was uncommon with the rest of the farmers. With regard to conventional tillage, some of the farmers acknowledged the good tractors' performance especially in cases where necessary tillage practice steps were conducted. This is further discussed in details below.

##### 5.4.2.1 New farming methods (No-till)

The programme presented certain farmers with a new farming method known as “No-Till.” These particular farmers, specifically from Ixopo village, outlined that they were taught how to plant using no-till as a result of the programme. The farmers had their own mechanical planter and boom sprayer which were donated by an NGO called World Vision International (see pictures on Figure 5.2 below).



*Figure 5.2: Farmers own no-till equipment which were donated by an NGO called World Vision. On the left is a boom-sprayer and on the right is a two-row planter.*

The equipment was used to spray for weeds with Roundup chemical and to plant using a two-row planter- both pieces of equipment are tractor mounted. The seeds and fertilisers were mainly provided by the government and where necessary, farmers made supplementary contributions through self-purchases. The method was therefore appreciated and welcomed by this particular group of farmers. This, as a result, presented farmers with an opportunity to advance their cropping activities. In addition, other farmers highlighted that besides services being delayed, the tractors' performance was good, especially in cases where all

operations were done. This was supported by one of the local office managers who visited offices when it was asserted that:

“The programme was a package associated with production inputs such as fertilisers and seeds, the dedicated farmers and those with large tracks of land but couldn’t afford to hire a tractor benefited a lot since the operations were well executed” (Cwele, Ixopo local office Manager, 2015).

### **5.4.3 Theme three: programme inefficacy**

Contrary to what the respondents considered as helpful and effective, the programme was characterised by ill-timed services with respect to the planting season preferred by most farmers. This was associated with a number of factors and excuses given by government officials, with farmers having no control over the situation. As much as farmers had no control, they were the direct victims of the situation. Another contradictory attribute to the usefulness and effectiveness of the program was the concern raised by farmers that the land preparation service was only limited to the first stage of tillage- turning over of the soil. The respondents attributed the concern to the lack of associated tractor-mounted equipment such as disc ploughs, rippers, harrowers, planters and so forth. The inefficacy of the programme was outlined by beneficiary farmers as a result of poor management and planning by government officials. This led to the programme delivering insufficient inputs and services being misused, by some of the farmers while having too many stakeholders. The outlined points are unpacked further below.

#### *5.4.3.1 Delayed services and supplies*

The majority (80%) of the farmers affirmed that programme ploughing services were ill-timed and not aligned with their planting season, that is, services were rendered after the first rains had passed, with some farmers who mentioned to have received the service in December, a month not usually preferred for planting. However, a few (20%) of the farmers mentioned that the ploughing service was on time but good timing was not consistent every year (see Table 5.11). Table 5.12 below summarises the farmers’ preferred planting-to-harvest schedule in the two visited villages. The farmers preferred to plant maize during October/November months, with early December being the latest. The main reason supplied for the preferred planting season, was because October/November are rainy and warm months, which are the favourable conditions for the crops to grow. In terms of dry beans,

farmers preferred to plant in the month of January with February being the latest month for planting. The supplied reason for the chosen month was that the less rains at that time, serve to prevent seed-rot in the soil. Secondly, the reproductive phase happens at the right time because there are no beetles to destroy the blooms, as compared to planting in the earlier months. Another perception was that it was by a lucky chance, when service provision proved to be timeous. The delayed ploughing services led to delayed planting, which then exposed the crop(s) to unfavourable conditions, such as dry spells due to extreme hot conditions and/or prevalence of insect pests.

Table 5.13 below outlines the common challenges regarding the programme, as pointed out by the respondents. Most of these where seen to contribute to the delayed services and supplies. AEOs and Mechanisation Assistants mentioned running out of diesel, tractor breakdowns, tyre punctures, unfavourable weather condition and fewer tractors as some of the contributing factors to the delayed ploughing services (AEOs & Mechanisation Assistants, 2015). Broken down tractors were considered to take long to be mechanically repaired compelling the local offices to send even fewer units out to service the farmers. Delay in the renewal of tractor operators' contracts was also pointed out as a contribution to the delayed services. The outlined challenges can all be linked to the lengthy release of funds and the slow procurement processes necessary to run the programme and the preliminary processes thereof. Farmers' perceptions in this regard tended to relate to what AEOs told them, which consisted of the above-mentioned reasons. The problem was also identified in the literature having been experienced by farmers in Mozambique, Swaziland and Zimbabwe (see section 2.7.4).

Table 5.11: Farmers responses with regard to the timeliness of service (n=30) (after Appendix 4.5A, ToS column and Appendix 5.1 Table 9)

<b>Timeliness of service?</b>	<b>Frequency</b>	<b>Percent</b>
No	24	80.0
Yes	6	20.0
Total	30	100.0

Table 5.12: Planting and harvesting preferred schedule for the farmers, identifying the month(s) each crop can be planted and harvested (after Appendix 4.5B, Q 29: open question).

<b>Nkandla farmers' preferred schedule</b>													
Crop	Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maize	Plant										X	X	
	Harvest	X	X	X									
Beans	Plant	X											
	Harvest		X	X	X								
<b>Ixopo farmers' preferred schedule</b>													
Crop	Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maize	Plant									X	X	X	
	Harvest	X	X	X									X
Beans	Plant	X	X										
	Harvest		X	X	X								

Table 5.13: Challenges concerning the programme as identified by the respondents and researcher's insights

<b>Programme challenges as noted by the respondents</b>	<b>Challenge category</b>	<b>Possible causes (researcher's insights)</b>	<b>Person/personnel responsible (researcher's insights)</b>	<b>Possible solutions (researcher's insights)</b>	<b>Related sub-section in the literature review</b>
Frequent break-downs of tractors and associated implements;	Poor planning and management	Equipment not of the correct standard in relation to soil conditions	Coordinator/procurement manager and the planning committee	Pre-assessment of soil conditions in relation to equipment to be bought (site-specific equipment)	2.7.4
Delayed turn-over time of servicing equipment	Poor management; limited stakeholder participation	Lengthy processes to release funds	Multiple individuals such as service procurement officials, contractors etc.	Having local office based mechanic	2.7.4
Running out of diesel due to delayed orders	Poor management; poor communication		Multiple individuals	Make orders and payments in advance	2.7.4
Delayed renewal of operator's contracts	Poor management, limited stakeholders' participation	Limited funds (financial year)	Human Resource personnel/multiple individuals	Long-term contracts or have permanent operators	2.7.4 & 2.7.5
Late appointment of contract drivers (tractor operators)	Poor management, limited stakeholders' participation	Limited funds	HR personnel/multiple individuals	Long-term contracts or have permanent operators	2.7.4 & 2.7.5
Non-licensing of tractors to use public roads	Poor management, poor planning	Limited funds (licensing discs)	Multiple individuals/programme funder	Negotiations with relevant departments	

<b>Programme challenges as noted by the respondents</b>	<b>Challenge category</b>	<b>Possible causes (researcher's insights)</b>	<b>Person/personnel responsible (researcher's insights)</b>	<b>Possible solutions (researcher's insights)</b>	<b>Related sub-section in the literature review</b>
Smaller number of tractors in relation to farmers	Limited stakeholder's networks; poor planning	Limited funds	Programme sponsor/initiator (DAFF)/planning committee	Farmers' organisations/cooperatives	2.7.4
Lack of transport to monitor (follow-up) and facilitate the programme (challenge's degree varied by office)	Poor planning, poor management	Internal (local office) causes	Transport officers/office managers	Strong motivation letters stating the need for more vehicles	
Lack of storage facilities resulting to corrosion of equipment	Poor planning	Insufficient funds	Planning committee	Temporary structures till the department affords to build permanent ones	
Equipment not matching properly making it difficult to execute correct practices	Poor planning, poor communication	Incorrect specifications; limited knowledge on mechanisation equipment	Procurement officer	Sell non-matching equipment and reorder matching ones	2.10

<b>Programme challenges as noted by the respondents</b>	<b>Challenge category</b>	<b>Possible causes (researcher's insights)</b>	<b>Person/ personnel responsible (researcher's insights)</b>	<b>Possible solutions (researcher's insights)</b>	<b>Related sub-section in the literature review</b>
Programme was not well accepted by district staff saying it's not part of the job description resulting to slow adoption and uptake	Poor communication, limited stakeholder networks	Lack of incentives	Managers	Give incentives for participating in the programme	
Slow procurement processes making it difficult to meet deadlines of the production cycle	Poor planning, limited stakeholder participation	Slow/delayed release of funds	Managers/Senior managers & finance officer	Quick release of funds for urgent inputs and services	2.7.4
Lack of enough funding making it difficult to get things done	Poor planning	Limited budget	Programme sponsor/national department	Increased budget	2.7.5
Lack of policy amendment as time goes by which resulted to the loss of direction over time	Poor planning	Poor leadership	DAFF Policy developers	Assumed responsibilities	

#### 5.4.3.2 Limited time (in days) for service rendering

The fact that too many farmers were to be served with only a few tractors made the programme unable to meet the demand for services. This was justified by the farmers' complaints that each year of existence the services left out a number of potential beneficiaries, because services could not reach every farmer. Tractors spent only three days in an area under the same traditional leader and moved to the next one irrespective of having served all the farmers found in a sub-village. All the visited farmers complained that the number of days tractors spent in one area, were few. Those who owned draft animals and preserved harnessing implements ended up ploughing with draft-animal power and sometimes hired them out to those without. Figure 5.3 below shows a few examples of those farmers who still rely on animal draft power equipment to work their land.



Figure 5.3: Some of the visited farmers who still preserve their animal draft power ploughing equipment.

The usage of animals for ploughing also had problems. Farmers who continued to rely on animal draft power (especially cattle) mentioned that their usage depended on a number of factors. That is hardness (tillability) of the soil, availability of palatable grass, and the fitness of animals all of which depended on the amount of rainfall received. When these conditions proved negative this meant weak, skinny and unfit animals for field activities and when the tractor services were delayed, farmers without their own equipment resorted to hired tractor services and others resorted to hired draft animal service. This option depended on what was available to the farmers' surroundings. Farmers who could not afford to hire either draft-animal or tractor services when government services were delayed or if they missed them out, ended up planting late or they ended up skipping that particular season. Table 5.14 below expresses the farmers' opinions on possible solutions that would have helped mitigate the planting season's time constraints and made services accessible year-round.

The recurring assertions were, that the quantity unit of tractors was supposed to be increased, so that each tribal area could have allocated, locally based equipment available throughout the year.

Table 5.14: Farmers’ propositions on how the programme was supposed to operate

Category	Theme	Suggested solutions	
Programme’s “poor” planning	Inefficient program (top-down approach)	“Programme should start from farmers, listen to farmers’ views and what they think should happen.”	“ Tractors to be given to ‘working’ cooperatives and that is feasible if there could be many tractors;”
		Farmers to work as cooperatives or any farmers organisation;”	Each local Tribal Area should have its own tractor which stays in the village year-round with enough associated implements;”
Programme’s poor management	Inefficient programme (misused services)	“Having a tractor that stays locally even if it means paying for the service;”	Tractors must be issued with respect to each traditional authority and passionate farmers need to be identified;”
Programme stakeholders (roles & responsibilities)	Inopportune services	Tractors to be close to the community with a certain number of services’ recipients;”	Government must have enough implements assigned in one area not to include many areas with the available few
Programme’s poor implementation	Limited services	“To plan services in relation to hectares (ha), have a locally based mechanic and increase the number of tractors available;”	Government must have enough implements assigned in one area not to include many areas with the available few;”

#### 5.4.3.3 Ploughing only

Most of the interviewed farmers outlined that the programme only rendered the first stage of primary tillage; which refers to turning over the compact surface of the land at a certain depth to loosen up the soil and bury weeds. A few of the farmers mentioned to having

received disking services as well but it was not without problems, since there was only one disc plough which had frequent breakdowns. Some farmers mentioned that the tractor brought up big lumps, creating more labour to break them up and to prepare proper seedbeds. This problem was associated with a shortage of associated tractor-mounted implements needed to perform subsequent land preparation activities. One Mechanisation Assistant affirmed this by stating the following:

“Since the programme started, tractors came with relatively few associated implements, others haven’t got any thus far, so ploughs were being borrowed from the community and when some implements got broken were serviced with Extension Officers cash.”(Ntenga, 2015)

This particular Mechanisation Assistant from Nkandla local office was asked what equipment was still in full operation. The source mentioned tractors (without specifying the number), planters, two ploughs, one boom sprayer, one combine harvester, trailer, *skoffel* and the ripper.” In Nkandla there were also tractors operating in some parts of the area for the Masibambisane<sup>16</sup>project, separate from the nationwide mechanisation programme (Ntenga, 2015). The Ixopo local office’s AEOs mentioned that at least less than half of the tractors (four out of nine) were still in operation with a few associated implements. Even the few available mouldboard ploughs that the local offices had, were considered as having frequent break-downs when in action. The Figures 5.1 to 5.4 in Appendices 5.2 to 5.5 show some of the mechanisation equipment, and programme related facilities observed in one of the local offices.

#### 5.4.3.4 *Insufficient inputs*

The inputs farmers received (i.e. tractor ploughing service, fertilisers and seeds) as part of the programme, were considered meagre for all the beneficiaries. Given the large number of beneficiaries, farmers were receiving small sachets (packages) of seeds and fertilisers with many having to purchase the needed supplements. Those who could not afford to make supplementary purchases for inputs, had to improvise and only use the government supplied

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<sup>16</sup>The Masibambisane project was initiated by the then President of the Republic and business associates in the year 2011 at his hometown of Inkandla, KwaZulu-Natal. The programme was also implemented at nearby Eshowe in the Umlalazi Municipality to create job opportunities for poor and vulnerable communities in rural area. Since its launch, the programme has been extended to Mpumalanga’s Mkhondo Local Municipality in Piet Retief and the Eastern Cape’s Mhlontlo Local Municipality in Qumbu s (©vukuzenzele.gov.za).

inputs. The charts (bar graphs), Figures 5.5 to 5.8 in Appendix 5.6 show expressed sources of inputs available to the farmers concerned. The charts (bar graphs) show that the major source of ploughing services was government and hired tractors services, followed by a combination of government, self-service using their own equipment/assets and hired services. The least ploughing source utilised being government only and a combination of government and hired services. When it comes to labour, the majority of farmers seemed to rely on a combination of both local and family members (see Table 5.15 below). The farmers obtained seeds mostly through a combination of government supplies and self-purchases. The means to obtain fertilisers were mostly by self-purchases followed by government supplies. The above statements denote that many of the farmers used a number of possible ways rather than only one way, in order to acquire inputs.

Table 5.15: Possible sources of labour for the respondent farmers (n=30)

Sources of labour	Frequency (no. of farmers)	Percent
local community members only	13	43.3
family members only	2	6.7
both local & family members	15	50.0
Total	30	100.0

The lack of irrigation water was a common complaint among the interviewed farmers. About 70 % mentioned that they do not irrigate with only a lucky few having the means to do so. The irrigation material (i.e. water pump engine, sprinklers, pipes, water tanks) these few farmers had, were not obtained as part of the programme. This meant the programme was not accompanied by irrigation water supplies. In many of the cases, of the interviewed farmers, water availability was not a problem, since they had running rivers, wetlands or water streams nearby. The problem was the means of channelling water to their croplands. However, a few mentioned that they did not even have clean drinking water and only got it from unreliable sources which often got tramped over by livestock and thus becoming dirty. This meant that the majority of the farmers practiced rain-fed (or dry land) agriculture. In this regard, good rains rather than irrigation were considered by farmers as one of the important inputs.

#### *5.4.3.5 Misuse of programme services*

According to the interviewed farmers and government officials (AEOs, 2015) some locals demanded the services (ploughing and inputs) simply because they were offered free of charge. According to the respondents, particular individuals received ploughing services but ended up not planting, or planted but never weeded, or planted land that was not properly fenced exposing planted crops to be devoured and destroyed by livestock. Another concern raised by both aforementioned respondents was conflict over the sequencing of farmers to be served whereas some demanded ploughing of unsuitable land (too small, rocky or stumpy) for a tractor, exacerbating mechanical breakdowns. Free services and input handouts, tended to create squabbling and conflicts among beneficiaries, since they were insufficient for every farmer. The issue of conflict over sequencing was also outlined by Pingali et al. (1987) who went on to say that there is no managerial solution to this problem (see section 2.8). However, a solution that is most likely to work, is that every season there should be a dated registration list of farmers to be served, who may book for the service. Then the operator(s) must follow the sequence according to the farmers' registration dates and time. When farmers were asked:

“What contribution did the programme have in your social life and the way you relate as farmers?”

The common response was:

“it created conflict because it was selective, uncontrollable and the decisions were made on our behalf.”

The efficiency under these challenges was doubted by the concerned farmers.

The programme, therefore, did not follow its own rules as stipulated in the policy document. The department set to render ploughing and planting services to underprivileged individuals who may own, or have access to large agricultural land within communal areas and working capital but lack the mechanisation resources, to work the land. The targeted beneficiaries of the programme were said to be indigent, vulnerable and underprivileged people within communal areas. Initially, the beneficiaries were identified through personal application and resource assessment (land, soil, slope) – that is farmers had to register in the respective local offices as recipients of the service (Van Rensburg, 2015; Cwele, 2015; AEOs, 2015). However, in the subsequent years the programme ended-up being open to every farming member of the community and the application process was dropped. This can be attributed to the poor communication and planning of the programme's guiding principles. According

to Van Rensburg (2015) the lack of policy amendment as time went by led to the loss of direction along the way (see also Table 2 in Appendix 4.2). Table 5.16 below highlights the common methods that were used to communicate the programme's initiation, and implementation proceedings. The use of the media, FM-radio station used to announce the programme, gave it public popularity and being renowned, made many people feel entitled to the services- even villagers who were less active and not full-time farmers.

