# INVESTIGATING THE RELATIONSHIP BETWEEN SUSTAINABILITY AND FARMER DECISION-MAKING: A QUALITATIVE STUDY OF MAIZE FARMERS IN MPUMALANGA, SOUTH AFRICA

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## Integrative Summary

The goal of the research paper was to understand the complex relationship between the issue of sustainability and maize farmers' decision-making processes. The aim is to shed light on the realities experienced by maize farmers in terms of how sustainability impacts on the decisions they make and how the decisions they make impact on sustainability.

The importance of the research lies in the current state of affairs in the world in terms of the current economic recession, overpopulation, dire poverty and hunger, and the poor state of the environment. If humankind is to continue its existence on Earth in a happy, healthy world, something is going to have to give. In order for this to happen, people need to start grappling with the concept of sustainability. Focusing on sustainability as a whole is likely to end in despair. However, breaking the problem down into its component pieces will allow people to influence the particular sector in which they operate. It is therefore imperative for research into sustainability to be undertaken in all sectors of society and the economy.

Agriculture presents an excellent research area due to its intrinsic link with the environment, society and the economy. Agriculture and its wellbeing is inextricably tied to environmental health. Healthy plants and animals will not grow in unhealthy conditions. Society is to a large degree dependent on agriculture for food, agriculture therefore has a significant impact on social order and function. Agriculture is one of the primary contributors to GDP, particularly in poor and developing nations. As a result, agriculture has an important role to play in ensuring economic sustainability.

In order to engage with sustainability from an agricultural perspective it was decided to engage on the farmer-level. Gaining an understanding of their reality in terms of what motivates their decisions is key to understanding the relationship between agriculture and sustainability. Three maize farmers in Mpumalanga, South Africa, were interviewed with the aim of collecting qualitative data and then analysing the data using thematic analysis. The methodology employed enabled the researcher to uncover patterns in the data that constituted themes across the interviews.

The following themes emerged: Theme 1: Economic factors are the primary decision driver. This is primarily due to the extent of the financial risk experienced by farmers as

a result of market risk, production risk, finance risk, and rising input costs. This results in economic considerations superseding environmental or social concerns in farmers' decisions. This has a negative impact on the overall sustainability of the farming operation. Theme 2: There has been a decrease in the number of family-run farms. This is attributable to a number of factors including economic failure, fear of loss of land due to land-reform policies, as well as crime. Family-run farms tend to have a greater focus on sustainability due to the vested interest in the next generation taking over the farm. The corporate farming operations that are taking over the farms tend to be more focussed on short-term gains in order to satisfy shareholders. Theme 3: Mechanisation is preferable to manual labour. There has been an alarming decrease in the number of labourers employed on farms. Farmers say this is due to two factors. Firstly, machines are more efficient than labour. Secondly, restrictive labour laws have made famers less keen to employ people. The net effect of these two factors is that unemployment is rising. This has negative consequences for society, the economy, and the environment. Theme 4: Farmers believe they do very little environmental damage. This results in decisions being made that do not consider environmental wellbeing other than soil health. This is because farmers see healthy soil as an integral input that optimises economic performance.

Farmers tend to prioritise economic factors in their decisions more than environmental or social factors. This results in an unsustainable perspective. The only ways in which this is likely to change is if the financial risk associated with agriculture is decreased, or if farmers are given financial incentive to change their ways.

In order to deal with this issue it is necessary for further research to be conducted. Research needs to be conducted to confirm the results of this study. It is important to know whether the results pertain only to maize farmers in Mpumalanga or whether most farmers in South Africa, and indeed the world, face similar problems. Research should also be conducted to propose policies or procedures to reduce financial risk in agriculture. Research should focus on reducing market risk and reducing input costs, possibly via subsidisation.

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# Section 1: Academic Paper

## 1.1 Abstract

The purpose of this research paper was to investigate the relationship between sustainability and farmer decision-making. The relationship was explored, through qualitative analysis, both in terms of how issues of sustainability impact on the decision-making processes of farmers, but also how those decisions in turn affect sustainability.

Three maize farmers from the Bethal district in Mpumalanga, South Africa were interviewed. Analysis of the transcripts from the interviews led to the emergence of the following themes. Theme 1: Financial and economic factors are the primary decision drivers. Theme 2: There has been a decrease in the number of family-run farms. Theme 3: Mechanisation is preferable to manual labour. Theme 4: Farmers think they do very little environmental damage.

From the analysis of the data in terms of these themes it became abundantly clear that financial factors play the biggest role in determining the decisions made by farmers. The primary reason for this is the high level of financial risk in the agricultural sector. Financial risk leads to the prioritisation of the economic sustainability of the farm over social or environmental sustainability. This has negative effects on the overall sustainability of agriculture. Changing this requires economically incentivising farmers to do things differently or reducing the financial risk in the industry.

## 1.2 Introduction

### 1.2.1 Context of the study

The current world reality is that sustainability is becoming a serious issue worthy of research. It is becoming increasingly evident that human impact on the environment is reaching critical levels. The impact on the environment consequently has negative impacts on society and the economy. In order to address the issues relating to the sustainability of the environment, society and the economy it is important to shed more light on the intricate balancing act between these three spheres of human existence and influence.

Conducting research into sustainability involves developing a conceptual framework within which to understand and explain sustainability. Once the framework for understanding sustainability has been formulated, it is necessary to apply the framework to a specific area of study. This research will look at the relationship between agriculture and sustainability. The reason that this field of research has been selected is due to the fact that agriculture forms such an integral part of human society. Agriculture is the tool that allowed humans to settle and form civil societies. Without agriculture, humans would still be living as nomadic hunter-gatherers. Agriculture impacts markedly on society in that it is the source of food for the entire population of the Earth. Agriculture is inextricably linked with environmental wellbeing and is a large contributor to the economies of almost all countries in the world.

The relationship between agriculture and sustainability presents an immensely interesting yet incredibly broad topic for research. In order to reach meaningful conclusions about this relationship, it is necessary to focus on a micro element of the macro relationship.

### 1.2.2 Aims of the Research

The specific element of the relationship between sustainability and agriculture that will be explored in this thesis is the complex relationship between sustainability and farmer decision-making. The research will endeavour, through qualitative analysis, to shed light on the extent to which issues of sustainability impact on the decisions that farmers

make and the degree to which the motivating factors in the farmers' decision-making process impact on the sustainability of the farming operation.

The research component of this thesis involved interviewing three maize farmers in the Bethal area of Western Mpumalanga in South Africa. Maize is South Africa's most important crop due to the fact that it is the staple diet of the majority of the population and contributes the most in terms of economic value added of any agricultural product. Mpumalanga is South Africa's second largest maize producing province, contributing 22.6% of the total tonnage for the 2007/08 growing season.

## 1.3 Literature Review

### 1.3.1 Why Sustainability?

The issue of sustainability has increased markedly both in use and popularity over the last decade. Sustainability is high on the agendas of most governments, media coverage relating to sustainability has increased significantly, and as a result, sustainability has begun to permeate the conscience of the man on the street (Berns *et al.*, 2009). "Ensuring Environmental Sustainability" was listed as Goal 7 of the 8 Millennium Development Goals at the United Nations Millennium Summit in September 2000 (Adams, 2006).

There are a number of key factors that have driven the increased awareness of the issue of sustainability. The three major areas of concern are environmental degradation, hunger and poverty, and the global economic meltdown of 2009 and the general inequitable wealth distribution across the globe. One of the primary concerns of governments and financial institutions is to engage with the issue of sustainability in order to create more balance in the current systems and make them inherently more sustainable.

In considering the depth of the social and environmental crisis and the pressure to respond, it is imperative for further research to be conducted to better equip people in tackling this crisis (Flannery, 2005). Without such research, knee-jerk reactions are likely to occur, which, in some cases, might further exacerbate these issues rather than diminish the negative effects associated with them.

Further research into sustainability will increase the knowledge base surrounding these issues and will provide better insights into how to begin to solve the problem. It is for this reason that this research should be conducted.

### 1.3.2 Defining Sustainability

According to their research, Faber *et al.* (2005) discovered that about 50 definitions and circumscriptions of sustainability exist. The difficulty of defining sustainability is further compounded by the fact that experts in different fields apply bias to their definitions of sustainability. Ecologists, economists, biologists, sociologists, etc. all have a particular

perspective on sustainability that suits their field (Faber *et al.,* 2005). In order to contextualise this research, it is imperative to formulate as unbiased a definition as possible.

A sustainable system is one which survives or persists (Costanza and Patten, 1995: 193). Therefore, sustainability, in its most basic form, refers to the capacity to endure over time. This can refer to the durability of living organisms, environmental systems, businesses, cultures, languages, economies, countries, social agendas, etc. This seems like a fairly straightforward definition. Further investigation into the details of this basic description, however, reveals an immensely more complex notion.

Sustainability involves making decisions about how best to manage competing human needs so as to ensure that those needs are "met in the present without compromising future generations from meeting their own needs" (WCED, 1987). This definition was put forward in the report by the Brundtland Commission, or World Commission on Environment and Development (WCED), in 1987, entitled *Our Common Future*. The WCED's specific focus was cooperation between nations in search of a path for sustainable development. "Sustainable development is a program to change the process of economic development so that it ensures a basic quality of life for all people, and protects the ecosystems and community systems that make life possible and worthwhile." (Van der Merwe and Van der Merwe, 1999:5). This definition of sustainability hints that the issue pertains to three distinct yet interrelated areas of focus, namely, the economy, society, and the environment. These three spheres of human existence are commonly collectively grouped together and are widely considered the "three pillars of sustainability" and have formed the basis for what is referred to as the "triple bottom-line" (Adams, 2006).

In order to conduct this research it is necessary to put forward a definition for sustainability. The definition that will be used when analysing the literature and data is as follows. *Sustainability is the prevalence of the long-term wellbeing and a state of balance between the environment, society and the economy*. The world we live in is a social world, but the needs of society need to be met within the constraints of the environment and economic growth.

### 1.3.3 The Issue of Sustainability in Agriculture

Sustainability, as previously defined, pertains to equitable economic, social and environmental wellbeing and development over the long-term. There is an imperative for all business sectors to evolve their processes and functions so as to be more sustainable. In considering which industry might be most interesting to study, agriculture presented a logical choice. Agriculture can have immensely profound effects on the environment, the economy, and human health and social order (Horrigan *et al.*, 2002). It is therefore a vital component of any drive toward sustainability. It is for this reason that agriculture has been chosen as the industry in which this research is to be conducted.

For almost 40 years after World War II, agriculture in the USA set the example on a global stage. Records for crop production were set on an almost annual basis. The farms in question were characterised by a high level of mechanisation, dependence on fossil fuels for vehicles and machinery, borrowed capital, and extensive use of chemical fertilisers and pesticides (Reganold *et al.*, 1990). From the preceding description of the state of affairs, it is clear that the farming methods employed are unsustainable.

From an environmental perspective there are a number of issues relating to "standard" agricultural practices. Fertilisers present a major environmental problem as far as run-off is concerned. Researchers estimate that fertiliser consumption for the world will have increased from 153.8 million metric tons in 2005 to 187.7 million metric tons in 2015, and to 223.1 million metric tons by 2030 (Tenkorang and Lowenberg-DeBoer, 2008). This equates to a 22 percent increase in 10 years (2005-2015), and a staggering 45 percent increase over 25 years (2005-2030). The danger that fertilisers pose to the environment is that they cannot be wholly absorbed by plants and vast quantities of concentrated chemicals, primarily Nitrogen (N), Phosphorous (P) and Potassium (K), are washed into dams and rivers and can do irreversible damage to the biodiversity in these water systems (Horrigan *et al.*, 2002).

According to research conducted by the World Health Organisation (WHO), acute pesticide poisoning will affect three million people and will account for 20 000 deaths per year, especially in developing countries (Pesticide Action Network, 2010). Aside from negative impacts on human health, pesticides are detrimental to the wellbeing of the environment. One of the major issues associated with pesticide use is the decline in

the bee population worldwide. Bees play an essential role in pollinating almost a third of the total food production for the world. Use of pesticides has had serious impacts on the global bee population, (Horrigan *et al.*, 2002). As with fertiliser, the use of pesticides is increasing. Between 1999 and 2008 there was a 33% increase in global sales from US$30bn in 1999 to US$40,4bn in 2008 (Pesticide Action Network, 2010).

Soil degradation presents a major challenge to Earth's burgeoning population. Unsustainable farming methods have led to a considerable decrease in both quality and availability of arable land. 70% of the 5.2 billion hectares of dry land crop production are degraded, with as much as 24 billion tons of topsoil lost annually (Fowler and Rockstrom, 2001). Overgrazing, over-cultivation, deforestation and overuse of water can lead to erosion and in some cases to desertification, an extreme form of land degradation.

Agriculture affects water quality and supply in two ways. Firstly, some agricultural practices divert the water supply so as to irrigate crops. Agriculture uses about two-thirds of the water used worldwide (Horrigan *et al.*, 2002). The second impact that agriculture has on water is the runoff of fertilisers and pesticides. These chemicals can cause an imbalance in the downstream ecosystems, resulting in loss of biodiversity (Moore *et al.*, 2008). The chemicals in the water can also have detrimental effects on communities living downstream who drink, bathe and subsist off rivers and dams.

The use of fossil fuel energy in agriculture occurs primarily in the use of mechanised equipment such as tractors and trucks to carry out tasks on farms. The emissions from these vehicles contribute to the total $CO_2$ output. Transporting produce from producer to retailer also contributes dramatically to $CO_2$ output (Horrigan *et al.*, 2002). Irrigation pumps and the use of nitrogen-based fertilisers are also major contributors to the total green house gas (GHG) emissions from farming systems. Together, mechanised vehicles, pumps and nitrogen fertilisers make up 90% of the energy inputs of a farm (Pretty *et al.*, 2002). According to Horrigan *et al.* (2002), agriculture is directly responsible for about 20% of the human generated emissions of GHG's.

Loss of biodiversity is inextricably linked with agriculture, with human food needs competing with many species for their natural habitat. The growing population of the world is applying immense pressure on the natural habitat of a multitude of species of

plants and animals as ever-expanding agriculture wipes out natural biodiversity. Furthermore, adoption of genetically engineered crops has eliminated local cultivars. (Horrigan *et al.*, 2002).

Agriculture has various impacts on society. The major social role that agriculture plays is ensuring food security in the world. Maize, particularly in South Africa, is the most important agricultural product. It is the staple food of the overwhelming majority of the population. Reduced production or high costs of production can have detrimental effects on the poor. Nutrition is a major issue in sub-Saharan Africa. Malnutrition affects millions of people. Efficiency in agricultural production is of paramount importance in overcoming this problem (Pinstrup-Andersen, 2000).

Agriculture is the primary economic activity in poor countries and as a result is often the primary source of employment. In some developing countries, agriculture provides as much as 80% of the total employment. In South Africa, the most recent statistics indicate that approximately 814 000 people were employed in the agriculture, hunting, forestry and fishing sector. This comprises around 10% of total employment (NDA, 2010). However, during the 11 year period from 1988 to 1998 the commercial farming sector shed an astounding 140 000 jobs, almost 20% of the workforce (Simbi and Aliber, 2000). The primary factors influencing this were the move toward mechanisation and away from labour intensiveness, and the increased cost of labour and stricter labour regulations.

From an economic perspective, one of the biggest issues in agriculture is the degree of risk experienced in the marketplace. Commodity prices in general are prone to volatility, which is why speculators enter the marketplace. The South African Futures Exchange (SAFEX) is the market exchange through which agricultural products are traded. The inelastic nature of the supply and demand curves for agricultural products leads to large changes in prices. This leads to high volatility in farm incomes. The supply of agricultural products is highly dependent on climatic conditions, which increases the risk for farmers (Geyser and Cutts, 2007).

In summary, it is evident that standard agricultural systems have many undesirable impacts on the environment and society and are subject to high economic risk. In order to mitigate these adverse conditions, it is necessary to pursue alternate agricultural

systems. Much has been written about the capacity of sustainable agricultural systems to address the concerns discussed in this section. What follows is a discussion of the concept and methodology of sustainable agriculture.

### 1.3.4 Sustainable Agriculture

When engaging with the concept of sustainable agriculture it is important to understand it in terms of the world context of food security. Commercial agriculture as it stands is not feeding the world. This is evidenced by the increasing number of food insecure people across the globe. Sustainable agriculture does not simply involve the substitution or replacement of certain inputs or changes in methodology, but requires system redesign (Flora, 2010). Sustainable agriculture represents a move away from the systems and methods associated with conventional agriculture. The aim of sustainable agriculture is to improve the overall sustainability of the farming process by reducing economic risk, improving environmental wellbeing and eliminating social conflict associated with poverty, hunger, land use, and unfair labour practices. Sustainable agriculture is not a specific farming strategy or set of farming practices per se, but is a system-level approach aimed at understanding the complex interactions between the various components of the agricultural system (Reganold *et al.*, 1990). For the purposes of this thesis the term agriculture is loosely used to describe the more specific concept of crop-based agriculture.

Increased production and efficiency in resource use are critical elements of any farming operation. A farming operation that has poor production and inefficient use of resources is clearly unsustainable. One of the most hotly debated components of agriculture is the use of genetically modified (GM), also known as genetically engineered (GE), crops. GM crops are aimed at improving the production of the farm as well as reducing the use of resources, both internal and external. GM crops are bred to be stronger, produce bigger yields, require less or no fertiliser, require less soil tillage resulting in lower emissions from vehicles, and be pest resistant and thereby reduce pesticide use. It is evident that GM crops can play a huge role in reducing environmental damage through the reduction of soil tillage and chemical use and

improve economic performance through ensuring larger yields with lower input costs (Ervin *et al.*, 2010).

The potential exists for agriculture to play a role in reducing GHG emissions not only by reducing direct and indirect energy consumption, but also by providing the biomass to act as carbon sinks which remove $CO_2$ from the atmosphere (Pretty *et al.*, 2002). Adopting conservation tillage or zero tillage methodologies involves maintaining a permanent or semi-permanent organic layer on the soil. This not only reduces the machine hours required to till the land, but also increases the carbon content of the soil, acting as a carbon sink.