Table 5.16: Programme communication methods used during initiation and implementation

<b>Means of communication</b>	<b>Channels between/among...</b>
Meetings (personal)	Farmers, AEOs and mechanisation assistant
	Farmers only
	AEOs and managers
	Service providers and officials
	Coordinator and senior managers
	Coordinator, service providers and input suppliers
	All officials at different levels
Telephone/cellphones	AEOs and farmers
	AEOs and managers
	All officials at different levels
E-mails	All officials and their managers
	coordinator and input suppliers
Media (radio station, newspapers)	Everyone with an access

#### 5.4.3.6 *Too many stakeholders involved in the programme*

The core of the problem regarding the delayed services was laid not at the local managerial and operational level, since there were many stakeholders involved in the operationalisation of the programme. The Figure 5.4 below, represents the number of stakeholders that were involved in the initiation, planning, implementation and management of the programme. Arrows represent who was linked to whom and the direction of information flow. The position of each stakeholder in the diagram represents the level of operation and the attached ones were regarded as having inseparable roles. There were internal and external stakeholders. The internal ones were those who sat in the meetings and took important decisions about the programme. Whereas the external ones, were the opposite, and were only brought into the programme on an *ad hoc* basis and they usually worked on a contractual basis with the department. The examples of internal stakeholders were DAFF and the Provincial Department Managers at different levels, Programme Coordinators, and the relevant departmental dignitaries such as the Head of the Department (HOD) and the

Member of the Executive Council (MEC), and AEOs. The farmers and tractor operators were not treated as important stakeholders since they were passive in decision making. The examples of external stakeholders were input suppliers and service providers.

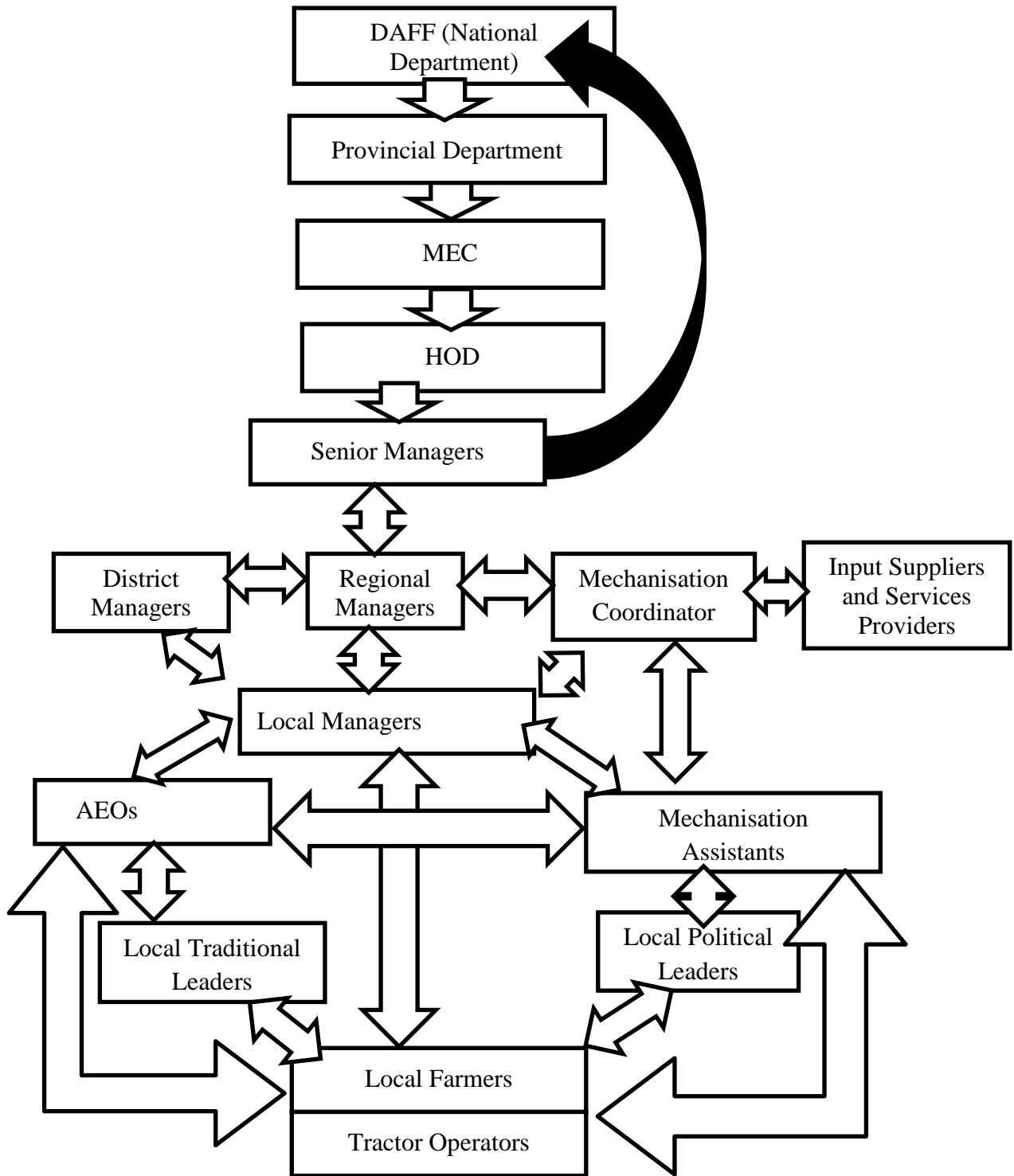


Figure 5.4: Different stakeholders involved in the programme and flow of information

The stakeholders involved had varied degrees of importance and impacted the implementation and decision making of the programme differently. The chief stakeholder was DAFF who initiated and funded the programme and introduced it in a top-down approach. The following was said on the matter:

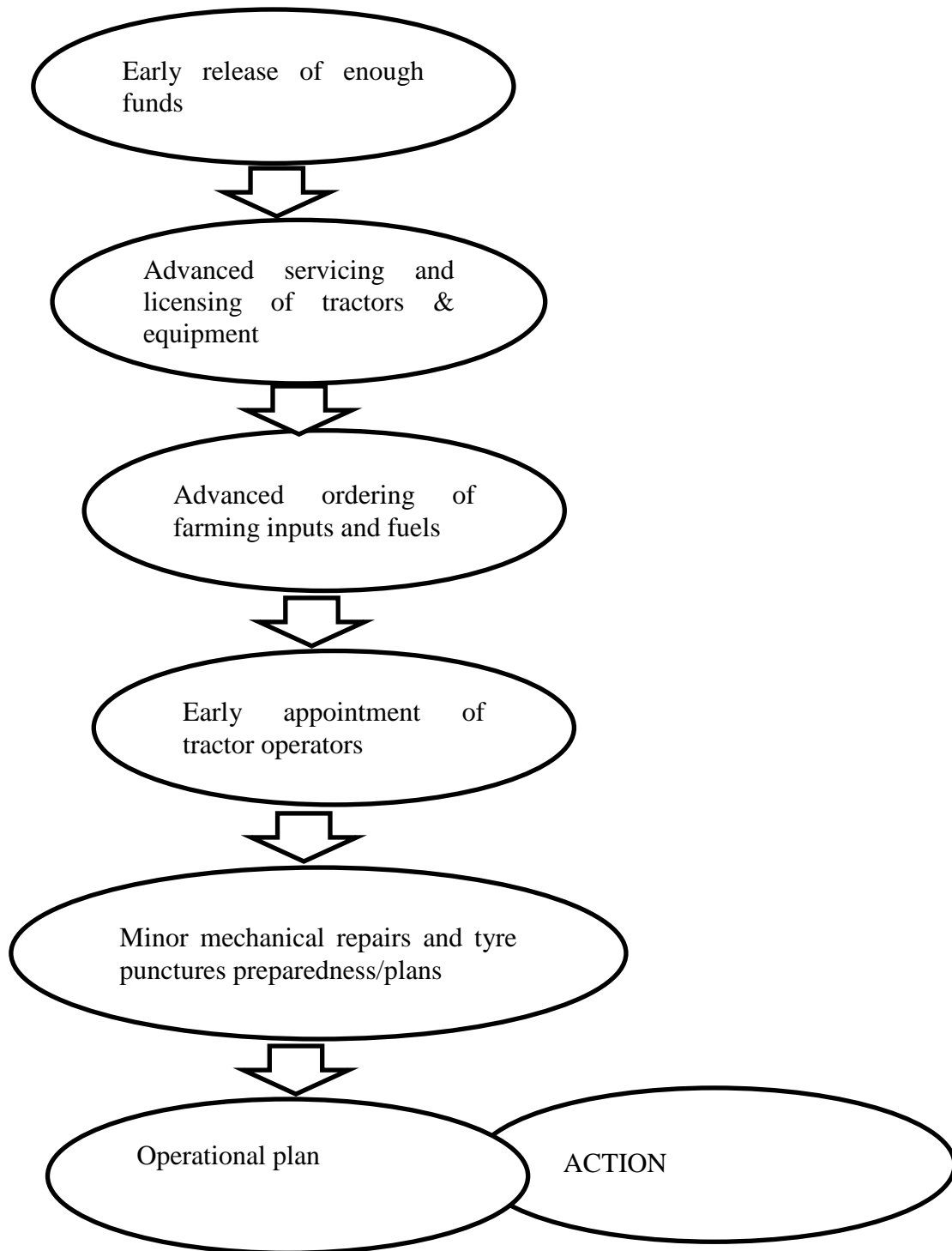
“The programme was a political mandate from DAFF to all the nine provinces to mechanise on behalf of farmers” (Van Rensburg, 2015).

The provincial departments of agriculture were held responsible to roll-out (launch), implement and regulate the programme (without a national policy) to the districts and local offices concerned, under the leadership of office managers. The mechanisation coordinator from the provincial head office was responsible for the procurement processes, and also liaised with service providers and input suppliers needed in the programme. Due to many duties, local managers appointed the Mechanisation Assistants among AEOs. The Mechanisation Assistants were responsible for administrative maintenance (not mechanical) and had to ensure the security of equipment in their respective local offices and they liaised with the programme coordinators and office managers. The coordinator reported to the senior managers who reported to the national department (DAFF). The path of information from the ground travelled from the extension officers (who had close contact with beneficiary farmers) to the mechanisation assistants and from the office managers to the programme coordinator to senior managers at the provincial level and to the nation office, as the final destination. The regulation and ownership of the programme was unclear, as there were two extreme ends and numerous role players in-between, who acted as connections between the initiators and the beneficiaries of the programme. However, the programme was monopolised by national and provincial government.

At the communal ground level where actual operations occurred, there were also protocols to observe. The programme had to be recognised and acknowledged by the chiefs and their right-hand men (*iziNduna*) and also by the local political councillors. These prominent individuals were often given first priority to receiving ploughing services. In areas where land acquisition is still under traditional jurisdiction, such leaders were also involved in land grants (permission to occupy) and the emergent issues thereof. Numerous stakeholders made it difficult to properly control the programme; meaning everyone had their own expectations and agendas. The flow diagram, Figure 5.5 below shows the researcher’s insights into the critical steps that would have possible mitigated against the challenges in the programme, as relating to how the dominant stakeholders should have run it.

#### *5.4.3.7 Poor management and planning by stakeholders*

Many of the interviewed farmers were unhappy about the way such a programme was conducted associating their unhappiness with poor management and favouritism. There was general agreement about this dissatisfaction with some farmers raising concerns of “political favouritism” between certain beneficiaries and local offices. The examples given by farmers were that local office(s) would target favoured beneficiaries and the distribution of promised packages in terms of inputs and tractor services, was not done on an equitable basis. Many farmers raised concerns that if tractors were regulated and managed properly, the programme would have been more relatively helpful, than it in fact was. The diagram (Figure 5.6) below depicts how the programme was planned and what actually happened during the implementation process. Table 5.17 summarises various platforms engaged in the management of the programme, as identified during interviews.



*Figure 5.5: The critical steps that were necessary to avoid delayed ploughing services and mitigate programme challenges*

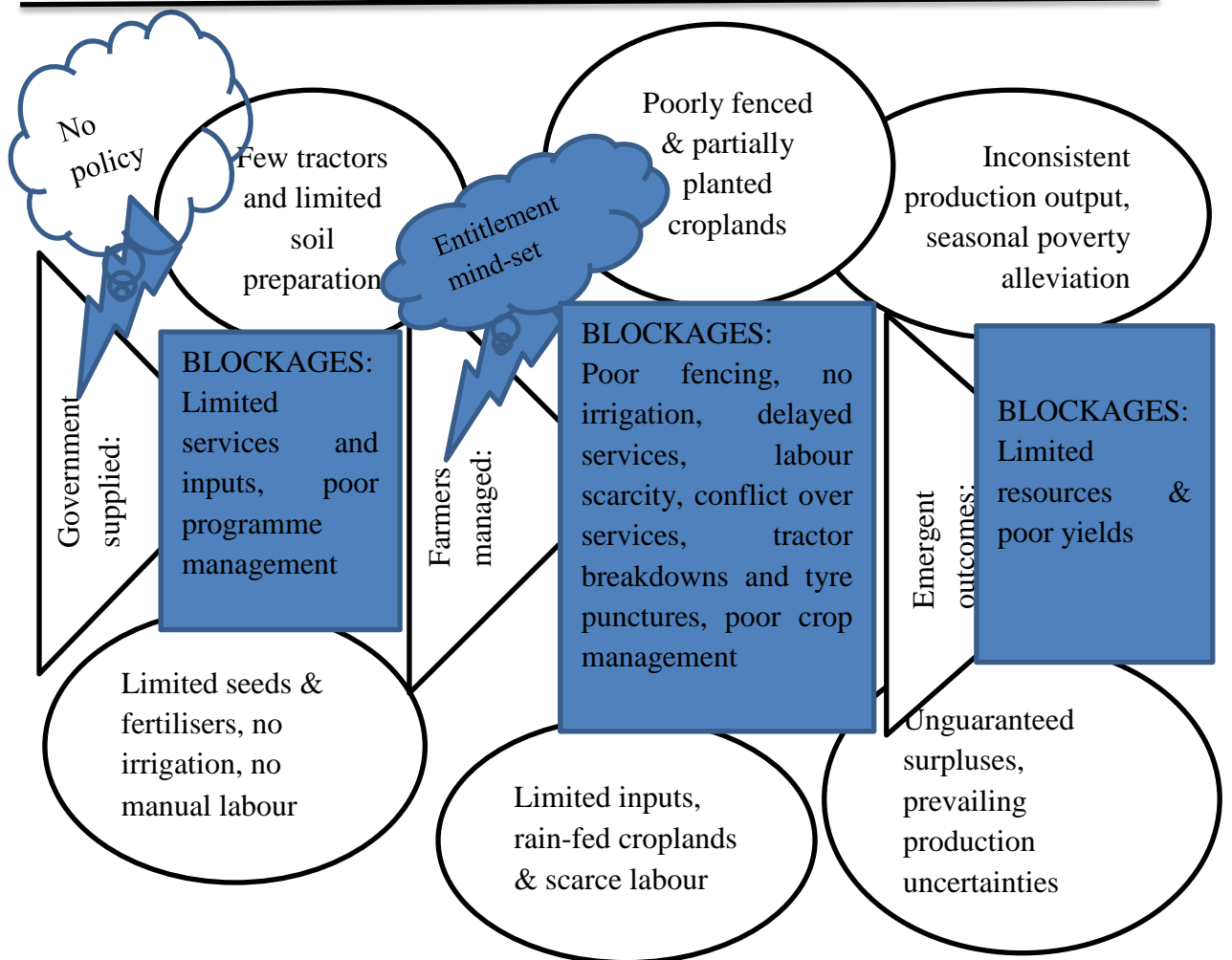
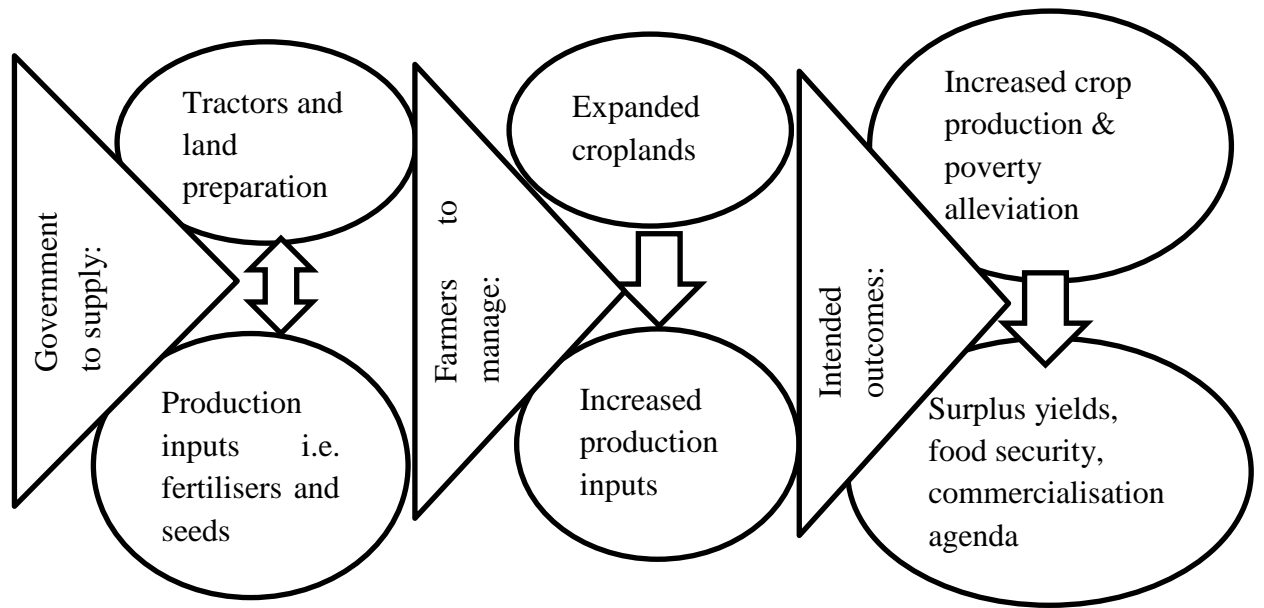


Figure 5.6: The comparison of two scenarios- the above diagram shows how the programme was planned to work and below is what happened in reality.