Cropping methods are an important facet of sustainable agriculture. Crop rotation is an important policy for a number of reasons. Firstly, rotating crops interrupts pest insects' breeding cycles, which helps to reduce the need for the spraying of insecticides. Secondly, crop rotation can reduce the need for fertiliser, as certain crops can provide nutrients for a second set of crops and vice versa (Horrigan *et al.*, 2002). Thirdly, crop rotation can help combat plant disease by ensuring biodiversity within the field. Finally, crop rotation can increase yields by ten to fifteen percent, improving profitability and efficiency (Reganold *et al.*, 1990).

Cover cropping involves the planting of crops such as legumes during the off-season (Francis and Madden, 1993). Cover crops have a number of benefits including preventing soil erosion due to water runoff and wind erosion, reducing weed growth, reducing pest populations and providing organic material to revitalise soil nutrients. Cover crops can also be used a means of income supplementation outside of the growing season (Horrigan *et al.*, 2002).

Integrated pest management (IPM) is an approach aimed at reducing pest populations by interrupting breeding cycles. IPM makes use of the methods previously discussed such as crop rotation, cover cropping, and conservation tillage. An IPM methodology reduces the input of chemical pesticides, thereby increasing profitability and environmental wellbeing (Reganold *et al.*, 1990).

There are various farming practices associated with sustainable agriculture. These practices can improve environmental health, social wellbeing and economic prosperity of the agricultural industry. However, in order for sustainable agricultural practices to

permeate the industry, there need to be incentives to encourage the adoption of these practices. Systemic change is required in terms of the trade and subsidisation of the production of commodities (Flora, 2010).

### 1.3.5 Maize Agriculture in South Africa

Maize is the most important grain crop in South Africa due to the fact that it serves as the staple diet for the majority of the African population as well as being the major livestock feed grain (NDA, 2004a). South Africa produces both white and yellow maize (van Zyl, 2010).

South Africa is ranked between ninth and fourteenth in the world in terms of total maize production. The USA is the largest producer of maize and is followed closely by China. South Africa lags well behind the USA and China, not only in total production but also in terms of yield (van Zyl, 2010). This is an area that should be addressed to ensure efficiency of production.

Maize is planted during late spring and early summer and is primarily grown under dryland conditions, in other words, it is not irrigated but is rainfall dependent. For the 2007/08 growing season, the Free State was the country's leading producer of maize, contributing 38.8% of all the maize grown in South Africa. Mpumalanga contributed 22.6%, the North West 22.3%, the Northern Cape 5.2%, Gauteng 4.5%, and the rest of the provinces combined contributed 6.6% of the maize crop (NDA, 2009).

South Africa is a net exporter of maize, with local production exceeding consumption in most seasons (NDA, 2004a). In surplus seasons, the primary export locations for South African maize are Kenya, Malawi, Mauritius, Mozambique, Zambia, Zimbabwe, and Japan. The export of maize is an important foreign revenue earner (van Zyl, 2010).

Maize is the largest contributor of gross value for all agricultural products. In the preliminary figures for the 2007/08 marketing year, maize contributed 17.3% of the total gross value of agricultural products with a gross value of R20.8 billion. Although agriculture's contribution to the Gross Domestic Product (GDP) is diminishing as a result of South Africa's economic development, agriculture remains an important contributor to the GDP (van Zyl, 2010).

There are approximately 9 000 commercial maize farmers in South Africa. Collectively they plant almost 3.4 million hectares of land and employ about 150 000 farm labourers (NDA, 2004a). There is, however, a move toward further mechanisation, which is in direct opposition to job creation. This is one of the areas that needs to be investigated in order to understand the rationale of farmer's choices. It is evident that the maize industry in South Africa is a major role player both in terms of economic contribution and employment.

Maize farmers in South Africa are currently experiencing a cost squeeze effect with relation to input costs versus revenue generated. Input costs per hectare have increased from R3 000/ha in 2002 to a projected R8 000/ha in 2011. Between 2006 and 2008, the costs of fuel, requisites and intermediate goods almost doubled and the cost of fertiliser more than doubled (van Zyl, 2010). Due to the current free market dispensation, farmers are essentially price takers. They have to sell their maize at the price that is generated by the market as a result of domestic demand and supply factors, world commodity prices, exchange rates and export tariffs (NDA, 2004b). Farmers are predicted to break even in the period 2009 to 2011 (van Zyl, 2010). This is a highly risky predicament for farmers to find themselves in and is likely to be a major factor in determining the behaviour and decisions that farmers make.

### 1.3.6 Conclusion

A move toward a more sustainable future is an imperative. The current situation faced by the globe in terms of rampant population growth, environmental degradation and the trouble in the economic system are clear indicators that life cannot continue on its current trajectory, at least not without a lot of suffering and potential global meltdown. In order to realise a more sustainable future, there needs to a collective social effort to address the current imbalances in the system. Individual behaviour is going to need to change, as are business practices and government policies. This change can only begin by increasing awareness and through the development of thinking on the subject.

In order to increase the knowledge base surrounding sustainability, it is necessary to break the problem down into bite-sized chunks, country by country, industry by industry, person by person. This research is being conducted to take an industry-sized chunk and

begin to grapple with the issues that drive the individuals who are making the decisions that ultimately affect the overall sustainability of the system.

Agriculture has a critical role to play in ensuring a sustainable future. It affects people in terms of satisfying one of their most basic needs, the need for sustenance. This is the cornerstone of the social impacts that agriculture has. Inefficiency in production leads to food insecurity, which inevitably leads to social unrest. The equitable distribution of food, and the economic capital earned from the production of food, is a fundamental goal of sustainable agriculture. Agriculture also has a vital role to play in ensuring environmental sustainability. Current agricultural practices are placing an unsustainable burden on the environment. Through reviewing the agricultural system and practices, headway will be made in securing a healthy environment for the generations to come.

Maize farming in South Africa is the largest contributor to economic value added through agricultural products. Maize is the staple diet of the overwhelming majority of the population and as such is a very worthy research subject. Maize farmers are responsible for making critical decisions that affect their own wellbeing, the wellbeing of their workers, the wellbeing of the local environment, the wellbeing of greater society, and the overall development of the South African economy. It is therefore essential to engage at the farmer level to better understand the rationale for the decisions they make. Only once the individual decision-making process and the individual context within which those decisions are made are better understood will systemic change begin to become a reality.

## 1.4 Research Methodology

### 1.4.1 Introduction to Social Research

When undertaking research, there are three main philosophical questions that need answering, “Why research?”, “What to research?”, and “How to research?” (Remenyi, 1996). This chapter is concerned with the “How to research?” question. This question will be addressed by discussing the research design and the research methodology. These are integral components that ultimately guide and define the research process.

### 1.4.2 Research Design

The research design of this study is based on a phenomenological approach. It aims to describe and understand the social phenomena, the farmers’ decision-making process, within the context in which it occurs. The research assumes multiple realities that may or may not be common to the farmers involved in the study (McMillan & Schumacher, 2001). The research aims to gather qualitative data through the use of one-on-one interviews in an attempt to gain a subjective perspective of the farmers’ lived experiences and thereby delve deep into the complexities of their decision-making process in light of issues of sustainability.

### 1.4.3 Goals of the Research

The objective of this research is to gain insight into the complexities of the decision-making process of maize farmers in Western Mpumalanga, with particular focus on the effect of issues of sustainability. The research aims to investigate the extent to which farmers account for issues of sustainability in making decisions and how the decisions they make impact on issues of sustainability.

Farmers need to make critical business decisions regarding crop selection, cultivar and seed selection, soil preparation, planting, harvesting, and marketing their produce (Geyser, 2000). This research aims to understand the rationale behind these decisions, particularly in light of issues relating to sustainability. In order to conduct this research it was necessary to spend time with farmers and discuss the choices they make. The aim

of the study is not to make judgements about the sustainability/unsustainability of the individual farmers, but rather to gain insight into their decision-making behaviour.

The data that was collected was qualitative in nature and is aimed at unpacking the behaviour and thinking of farmers. The data will be analysed by picking out common themes that are contained within the transcripts of the interviews that were conducted. The process of this thematic analysis will be discussed later in this chapter.

### 1.4.4 Qualitative Research

Qualitative research provides the capacity to develop a depth of understanding that is often lost by quantitative research. Due to the nature of the qualitative research process and data analysis it is possible to delve deeper into the research topic. This enables qualitative researchers to develop rich and thick descriptions of the phenomena.

Qualitative research, however, is less useful for developing statistical descriptions about a broad population. Due to the depth of the research and the understanding that the phenomena occur deeply embedded within the social context, extrapolating the results to a large population is less reliable for qualitative research (Babbie, 2008).

### 1.4.5 Scope of Research

Qualitative research generally focuses on small, non-random samples that are purposefully selected so as to provide a wealth of information on the research subject (Patton, 2002). This provides the researcher a better opportunity to delve deeply into the subject matter and develop rich descriptions and interpretations of the data. The research involved conducting in-depth interviews with three maize farmers in Western Mpumalanga. The meaningfulness and validity of qualitative inquiry relies more on the depth of information from the cases than the number of cases selected (Patton, 2002). It was necessary to limit the scope to farmers who farmed the same crop in the same area as this was most likely to provide a solid means of comparison between them as their lived experiences are more likely to be similar in terms of the parameters within which their decisions are made. Examples of these parameters include climate, distance from market, culture of workforce, as well as the farming legacy in the area.

Concerns about limiting the scope are that the findings of the research might not be applicable to other farmers in different areas, deciduous fruit farmers in the Western Cape, might, for example have very different experiences and might make very different decisions in light of issues of sustainability. There are, however, many similarities between farmers from multiple disciplines. Environmental factors, such as the use of chemical fertilisers, soil preparation, crop selection etc., that affect decision-making are prevalent in all crop farming. Likewise the social factors, such as labour practices etc., impacting on agriculture are for the most part true across the board. The economic aspects of sustainability are also common to all farmers who need to ensure that they can be economically sustainable in light of various market demands and input cost increases. These factors mean that the findings of this research will be able to be applied across agricultural sectors and bear relevance to overcoming the issue of sustainability in agriculture.

### 1.4.6 Data Analysis

Qualitative data analysis refers to the "non-numerical examination and interpretation of observations, for the purpose of discovering underlying meanings and patterns of relationships" (Babbie, 2008: p415).

In order to successfully conduct qualitative research, it is necessary to be familiar with the theory that relates to the research topic, as well as the theory that pertains to qualitative inquiry itself. If the analysis of the data is not linked to theory, then the results can easily be called into question. Theory in this instance refers to plausible relationships between concepts or sets of concepts (Babbie, 2008).

The researcher will attempt to distil common themes between the cases so as to gain a more holistic perspective of contextually entrenched behavioural phenomena pertaining to issues of sustainability in agriculture. The research will endeavour to develop "thick and rich descriptions" of the phenomena being investigated (Remenyi, 1996). These thick and rich descriptions will then be analysed according to a theory driven code approach (Boyatzis, 1998). In analysing the data, it will be necessary to look for patterns in the data. This will enable the grouping and coding of certain patterns that occur in the transcripts of the interviews (Babbie, 2008).

### 1.4.7 Ethical Considerations

The most critical ethical consideration for this research was ensuring the confidentiality and anonymity of the sources. Due to the nature of the research, it was clear that the individuals concerned did not want their identities revealed. It is of utmost ethical consideration to ensure the meticulous respect of this request (Remenyi, 1998). When conducting face-to-face interviews, it is often difficult to elicit honest comment from the interviewee unless their identity remains concealed. In this case, to get farmers to speak about the environmental and social impacts of their decisions is incredibly difficult without ensuring them that their identity will not be revealed.

Confidentiality and anonymity was not the only ethical consideration for this research. It was also important, in the first place, for the researcher to identify himself as such and be open and explain the goals of the research to the research subjects. Had the researcher engaged with the research subjects under different auspices and extracted the information from them, this would have cast the ethics of the research into doubt. Identifying the purpose of the research in this context also allowed the farmers the opportunity to state their case with the knowledge that the researcher did not intend passing judgement on them as being sustainable or unsustainable but rather to understand the context within which they operate. Furthermore, it was ethical to declare that the interviews were being tape recorded. Had this not been openly stated, the ethics of the study would have been compromised (Babbie, 2008).

### 1.4.8 Research Limitations

As discussed, one of the major limitations of this study is as a result of the scoping of the research. The research population has been limited to three farmers. It is possible that these farmers are extreme outliers in the world of sustainability in agriculture and that their views are incongruent with the views of the greater population. It would be useful to conduct the same research on different farmers, cultivating different crops in different areas to see how much of the findings of this research still ring true.

Another limitation of the research is related to the goals of the research. The goal is to better understand the decision-making process. It might be useful to first analyse, through quantitative analysis, the extent to which the farmers in question are or are not

sustainable. Once the analysis of how sustainable the farmers are is completed, then the analysis of their decision-making process might be more useful.

### 1.4.9 Conclusion

It is clear that qualitative research has its own benefits and drawbacks. The qualitative research process is more suited to the exploratory, descriptive purpose of this research. The data that is collected might be from a smaller population, but delves to greater depths than a quantitative study of the same type would do. The ultimate success and credibility of the research hinges on the linkage between data and theory. If the data that is gathered is not analysed in relation to the theory, the findings of the study will be questionable.

The next section will involve the analysis of the data in terms of discussing the themes that emerge out of the interview transcripts.

## 1.5 Results and Analysis

### 1.5.1 Introduction

The introductory section to this thesis described the goal of the research to be to better understand the decision-making process of maize farmers in Western Mpumalanga in light of issues of sustainability. It is important to understand both the impact of sustainability on decision-making as well as the impact of decision-making on sustainability. The data was gathered by means of face-to-face interviews with three maize farmers in the Bethal area of Mpumalanga. The data arising from these interviews is analysed using thematic analysis.

### 1.5.2 Results and Analysis

Conducting a thematic analysis of qualitative data involves generating a code that will ultimately group common themes emerging from the interviews together. Coding the interviews entails classifying and categorising individual pieces of data and assigning codes to those pieces of data (Babbie, 2008). This allows for the grouping of similar pieces of data from all of the interviews. These similar pieces of data from the various interviews represent the common themes in the interviews. In order to ensure a thematic analysis that is linked to the theoretical underpinnings presented in the Literature Review, it was decided to group the themes into the three pillars of sustainability; economic, social, and environmental. Each of the themes presented below is analysed in the following manner. First, the theme is described with supporting quotes providing evidence of the theme. Then the causes of the phenomena are examined. Thereafter the resultant sustainability issues arising from the behavioural phenomena are discussed.

Through the coding process of the interviews, the following themes emerged:

- Theme 1: Financial and economic factors are the primary decision drivers;
- Theme 2: There has been a decrease in the number of family-run farms;
- Theme 3: Mechanisation is preferable to manual labour;
  and
- Theme 4: Farmers think they do very little environmental damage;

The themes have been broadly grouped into economic, social and environmental categories. However, there is a large amount of overlap between them. Each theme will now be elucidated upon.

### 1.5.3 Theme 1: Financial and economic factors are the primary decision drivers

From the analysis of the transcripts of the interviews, it has become abundantly clear that financial and economic factors play the biggest role in the farmers' decision-making process. It is important to understand the reasons for this, and to analyse the impacts that this has in relation to sustainability.

- *"At the end of the day, my main reason for doing what I am doing is financial. That's it, otherwise I wouldn't be here. And I mean that honestly."*
- *"The first thing is economic sustainability. If you don't survive economically, financially, then it's pointless to try and do anything else."*

The farmers' view is that considering society or the environment is secondary to making good economic decisions because being economically sustainable ultimately determines the survival of the farm. It is pointless to consider society or the environment if the farm does not continue to exist. Farmers have the "weak sustainability" viewpoint that trade-offs between the three pillars of sustainability can and should be made (Adams, 2006). There is little consideration that should the environment cease to be able to support agriculture then the farm could not exist. Or, if society finds alternative sources of food, then the existence of the farm would be superfluous.

In order to better understand the impacts of the fact that economic drivers are the most prevalent drivers of farmer behaviour, it is necessary to understand why this is the case. Through analysing the data, it is evident that financial risk plays a large role in the situation.

The financial risk experienced in agriculture stems from a number of different sources. The first source of financial risk is market risk.

- *"You can be the best farmer and produce ten tons per hectare and still go under, it's not difficult. Because you're totally at the mercy of the market and you have no control, you can do nothing. You're always just surviving, just*

*surviving. Then you've got to go to the bank. And borrow some money, just for the next year."*

- *"So this price fixing [selling forward on SAFEX] kills a lot of farmers. They're actually screwed before they've even started. They're working for the bank."*

Since the deregulation of the agricultural industry, most maize is traded on the South African Futures Exchange (SAFEX). Agricultural prices in general are subject to price volatility due to the inelasticities of supply and demand. The supply of agricultural products is inelastic because production is fixed in the short-term, once the plants have been planted, the commodity is in production. Supply is also, to a large extent, dependant on growing conditions. These factors frequently result in seasonal over and under supplies, hence the inelasticity of supply. The demand for agricultural products is also inelastic. Demand for food tends to change based on tastes and preferences, not on income. Demand for food is therefore income inelastic. People will not buy less food due to increases in price, their choices of food might change, but overall demand will be largely unaffected. Demand for food is therefore also price inelastic. The combined inelasticities of both supply and demand contribute dramatically to the price volatility experienced in agricultural markets (Geyser and Cutts, 2007). Farmers are therefore subjected to major fluctuations in price and cannot be guaranteed to make a profit, irrespective of their yields.

The second source of financial risk is the high input costs in agriculture. Input costs per hectare have increased from R3 000/ha in 2002 to a projected R8 000/ha in 2011. Between 2006 and 2008 the input costs of goods such as fuel, requisites and intermediate goods almost doubled. During the same period the cost of fertiliser more than doubled (van Zyl, 2010). This is obviously a dire state of affairs for farmers to find themselves in. High input costs combined with volatile selling prices add a high degree of financial risk to the industry.

The farmers who were interviewed mentioned the lack of subsidisation and the negative effects this has had on their farming operations.