Table 5.17: Programme's management platforms and role players identified

<b>Who is the manager or role player:</b>	<b>What (who) to manage:</b>	<b>Level of participation:</b>
Farmer	Production process and production resources	Ground (farm) and communal level
Tractor Operators	Tractor in the field, Field (e.g. ploughing) practices	
Community leaders	Land acquisition issues	Communal level
AEOs	Service provision; Farmers' needs and problems; Government resources	Local level
Mechanisation assistant	Tractors' safety and maintenance processes (including associated implements); Tractor operators	Local level
Local manager	AEOs and mechanisation assistant; Government resources; Service provision	Local level
Programme coordinator	Tractors and associated implements, Procurement processes, service providers/input suppliers engagement: Outsourcing of services (i.e. trainings, input supplies)	Provincial level
District managers	Local managers, AEOs and other officials, government resources at their disposal	District level
Senior Managers in the department	District and local managers, government resources at their disposal, government officials	Provincial level
HOD	All managers; All government resources at his/her disposal	Provincial level
MEC	HOD and Senior Managers; All government resources at his/her disposal	Provincial level
DAFF	Programme finances/distribution of funds, and all other government resources at its disposal.	National level

In summary, the findings are that the programme was perceived as helpful and efficient in terms of allowing farmers to work larger (often fallow or underutilised) land areas, than before. In addition, farmers claimed benefits (savings) from privately owned tractor hire services and less time was spent preparing the soil. The inputs supplied as part of the programme reduced the quantities farmers needed to purchase for farming. The farmers also claimed that the programme enabled planting more food and cash crops, as compared to working on small household-yard-based plots. With a good harvest, a number of farmers

were able to sell part of the produce from the land ploughed under the programme. There was no measurement of harvested units to determine the quantity that was being sold and how much was consumed within the household. In contrast, the programme was perceived as inefficient because of: inopportune services; limited operations; meagre inputs; poor planning, management, implementation and the organisation of the programme.

## **5.5 DISCUSSION**

### **5.5.1 Farmers' management decisions in relation to mechanisation**

The admired appeal of using a tractor attracted many smallholder farmers into re-working years-long fallow land areas, though services were limited, to a single primary tillage operation. This was indicated by a common tractor dependence for the first-ploughing (turning over of the soil) with hand-tools usage being still prevalent for operations such as planting, weeding and harvesting (see Appendix 4.5B, Q10-Q15). Due to the expanded 'tractor-ploughed' fields, one farmer could no longer accomplish all the farming activities, meaning mechanised farming came with a high labour demand. The labour management strategy employed, was the use of local community members and family labour. The argument about mechanised farming versus scarcity of labour, has contested convictions. The question is: does a mechanised farm deplete or create labour availability as compared to a less mechanised one? The answer depends on the nature of an operation and enterprise. Some operations and/or enterprises are easier to mechanise than others. Under conditions where labour is scarce, mechanised cropping is supposed to cover all field operations, instead of just one or two, thereby depleting labour even further. In contrast a mechanised farming operation may attract more labourers than a less mechanised one, because of a lighter workload and the reduced drudgery associated with it and also it creates off-farm labour for mechanical repairs.

The supplementary input purchases farmers made, were an indication of the willingness to grow big. This means mechanised farming came with high input costs, due to land expansions. However, the expanded, ploughed-and-planted fields were often limited by water shortage to produce good harvest. Thus, farmers sometimes preferred to plant water-stress resistant crops such as beans rather than maize and vegetables. There was no direct link between tractor services provision and whether farmers irrigated or not, since the majority (70 %) practiced rain-fed farming. From the literature, it was highly recommended

that irrigation systems should form part of mechanisation. In cases of the concerned farmers, enough rainfall, rather than an irrigation water system, was regarded as one of the important inputs.

Due to the open fields ploughed using tractors, farmers were able to rotate certain crops on expanded pieces of land, rather than on smaller plots, thus increasing quantities of harvested crops. Residues from a bigger crop enabled farmers to store some to feed livestock when natural pastures were in poor condition. Many farmers tended to allow livestock into the field after harvesting particularly to feed on maize stover leaving dug manure and a clean field behind for the next cropping season. This is a timeless practice important to improve soil fertility. However, some farmers preferred collecting the residues to feed their own livestock and to prevent other farmers' unintended access (see Figure 4.5 in Appendix 4.7). Certainly, mechanised crop production highly benefits livestock production by making more feed available, as compared to a less mechanised farming operation. Some of the farmers mentioned they also use crop residues for making compost as well, which helps maintain soil fertility, without the use of chemical fertilisers.

When farmers were asked:

“does it ever happen that you missed the planting season or planted too late because you waited for the government tractor service but did not arrive or arrived late? What did you do in that situation?”

Almost all the farmers answered with a definite “yes” which forced them to resort to hired services mentioned in the previous section. Some of the farmers mentioned that:

“when the government tractor service was not rendered we did not plant, we did not do anything.”

This makes it clear that there are farmers who are completely dependent on government services in order to grow big. Nevertheless, poor management practices are still prevalent among the concerned smallholder farmers. For example, the researcher observed partially planted fields with an unplanted portion covered with tall-standing grass and weeds that harbour insect pests. It is recommended that weed management practices such as spraying, cutting and maintaining clean field hedges, are emphasized prior to mechanisation.

The survey questions highlighted above address the inquiry about the programme's influence on the farming activities of the concerned farmers; since they provided explanations on what the farmers do, as well as how they conduct farming activities and why they do so. It can be concluded that the availability or shortage, of certain inputs, dictated

the farming activities of each farmer concerned. For instance, the unaffordability of synthetic fertilisers made some farmers combine the scanty, freely supplied quantities with the use of kraal manure. In many given circumstances the purchasing power of the farmer was very important. The farmers that had less purchasing power relied a lot on public goods and services to carry out their farming activities. Whereas those with more purchasing power, were able to supplement government handouts and services, through self-purchases.

### **5.5.2 Farmers' landholdings in relation to tractor usage**

The landholdings for many of the visited farmers were not large enough to justify good economic returns from using a tractor. With an average of 6.5 hectares (ha), a minimum of 0.5 and maximum of 60 hectares (ha) (when put together), tractor usage is only justified, if not owned; that is it is either owned as government property and or local individuals own the tractors and hire them out. According to Binswanger (1986) the profitability and growth benefits of mechanisation are highly correlated to the plentiful amount of land and scarcity of labour. Binswanger (1986) went on to say, the resulting yields increase due to mechanisation is often exclusive to conditions where modern inputs such as high-yielding seed varieties, crop protection chemicals and fertilisers, are also utilised. The majority of farms where the economic importance of a tractor is significant are above 100 hectares (ha) in size (Starkey, 1995). Starkey also asserted that tractor usage is least recommended for small-scale farming operations, where fields are small and scattered and situated in remote areas. More than 50% of the interviewed farmers said they were able to expand land if the need arose through negotiations with the relevant people (see Figure 5.7 below). However, in a rural setting such possible expansions are certainly not of the extent to reach the recommended 'one-block' of 100 hectares (ha) suitable to use ones own tractor. This means that with the programme being "phased-out" farmers who will not receive a tractor as potential beneficiaries, will result in their land likely to remaining fallow indefinitely. This was signified by the farmers' wish for the programme to be continued. The minority, however, who still utilised draft animals, especially cattle, will not suffer much as a result of the termination of the programme.

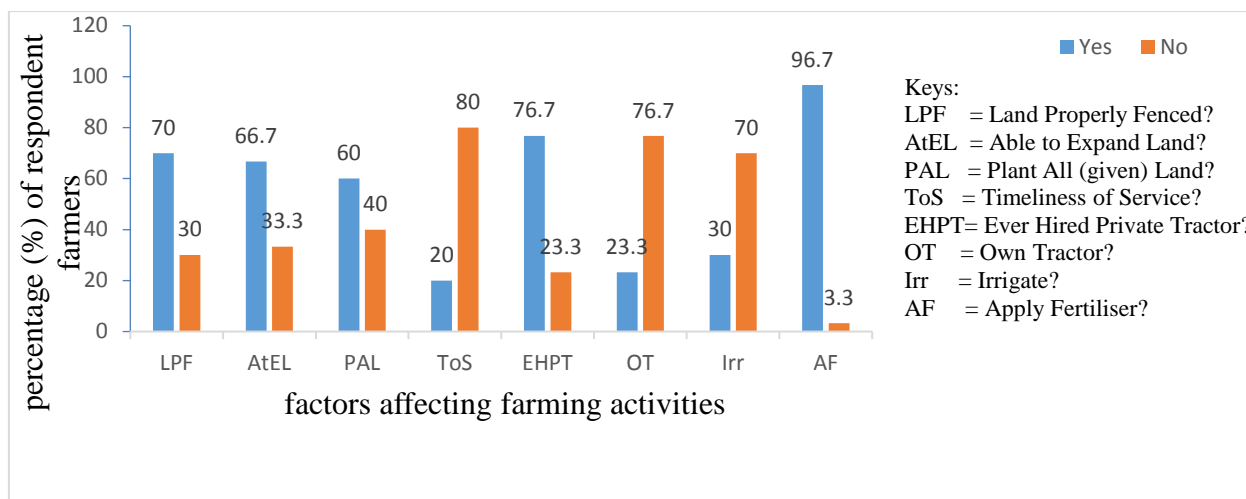


Figure 5.7: Factors affecting farmers' production process

When farmers were asked:

“say you have your own tractor how would you use it to benefit your farming activities?”

Many were confident enough to say they would work the land year-round with or without hiring out to others. For further enquiry farmers were asked:

“who could drive it?”

The majority of males said they can personally drive a tractor if not their sons. The researcher asked:

“where can farmers, if possible, service a tractor and buy spare parts?”

A few (especially those who own or have owned it before) said they are able to personally fix a tractor and or could use local workshops or mechanics in the local or neighbouring towns. The farmers were also asked:

“how they could cover the costs of tractor service, purchase of spare parts and associated implements?”

The common response to this, was that through sales' profit from the harvest. It transpired that, irrespective of land sizes many visited farmers cannot afford to maintain a tractor, not to mention the associated implements due to a lack of mechanical skills and limited financial resources (see Appendix 4.5B, Q50-Q52). According to Starkey (1995) tractors have high efficacy at ploughing large fields quickly, but are expensive and often justified for use on thriving farms (Starkey et al., 1995). Starkey added that although the tractors are uneconomical on small farms, their popularity conveys high status and most farmers would like to own one. The latter statement is definitely true regarding the farmers concerned. A

few exceptions (23 %) which is seven out of the thirty farmers, who owned a tractor or have owned before, may be capable to maintain one, should finances permit. However, observation of the farmers' own tractors indicated they were either too old or worn down beyond repairs (see Figure 4.4 in Appendix 4.7). This indicates that one tractor unit is not profitable enough to raise enough money to buy another one due to various reasons such as bankruptcy and lack of economic viability. Instead, the equipment seemingly drains a farmer of hard-earned cash from other sources, rather than the land, even if hired out.

Almost all the interviewed farmers reiterated that they cannot afford to purchase the associated implements. Whereas others mentioned they might need a loan or funding from a particular source. Apparently, in a resource poor village, the use of a tractor, therefore, should never replace the usage of animal draft-power and other available alternatives. However, most farmers with enough numbers of draft animals, had no-one to help with harnessing and caring for animals. Pingali (2007) mentioned youth migration as one of the main drivers of mechanisation. Consequently many farmers think tractors as the only viable option despite their relatively small landholdings. A well mechanised farming operation could increase labour productivity (expanded hectare (ha) per worker) but that does not automatically guarantee better income per man-hour work. What is often acknowledged even less, is the fact that tractor usage forms part a combination of inputs required to achieve a better yield. One cannot do just one-activity which is part of a whole sequence of activities and expect better results. Biological, chemical and technical advances such as the usage of high yielding varieties (HYVs), fertilisers, pesticides, modified tillage methods and the introduction of irrigation, serve to improve land productivity (yield per hectare) therefore compensating for a shortage of arable land. The affordability of such inputs among smallholder farmers remains a challenge, especially since limited access to credit is concerned. At a farm level, assumed yield increases are hardly mentioned as a motive for pushing mechanisation. The plausible economic benefits that are often outlined are the wish to achieve a lighter workload, mobility and prestige while demonstrating the farm's economic efficiency (Holtkamp, 1990).

### **5.5.3 Farmers' trading potential in relation to the programme**

As mentioned earlier, with the presence of such programmes, farmers were able to plant some cash crops (e.g. beans, maize, potatoes and other vegetables). However, the lack of a reliable market was among the hindrances that prevented farmers from formal trading (see

Appendix 4.5B, Q36- Q37). The trading method for such farmers was informal and without a proper keeping of records. There were underlying reasons for this. Firstly, the way farmers measured the harvest was informal. Secondly, some did not know the given land size and how much harvest (of any given crop) was to be expected. Thirdly, the lack of storage facilities dictated direct and immediate sales to avoid spoilage. Some of the farmers stored grains in the huts, or homemade structures called *inqolobane* while others had storage tanks of an unknown volume. One of the challenges which made their crops difficult to sell, was the lack of transport to take the produce to market points. Most of the farmers visited mentioned that local van (*bakkie*) services are expensive, so they prefer selling from homes. The customers had to carry purchased crops either on their heads, wheelbarrows, animal backs or with own vehicles for those privileged enough. It was not uncommon for farmers to grow a particular crop, for the purposes of family consumption and selling. One cannot firmly say “sell the surplus” because of the many determinants and the uncertainty as to how much was required to feed the entire family, until the next harvest. Many farmers mentioned that the harvest did not last longer than three to six months and how long it lasted depended on various factors; that is, provided it did not get spoilt, or that the farmer did not give some to the relatives or extended families and how big the crop was, for that particular season. The survey questions that addressed the question about the extent the tractor services provision contribute to farmers being able to produce a sellable surplus were:

- Do you know how much harvest of any given crop (especially maize and beans) you can get from the piece of land you have?
- Do you measure your harvest and understand its importance?
- What do you do with your harvest?
- If you sell it how do you sell it? That is, how much is costing which price, and where do you sell?
- What are the challenges in selling your harvest?
- What do you do with the profit from your harvest?

The above questions assessed the marketing potential of the concerned farmers. Producing a sellable surplus was hardly guaranteed due to various factors. Many did a variety of things with the harvest from family consumption, selling, milling for maize meal, feeding livestock and some was stored (see Appendix 4.5B, Q36). Thus, the main purpose was not to chiefly or merely sell the produce. It was not uncommon for many to produce primarily for family consumption, rather than to seek a market. When talking about seeking the market, the

majority of farmers seemed to sell by customary chances or opportunities. Seemingly, some were less active in seeking the market even around the local village. To second this premise, many farmers had no minor deals with the local tuck-shop owners to supply them with agricultural products. Probably the nature of relationships among villagers becomes important in this regard. However, people are less likely to speak about such matters to an outsider. Thence striking a deal with another community member(s) much depends on the state of the relationship between the parties (to be) involved. Therefore, it is important to build strong and healthy relationships among villagers for trading purposes.

The survey questions which addressed the question about “farmers’ potentially to independently work expanded land areas” were the following:

- Do you wish the programme to be continued or re-initiated and why?
- Do you hire or have you ever hired any privately owned tractor and why?
- How do you access labour, fertilisers and information you need in order to keep farming?
- Do you irrigate, if not why; and if yes how?

The answers to these questions provided some baseline on how farmers are capable of working the land without government assistance. Provided the land remains fallow in the absence of free of charge government services, such farmers could be classified as dependent. Any farmer who is capable to lookout for the available means needed to work the land, but happens to skip particular seasons due to limited efforts, could be classified as partially independent. A farmer who works the land every year or season, regardless of government assistance, could be classified as completely independent.

## **6. CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS**

The tractor service provision in itself, cannot develop smallholder farmers from a subsistence existence to commercial farming. This is due to the commonly found lack of other necessary inputs, such as irrigation systems, sufficient labour, crop protection measures, accurate doses of fertilisers and high-yielding seed varieties. However, in the case of a few smallholder farmers with irrigation systems and nearby reliable sources of water, access to more land and inputs, progress is possible and to some, it is already evident. For such farmers, a tractor services provision is of great benefit since they are able to plant a variety of cash crops in one year. The farmers are capable of obtaining more land, but without irrigation systems and the ability to buy farming inputs have less chances of being progressive. This is because dry land agriculture cannot guarantee a good harvest, even if enough doses of fertilisers were applied.

Fencing or proper fencing among smallholder farmers was also identified as another pressing concern, especially in areas where free range grazing of livestock is practiced. Farmers without proper fencing have difficulty in growing crops in villages keeping a variety of livestock- i.e. goats, sheep, cattle even wild animals. Definitely such livestock (unless there is a designated camp which is rarely the case) will find their way into an attractive, actively growing crop in order to feed on it. This, most often than not, creates quarrels and unhealthy relationships between the pastoralists and the crop growers. As much as fencing is indispensable for farmers living in a pastoral rural area, it interferes with the tractors' action; especially large tractors pulling large implements. Firstly, the gates need to be wide enough to accommodate the width of tractor mounted implements and to allow enough turning space to prevent the unintentional tearing down of fences. During the fencing of property, such considerations are important, especially for big tractor models; and small tractor models for land areas of about 0.5 hectares (ha) or a little more than that, might be the best option.

The study, therefore, proposes the evaluation and classification of farmers in terms of their personal and land potential, in order to decide on an equal footing, which ones to target for what power options. The study further recommends that for indigent farmers, mechanised farming needs to be initially introduced on a small scale and with the appropriate set of equipment a farmer can afford to manage and sustain. The equipment can be gradually

improved from time-to-time, as the farmer progresses. The establishment of multiple programmes of varied power options, ranging from advanced hand-tools, draft power technology to different sized (smaller, medium to larger) tractors is also recommended. This will avoid potentially burdening farmers with machines they cannot independently afford to purchase and maintain. With reference to the literature, investments in irrigation, fertilisers, crop protection measures, and high-yielding varieties should go hand in hand with increasing power inputs.

From this research, AEOs may acknowledge the significance of a gradual and progressive development of smallholder farmers, if independence is to be achieved. They must present a farmer with the equipment s/he can independently use, manage and sustain. A detailed assessment of each individual farmer in terms of physical, natural, financial, social and human assets, may help AEOs categorise farmers. Consequently AEOs may develop a local database (updated annually or biennially) to monitor and evaluate farmers' progress.

### **6.1 What the results communicate about the realities of mechanisation programme**

The results tells us that mechanisation cannot be a stand-alone programme. This means that other programmes or sub-programmes and projects, need to accompany the mechanisation programme. Such programmes (or projects) can be run preliminary or concurrently with the mechanisation. In addition, the results also tell us that smallholder farmers need to be equipped with all the necessary skills, knowledge, attitudes and behaviours (SKAB) required to operate (in a sustainable manner) a mechanised cropping system. Farmers' landholdings (including soil properties) and access to other necessary inputs and resources need to be thoroughly investigated before the introduction of mechanisation. This will help devise whether the benefits from the economies of scale are attainable or not. In addition supportive infrastructure such as rural roads, storage, processing and value adding facilities, also need to be improved or established, if they are in poor condition or unavailable. The indicators of success for the programme were found to be not clearly defined nor well thought through.

### **6.2 Implication of results in relation to what is known about the use of mechanisation for improved production**

The results relate to the fact that mechanisation is no panacea for improved crop production. Creating an enabling environment for smallholder farmers to access credits necessary to run a mechanised farming system, is indispensable. Thence, scaling-up of smallholder farmers needs to be associated with economic transformation in the agricultural sector. This

economic transformation may come through the mobilisation of financial institutions to accommodate high risk smallholder farmers. This shall, if possible, necessitate government subsidies and or strong binding agreements between the parties involved.

Environmental degradation and pollution are major concerns related to mechanised farming activities. It is therefore important to conduct environment-degradation and pollution awareness campaigns that are against the heavy reliance on fossil-fuels dependent equipment for crop production. In addition, modern agricultural equipment has many negative impacts on soil conservation and the ecosystem, and these bad practices, need to be discouraged. For example, tractors compact the soil and they damage soil structure and reduce soil microbial activity. Such important considerations and many others, are known, but to a lesser extent, by a number of smallholder farmers.

### **6.3 The role of extension in better practices**

The major role of extension for a successful mechanisation could be the creation of strong linkages between the farmer and all the other fields of agriculture. For example, extension should link farmers with agricultural engineers, economists, plant breeders, agro-meteorologists, seed technology specialists and many others. This is of paramount importance to ensure that adoption decisions for new technologies do not result in the bankruptcy and failure of a farmer. In this regard, extension needs to bring Subject Matter Specialists (SMS) close to the farmer for continuous support and guidance, until independence is certain. The way public extension is rendered in South Africa results in the defined educational context to be forgotten thus public extension is seen as a welfare rather than a sustainable development approach, thereby making many of the smallholder farmers dependent on public goods and handouts for progressive growth. The narrow definition of mechanisation by extension practitioners needs to be broadened to cover a wide variety of mechanisation options. Judging by definitions supplied by the contacted government officials, it can be said that the concept of mechanisation continues to be viewed as tractorisation.

### **6.4 Recommendations for further research**

This research proposes the following further studies for an in-depth understanding on how to transform smallholder farmers from using centuries-old farming equipment, to improved ones:

- What is the economic importance of owning a farm tractor in a rural village?

- How does mechanical power and draft animal power complement each other in rural cropping systems, and what trade-offs are there?

### **6.5 The study's contribution to the policy decision making for the next phase of mechanisation**

The recent mechanisation programme was not different from the previous one under the apartheid government in terms of initiation and implementation. It transpired that both programmes had been dominated by a single stakeholder and were introduced in a top-down approach. Secondly, the beneficiary farmers had little or no voice on how the programme should operate at a communal level. The services for both programmes were rendered free of charge, which resulted in higher service demands than what was available. Probably both programmes were implemented without a clear national policy. The noticeable difference is the implementation. For the former (first phase) the programme was implemented under hastily established homelands with parastatals. Whereas for the recent programme was implemented under small-scale farms with some emerging (land-reform beneficiaries) farmers. The motive for the previous programme was to try to show the international community that South Africa's separate development could work, however separate development did not in fact work. The motive for the recent one was claimed to be the promotion of food security. However, both motives, those before and after apartheid, were politically driven. Thence some similar mistakes were made. These are: free of charge services, top-down approach, inappropriate equipment for existing soil conditions, poor management and a politicized programme. One important lesson learnt, is to rather change the motives behind such a programme or programmes of similar nature, and to depoliticise them and put the farmers' needs first, rather than political agendas.

The study contributes to understanding the consequences (intended or unintended) of programme planning. For example, the intended consequences covered by the study were: expanded production areas; increased production output; promotion of a sellable surplus and food security, whereas the unintended outcomes, were the farmers' conflicts for services (jeopardising social cohesion or farmers' relations), the abandonment of draft-power and soil degradation (long term) due to unsustainable practices.

The study's contribution to the relevant discourse is multifaceted. Firstly, the study supplied the proposition of feasible strategies to be employed to mechanise smallholder farmers. Secondly, it provided important considerations prior to the introduction of mechanisation.

Thirdly, it touched on the acknowledgement and identification of key, internal and external stakeholders in the programme; and lastly it put an emphasis on the genuine involvement of farmers, right from the beginning. Consequently, the study informs policy makers that smallholder farmers (just like large-scale commercial farmers) have varied attributes in terms of land size, access to resources, skills/knowledge and management decisions. Therefore, initiating mechanisation as an overall solution programme, will never mitigate the farmers' challenges or address their real needs (as opposed to felt/immediate needs). This is because of unintended imbalance and exclusion where there would be farmers who are favoured by and those excluded from the programme. For example, road side farmers with easy road access, are more likely to be favoured for tractorisation, as compared to those farmers high up in the mountains or deep down in the valleys with poor, or no road access. In conclusion, it is suggested that multiple programmes targeting multiple categories of farmers, may help to eliminate the boundaries of exclusion.

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## APPENDICES- CHAPTER ONE

### Appendix 1.1: Ethical Clearance letter from the university's research ethics committee



31 August 2015

Mr SS Gwala 206506828  
School of Agriculture, Earth & Environmental Sciences  
Pietermaritzburg Campus

Dear Mr Gwala

Protocol reference number: HSS/0962/015M  
Project title: Agricultural Extension / the impact of tractor services provision (mechanization) programme on small-scale farmers: The case of Nkandla and Ubuhlebezwe (Ixopo) maize and dry beans farmers

#### Full Approval – Expedited Application

In response to your application received on 14 July 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

**PLEASE NOTE:** Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....  
Dr Shenuka Singh (Chair)  
Humanities & Social Sciences Research Ethics Committee

/pm

Cc Supervisor: Dr Karen Caister  
Cc Academic Leader Research: Prog Onesimo Mutanga  
Cc School Administrator: Ms Marsha Manjoo

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Humanities & Social Sciences Research Ethics Committee

Dr Shenuka Singh (Chair)

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## Appendix 1.2: Acknowledgement/permission letter from the KZN Department of Agriculture and Rural Development



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& rural development**  
Department:  
agriculture  
& rural development  
PROVINCE OF KWAZULU-NATAL

KZN Department of Agriculture & Rural Development  
Bag X9059, Pietermaritzburg, 3200

Enquiries: M.J Mfusi  
Tel: 033 3559112  
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Website:

02 June 2015

Attention: Mr. Sicelo Gwala

**Re: Request for permission to conduct research (farm survey).**

The above subject has reference.

Your letter dated 23 April 2015 with regards your request for permission to conduct research (farm survey) was received by this office and is acknowledged. Please be advised that your request has been accepted.

Please contact the relevant Local Office Managers regarding your request.

Yours sincerely

  
Mr M.J. MFUSI  
A/SGM: ADS

Appendix 1.3: Consent form/letter for the participants prepared by the researcher

Dear Participant

**Title: Experiences with Mechanisation - Government Tractor Service Provision and Small Holder Farming In Nkandla and Ixopo, KwaZulu-Natal**

My name is S'celo Gwala, I am studying for a Master's degree in Extension and Rural Resource Management through the University of KwaZulu Natal, Pietermaritzburg, South Africa.

During my recent work experience, I noticed that there is a growing interest for small-scale and/or emerging farmers to be mechanised, that is tractorize their field operations. This has raised the question in my mind of how tractor services provision affects the farmers' production process and production output and contribute to the development of rural economy.

During this interview, I will be asking you to answer some questions through an in depth interview which might take approximately an hour of your time. The results from this research are strictly for academic purposes meaning that there are no material benefits as a result of your participation. The information will be made available however, through publications and research reports that will be permanently located in the University of KwaZulu Natal. Your name and identity will not be given unless you give me the permission to do so.

Should you need to ask for any further information or clarification regarding this study, you may contact me on +27 76 863 8420 or my supervisor Dr Karen Caister on +27 74 107 4750. You may also contact a University Ethics Committee member should you wish to go through the HSSREC (Humanities and Social Science Research Ethics Committee) Research Office (Ms P Ximba, Tel: 031 260 3587, Email: [ximbap@ukzn.ac.za](mailto:ximbap@ukzn.ac.za). If you are happy to continue with my study, can you please read and sign below and indicate whether you allow me or not to use the following devices:

	agree	disagree
tape recorder		
camera		

I.....(full names of participant)  
hereby confirm that I understand the contents of this document and the nature of the research  
project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF PARTICIPANT.....DATE.....

## APPENDICES- CHAPTER TWO

### Appendix 2.1A

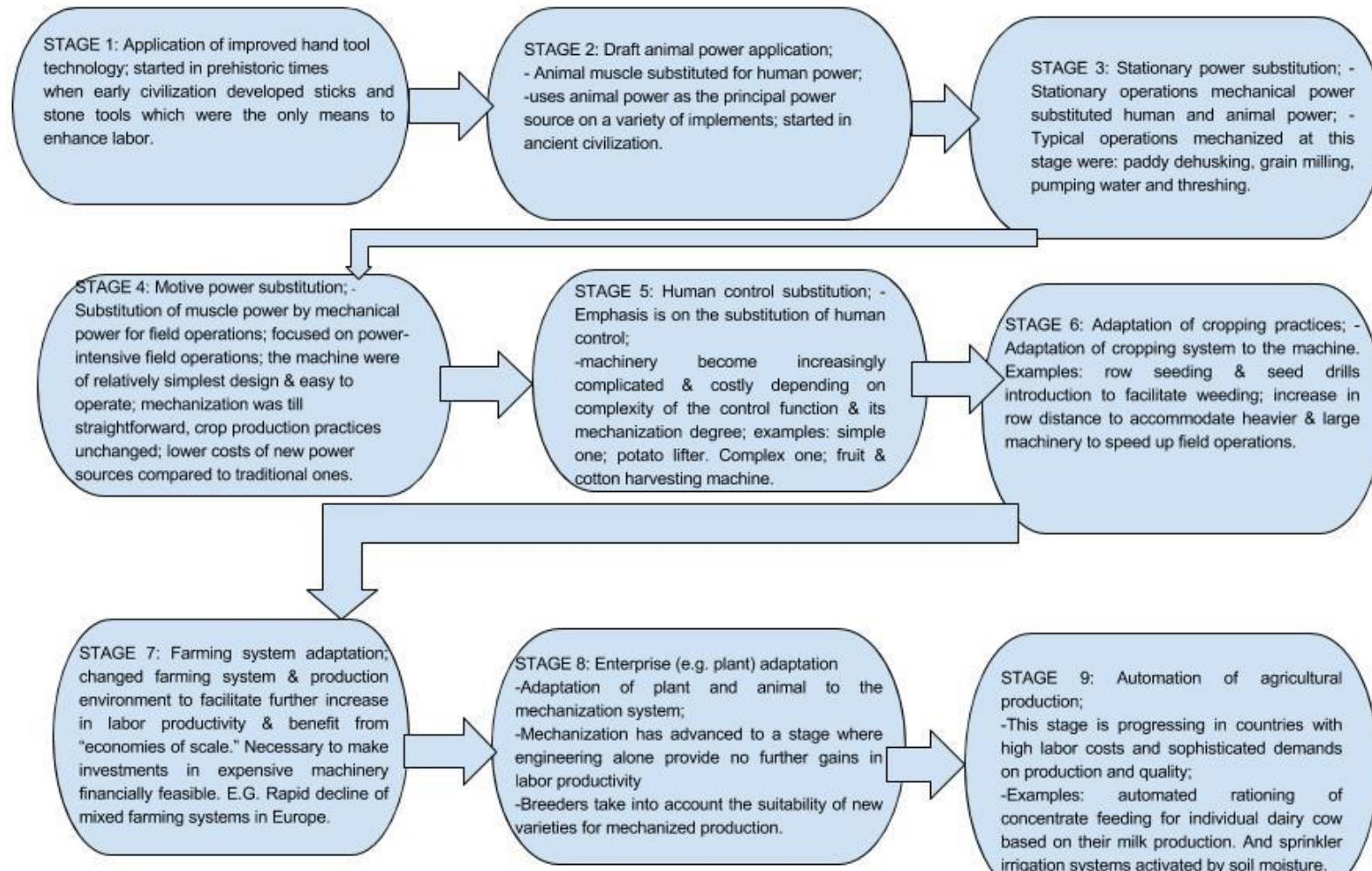


Figure 2.1: Nine stages of mechanisation adoption process and or labour productivity enhancing technology (After Rijk, 2012)

Appendix 2.1B

Table 2.1: Historical generalisations about mechanisation (after Binswanger, 1986)

Adoption	Depends on labour availability Larger farms adopt sooner than small farms Primary tillage followed by secondary nechanisation Transport and primary tillage are first users for mobile power
Influences for adoption	Labour scarcity in agriculture Land abundance (size of farm) Land abundance (availability of rental land) Light workloads and quick operations
Impacts	Motivation toward bigger farms Increased yields are exceptional when irrigation, high-yielding seeds, pesticides and fertilisers are also used

## APPENDICES- CHAPTER THREE

### Appendix 3.1: Maps showing the location of the two research areas

#### Appendix 3.1A

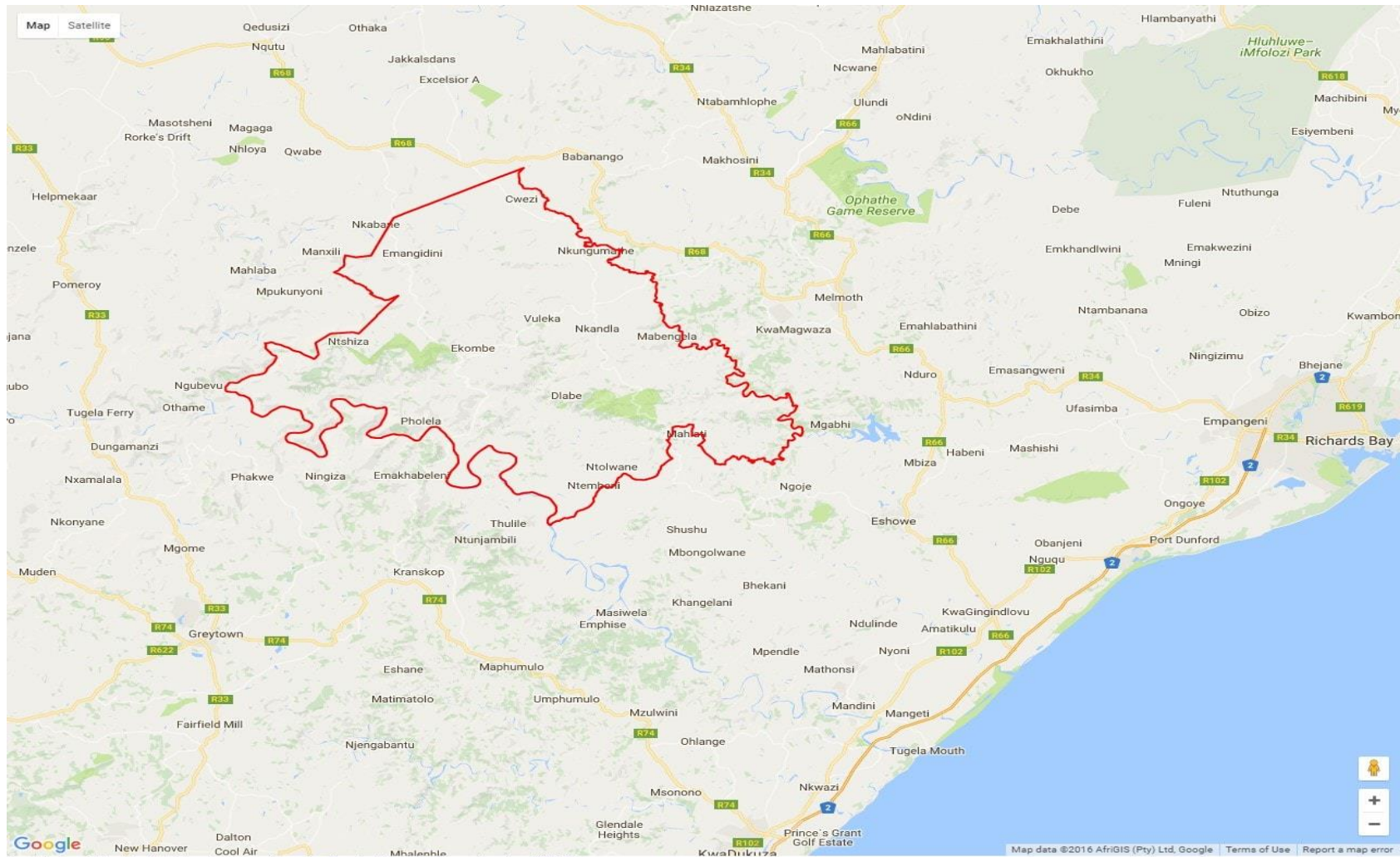


Figure 3.1: Part of the KwaZulu Natal Province map showing the location of Nkandla village (Source: Google Earth)