- *"The old apartheid government, they used to help the farmers, like they do in most countries. In the United States all the farmers are subsidised. We're only subsidised on the diesel. We get R1.30 per litre on eighty percent of our diesel*

*consumption. It's very small and the government doesn't help the farmers here. And because they help the farmers elsewhere, that in itself doesn't allow us to be in a free enterprise system, we can't compete."*

State spending on the farming sector in 1998 was R2.8 billion, which was 46% of the total spent in 1988. State funding for agricultural research declined by 55% from 1992 to 2001/02. State subsidisation of agriculture peaked in 1984/5 and has gradually diminished since then, it is currently close to zero (Kirsten *et al.*, 2007). Perhaps the most salient point raised by farmers is that due to the deregulation of the market, they are expected to compete on a global scale against farmers who receive large agricultural subsidies. The profit margins that local farmers earn are unsustainable in light of them competing on price with farmers who receive subsidisation.

High risk in terms of selling price volatility coupled with high input costs has put farmers into a "profit squeeze" scenario where their profits are being eroded simultaneously by reduced revenues and increased input costs. This cost squeeze situation could have adverse effects on the overall sustainability of maize farms (van Zyl, 2010).

- *"If you take a fancy businessman from Jo'burg and show him a cash flow, he'll tell you you're crazy! It's not for sissies!"*

The third source of financial risk is the debt incurred by farmers to cultivate their crops. Finance is available through the Land Bank or various commercial banks and private institutions. There has been a growing trend in the agricultural industry for the debt profile of farmers to shift to a higher proportion of short-term debt (Vink and Kirsten, 2000). Farmers are substituting long-term debt for short-term debt. The implication of this is that farmers are getting stuck in a cycle of financing themselves from season to season. It was indicated by the farmers that production loans from financial institutions "enslave" farmers to the bank. The farmers are required to undertake to sell their maize forward on SAFEX at an agreed price in order to ensure that the loan can be repaid. This reduces their capacity to play the market and potentially earn a profit by making market savvy selling decisions.

- *"In the last few years we've started selling privately to the mills* (in order to mitigate market risk)*. Most people can't do this because they have to take a*

*production loan from the bank. With a production loan you have to sell your maize forward on SAFEX. In order to ensure you can pay it back. So the bank actually forces you to do that.... "*

The fourth and final source of financial risk in agriculture is production risk (Cass, 2009). Agriculture, particularly dry land grain crop agriculture such as maize farming, is highly dependent on the weather and climate. Episodes of severe drought, flooding, hail storms etc. can, and do, wreak havoc on the crops planted by farmers. The production of farms is highly dependent on factors outside of the farmers' control. Uncertain production means uncertain profits. This further contributes to the total risk involved in agriculture.

- *"*(If I sell my maize forward on SAFEX) *I'm committed to the tonnage in four months time. If there's a total disaster now and I can't produce the tonnage, I have to buy the mielies in at SAFEX prices."*

If farmers are contractually committed to a certain tonnage, they must produce that tonnage. If for any reason they fail to produce the tonnage they would need to purchase the tonnage at market prices which reduces profits and can ultimately result in a financial loss.

The risky financial and economic climate has had serious impacts on the decisions that farmers make. One of the biggest issues is that the farmers get caught in a seasonal cycle that prevents them from considering the long-term impacts of their actions. A second issue is that farmers are on a constant endeavour to increase yields in an effort to maximise profitability in the short-term. This can have negative long-term impacts on the environment and on society.

The level of economic risk in the industry means that farmers need to actively deal with the risk and ensure that they can continue to be profitable. This has dire consequences on their capacity to maintain a long-term, sustainable picture of their operations. Sustainability is by definition a long-term concept. If farmers are unable to achieve a long-term perspective, the potential for them to be sustainable is reduced. Their need to ensure economic sustainability in the short-term is contrary to the long-term imperatives of sustainable agriculture.

- *"The main thing that causes people not to think sustainably is their short-term view. It's the risk in the market that causes people not to think forward."*
- *"That's a problem I have with farmers, their only consideration is this season, what they're going to plant now, and how they're going to pay for their input costs, and how much profit they're going to make this year. So, they are willing to sell themselves to big companies and become a labourer on their own farm, they're just managing it for someone else. And just because they're afraid of next season. And if you've got this short-term view you're never going to move people from just mining and depleting resources."*
- *"People become labourers on their own farms. I think that's because of a lack of vision and long-term view. If you fall into the seasonal cycle thing then you're on the way down."*

The high degree of financial risk means that the farmers' focus is on the current growing season and the price that they might get for their crops. Consequently, farmers constantly need to strive to increase their yields in order to ensure profitability. The resultant intensiveness of the farming process invariably has negative consequences for the environment.

- *"...so you've got to be more intensive, and that puts more pressure on the environment."*

Sustainability in agriculture requires a concerted effort to adopt sustainable farming methods. Financial insecurity means farmers are unlikely to adopt less proven methods that might cost them both in terms of implementation of different practices, and in terms of the risk of reduced yields.

From the interviews it emerged that if there was an economic reason or incentive to change behaviour and engage in more environmentally or socially sustainable practices, then farmers would be open to transformation, but until such time as it made economic sense to be more sustainable, things were unlikely to change.

- *"If there's not an economical incentive to really farm better environmentally, nobody will do it."*

It is evident that if farmers continue to prioritise economic factors in their decision-making process, this will have negative impacts on the sustainability of their farming

operation. Inevitably, the prioritisation of economic considerations will impact harmfully on society and the environment. In order to change the decisions that farmers make with regards their farming practices, it is necessary to provide some sort of economic incentive for them to do so.

### 1.5.4 Theme 2: There has been a decrease in the number of family-run farms

The farmers who were interviewed discussed the changing demographics of the farming community in the area. It is apparent that a large number of family-run farms in the area have been bought up by large farming corporations or mining operations. There are a number of causes for the farmers' decisions to leave farming including crime, land reform policy, financial difficulties, and even divorce. These causes will be discussed in greater detail. An analysis of the impact of the reduction of family-run farms will be analysed in relation to issues of sustainability.

From discussing the financial risk involved in farming it is not surprising that a number of famers have gone out of business and have been forced to stop farming due to financial difficulties. Success in farming is dependent on a number of factors that are out of the farmers' control like the weather or market prices. A spell of bad luck is sufficient to financially ruin a farmer and force them out of business.

- *"Most of the farmers that are farming on my sort of size or scale I think have disappeared. They have either gone insolvent or been forced to stop farming by the bank, or have been taken over by larger companies. All the farms along this road all used to have a farmhouse with a family that lived there. That's just not happening anymore. A lot of the farmhouses have been abandoned or just left."*

The farms that are left are bought up by larger farming corporations or mines. Due to the high coal content of the bedrock in the Bethal area, land is a lucrative resource.

- *"It's not only the land reform policies that are the problem, it's all the mines. They're buying land for ridiculous prices from farmers and those farmers just go and buy land also at ridiculous prices, you can't farm that value out of the land in terms of production."*

The price of land is highly inflated due to the interest of mining prospectors. This increases the financial risk of farming, particularly for farmers wanting to expand their

operations or new entrants into the market. The scarcity of farming land is increasing. This in turns places more pressure on farmers to be more intensive in their cultivation of the land, which in turn places extra pressure on the environment.

As alluded to in the previous quotation land reform policies have also played a role in reducing the number of small scale commercial farmers. The Department of Land Affairs instituted land reform policy with its White Paper in 1997. Land reform was to consist of land restitution, redistribution and tenure reform programs. The land reform program was designed in accordance with the market-assisted approach recommended by the World Bank. However, beneficiary households had to collectively combine their grants to afford land from a willing seller. The Land Reform for Agricultural Development (LRAD) programme was implemented by government in 2000. The purpose of LRAD was to increase grants dependent on an increase in the farmer's own contribution. At the same time the Comprehensive Agricultural Support Program (CASP) was initiated. Its purpose was to implement farmer support services such as research, extension, finance, information and infrastructure. (Kirsten *et al*., 2007). To date, the amount of land that has been handed over through reform policies is a very small proportion of the total land designated for land reform. However, the threat of land reform is, in some instances, sufficient for farmers to decide to give up farming. Farmers are aware of the potential risk involved in land reform and as a result land up focussing on short-term objectives rather than adopting the long-term, sustainable perspective. The phrase "make hay while the sun shines" is particularly apt in describing the current situation.

- *"One farm* (we own) *is* (under) *a land claim; it's quite scary to actually live like this, not knowing if it's going to go Zimbabwe style. We're trying to get to a point where you don't put all your eggs in one basket, in case, so if we need to pull out we can. I'll be honest, if we could get someone to buy this whole farm as a running concern, I would be prepared to sell it."*

Crime is another contributing factor in the farmer's decision to leave farming. Farm murders in South Africa dominate the news on a weekly basis. Security on farms is a major concern for farmers.

- *"Just last week a policeman was shot here. He was shot by another policeman while they were trying to ambush the guys who had broken in and stolen the*

*safe full of guns on my neighbour's farm. The guy thought he was one of the robbers and shot him by mistake. When I got here they were carrying the guy away in one of my blankets. He's in Bethal hospital now."*

- *"There's a big problem with theft. Anything that can be stolen will be stolen. We've got security here, especially during the harvest season."*

One of the more trivial factors contributing to the declining numbers of family operated farms is divorce. Farmer's typically tended to marry in community of property. This entitles both parties to an equal share of the combined estate should they divorce. In the case of divorce, farmers have had to sell their farms because neither party could afford the other half of the farm.

- *"One of the reasons is divorce. I'm not kidding. Back in the days everyone used to get married in community of property. If they get divorced, no one can afford to buy half a farm these days, so they have to sell it."*

There are clearly a number of factors that contribute to the farmer's decision to quit farming. Financial risk, land risk, and security risk amongst others are the primary motivators in the decision-making process. It is important to consider the impacts of this phenomenon in light of sustainability.

One of the primary issues associated with the decreasing numbers of family-run farms is the fact that family farmers tend to be more responsible stewards of the land than industrial farms. The farmer necessarily has a more long-term, sustainable view because they have vested interest in the farm continuing to be run by future generations. The families typically live on the farm and are more aware of the environmental issues associated with certain farming practices. There is also a greater sense of community which enables farmers to hold one another responsible for maintaining a certain level of environmental and social wellbeing. Family farmers also typically have a better relationship with the local people and labourers and are less likely to engage in unfair labour practices.

- *"You get these big guys coming in. They've got a long term view on profit, I don't know if they've got a long term view on sustainability, the environment, or even socially for the farmer and his concern."*

The takeover of farms by farming corporations or mines has negative effects on sustainability. Corporate farms are even more likely to prioritise short-term profits over long-term sustainability. Mining is inherently unsustainable as it involves the active depletion of a non-renewable resource.

Another issue associated with the decline of family farms is that the farmers who are still farming are aware of the trend and therefore need to try and mitigate the risks that contribute to the reduction in family operations.

- *"The whole* (farming) *thing is risky. You can't afford to put everything into it. I've got property in town, and in Jo'burg. I've also invested my money. Just for in case something happens. It's too risky to just be a farmer these days"*

Farmers are forced to concentrate on issues other than their farming enterprise such as investing in stocks and shares, and buying property to offer insurance should they go out of business or leave due to political or social issues. This can have negative effects on their farming practices as their focus is divided and is focussed on the short-term.

### 1.5.5 Theme 3: Mechanisation is preferable to manual labour

The preference of mechanisation to manual labour is an area that has serious social implications. The farmers indicated that mechanisation was preferred to labour. A number of reasons were cited for this choice. The two major drivers of the decision-making process were productivity and profitability, and the difficulties of dealing with a large labour force, specifically in light of recent developments in labour regulations.

The increased reliance on mechanisation to perform tasks on the farm has negative consequences for the job market and for the socio-economic situation in local communities. Farmers, however, rate this as a secondary concern to ensuring high levels of productivity and thereby maximising profit-making opportunities.

- *"I think you've got to mechanise everything. It's got to become more mechanised and less people actually working on the farms. The productivity is much higher. When my grandfather was here there were 400 people working here and hundreds of people living on the farm. Today we have about 22. And we're more productive now than what my grandfather was. I'm not saying he was a shit farmer, it's just that technology has changed."*

It is evident that decreasing reliance on manual labour does not necessarily equate to a decrease in productivity, in fact it seems to have the opposite effect. However, the ramifications of the loss of 378 jobs on one farm during the period of two generations are severe. Population levels are increasing. If the number of breadwinners is decreasing, the combined effects can be devastating to local communities.

The move toward more technologically advanced farming methods means that skilled workers who operate the machinery are increasingly valuable to the farmer. There is also, however, a major decrease in semi-skilled and un-skilled labour as well as a reduction in the availability of work for casual labourers (Simbi and Aliber, 2000).

- *"There are a lot of things we can do by hand labour that we'd rather do mechanically. Not only for effectiveness, mechanical means are more effective than manual means, but also all the labour problems."*

Of primary concern to the farmers are the issues relating to labour legislation in South Africa. Farmers argue that strict labour regulation makes the employment of labourers unappealing. There are a number of interrelated issues pertaining to changes in labour legislation that are of concern for farmers. One of the largest issues for farmers is the Extension of Security of Tenure Acts (ESTA). ESTA was introduced in 1997 and made provision for the protection of residence of permanent, resident farm workers. In order to remove a worker who is protected by the act, farmers are required to provide suitable alternative accommodation. One of the negative impacts of this act is that farmers are not replacing exiting farm workers with new permanent resident labourers. Farmers are also resettling their labourers in towns and townships (Simbi and Aliber, 2000).

- *"If you employ someone you've got twice the problems. All the regulations you've got to comply with. And people are so fickle; they can just turn like this. You can go out of your way to help someone get into employment and the next day you're at the CCMA. Because he just didn't come to work and you didn't take him back and you had to do all the paperwork and all the procedures and everything."*

Another source of the decrease in manual labour in maize farming is the minimum wage for farm workers.

- *"I think for the primary functions like planting that it's much more effective doing it mechanically. But there are a lot of things on the side that you actually can use labour for. That's why we started using Roundup Ready soya beans. Before we had this technology we used manual labour to go into the fields and pull up all the weeds, and we used a lot of labour to do that. But now we'd rather use the technology, it's much easier, and much more effective and more cost effective. I don't say you must take people below the bread line, but minimum wages have made it impossible for you to hire someone for a day."*

The agricultural sector has been included in the four major labour laws in South Africa, the Labour Relations Act (1995), the Basic Conditions of Employment Act (1997), the Skills Development Act (1998) and the Employment Equity Act (1998). One of the consequences of the application of these laws to the agricultural industry has been the implementation of a minimum wage for farm workers (Kirsten *et al.*, 2007). Consequently, farmers have reduced their reliance on labour.

- *"So if you think about it, you don't really want to create jobs even though you know you should and you can."*

The implementation of ESTA and minimum wages in agriculture has had a large impact on the decrease of the number of labourers on farms. Technological advance has also played a significant role in reducing the total number of farm workers in South Africa, and indeed across the world. The reduction in the workforce has negative effects on the local community and the farmer. Unemployed people endure poor living conditions, increased food insecurity, and high incidences of disease and criminal behaviour. The local communities suffer as a result of high levels of unemployment. Farmers too are subject to higher levels of crime as a result of lack of employment. The impact of the decision by farmers to reduce employment clearly has dramatic implications for social sustainability.

### 1.5.6 Theme 4: Farmers think they do very little environmental damage

An unexpected result of the research was the perception of the farmers that they do very little damage to the environment. This mindset, to a large extent, determines the nature of the decisions they make, particularly with regard to the farming methods they

employ. It is important to analyse the decisions that farmers make within the context of their assumption that the impact of their activities has minimal environmental impact.

- *"I can't think that farmers do any environmental damage. No."*

During the interview process the farmers were asked about incidents or decisions that they make that could have a direct or indirect effect on the environment. Two of the farmers discussed dealing with pest management issues in the form of rodent problems. Both farmers said that preserving bird life was an important environmental consideration in their actions.

- *"We've got a mice problem, you've got to control it, but that's actually the first time that you start to think environmentally, because you don't want to kill the natural predators. So if you use a poison it must be friendly to the owls or falcons, or whatever you call them, or the birds. So there definitely, we did take it* (the environmental impacts) *into account. How we're going to control the mice."*
- *"We've got a problem with rats and we had to work out how to get rid of the rats without killing the birds. We put down poisoned seed, but then the birds eat it and die. So we dug pipes into the ground where the birds can't get, and the rats go down there and eat the seed and die down there."*

One of the farmers who had a rodent problem also described another incident concerning pesticide use.

- *"I had some land with a big dam next to the field. One day we sprayed insecticide* (by air)*, and then some of the fish died. And I was wondering if some of the insecticide got into the water. But you can't imagine, you can't get around it that, it's so little and you didn't even apply it directly into the water. Was it really the insecticide that killed the fish or was it something else?"*

In this instance it is clear that the farmer was unsure of whether the death of the fish in the dam was as a direct result of pesticide use or whether it may have been caused by some unrelated issue. When asked about this, the farmer responded with the following answer.

- *"There's so much control and regulation these days that there are not many insecticides that do damage, I doubt whether it has a bad influence on the environment..."*

There seems to be a common conception amongst farmers that their activities do little damage to the environment and that regulation of pesticides makes them environmentally safe. The impact of pesticide use on the environment and on society has been studied at length. Pesticide use has been shown to cause adverse health effects in humans including dizziness, headaches, and blurred vision. The long-term chronic effects of pesticide poisoning include increased cancer risks and immune and reproductive system impairment (Pesticide Action Network, 2010).

The conundrum of why farmers were worried about the impact on birdlife when dealing with rodent infestations, but were altogether less aware of the impacts of other farming practices was answered in the following way.

- *"... it* (the impact of other farming practices) *doesn't have a direct effect on you, that's the main thing. If you don't kill the birds then they help you with the* (mice) *problem, so you need them to help you. But if you've got fertiliser going to the river, it doesn't affect you."*

It is apparent that farmers are concerned with the direct externalities of their operations, but are less concerned or aware of the more indirect externalities.