## Appendix 3.1B

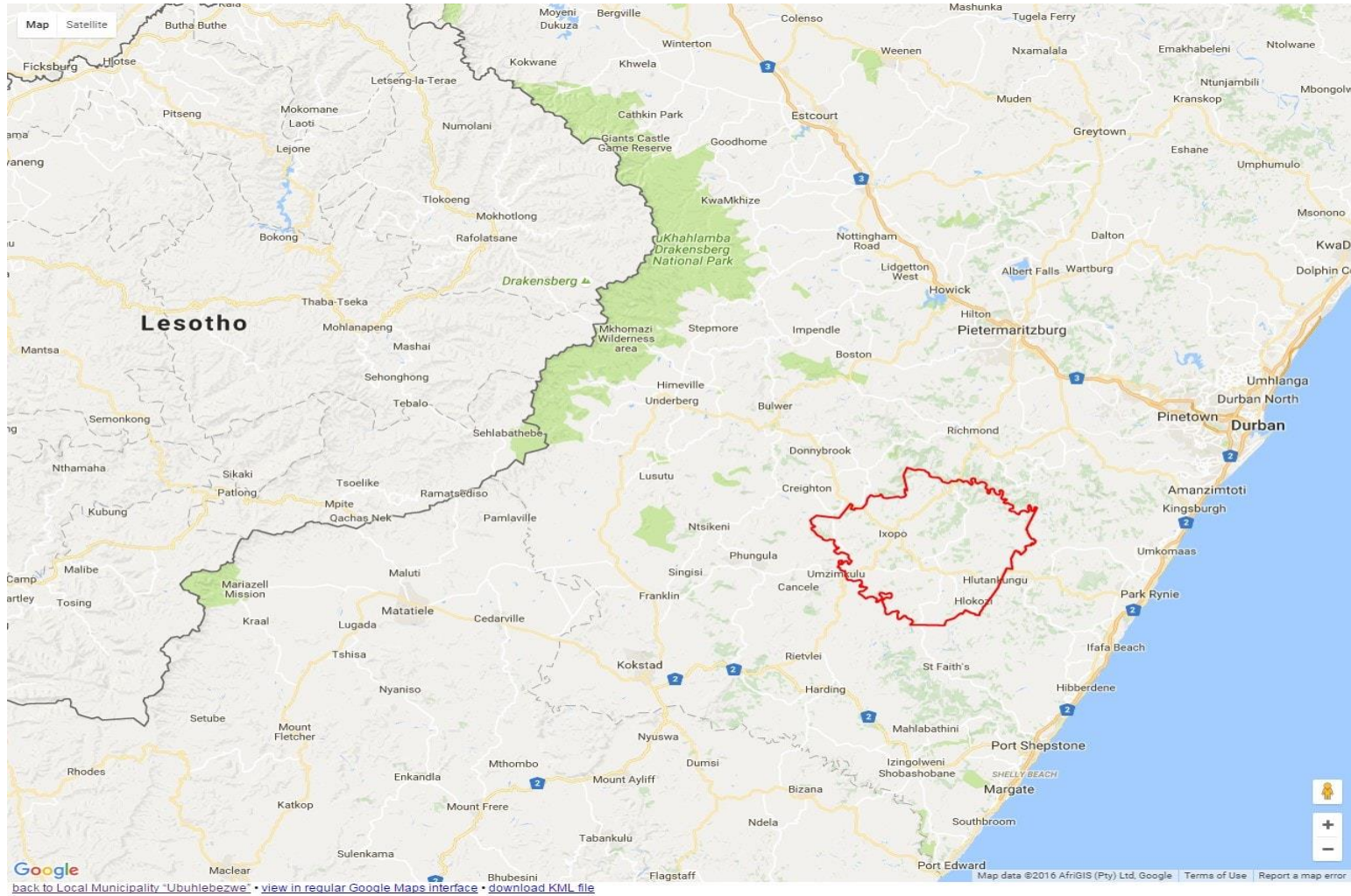


Figure 3.2: Part of the KwaZulu Natal Province map showing the location of Ixopo village (Source: Google Earth)

## APPENDICES- CHAPTER FOUR

### Appendix 4.1

Table 4.1: Chronology of events leading to the field visits

Event	Stakeholders involved	Location(s)	How accomplished	Date(s)
Made a request to local offices to conduct research	Local office Managers/Receptionists, Researcher	Nkandla/Ixopo, PMB-UKZN	Telephonically	April 2015
Submitted Ethical clearance form	Research Committee, Supervisor, Researcher	PMB-UKZN	e-mails	May 2015
Prepared questionnaires	Supervisor and Researcher	PMB- UKZN	Typed	May 2015
Visited (Head Office- Cedara) – interview request	Programme Coordinator, Researcher	PMB (Cedara)	Personal communication	19 May 2015
Made 1 <sup>st</sup> schedule to meet with the Programme Coordinator	Programme coordinator and Researcher	PMB (Cedara and UKZN)	Telephonically and through e-mails	29 May 2015
Requested a letter of acknowledgement	Programme Coordinator, Senior Managers (Head Office and Hilton office), Personal Assistants and Researcher	PMB (Cedara, Hilton, UKZN)	Telephonically and through e-mails	29 May- 02 June
Acknowledgement letter received	Senior Manager and his PA (Cedara), Researcher	PMB (Cedara, UKZN)	Telephonically and through e-mails	03 June 2015
Made 2 <sup>nd</sup> schedule to meet Programme Coordinator	Programme Coordinator, Researcher	PMB (Cedara, UKZN)	Telephonically and through e-mails	05 June 2015
Made 3 <sup>rd</sup> schedule (final) to meet the Programme Coordinator	Programme Coordinator, Researcher	PMB (Cedara, UKZN)	e-mails	08 June 2015
Met with the Programme coordinator	Programme Coordinator, Researcher	PMB (Cedara)	Verbal interview, notes taking	11 June 2015
Gave feedback to the supervisor	Supervisor and Researcher	PMB (UKZN)	Verbal and e-mails communication	18 June 2015
Met with supervisors (ARC/UKZN)	Funder and Academic Supervisors, Researcher	PMB (UKZN)	Verbal communication and notes taking	29 June 2015
Departure to the field	Researcher	PMB to Nkandla/PMB to Ixopo	Motor vehicle	13 July 2015 (13 July- 07 Aug 2015)

## Appendix 4.2: Interview questionnaire for the Programme Coordinator

1. Would you please define your role and responsibility in terms of the government's mechanisation programme?

**“Responsible for a number of activities especially with procurement (purchase) of tractors and implements, servicing and maintenance, training the farmers and also the tractor drivers. Also responsible for specification and procurement of inputs such as seeds, fertilizer, chemicals then reporting to the Manager. Also responsible for Monitoring and Evaluation and all the information is given to senior management to make decisions, track progress and note if there is a lack of progress because everything done is reported to DAFF (National Department) Management staff.”**

2. Would you be able to tell me how you define “mechanisation” in terms of your own experience of the planning and implementation of the programme?

**“Mechanisation is the process of using motorised equipment with associated implements to lessen the amount of work to be done manually and speed-up agricultural production processes, and be able to produce on large areas so to increase yields and income.”**

3. I understand that vision 2030 of the integrated rural development plan of the National Development Plan envisions an expansion of irrigated agriculture supplemented by dry land farming, and to convert some under-used land in communal areas and land reform projects into commercial production!!!

How has this political agenda influenced the implementation of mechanisation programme?

**“The programme was politically initiated, it came from DAFF guided by “not clear” policy-intention of a ruling party and it started in 2010. As from 2010 the programme was aligned with the political agenda and requirements of government. Since 2010 the intention was for the department to mechanise on behalf of farmers. There was no political intervention ...from 2014 there was a change since the requirement was to dispose all mechanisation assets to communal estates with the intention that they (beneficiaries) will farm for themselves. In this process they will be financially assisted because they will be expected to farm on a large scale since they won't be able to do it for themselves. Since its inception it**

**was well aligned but some adjustments were made along the way. Funding is based on policies and regulations from the national government.”**

4. Can you explain to me what legislation affects how you are able to operate? For instance, which legislation assists you and which hinders you in planning and implementation or monitoring? (Import/export legislation or labour laws or gender favoured laws).

**“All normal regulations of the department and definitely the vision and mission of DAFF. In terms of labour laws or gender favoured laws there is none since this is dealt with in a district and/or ground level. The main guideline is the Mechanisation Policy which was signed in August 2010.”**

5. How does the mechanisation programme work in partnership with other public services and programmes?

**“Since the end of 2013 there was none, the reason being all the work was to be paid for services rendered. Only partnership with reference to training is with Landini, John Deree and others who were involved in training programme of tractor drivers and the department officials “free of charge” the rest had to be paid for. The training was “negotiated service” in order for it to be rendered freely since the Coordinator has good relations with the above mentioned companies, besides they (companies) also believed it was good for their product to be properly maintained and operated. Since 2014 there is a new strategy and policy and change of approach (farmers to farm for themselves), now there is a strong drive for partnership with different companies (private companies and banks) since the department cannot do all the work by itself, but this is still in the process.”**

6. Who would you say are the most important stakeholders in the implementation and monitoring of the programme (for both the programme implementation and farmers)

**See Table 1 below**

Table 1: stakeholder list and their influence in the programme

Stakeholder list	What or who do they influence	Why or how they are important
<b>DAFF (internal)</b>	<b>Provincial Dept; farmers' attitudes through radio broadcast; districts/regions/locals</b>	<b>Issuing instructions, funding, expectations to meet targets</b>
<b>Prov. Dept of Agric &amp; Rural Dev. (internal)</b>	<b>Farmers, service providers,</b>	<b>Planning and execution of the plan</b>
<b>Beneficiaries (internal)</b>	<b>Prov. Dept.</b>	<b>Recipients</b>
<b>Contractual tractor drivers (6 month)</b>	<b>Farmers, Prov. Dept,</b>	<b>Tractor operators</b>
<b>John Deree &amp; Landini companies (external)</b>	<b>Farmers through drivers; Prov. Dept.</b>	<b>They are specialists and suppliers of equipment</b>
<b>Rogue Agric company (external)</b>	<b>Farmers and the prov. Depart.</b>	<b>Input suppliers</b>
<b>Spray Rig company (external)</b>	<b>Framers</b>	<b>Input suppliers</b>
<b>Rovic Leers company (external)</b>	<b>Farmers</b>	<b>Input suppliers</b>
<b>KZN oils company (external)</b>	<b>Farmers</b>	<b>Input suppliers</b>

7. Do any of these stakeholders have a direct influence on the farmer and his production?

**“Yes- DAFF for instance, the provincial department execute their mission and vision to some extent and to mechanise on behalf of farmers. The provincial department design programme and approach to improve farmers and production of output. Companies (equipment suppliers), their special technical knowledge influences the way in which production is executed at the ground level. General input suppliers (seeds, fertilizer, chemicals)- quality of products they supply definitely influences (improve) production within farmers on communal land. Farmer-to-Farmer influence, one farmer may see a particular equipment from another farmer and happen to like it.”**

8. How were the beneficiaries consulted prior to the implementation process? How did you know which farmers to work with and what they were looking for? Was this controversial within districts? What challenges were there in being “participatory or consultative?”

**“Consultation; farmers were consulted through personal application and resource assessment (land, soil, slope) and it was them showing the intent and interest to be part of the programme.”**

**“It was only allowed to work with farmers who applied to be part of the programme, in that application farmers indicated types of crop to grow and size of land area; and application for service was a standard process, that is known approach.”**

**“It was a well-thought approach which did not yield any challenges at Coordinator’s level since the application process was a bottom-up approach. Once framers have applied the application stand for four years no need to apply yearly.”**

9. How do you acquire tractors/implements? How the tractors and relevant implements were bought? That is, imported or bought locally? Brand new or second hand?

**“Through “Procurement Standard,” or “Government Procurement Process.” Specifications are drawn, advertised, the cheapest bidder is considered but on BEE basis. Both tractors and implements were bought locally (SA) and the government is only allowed to buy new not second hand equipment.”**

9.1. What equipment are still in operation?

**“All are still in operation but some need serious servicing and maintenance.”**

9.2. Who owns it and Why?

**“Government property with specific to “Public Finance Management Act,” but since 2015 it will be disposed to communal estates.”**

9.3. How the equipment is managed?

**“It is managed at a district level with regard to utilisation plans, servicing, maintenance and storage. All are barcoded so to verify existence and ensure they do not get lost and there is a “Mechanisation database” to verify numbers and position, and tractor condition is checked on daily basis using “Tractor Inspection Book.”**

9.4. Under what conditions is it handed over?

**“100 % operational, and where required should have COR (Certificate Of Roadworthiness). Final transfers can only be done to communal when they have proved that they will manage the equipment properly under two conditions: (1) should at least cultivate 80% of available arable land; and (2) should manage the equipment properly.”**

9.5. What systems in place to keep tractors and implements functional? Where does funding come from (who pays)? Do local contractors (SMMEs) do the repairs or what?

**“Initially there were “Standing Orders” with reputable suppliers to keep servicing equipment until their expiry date. Thereafter normal procurement process was followed, that is applications for potential service providers to the head office and the office had to appoint the service provider in the local or around that municipal area, that is, after the expiry of standing contracts they used local suppliers which did not do quite well. Funding comes from government’s departmental funds (National- Provincial treasury- Departmental funds).”**

9.6. Who is involved in making the above decisions, how is it done?

**“Coordinator, Procurement Section and Relevant Department Staff.”**

10. Do you mind if I look at your records/reports to understand the patterns of acquisition and hand-over of the equipment to farmers?

**“NOT with the Coordinator with the Central Procurement Section.”**

11. Some literatures reveal that one of the reasons of “failed tractor schemes” is lack of after sales support and spare parts. Is there after sales service support from brand owners or suppliers of equipment?

**“Not relevant to them/no after sales were required from their side since for the two year period “standing orders” were there, after two years the service was given to local service providers.”**

12. What would you say have been the challenge(s) from your own department with getting the programme up and running? (would you rank them using a scale of 1-5)

(1) Very easy ; (2) easy ; (3) moderate ; (4) difficult ; (5) very difficult .

Table 2: challenges list and their rankings

Challenge list	Rating of difficulty to re-solve	Additional remarks
<b>Insufficient equipment</b>	<b>4</b>	<b>Cannot serve all the farmers</b>
<b>Equipment not matching properly</b>	<b>5</b>	<b>Difficult to execute correct practises</b>
<b>No storage facilities for both tractors &amp; equipment</b>	<b>5</b>	<b>Damage by weather conditions esp. sun &amp; rain</b>
<b>Programmes not accepted by district staff, regarded as not part of job description</b>	<b>4</b>	<b>Slow adoption &amp; uptake</b>
<b>Slow procurement processes</b>	<b>5</b>	<b>Difficult to meet deadlines of the production cycle</b>
<b>Lack of funding</b>	<b>4</b>	<b>Difficult to get things done</b>
<b>Lack of policy amendment as time goes by</b>	<b>4</b>	<b>Lose direction over time</b>

13. Using the same scale as above, what would you say have been the challenges with farmers in trying to implement the nechanisation programme? **(NOT ABLE TO COMMENT FIND OUT AT GROUND LEVEL)**

(1) Very easy ; (2) easy ; (3) moderate ; (4) difficult ; (5) very difficult .

Table 3: challenges list related to the farmers

Challenge list	Rating of difficulty to re-solve	Additional remarks

14. How would you evaluate whether the beneficiaries are responding (taking-up) the programme? Feedback from farmers?

**This can also be obtained at district/local level**

15. What incentives do farmers currently had for participating in the programme?

**“Up to mid-2014 they got everything for free (free service and inputs), except where they made their own contributions.”**

16. What was, or have been reported as success stories and/or achievements since the programme started (within the department and among farmers)? **[among farmers cannot respond]**

**“In the department they have achieved most of the targets and in the absence of a clear initial plan the programme was still well executed.”**

17. What skills shortages you have struggled with in this programme and how you addressed them?

Table 4: skills shortages in the programme

Skills shortage list	Addressed how	Other remarks
<b>Staff lacking basic knowledge- inexperience with basic mechanisation</b>	<b>Very difficult to address but managed through drivers’ training &amp; numerous communication</b>	
<b>Tractor drivers shortage</b>	<b>Training together with agencies; contract tractor drivers</b>	
<b>Lack of servicing &amp; maintenance on staff at local levels</b>	<b>Training &amp; numerous communication</b>	

18. Do you think looking at the special conditions of the region or community before implementing such programme would help? That is, priorities, local situations and needs of the community? **[resp.: we did this through applications]**

Yes  No

(I). If Yes How, if No Why it would not?

(R).....  
 .....  
 .....

19. The programme is being “phased out” how the department is planning to do this?

**“Through the new policy (you can ask for the document from the Senior Manager’s office)- in a nutshell, there will be a transfer for a three year trail period and transfer if they have proven to manage it properly.”**

20. Do you think are all the beneficiaries aware that the programme is being phased out?

**“I don’t know, most might be aware but not sure if all are aware, senior management and MEC are to inform them.”**

21. In the foreseeable future, what do you think is likely to happen with tractors and implements after the programme has been phase-out completely?

**“Not sure, but hope they will be transferred in a good condition and likely to remain so, so that farmers can execute their production processes successfully.”**

22. If you were to start all over again, how would you change what has been done to support farmers with a mechanisation programme?

**“Plan the whole process in a different way, since was not involved with initial planning. Address the issues such as the above listed challenges and consider all the technical requirements of such a huge programme and costs implications it might have over the long term. This all should relate to farmer’s needs and the most appropriate way to address them.”**

**Appendix 4.3: Agricultural Extension Officers (AEOs) and Mechanisation Assistants schedule of questions**

**Interviewer (I): Gwala SS**

**Combined responses from Respondent(s) (R): AEOs of both Nkandla & Ixopo villages**

<b>Nkandla group</b>	<b>Ixopo group</b>
Date: 14/07/2015 Time start: 11:26; time end: 01:30pm Place: Nkandla Department of agriculture local office	Date: 03/08/2015 Time start: 12:29; time end: 01:45pm Place: Ixopo Department of agriculture local office

1. On average, how much land do most of the farmers you serve own or have access to?

**“0.5- 5 hectares, and a few have above 5ha.” (Nkandla)**

**“0.5-20 hectares” (Ixopo)**

2. How do most of the farmers you serve access production inputs (seeds, fertilizer, labour, irrigation water, ploughing services)?

**“Through extension officers- fertilizer, seeds/seedlings/hand hoes, watering cans, labour is self-service. A few received water tanks from the local office and municipality- it was related to one-home-one-garden programme.”**

3. Besides public extension, what other sources of information and relevant support services related to “farming activities” and “farming decision making” do the farmers you serve have access to?

**“Radio station (ukhozi fm) and television. Previously they used to receive *Farmers Weekly* magazines and *New Farmer* newspaper. Other stakeholders are NGOs such as Siyasiza Trust, LIMA Rural Development Foundation, Heifer international, PANNAR (information days), Grain SA (rendering trainings).”**

4. Would you please define your role as Agricultural Extension Officers/mechanisation assistant with regard to government mechanisation programme?

**“Each AEO coordinate the programme in the allocated respective ward this includes identifying areas to be serviced, filling and filing of application forms for potential farmers**

and monitoring the programme (follow-up after tractors when they plough and make necessary records).”