- *"I think if you know you're going to influence something directly..* (you might do things differently)"

One area of the environment that all of the farmers are concerned with is the health and quality of the soil in their lands. However, this is not due to concern about the environment, but rather as a result of their view that soil is an integral input into the cultivation of crops and that healthy soil means healthy crops which means bigger yields which means greater profits.

- *"Productivity is down to soil quality and farming techniques. The number one thing that we've found out is that it's down to the pH of your soil. If your pH is low, it doesn't matter how much fertiliser you put, your productivity will be low. Lime is one of the keys for us. We're putting in 3.5ton per hectare of lime every year. We do the soil samples on all the lands and if the pH level has dropped*

*below 4.5 then we put in lime. As soon as you get your pH above 5.5 then whatever is there is available to the plant in terms of fertiliser and all the nutrients. If you're going below 4 then you're starting to cut your throat. If you plant in land that has a pH of 3, you can put in as much fertiliser as you want, but the plant just can't take it up. What was good was that as soon as we started putting lime in the soil was that all that was there, all the NPK* (Nitrogen, Phosphorous and Potassium)*, became available to the plant and we actually didn't need to fertilise. Last year we averaged, on our white mielies, 10 ton per hectare, we've never got that before. On yellow maize we averaged between 7 and 8 tons* (per hectare)*."*

In order to ensure good soil quality, one of the practices that is in line with sustainable agricultural practices is crop rotation. All of the farmers practice crop rotation. The crop of choice is soya bean. One of the benefits associated with crop rotation is the nutrient deposits into the soil by a first set of crops that can then be used by a second set of crops (Horrigan *et al.*, 2002). Soya beans are used by the interviewed farmers because they provide nitrogen for the soil which means that farmers can save on fertiliser costs when preparing the soil for maize cultivation.

- *"We generally plant the same hectarage of mielies and soya beans every year. We plant two years of soya bean, one year of maize. The quantities always remain the same; it's just the lands that rotate. Because soya beans put nitrogen into the soil. Previous to soya beans we used to farm potatoes. The decision to move was purely financial. Your input costs for potatoes is massive. One of the other problems here was potatoes were being planted over and over and diseases started to creep in, everything was under-grade. Crop rotation helps with diseases."*

Farmers also recognise the benefit of crop rotation as a tool to be used in combating plant disease. Soil systems can be modified though crop rotation and conservation tillage to improve disease suppression (Peters *et al.*, 2003).

The prevalence of other elements of sustainable agriculture are few and far between. One of the farmers indicated the use of biological methods to help deal with root mould in maize plants.

- *"But you know, to be farming in 40 years, you've got to do it right now. So it forces you to be more considerate about the environment. Especially the land, not depleting the soil. We're already trying to incorporate a lot of biological farming things, trying this and trying that. Because you know you need it for the future. I'm using biological methods to protect the maize against mould. Last year we had very good results."*

Although this seems to indicate environmental awareness on the part of the farmer, it is clear upon further analysis that consideration for the environment is focussed solely on the land and soil and, as explained earlier, this view is motivated mainly by the fact that soil is an integral input into maize cultivation and that soil health invariably means economic health.

When asked if the market for fertilisers, pesticides, etc. was shifting toward "greener" technology the farmer gave me the following response.

- "*Definitely. The pioneers are already doing it. I would rather see myself as a late follower. I've got to pay the school fees* (laughs)*."*

This is one of the primary issues that results from the financial risk in agriculture. Migrating to new technologies involves increased input costs and the risk that yields might decrease. The majority of farmers, as a result of the financial risk, are unwilling to pioneer new, more sustainable methods.

The view shared by farmers that their operations have minimal environmental impact poses a threat to environmental and social wellbeing. Farmers make critical decisions based on poor information regarding the environmental impact of their actions. This ultimately impacts negatively on the overall sustainability of agriculture.

### 1.5.7 Conclusion

From the analysis of the economic aspect of sustainability and its relation to farmer decision-making it is clear that financial risk plays a highly significant role in influencing decisions. Farmers place a high value on the economic sustainability of their enterprises. This leads them to prioritise their focus on economic considerations before they consider the social or environmental impacts of their decisions. The economic risk

in the industry also leads to farmers making short-term, season-to-season decisions which inevitably compromises the sustainability of their farming operations.

The social elements of sustainability that emerged from the research were that the number of family farms is decreasing and that farmers are moving toward more mechanised, less labour intensive farming methods. The decrease in the number of family-run farms impacts on sustainability in a number of ways. Firstly, the remaining farmers have noticed the trend and are putting in place mitigation strategies aimed at reducing the barriers to exit from the industry. This leads to a reduction in their focus on farming and could lead to poorer decisions being made. The second issue with the reduction of family farms is that family farms tend to have a longer term view as the intention is for future generations of the family to continue farming. The final issue is that the industrial farms that replace the family-run farms are even less motivated to care for the environment as their focus is on short-term profit taking to keep the shareholders happy.

Decreasing the workforce on farms in favour of mechanical means has dire consequences for local communities. Unemployment breeds a plethora of social ills including crime. Crime is a major concern for farmers; this is exacerbated by the number of unemployed people in the immediate surrounds. Increased productivity and strict labour relations laws are cited as the primary contributors to the move to mechanisation. Farmers argue that increased productivity and reduced labour problems make it incredibly appealing to lay off workers in favour of machines.

Farmers are of the opinion that their activities do little to no environmental damage. Farmers consider direct environmental damage in a more serious light than they do indirect environmental damage. Farmers place a high value on soil health and quality, but this is not motivated by a genuine concern for the environment, but rather due to the fact that soil health is vital to ensuring big yields and profitability. Farmers acknowledge the increased prevalence of alternate technologies in the market but are reluctant to adopt them due to the perceived financial risk of doing so.

## 1.6 Conclusion

### 1.6.1 Summary of Findings

In summarising the results of the study, the extent to which the three pillars of sustainability impact on farmer-decision making will be discussed first. This will be followed by a discussion on the impact of farmer-decision making on issues of sustainability.

In order to better understand the rationale behind the decisions that farmers make, it is important to understand the extent to which economic, social and environmental factors influence their decisions. Through the interview and data analysis process it became abundantly clear that the farmers' principal reason for farming was to earn a profit. As a result, economic factors are the primary drivers of farmer's decisions. Almost every decision made by farmers prioritises the impact on profitability over the impact on society or the environment. This prioritisation of economic factors stems directly from the high degree of financial risk experienced in the agricultural sector in South Africa. The economic risk in this sector stems from market risk, rising input costs and lack of subsidies which leads to decreased global competiveness, sources of finance that control marketing behaviour, and production risk. In order to reduce the prioritisation of economic factors by famers it is necessary to reduce the financial risk they experience.

Farmers consider environmental issues only in cases of direct impacts or where they have a vested economic interest in environmental wellbeing. The primary area in which this is evident is the case of soil quality management. Farmers recognise the fact that good soil is a prerequisite for producing large yields of high quality maize. Farmers therefore place a high degree of emphasis of ensuring good soil management practices in order to maximise the economic value of this asset. Once again, however, the motivation for this behaviour is not due to a genuine concern for the environment, but rather for the asset that can promote financial security.

Social considerations impact on decision-making where there is a direct impact on the farmer. There has been a reduction in the number of family-run farms. This is in part due to the levels of crime and the instability induced by land reform policy. Farmers make decisions to leave the industry, these are in part influenced by social factors.

Another social factor that is important but critically does not have a large impact on farmers is labour retention. Farmers frequently introduce machine intensive methods into their farming practices. In these cases the social good of job creation and employment is overlooked for the sake of efficiency and avoidance of labour issues. The labour issues that farmers cite as influencing their decision to move away from labour are ESTA and the statutory requirement to pay minimum wages.

The negative impacts on sustainability that arise from the preference of economic drivers for behaviour include the short-term, season-to-season perspective. Farmers focus on short-term gains as a means of mitigating financial risk. This means that the long-term imperatives of sustainability fall by the wayside.

The implications for sustainability of the farmers' lack of environmental consideration are severe. If farmers fail to consider the environment when making decisions, the current rate of environmental degradation is set to continue and worsen. The barriers to the adoption of more sustainable methods are primarily driven by the financial risk in the industry. Farmers are unwilling to prioritise environmental imperatives for fear of financial ruin. The adoption of more environmentally friendly practices inevitably involves increased implementation costs and carries with it the risk of reduced yields, both of which are unacceptable consequences for farmers.

The decision by farmers to move away from labour intensive practices has detrimental knock on effects for the affected communities. Unemployment results in a wide range of social ills including poverty, food insecurity and crime. This is obviously undesirable both for the local communities and the farmers alike. However, stringent labour policies are proliferating the loss of jobs in the agricultural sector.

### 1.6.2 Areas for Further Research

Further research into sustainability and decision-making consists of two potential paths. The first path is to analyse the results of this study and to verify them against different populations of farmers in different agricultural industries. The second area of study is to attempt to reduce the sustainability problems associated with the decisions farmers make by reducing the prioritisation of economic factors in their decision-making process..