**Mechanisation Assistant’s role: “to allocate tractor operators according to wards. During allocation to a particular ward I also instruct AEOs to accompany the drivers with inputs such as seeds, fertilisers, and herbicides. Before tractors get out of office I also check the condition of tractors, put the diesel, then note the condition if it needs servicing and then call the region to attend to the problem and book for the service then technician will come to service that defected tractor. Am also responsible to schedule the operation plan.”**

5. From your own experiences regarding the programme, how would you be able to define “nechanisation?”

**“The introduction of tractors and associated implements to farmers to facilitate farming activities.”**

6. Who would you say are the most important stakeholders in the implementation of the programme (for both the programme implementation and farmers)

Table 1: stakeholder list and their influence in the programme

Stakeholder list	What or who do they influence	Why or how they are important
<b>DAFF</b>	<b>KZN dept of agric</b>	<b>Programme initiator and funder</b>
<b>KZN dept of agric</b>	<b>Managers</b>	<b>Programme implementation, supply of inputs</b>
<b>Managers</b>	<b>AOEs, farmers</b>	<b>Regulate service delivery</b>
<b>Local planning committee</b>	<b>Operators, local office, farmers</b>	<b>Drivers/operators of the programme locally</b>
<b>Traditional leaders</b>	<b>Farmers</b>	<b>Land permission (PTO)</b>
<b>Farmers</b>	<b>Local planning committee</b>	<b>beneficiaries</b>
<b>AOEs</b>	<b>farmers</b>	<b>Operate the programme at ward level</b>
<b>Tractor operators</b>	<b>Farmers</b>	<b>Operate the equipment (foot solders)</b>
<b>Endu-track/farm track (external)</b>	<b>Drivers, farmers, officials</b>	<b>Servicing of equipment</b>
<b>Zululand gearbox (external)</b>	<b>Drivers, farmers, officials</b>	<b>Servicing of equipment</b>

<b>KZN oils (external)</b>	<b>Drivers, farmers, officials</b>	<b>Supply diesel</b>
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7. Do any of these stakeholders mentioned above have a direct influence on the farmer and his production?

**“AEOs take soil samples and identify areas, also responsible for the calibration of planters along with operators. The department of agriculture fenced many areas to keep livestock at bay and supply inputs such as seeds and fertilisers. Tractor operators take the tractor to the farmers and do the ploughing and minor repairs/defects. The local planning committee ensures progress of the programme in their respective wards.”**

8. How were the beneficiaries consulted prior to the implementation process?

**“Though their traditional leaders who announced the programme in their respective areas then AEOs held meetings with farmers after Amakhosi have announced it.”**

8.1. In what decision making process were the farmers engaged regarding the programme?

**“Local Planning Committee (representatives of farmers) sit down with the local manager and AEOs and plan how the programme will work. They usually don’t have a direct say on what to plant especially if they don’t have seeds- some donate cash to buy seedlings after their land have been ploughed- in that way they can chose what to plant.”**

9. How did you know which farmers to work with and what they were looking for?

**“Through the application process which got disregarded along the way.”**

9.1. Was this controversial within districts?

**“Local Office Manager can argue/respond to this.”**

9.2. What challenges were there in being “participatory or consultative?”

**“Local Office Manager can argue/respond to this.”**

10. How do you acquire tractors/implements? How the tractors and relevant implements were bought? That is, imported or bought locally? Brand new or second hand?

[See Programme Coordinator’s response in appendix 4.2.4.1, question 9)

**“As AEOs we have no idea on this as we are not part of the procurement process, we just see tractors arriving or being told there will be tractors delivered to the office.”**

**(Mechanisation Assistant): “since tractors started operation came with a few associated implements, others haven’t got any thus far, so ploughs were borrowed from the community. When implements got broken were serviced with AEOs cash.”**

10.1. What equipment are still in full operation?

**(Mechanisation Assistant); “tractors and planters, two ploughs, one boom sprayer and one combine harvester, one trailer, *skofel*, and the ripper.”**

10.2. Who owns it and Why?

**(Mechanisation Assistant); “government because they were given by it. Some tractors are owned by the President’s Masibambisane Programme- they are still in operation and have been serviced.”**

10.3. How the equipment is managed

**(Mechanisation Assistant); “when the drivers go out to the community with tractors they make an itinerary and they usually sleep in the villages where they are working so that they can guard the equipment and that helps reduce travel time spent on the road. When tractors get broken-down and have tyre punctures that particular tractor stops and a contractor appointed from the district office comes to take service it, the punctured wheel is transported from the office to Eshowe for repairs, no need for a contractor (usually paid for with officials’ cash). In the office the equipment is under good security.”**

10.4. What systems in place to keep tractors and implements functional? Where does funding comes from (who pays)? Do local contractors (SMMEs) do the repairs or what?

**(Mechanisation Assistant): “they get serviced by the government and funding is also from the government. Local contractors are also hired by the department to do the service.”**

10.5. Under what conditions is it handed over?

**(Mechanisation Assistant): “in good condition because they were serviced.”**

10.6. Who is involved in making the above decisions, how is it done?

**(Mechanisation Assistant): “one official from the Regional Office and local managers who are not fully involved because of delegation”**

11. What would you say have been the challenge(s) from your own department with getting the programme up and running? (would you rank them using a scale of 1-5)

(2) Very easy □; (2) easy □; (3) moderate □; (4) difficult □; (5) very difficult □.

Table 2: challenges list and their rankings

Challenge list	Rating of difficulty to re-solve	Additional remarks
<b>Equipment breakdown</b>	<b>5</b>	<b>Takes time to be repaired delays planting time</b>
<b>Shortage of diesel</b>	<b>4</b>	<b>Delayed orders</b>
<b>Unfavourable weather condition</b>	<b>4</b>	<b>Delayed rendering of service</b>
<b>Tyre punctures</b>	<b>5</b>	<b>Waiting (delayed) orders; AEOs have to use own cash to fix them</b>
<b>Licencing of tractors</b>	<b>5</b>	<b>End-up not going to farmers</b>
<b>Small number of tractors</b>	<b>5</b>	<b>Not able to service all farmers</b>
<b>Lack of storage</b>	<b>3</b>	<b>Corrosion of implement</b>
<b>Lack of motor vehicles</b>	<b>4</b>	<b>Unable to follow-up</b>
<b>Lack of ploughs</b>	<b>4</b>	<b>No departmental ploughs received</b>
<b>Accommodation of operators</b>	<b>3</b>	<b>Not fairly treated in some areas</b>
<b>Payment of operators</b>	<b>5</b>	<b>Delayed payments due to contractual issues</b>

12. Using the same scale as above, what would you say have been the challenges with farmers in trying to implement the nechanisation programme?

(2) Very easy □; (2) easy □; (3) moderate □; (4) difficult □; (5) very difficult □.

Table 3: challenges list related to the farmers

Challenge list	Rating of difficulty to re-solve	Additional remarks
<b>Ploughing but some don't weed or plant</b>		<b>Some want the service because its free of charge</b>
<b>Lack of irrigation water/system</b>		<b>No other plan except rainfall</b>
<b>Lack of market, transport for produce</b>		<b>Sell of pension points, consume, give away or rot in the field</b>
<b>Lack of fencing</b>		<b>Livestock feed on crops</b>

13. What was, or have been reported as success stories and/or achievements since the programme started (within the department and among farmers)?

**“Some are independent others are close to being independent since they can hire local ploughing and transport services and are able to buy their own inputs.”**

14. What skills shortages you have struggled with in this programme and how you addressed them?

Table 4: skills shortages in the programme

Skills shortage list	Addressed how	Other remarks
<b>Driver’s training to deal with community</b>		
<b>Driver to know everything regarding the tractor (basic mechanical knowledge)</b>	<b>basic mechanical training</b>	
<b>Local engineers (mechanic)</b>	<b>outsourcing</b>	

15. Do you think looking at the special conditions of the community or the farmer (group of farmers) before implementing such programme would help? That is, priorities, local situations and needs?

Yes  **X** No

If Yes How, if No Why it would not?

**“There would be no waste of resources where services are not needed because only special farmers need will be targeted, for example some areas are very hot so planting maize without irrigation is a waste.”**

16. How did you monitor the programme during implementation?

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17. How did you evaluate the programme and the end of each cropping cycle?

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18. The programme is being “phased out”<sup>1</sup> how the department is planning to do this?

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<sup>1</sup> This refers to a sponsor’s withdrawal of involvement in a program without turning it over to another institution for continued implementation (Gardener, *et al.*, 2005).

**“The new phase out policy is in place.”**

19. Do you think are all the beneficiaries aware that the programme is being phased out?

Yes  No ? If Yes how they have been made aware, if No Why not?

**“We are in the process of informing them but most of them know.”**

20. In the foreseeable future, what do you think is likely to happen with tractors and implements after the programme has been phase-out completely?

**“They will be given to those with large areas (50ha plus) and some with managerial skills will cope but some may not be able to manage them properly.”**

21. If you were to start all over again, how would you change what has been done to support farmers with a nechanisation programme?

**“Increase number of tractors and associated implements may be a large number of farmers can be reached. At least each office should have a mechanic and have petty cash for minor defects/breakdowns such as tyre punctures that can be fixed locally.”**

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**Appendix 4.4: Farmers’ individual interview schedule of questions**

1. How land is given or allocated in this area (local procedures to obtain or work the land), “permission to occupy?”
2. Are you able to acquire more or expand land if you see the need and how does that happen?
3. How could you possibly tell if your soil is fertile or not?
4. If you see that your soil is becoming infertile (or less fertile) what do you do?
5. How do you know if your soil is suitable or not for the crop you wish to plant?
6. Who gives you advises when it comes to “soil fertility” measures and means of improving it

	tractor usage				draft animal usage				hand (hoe, fork) tool(s) usage				land under cultivation (ha)
	ploughing	planting	weeding	transport	ploughing	planting	weeding	transport	ploughing	planting	weeding	other	
Total land area (ha)													
Yes/no													

and other management decisions?

7. Besides public extension service what other sources of information relevant to your farming activities you have access to? (e.g. radio, TV, NGOs, other farmers and so forth)
8. How do you access cultivation services?
  - Self-service (animals/tractor/hand-tools)  (1)
  - Government tractor service  (2)
  - Private tractor service  (3)
  - Private animal draft service  (4)
  - Family labour service  (5)
  - Local manual labour service  (6)
9. Which one of the above is easy to obtain and which one is difficult and WHY?
10. May you specify what equipment you use at different stages of production, fill in table one below.

Table 1: assessment of tools and equipment used at various stages of production by farmers concerned on a given land area

11. Reasons for using a tractor

Advantages for using a tractor

Disadvantages for using a tractor

12. Reasons for draft using draft animals

Advantages for using draft animals

Disadvantages for using draft animals

13. Reasons for using hand-tools

Advantages for using hand-tools

Disadvantages for using hand-tools

14. Do you ever need more labour to help with farming activities? Yes  No ? If NO Why if Yes ask the next questions.

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15. When (farming activity) do you need more labour (fill in table two)?

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16. Who helps you when you need more labour and how do you pay them?

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17. How many more manual labourers (estimation) you usually need during peak periods and how readily available are they?

Table 2: land area under cultivation against labour demand (no. of individual manpower) at various stages of production

	Labour demand at various stages of production against land area				
	Land preparation	Planting	weeding	harvesting	transportation
Need for more labour (mark with X)					
Units of labour					

18. Let us do a list of inputs you as a farmer can afford to purchase or obtain on your own and the ones you cannot (fill in table three).

Table 3: summary of inputs the farmer can afford versus those s/he cannot afford

affordable inputs	unaffordable inputs

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19. Do you own animals (draft animals and other)? Yes  No ? (if *yes* fill table four below if *no* ask the next question)

Table 4: draft animal (and others) ownership assessment (Physical assets analysis)

Type of animal	Number of animals	Field usage of animal	Other uses	Comments
Cattle				
Donkey				
Horses/mules				
Other:				
Sheep				
Goats				

20. Did you own draft animals in the past? Yes  No  (If *yes* ask the next question, if *no* skip the next question)

21. How did you lose your animals (state event/period in household history)

22. Are you sometimes forced to sell animals (livestock) in order to buy grains (other inputs) and/or to feed your family? Yes  No

23. Do you ever use animals to cultivate your field? If *yes* would you please answer the following questions?

23.1 Do you own enough number of draft animals? Say “enough” is four (six) to eight and above in order to be harnessed for ploughing? Yes  No

23.2 Do you have necessary harnessing equipment for draft animal? Yes  No

23.3 What do you do if you either do not have enough numbers of draft animals or harnessing equipment?

24. Having said all of the above, let us compare and contrast the use of a tractor, draft animals and hand-tools by filling the table below (table five). Using the following scales, may you decide the affordability, timeliness, workable land, labour demanded, and maintenance with regard to using a tractor, draft animals and hand tools.

Scale: Accessibility

Very easy  (1); easy  (2); possible  (3) very difficult  (4); difficult  (5); impossible  (6)

Scale: Affordability

Very easy  (1); easy  (2); possible  (3) very difficult  (4); difficult  (5); impossible  (6)

Scale: Timeliness

Very timely  (1); timely  (2) less timely  (3); very delayed  (4); delayed  (5); little delayed  (6)

Scale: size of land under cultivation

Small □(1); moderate □(2); large □(3)

Scale: labour demand

Low □(1); medium □(2); high □(3)

Scale: maintenance

High □(1); moderate □(2); low □(3)

Table 5: differences to use a tractor, draft animal and hand-tools in terms of accessibility<sup>2</sup>, affordability<sup>3</sup>, timeliness<sup>4</sup> (ploughing and planting), “land under cultivation,”<sup>5</sup> “labour demand”<sup>6</sup> and “maintenance”<sup>7</sup> (Economic viability).

	Tractor	Animal draft	Hand tools
Accessibility (easy/difficult)			
Affordability (affordable/not affordable)			
Timeliness of planting (timely/delayed)			
Size of land under cultivation (large/moderate/small)			
Labour demand (low/medium/high)			
Maintenance (High/low)			

25. What are the income generating activities for your household members? (fill table six below)

Table 6: cash-income generating activities (Financial/economic livelihood analysis)

Household member (who?)	Activity (source of income)	Seasonality (when is the activity carried out)	Estimated income level per unit time

<sup>2</sup> Accessibility will be measured by “local (in)availability, easy/hard to obtain for service.”

<sup>3</sup> Affordability- to be determined by farmers

<sup>4</sup> Timeliness- soon after the first summer rains is timely, few months after its delayed

<sup>5</sup> Land size under cultivation: ±0.5 ha= small; between 1-5 ha= moderate; 6≥10 ha =large

<sup>6</sup> Labour demand would said to be high if more than family labour is required, medium if a small number (less than five) is required and low if not

<sup>7</sup> Maintenance- high if parts and/or services (including feed and veterinary service for animal draft) are not available locally, low if parts and/or services are available locally at an affordable rate, moderate if both local and external services are available at affordable rates.

26. Do you have relatives in the village or outside the village? Yes  No .
27. Do you help each other with farmland/or other work or any kind of aid? Yes  No ? If Yes How?
28. Have these forms of mutual aid increased, decreased or stayed the same over time?
29. When do you plant maize and dry beans and why?
30. How do you divide your land area for different crops and why? That is planting patterns.
31. How do you sequence your crops on the same piece of land and why?
32. What do you do with crop residues (e.g. maize stover and bean residues)? For example, burn them, feed animals with, mulch with and/or incorporate into the soil.
33. Do you know how much you could possible produce on this land? Yes  No
- 33.1 If Yes how much if No why?
34. Do you measure your harvest? Yes  No .
- 34.1 If *yes* How if *no* Why not?
35. Do you see the importance of measuring your harvest and Why? Yes  No
36. What do you do with your harvest (select applicable option/s below)?
- Sell
- Household consumption
- Process  (grounding for maize meal in case of maize)
- Feed to livestock
- Store
- Other (specify)  \_\_\_\_\_
37. If you consume it, how many family members you could possible feed, with how much? For how long? Depending on the family size.
- If you sell:
- 37.1 Where do you sell your produce?
- 37.2 How do you sell your produce? That is how much is costing which price?
- 37.3 How do you transport your produce to the market or customers if there is a need?
- 37.4 What do you do with the income from the produce?
- 37.5 Does the income from the produce able to pay-off input costs, how? Yes  No
- 37.6 What are the challenges of selling your harvest?

38. If you process it:

38.1 Where do you process it?

38.2 How do you process it?

38.3 What are the costs involved?

38.4 What are the challenges of processing your harvest?

39. If you store it:

39.1 What storage facilities you use?

39.2 How long do you keep the harvest in store?

39.3 Why do you store the harvest?

39.4 What are the challenges with “storage” of your harvest?

40. How tractor service provision has been helping you in your farming activities?

40.1 Was it on time according to your planting season?

40.2 Did it reduce labour demand and drudgery?

40.3 Were you satisfied with the level of the service (land preparation) you have been receiving?

40.4 Did you have the voice to complain if you were not satisfied at the level of the service received?

41. Who decides on the operational process (farmers’ sequencing, tractors’ arrival/departure and distribution, number of days per stay) of rendering cultivation services and why?

42. Did it ever happen that you missed the ploughing season, or delayed planting because you waited for government tractor service to prepare land for you but did not come or came late?  
Yes  No

42.1 If *yes* what did you do in that situation?

43. Which other infrastructure(s), inputs and/or resources do you think or wish should be coupled (or be in place) with mechanisation to make it work effective and efficient (e.g. irrigation systems, fertilizer)?

44. What contribution did the programme have in your social life as farmers? For example, formation of cooperatives, farmers conflicts over service sequential!!!

45. Is there any change in your production capacity and productivity since mechanisation is concerned? For example, increase of land under cultivation, harvest per hectare? Yes  No

46. Is there any contribution, increase or improvement in your household income since mechanisation is concerned? Yes  No
47. Was there any improvement in food availability in your household since the programme is concerned, and if *yes* How?
48. Do government officials consult you when deciding on the implementation process before the start of each season about how the programme will run? Yes  No  If Yes how if NO why not?
49. From your perspectives, how the programme should be organized or operated? That is, what do you think needs to be done to make it work effectively and efficiently?
50. Do you wish this programme to be continued/re-initiated in the future and Why? Yes  No
51. If you had your own tractor how would you use it to benefit your farming activities?
- 51.1 Who could drive it?
- 51.2 How and where would you service it?
- 51.3 Where would you buy spare parts?
- 51.4 How would you pay for fuel and tyres?
- 51.5 How would you buy necessary implements (e.g. mouldboard and disc ploughs)
52. Setting aside affordability, by looking at the size, the slope of your land and the above maintenance costs, would you buy your own tractor, and Why? Yes  No

## **Appendix 4.5A: Information Set, Farmer Interviews Data Sheet and codes**

### Code Keys:

Q No.= farmer participant no.

GenM = Gender Male

GenF = Gender female

EL (std)= Education level (standard)

LYaS = Last Year at Schhol

LA (ha) = Land Area (hectares)

LPF = Land Properly Fenced?

ATEL = Able To Expand Land?

PAL= Plant All the Land?

ToS = Timeliness of Services?

EHPTS= Ever Hired Private Tractor Services?

OT = Own Tractor?

NoC= Number of Cattle

DAU&O = Draft Animal Use and Ownership

IRR = Irrigate?

AF = Apply Fertiliser?

Own Vehicle= Own Vehicle?

Assoc= Association? (in terms of working the given land)

### **Interpretation:**

1= Yes

0= No

### **Interpretation:**

DAU&O= Draft Animal Usage and Ownership

1= Owned and used

2= Owned but not used

3= used but not owned

4= not owned not used

## Appendix 4.5 A continued...data sheet and codes

Data Set for Farmer Interviews (Closed Questions)

Interviewee	Interviewed from (Q..)	Gen M	Gen F	Age	EL (std)	LYaS (year)	LA (ha)	LPF?	A TEL?	PAL?	ToS	EHPTS	OT	NoC	DAU&O	IRR?	AF?	OV?	ASSOC
1	home	1	0	64	10	1970	7.5	1	1	1	0	0	1	16	2	1	1	1	0
2	home	0	1	60	2	1962	3.4	1	0	1	1	1	0	20	1	0	1	0	0
3	home	1	0	51	10	1986	60*	1	0	0	1	0	1	10	2	0	1	0	1
4	home	1	0	63	5	1968	3	1	0	0	0	0	0	39	1	0	1	0	0
5	home	1	0	55	10	1978	5	1	0	1	0	1	1	21	2	1	1	1	0
6	home	1	0	60	5	1969	5	1	1	1	0	1	1	15	1	1	1	0	0
7	home	1	0	59	5	1975	13	0	1	0	0	1	0	8	1	0	1	0	1
8	home	1	0	50	0	0	2	1	0	1	1	1	0	5	2	0	1	0	0
9	home	1	0	65	2	1967	15	1	1	0	0	1	1	15	1	1	1	1	0
10	home	0	1	59	8	1971	3.5	1	1	1	0	1	0	00	4	0	1	0	1
11	field	0	1	62	6	1969	2	1	1	1	0	1	0	00	4	0	1	0	1
12	home	1	0	57	9	1979	10	1	1	1	1	1	0	03	4	1	1	0	1
13	home	0	1	53	2	1972	1.5	1	1	0	1	1	0	00	4	1	1	0	1
14	field	1	0	65	6	1972	1.1	1	1	1	0	1	0	00	2	1	0	1	1
15	home	0	1	71	2	1961	2	0	0	1	1	0	0	00	3	0	1	0	1
16	home	1	0	28	10	2008	6	0	1	0	0	0	1	00	3	0	1	1	0
17	field	0	1	64	4	1968	0.5	1	0	1	0	1	0	00	2	0	1	0	0
18	home	0	1	72	7	1952	0.8	1	0	1	0	1	0	00	2	0	1	0	0
19	home	0	1	40	10	1996	0.8	0	1	0	0	1	0	07	3	0	1	0	0
20	home	1	0	33	10	1992	2	0	0	0	0	1	0	28	2	1	1	1	0
21	home	1	0	45	10	1990	6.2	1	1	1	0	0	1	00	2	0	1	1	0
22	field	1	0	64	0	0	2.5	1	1	1	0	1	0	15	2	0	1	0	0

Data Set for Farmer Interviews continued.

Q no:	Intervie wed from	Gen M	Gen F	Age	EL (std)	LYaS (year)	LA (ha)	LPF?	ATEL?	PAL?	ToS	EHPTS	OT	NoC	DAU&O	IRR?	AF?	OV?	Assoc
23	field	1	0	63	6	1966	3.5	1	1	1	0	1	0	24	2	1	1	1	1
24	home	1	0	61	9	1973	0.5	1	1	1	0	1	0	08	1	0	1	1	0
25	home	0	1	44	6	1989	20*	0	1	0	0	1	0	00	3	0	1	0	1
26	home	1	0	42	10	1994	2	0	1	0	0	1	0	00	3	0	1	1	0
27	field	1	0	51	10	1985	10	1	0	0	0	1	0	12	2	0	1	1	0
28	home	0	1	56	9	1977	0.7	1	1	1	0	1	0	00	3	0	1	0	0
29	home	1	0	57	1	1960	1	1	1	1	0	0	0	05	1	0	1	0	0
30	home	1	0	63	9	1970	4.7	0	1	0	0	1	0	15	2	0	1	1	0
	sums	20	10					22	20	18	6	23	7	289	67	9	29	12	10

\*The 60 ha land was fragmented into two 30ha; both 60ha and 20ha were worked by a group of farmers and the chair person was interviewed

## Appendix 4.5B: Farmer interviews Open Ended Responses

Farmer Interviewees Information from open ended questions.

Note: Farmer responses were similar and therefore, the variety of responses as a summary is presented rather than every single repetition.

Q no.	Question	common responses Nkandla (interviewee 1-15)	common responses Ixopo (interviewee 16-30)
Q1	allocation of Land	Through consultation with the Chief and Induna just like when you are being allocated a portion of land to build a home as a new resident or occupant.	We are residing on farms/former farm areas, restituted land. So if one needs land he/she speaks to the owner- the chief has little or no say. When one is allocated land as a new resident s/he is also allowed a portion to farm
Q2	Acquisition of more land	60%=Yes 10%=No. (Appendix 4.5, ATEL column, Q 1-15) Yes you approach the owner (of inherited land) and make an agreement on how s/he is going to benefit or you can go back to the chief to ask for more. No because some people are selfish with their land- they are not using it but also don't allow someone to use it.	73 % = Yes 27 % = No (Appendix 4.5, ATEL column, Q 16-30). Yes you consult the owner and make payment agreement. No because there isn't enough money to rent.
Q3	soil fertility	By just planting and see whether the crop grows well or not. One way to tell is seeing different types of weeds actively growing.	By just planting and see whether the crop grows well or not. One way to tell is seeing different types of weeds actively growing.
Q4	soil reconditioning	I put kraal manure and sometimes I also use fertiliser if I happen to get or afforded to buy it	I put kraal manure and sometimes I also use fertiliser if I happen to get or afforded to buy it
Q5	soil/crop choice	I just plant and judge by the performance	I just plant and judge by the performance
Q6	advisors, soil	AEOs	AEOs
Q7	Information sources	FM Radio, other farmers, NGOs	FM Radio, other farmers, Television, NGOs, Farmers Weekly magazine

**Appendix 4.5B: Farmer Interviewees continued**

<b>Q no.</b>	<b>Question</b>	<b>common responses Nkandla (interviewee 1-15)</b>	<b>common responses Ixopo (interviewee 16-30)</b>
Q8	services, cultivation	through government tractor service and hired services and own equipment	through government tractor service, hired services and own equipment
Q9	Services, availability	Government tractor is difficult to obtain because it serves many farmers, hired service is determined by cash whereas own service is easy because you use own equipment which are readily available	Government tractor is difficult to obtain, hired service is determined by cash whereas own service is easy because you use own equipment which are readily available
Q10	Equipment used in production	Tractor and or draft animals for ploughing and hand tools for planting, weeding and harvesting	Tractor and or draft animals for ploughing and hand tools for planting, weeding and harvesting
Q11	Reasons for using a tractor	It is fast, saves time and labour, it also ploughs deeper than draft animals	It is fast, saves time and labour, it also ploughs deeper than draft animals
Q11	Disadvantages for using a tractor	No disadvantage except that is it difficult to access. It brings up big lumps which are hard to break.	No disadvantage except that is it difficult to access. It also brings up big lumps which are hard to break.
Q12	Reasons for using draft animals	Because tractor is not east to get, readily available because are self-owned	readily available because are self-owned
Q12	Disadvantages for using draft animals	It is time consuming and animals depend on availability of palatable grass and softness of the soil	It is time consuming and animals depend on availability of palatable grass and softness of the soil
Q13	Reasons for using hand-tools	Readily available because are self-owned. Lack of other means	readily available because are self-owned and lack of other means
Q13	Advantages for using hand-tools	keeps the body active	keeps the body active

#### Appendix 4.5B: Farmer Interviewees continued

Q no.	Question	common responses Nkandla (interviewee 1-15)	common responses Ixopo (interviewee 16-30)
Q13	Disadvantages for using hand-tools	time consuming and allows you to work a small area	time consuming and allows you to work a small area
Q14, Q15	Additional labour	Yes especially during planting, weeding and harvesting	Yes especially during planting, weeding and harvesting
Q16	Labour sources	Mostly family and local community members	Mostly family and local community members and sometimes cash-payment labourers. But people no longer want to work the land.
Q17	Labourers estimates	Varied according to land size and what farmer could afford	Varied according to land size and what farmer could afford
Q18	Affordable and unaffordable inputs	Affordable: Seeds, hand-tools, labour and fertiliser. <sup>8</sup> Less or Not affordable: fertilisers, agro-chemicals, fencing, tractor and associated equipment, irrigation system	Affordable: Seeds, hand-tools, fertiliser, agro-chemicals, labour Less or Not affordable: labour, fertiliser, fencing, tractor and associated equipment, irrigation system
Q25	Sources of income	Social or old-aged grant, remittances, farming	Social or old-aged grant, remittances, farming, other employment
Q29	Planting time for maize and dry beans	Maize: Sep-November because those are summer rainfall months with favourable temperature for the crop. Beans: January, because if you plant during summer rainfall months there are beetles that destroy flowers	Maize: Sep-November because those are summer rainfall months with favourable temperature for the crop. Beans: January, because if you plant during summer rainfall months there are beetles that destroy flowers
Q30	Planting sequence	I do rotation by planting different crops during different seasons	I do rotation by planting different crops during different seasons
Q32	Management of crop residues	I keep it to feed livestock during dry winter months and also use some to make compost	I keep it to feed livestock during dry winter months and also use some to make compost

<sup>8</sup> Some farmers considered labour and fertilisers as affordable whereas others considered these inputs as unaffordable- depending on each farmer's financial position.

#### Appendix 4.5B: Farmer Interviewees continued

Q no.	Question	common responses Nkandla (interviewee 1-15)	common responses Ixopo (interviewee 16-30)
Q33	land to yield ratio information available	No because it differs by season and determined by number of factors such as amount of rainfall received	No because it differs by season and determined by number of factors such as amount of rainfall received
Q34	Ways to measure the harvest	By using sacks, usually re-used 50kg or 80kg empty sacks of maize-meal, rice, fertiliser etc. we also use buckets of 2, 5, 10, 15 and 20 liter	By using sacks, usually re-used 50kg or 80kg empty sacks of maize-meal, rice, fertiliser etc. we also use buckets of 2, 5, 10, 15 and 20 liter
Q no.	Question	common responses Nkandla (interviewee 1-15)	common responses Ixopo (interviewee 16-30)
Q no.	Question	common responses Nkandla (interviewee 1-15)	common responses Ixopo (interviewee 16-30)
Q35	Importance of measuring the harvest	It allows you to compare the past and the present cropping season by looking at the yield so that you know whether you are gaining or losing	It allows you to compare the past and the present cropping season by looking at the yield so that you know whether you are gaining or losing
Q36	Possible options done with harvest	selling, family consumption and ground maize to make maize meal	selling, family consumption and ground maize to make maize meal
Q37	Selling points	to the local community members, at pension points	to the local community members, at pension points
Q37	Selling price	Using two to 20litre buckets the prize increases with quantity. And also 25 and 50 kg sacks, price also increases with quantity	Using two to 20litre buckets the prize increases with quantity. And also 25 and 50 kg sacks, price also increases with quantity
Q37	Transport of produce to market	by hiring local bakies from local owners	by hiring local bakies from local owners
Q37	Possible options with income	I buy inputs and save some	I buy inputs and save some
Q37	Selling challenges	transport is expensive, slow market or market not reliable meaning the produce might end-up spoiled	transport is expensive, slow market or market not reliable meaning the produce might end-up spoiled

**Appendix 4.5B: Farmer Interviewees continued**

Q no.	Question	common responses Nkandla (interviewee 1-15)	common responses Ixopo (interviewee 16-30)
Q38	Harvest where Processing:	I send it to town (e.g. Dundee which is far) there is a mill there	I send it to town (Ixopo or Mzimkhulu) there is a mill there
Q38	Harvest costs Processing	transport and milling costs	transport and milling costs
Q38	Harvest challenges Processing	Mills are far from where we live thus increasing costs on transport	Mills are far from where we live thus increasing costs on transport
Q39	Harvest facilities Storage	storage tanks and home-made structures called <i>inqolobane</i>	storage tanks and home-made structures called <i>inqolobane</i>
Q39	Harvest Period for storage	Three to six months depending on how much was it	three to six months depending on how much was it
Q39	Reasons for storage	To keep the seeds healthy so to use it next season and feed livestock	To keep the seeds healthy so to use it next season and feed livestock
Q39	Storage challenges	Sometimes maize get spoiled- post harvest diseases	Sometimes maize get spoiled- post harvest diseases
Q40	Tractor service's aid	Through ploughing only	Through ploughing only
Q40	Timeliness of a tractor	No it was usually delayed	No it was usually delayed
Q40	Labour reduction of a tractor	No because it was usually late that made us work hastily, and it also brought up big lumps of soil	No because it was usually late that made us work hastily, and it also brought up big lumps of soil

#### Appendix 4.5B: Farmer Interviewees continued

Q no.	Question	common responses Nkandla (interviewee 1-15)	common responses Ixopo (interviewee 16-30)
Q41	Programme operational decisions	Extension officers, decisions are being taken for us	Government, decision are being made on our behalf
Q42	Seasonal gaps or delays due to government tractor	Absolutely, I opted for hired private tractor or harnessed my animals and ploughed or hired draft animals	Absolutely, I opted for hired private tractor or harnessed my animals and ploughed or hired draft animals
Q43	Tractor service and other support services	Proper fencing and irrigation water systems, lack of irrigation water is a common concern and weed control	Proper fencing and irrigation water systems, lack of irrigation water is a common concern
Q44	Tractor service and social life	It brought us together because some of us are working as a collective/cooperative, on the other hand it created conflict over services	I brought us together because some of us work as cooperatives/support groups, on the other hand it created conflict over services
Q45	Tractor service and production potential	Ability to work more land, and given good rains one can get a good harvest	Ability to work more land, and given good rains one can get a good harvest. We also learnt about no-till <sup>9</sup> farming method.
Q46	Tractor service and household income	We managed to have some crops to sell and we didn't have to buy maize meal all the time	We managed to have some crops to sell and we didn't have to buy maize meal all the time
Q47	tractor service and food availability	Part of the harvested crops is consumed within the household and as a farmer it takes time to buy certain food items (e.g. maize meal, beans, and vegies) that I had from the land.	Part of the harvested crops is consumed within the household and as a farmer it takes time to buy certain food items (e.g. maize meal, beans, and vegies) that I had from the land.
Q48	Consultation with farmers	Through meetings and cellphones	Through meetings and cellphones
Q49	Programme re-planning	Start from farmers and hear their views, have tractors that stay under each tribal area year round and increase the number of tractors	Start from farmers and hear their views, have tractors that stay under each tribal area year round and increase the number of tractors
Q50	Wish for programme continuation?	Absolutely, because it is helpful	Absolutely, because it is helpful

<sup>9</sup> NO-TILL farming method was less common as it was identified in one particular group of farmers from Ixopo the majority had no idea of the concept

**Appendix 4.5B: Farmer Interviewees continued**

<b>Q no.</b>	<b>Question</b>	<b>common responses Nkandla (interviewee 1-15)</b>	<b>common responses Ixopo (interviewee 16-30)</b>
Q51	Personal tractor and farming activities	Work the land year-round with or without hiring it out	Work the land year-round with or without hiring it out
Q51	Who could drive it?	I have sons who can drive or I can find a local boy to drive it. I can drive it myself	I have sons who can drive or I can find a local boy to drive it. I can drive it myself
Q51	How and where would you service it?	There are local mechanics and may also use services in the local town	There are local mechanics and may also use services in the local town
Q51	Where would you buy spare parts?	Local and nearby towns	Local and nearby towns
Q51	How would you pay for fuel and tyres?	Through profit from the harvest and hiring out	Through profit from the harvest and hiring out
Q51	How would you buy necessary implements (e.g. mouldboard and disc ploughs)	That might be a problem, I can try to get a loan or funding from government	That might be a problem, I can try to get a loan or funding from government
Q52	Would you buy your own tractor Yes <input type="checkbox"/> No <input type="checkbox"/>	Indeed because I can see the need and benefits of having a tractor	Indeed because I can see the need and benefits of having a tractor

## Appendix 4.6: Guided field observation walks

### Appendix 4.6A: Guided field observation walk (Nkandla example)

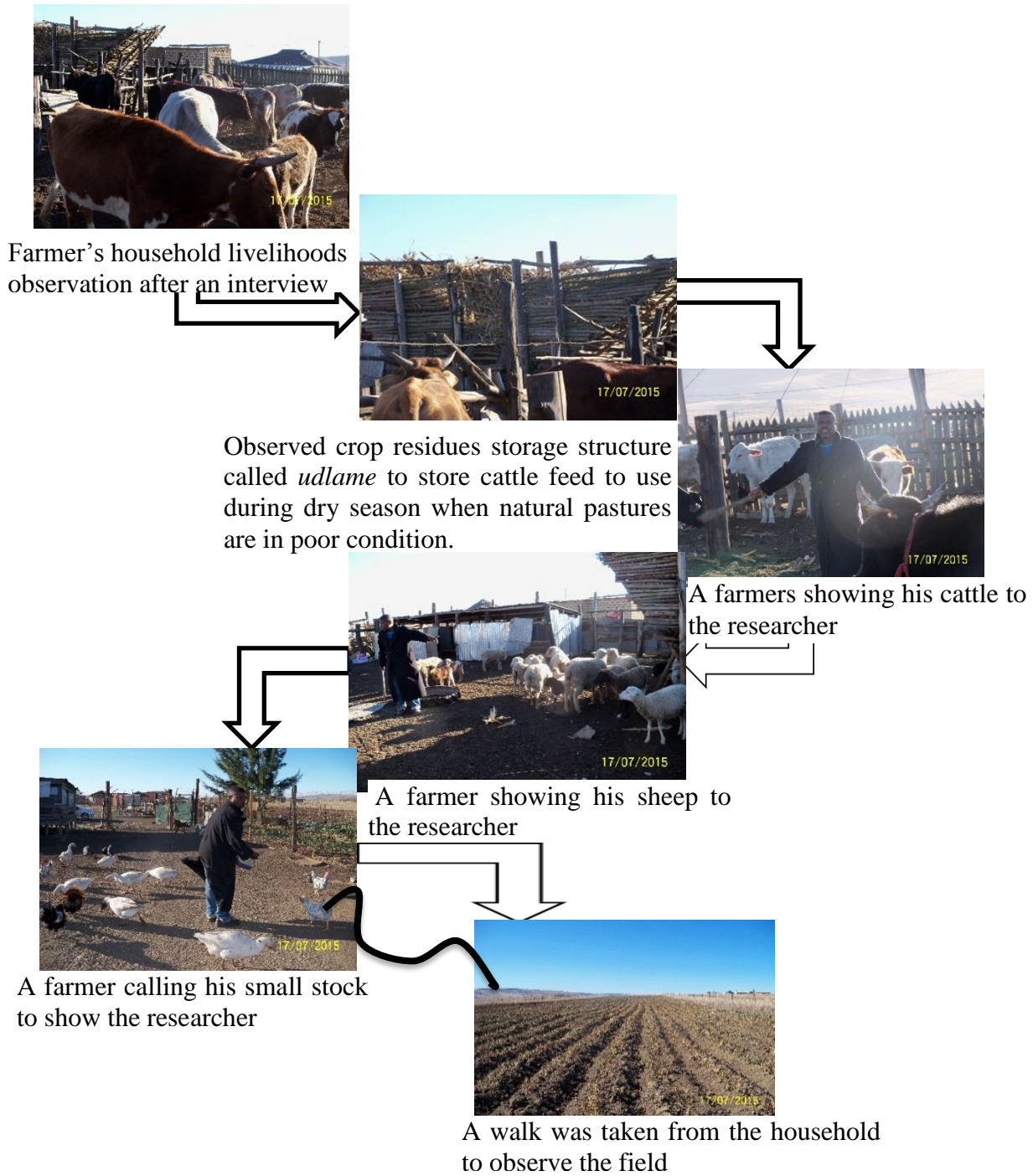
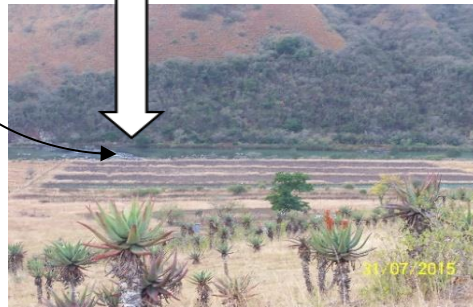


Figure 4.1: Nkandla example showing the evidence trail of guided field observation walk

Appendix 4.6B: Guided field observation walk (Ixopo Example)



The farmer and the researcher walked from the household into the



The farmer's field observed



The field was observed as properly fenced



Farmers were helping each other to connect an irrigation water pump into the river running next to the field



Sprinkler irrigation system running

Figure 4.2 Ixopo example showing the evidence trail of guided field observation walk

#### Appendix 4.7: Direct observation on farmers' assets and livelihoods



Sheltered grain storage tanks made of corrugated iron



Grain storage jojo tanks on water tower stands



Home-made grain stores called Inqolobane



Grain stored indoors (e.g. hut) is usually put in sacks and buckets after threshing



Grain milling facilities; one on the left is manually operated and the one on the right is tractor powered

Figure 4.3: Farmers' storage and/or grinding facilities observed

**Appendix 4.7: Direct observation on farmers' assets and livelihoods (continued)**



Typical examples of an animal-drawn (dragged along the ground without wheels) home-made transport facility called *isihlibhi* used to transport harvest, firewood, other farming material or heavy objects



Farmers who still rely on animal-traction facilities showing their equipment



Harnessing equipment as shown by some of the farmers



Some of the visited farmers own a tractor and associated implements though not in good functional condition

Figure 4.4: some of the farmers' physical assets observed as are used to assist farming activities as a livelihood strategy

**Appendix 4.7: Direct observation on farmers' assets and livelihoods (continued)**



Figure 4.5: above left and right; two different designs of home-made crop-residues storage structures farmers called *udlame*. Below left: other farmers tended to allow livestock to graze on maize stover after harvesting; below right: this farmer prefers feeding his livestock from home

## APPENDICES: CHAPTER FIVE

Appendix 5.1: Frequencies adapted from SPSS showing demographics information and relevant determinants on farming activities.

### Frequency Tables

**Table 1: Gender distribution**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid male	20	66.7	66.7	66.7
female	10	33.3	33.3	100.0
Total	30	100.0	100.0	

**Table 2: Age distribution**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 28.00	1	3.3	3.3	3.3
33.00	1	3.3	3.3	6.7
40.00	1	3.3	3.3	10.0
42.00	1	3.3	3.3	13.3
44.00	1	3.3	3.3	16.7
45.00	1	3.3	3.3	20.0
50.00	1	3.3	3.3	23.3
51.00	2	6.7	6.7	30.0
53.00	1	3.3	3.3	33.3
55.00	1	3.3	3.3	36.7
56.00	1	3.3	3.3	40.0
57.00	2	6.7	6.7	46.7
59.00	2	6.7	6.7	53.3
60.00	2	6.7	6.7	60.0
61.00	1	3.3	3.3	63.3
62.00	1	3.3	3.3	66.7
63.00	3	10.0	10.0	76.7
64.00	3	10.0	10.0	86.7
65.00	2	6.7	6.7	93.3
71.00	1	3.3	3.3	96.7
72.00	1	3.3	3.3	100.0
Total	30	100.0	100.0	

**Table 3: Education level distribution**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	2	6.7	6.7	6.7
	1.00	1	3.3	3.3	10.0
	2.00	4	13.3	13.3	23.3
	5.00	3	10.0	10.0	33.3
	6.00	3	10.0	10.0	43.3
	7.00	1	3.3	3.3	46.7
	8.00	1	3.3	3.3	50.0
	9.00	5	16.7	16.7	66.7
	10.00	10	33.3	33.3	100.0
	Total	30	100.0	100.0	

**Table 4: Last year at school differences**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0000	2	6.7	6.7	6.7
	1952	1	3.3	3.3	10.0
	1960	1	3.3	3.3	13.3
	1961	1	3.3	3.3	16.7
	1962	1	3.3	3.3	20.0
	1966	1	3.3	3.3	23.3
	1967	1	3.3	3.3	26.7
	1968	2	6.7	6.7	33.3
	1969	2	6.7	6.7	40.0
	1970	2	6.7	6.7	46.7
	1971	1	3.3	3.3	50.0
	1972	2	6.7	6.7	56.7
	1973	1	3.3	3.3	60.0
	1975	1	3.3	3.3	63.3
	1977	1	3.3	3.3	66.7
	1978	1	3.3	3.3	70.0
	1979	1	3.3	3.3	73.3
	1985	1	3.3	3.3	76.7

1986	1	3.3	3.3	80.0
1989	1	3.3	3.3	83.3
1990	1	3.3	3.3	86.7
1992	1	3.3	3.3	90.0
1994	1	3.3	3.3	93.3
1996	1	3.3	3.3	96.7
2008	1	3.3	3.3	100.0
Total	30	100.0	100.0	

**Table 5: Land area distribution**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.50	2	6.7	6.7	6.7
	.70	1	3.3	3.3	10.0
	.80	2	6.7	6.7	16.7
	1.00	1	3.3	3.3	20.0
	1.10	1	3.3	3.3	23.3
	1.50	1	3.3	3.3	26.7
	2.00	5	16.7	16.7	43.3
	2.50	1	3.3	3.3	46.7
	3.00	1	3.3	3.3	50.0
	3.40	1	3.3	3.3	53.3
	3.50	2	6.7	6.7	60.0
	4.70	1	3.3	3.3	63.3
	5.00	2	6.7	6.7	70.0
	6.00	1	3.3	3.3	73.3
	6.20	1	3.3	3.3	76.7
	7.50	1	3.3	3.3	80.0
	10.00	2	6.7	6.7	86.7
	13.00	1	3.3	3.3	90.0
	15.00	1	3.3	3.3	93.3
	20.00	1	3.3	3.3	96.7
	60.00	1	3.3	3.3	100.0
Total		30	100.0	100.0	

**Table 6: Differences on where land is properly fenced or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	9	30.0	30.0	30.0
	yes	21	70.0	70.0	100.0
Total		30	100.0	100.0	

**Table 7: Differences on whether the farmer was able to expand land or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	10	33.3	33.3	33.3
	yes	20	66.7	66.7	100.0
Total		30	100.0	100.0	

**Table 8: Differences on whether the farmer planted all the land or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	12	40.0	40.0	40.0
	yes	18	60.0	60.0	100.0
Total		30	100.0	100.0	

**Table 9: Different responses on whether government tractor service was on time or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	24	80.0	80.0	80.0
	yes	6	20.0	20.0	100.0
Total		30	100.0	100.0	

**Table 10: Different responses whether the farmer ever hired private tractor or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	7	23.3	23.3	23.3
	yes	23	76.7	76.7	100.0
Total		30	100.0	100.0	

**Table 11: Responses on whether the farmer own a tractor or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	22	73.3	73.3	73.3
	yes	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

**Table 12: Responses on whether the farmer owned and/or used draft animals or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	own and use	7	23.3	23.3	23.3
	own but not use	13	43.3	43.3	66.7
	do not own do not use	6	20.0	20.0	86.7
	do not own but use	4	13.3	13.3	100.0
	Total	30	100.0	100.0	

**Table 13: Responses on whether the farmer applied irrigation or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	21	70.0	70.0	70.0
	yes	9	30.0	30.0	100.0
	Total	30	100.0	100.0	

**Table 14: Responses on whether the farmer applied fertiliser or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	1	3.3	3.3	3.3
	yes	29	96.7	96.7	100.0
	Total	30	100.0	100.0	

**Table 15: Responses on whether the farmer owned a farm vehicle or not**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	18	60.0	60.0	60.0
	yes	12	40.0	40.0	100.0
	Total	30	100.0	100.0	

**Table 16: The Mean, Median and the Mode for age, education level and land area of the interviewed farmers (n=30)**

		Age (yr)	education level (Std)	land area (ha)
N	Valid	30	30	30
	Missing	0	0	0
	Mean	55.9000	6.7333	6.5067
	Median	59.0000	8.5000	3.2000
	Mode	63.00 <sup>a</sup>	10.00	2.00
	Minimum	28.00	.00	.50
	Maximum	72.00	10.00	60.00

a. Multiple modes exist. The smallest value is shown

Appendix 5.2:



Figure 5.1: The government owned tractors observed, some were functional and others dysfunctional or worn-down seemingly beyond repairs.

## Appendix 5.3



Figure 5.2: Some of the associated implements observed namely the planter, econo-sprayer, diesel storage facilities, disc plough and the ripper.

Appendix 5.4



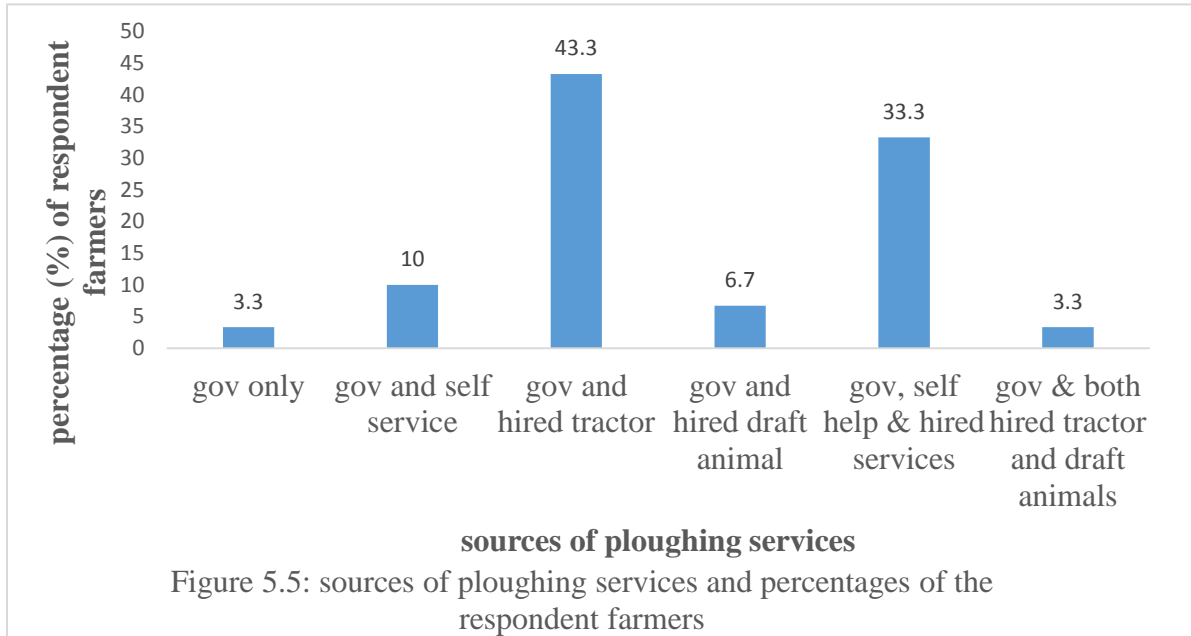
Figure 5.3: Some of the broken-down associated equipment observed namely maize and beans harvesters, mouldboard and dics ploughs, maize planter and lime spreader.

Appendix 5.5:



Figure 5.4; Government vehicles needed to support the programme with delivery of inputs such as fertilisers were considered to be few as the defected ones took long to be fixed.

**Appendix 5.6: Chats showing different sources of inputs for concerned farmers in both villages combined**



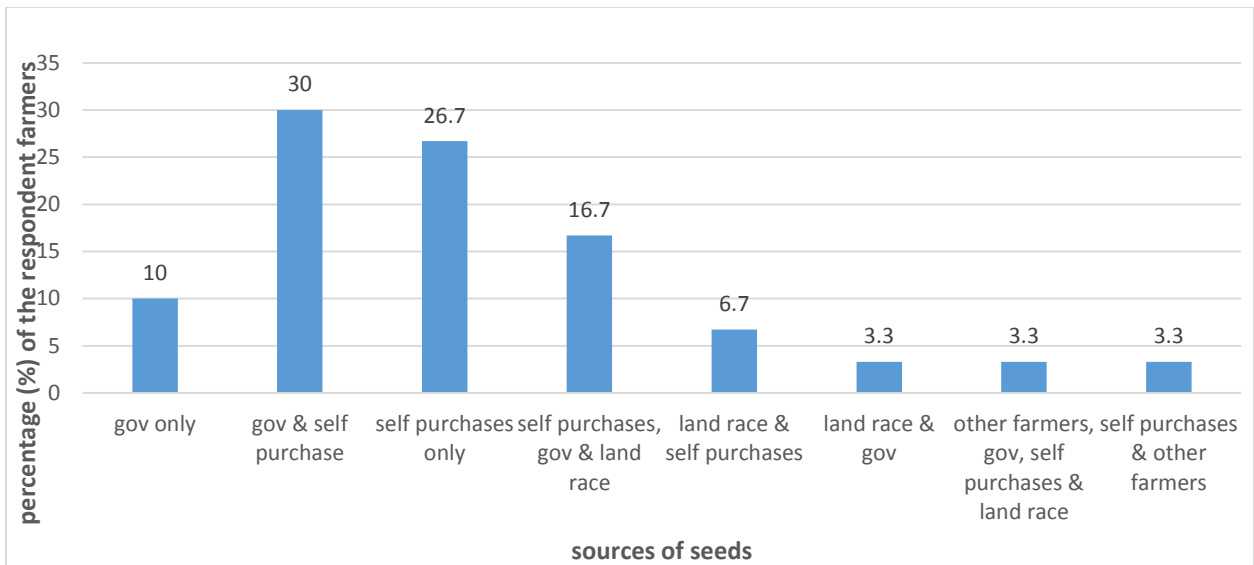


Figure 5.6: different sources of seeds and farmers' respondents in percentage (%)

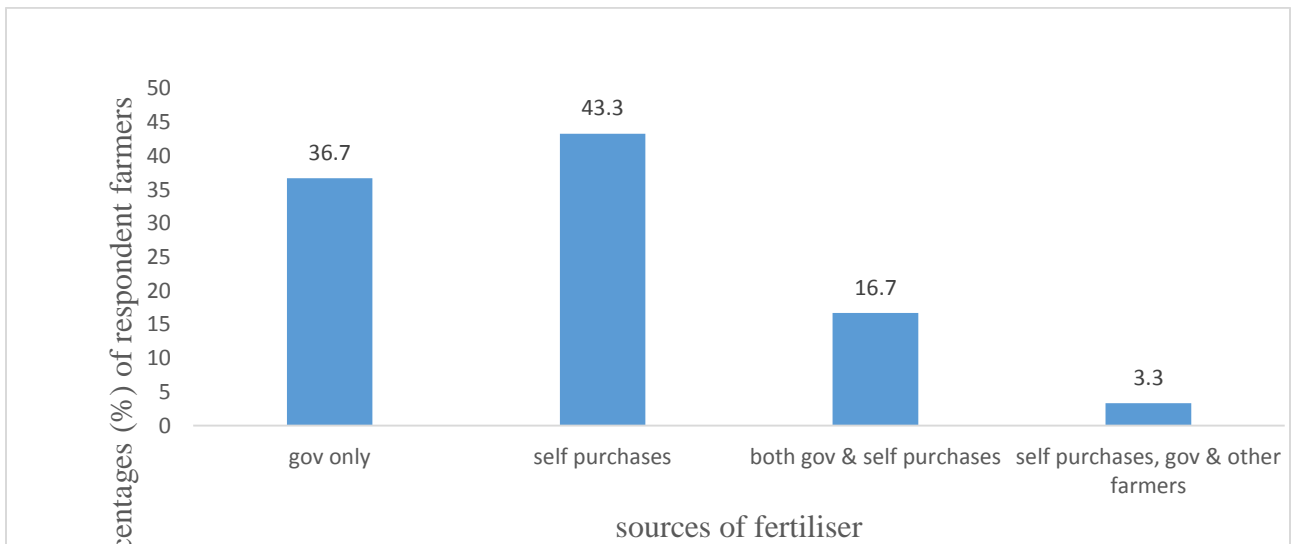


Figure 5.8: sources of fertilizer and percentage of farmers' respondents