A similar study to this would be very interesting if conducted on farmers operating in different geographical areas or cultivating different crops or producing livestock. It would be interesting to ascertain whether the findings of this study only hold true for maize farmers in the Bethal area or if deciduous fruit farmers in the Western Cape and cattle farmers in the Eastern Cape have similar decision-making processes. There is a high likelihood that the results would be confirmed in other areas of the country and within different agricultural disciplines. The motivating factors of financial insecurity and labour regulations pertain to a large portion of the agricultural industry in South Africa. It would need to be confirmed whether this results in the same kinds of decisions being made.

It would also be valuable to assess the sustainability of different farms via a quantitative methodology and then conduct the qualitative analysis of decision-making. This would determine if there was any correlation between sustainability and decision-making factors. This would enable the development of a decision-making model that was most conducive to sustainable agricultural practices.

The second sphere of research involves changing the decision-making drivers for farmers. In order to reduce the extent to which financial factors dictate farmer's decisions, it is necessary to reduce the financial risk associated with farming. Geyser and Cutts (2007) have already looked at price volatility on SAFEX. Although they have conducted a detailed study of the intricacies of the source of the risk, little is suggested to combat this volatility. It would be useful for a study to build on theirs and examine ways of reducing price volatility. Kirsten *et al.* (2007) note that it is important for the market to be a true reflection of price and not use artificial means to distort prices as was the case during the regulation era in South African agriculture. It is a big task to reduce market risk without price distortion. This is an important area for future studies to focus on.

High input costs are a second source of financial risk in agriculture. The farmers all stated that the reduction in subsidies meant that they were handicapped when competing in a global market. Implementing farming subsidies aimed at improving the overall sustainability of the farm are a potential solution to reducing financial risk, whilst simultaneously increasing sustainability. Subsidies could be given to offset the costs of the adoption of more sustainable methods. Machinery and equipment that are required

to change farming practices should be subsidised. Likewise, the subsidisation of “green” technology such as organic fertilisers, biological pest control methods etc. would be beneficial both to the profitability of the farm, and the wellbeing of the environment. More research should be conducted to identify specific policy changes that could make this a reality.

Reducing the layoff of workers in favour of machinery is a touchy subject. Getting involved in labour law disputes is a complex topic. However, it is imperative for the country that jobs are created on a sustainable basis. Reducing the number of people in employment is counter-productive and exacerbates the issue of social sustainability. High unemployment places immense pressure on government coffers and is a massive burden for employed people to bear in the form of taxes to support social grants. Farmers need to be incentivised to employ people on a sustainable basis. Investigation needs to be done into the logistics of labour subsidisation. This is a highly complex issue that needs to be addressed at a policy level. It is imperative to involve all stakeholders in the research process so that no side feels unrepresented or hard done by.

Educational programs should be implemented to educate farmers about the impact of their activities on the environment. The general level of unawareness of environmental impact by farmers is concerning. The farmers all indicated that they are concerned by direct environmental impacts such as the poisoning of birds. Research needs to be conducted as to how to effectively educate farmers about the detrimental effects of their indirect impacts on the environment such as fertiliser runoff. The development of an educational program for farmers would be immensely beneficial in lessening the impact of their actions on the environment. The program should focus on encouraging the adoption of sustainable methods such as conservation tillage, cover cropping, integrated pest management and the use of organic rather than chemical inputs such as pesticides and fertilisers.

### 1.6.3 Concluding Remarks

The brutal reality of the findings of this research indicate that unless the financial risk in the industry is reduced or farmers are provided with economic incentives to do things

differently, things will not change. Although this is not an ideal state of affairs, the knowledge gained through this research is incredibly valuable in uncovering the truths about farmer decision-making.

Many papers have been written detailing the issues with current farming methods and the benefits of sustainable agriculture. The gap in the research is understanding the reality that the farmers face in making difficult decisions. Armed with the knowledge that the primary drivers for behaviour are financial, concerned policy makers can more effectively develop policies aimed at increasing job creation and reducing environmental degradation.

It is sincerely hoped that this research will contribute toward meaningful change in the agricultural sector and beyond. Society is at a cross roads, research like this will help to ensure that the best path is chosen.

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## Section 2 – Literature Review

### 2.1 Why Sustainability?

The issue of sustainability has increased markedly both in use and popularity over the last decade. Sustainability is high on the agendas of most governments, media coverage relating to sustainability has increased significantly, and as a result, sustainability has begun to permeate the conscience of the man on the street (Berns *et al.*, 2009). "Ensuring Environmental Sustainability" was listed as Goal 7 of the 8 Millennium Development Goals at the United Nations Millennium Summit in September 2000 (Adams, 2006). The four targets of this goal are as follows:

- 7A. Integrate the principles of sustainable development into country policies and programmes and reduce the loss of environmental resources
- 7B. Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss
- 7C. Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation.
- 7D. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers.

  *Source: United Nations, 2010*

There are a number of key factors that have driven the increased awareness of the issue of sustainability. First, and foremost, environmental degradation, climate change and global warming have proliferated the increased focus on the issue of sustainability on a global scale. Secondly, hunger and poverty, particularly in developing nations, presents a major social crisis in the world today. It is only through engaging with these issues and formulating structured debate that solutions are likely to be found. Finally, the economic crisis experienced in 2009 has led many people to point fingers at "unsustainable" financial and economic systems. One of the primary concerns of governments and financial institutions is to engage with the issue of sustainability in order to find more balance in the current systems and make them inherently more sustainable.

In considering the depth of the social and environmental crisis and the pressure to respond, it is imperative for further research to be conducted to better equip people in tackling this crisis (Flannery, 2005). Without such research, knee-jerk reactions are likely to occur, which, in some cases, might further exacerbate these issues rather than diminish the negative effects associated with them.

Further research into sustainability will increase the knowledge base surrounding these issues and will provide better insights into how to begin to solve the problem. It is for this reason that this research should be conducted.

## 2.2 Defining Sustainability

According to their research, Faber *et al.* (2005) discovered that about 50 definitions and circumscriptions of sustainability exist. The difficulty of defining sustainability is further compounded by the fact that experts in different fields apply bias to their definitions of sustainability. Ecologists, economists, biologists, sociologists, etc. all have a particular perspective on sustainability that suits their field (Faber *et al.,* 2005). In order to contextualise this research, it is imperative to formulate as unbiased a definition as possible.

A sustainable system is one which survives or persists (Costanza and Patten, 1995: 193). Therefore, sustainability, in its most basic form, refers to the capacity to endure over time. This can refer to the durability of living organisms, environmental systems, businesses, cultures, languages, economies, countries, social agendas, etc. This seems like a fairly straightforward definition. Further investigation into the details of this basic description, however, reveals an immensely more complex notion.

There is a commonly held misconception that sustainability is only about the environment and environmental issues. The concept of sustainability is significantly more complex than simply sustaining the environment. Sustainability involves making decisions about how best to manage competing human needs so as to ensure that those needs are “met in the present without compromising future generations from meeting their own needs” (WCED, 1987). This definition was put forward in the report by the Brundtland Commission, or World Commission on Environment and Development (WCED), in 1987, entitled *Our Common Future*. The WCED’s specific

focus was cooperation between nations in search of a path for sustainable development.

There is a more descriptive definition of sustainable development that is useful in furthering the definition of sustainability. “Sustainable development is a program to change the process of economic development so that it ensures a basic quality of life for all people, and protects the ecosystems and community systems that make life possible and worthwhile.” (Van der Merwe and Van der Merwe, 1999:5). This definition of sustainability hints that the issue pertains to three distinct yet interrelated areas of focus, namely, the economy, society, and the environment. These three spheres of human existence are commonly collectively grouped together and are widely considered the “three pillars of sustainability” and have formed the basis for what is referred to as the “triple bottom-line” (Adams, 2006).

There is, however, a problem with this conceptualisation. The triple bottom-line approach assumes that trade-offs can be made between the three pillars of sustainability. There is an underlying assumption that the trade-offs that are made are equivalent. So, the environment can be traded off in exchange for social good. This issue has led to the distinction between strong sustainability and weak sustainability. Strong sustainability conceptualises certain elements that are untradeable. The argument of strong sustainability is that if the environment, which is referred to as critical natural capital, did not exist in its present form, life would be unable to be supported, therefore neither society nor the economy would exist or be relevant to talk about (Ott, 2003). This is a perfectly rational argument. However, decisions, relating in particular to development, are made by governments and business and these decisions seem to adopt the weak sustainability perspective that allows trade-offs between all three pillars. As a result, the environment tends to come last (Adams, 2006).

It is evident that the definition of sustainability is imperfect. However, in order to conduct this research it is necessary to put forward a definition for sustainability. The definition that will be used when analysing the literature and data is as follows. ‘Sustainability is the prevalence of the long-term wellbeing and a state of balance between the environment, society and the economy’. The world we live in is a social

world, but the needs of society need to be met within the constraints of the environment and economic growth.

### 2.3 The Issue of Sustainability

From the definition of sustainability outlined above, two key concepts emerge. Firstly, sustainability and sustainable development need to meet the long-term needs of the human population. Furthermore, there is significantly greater need in poor countries than in wealthy countries. Priority therefore needs to be given to development in poor, third world countries where there is a high level of inequitable wealth distribution (Goodland, 1995). Secondly, there are numerous limitations or barriers that will affect the achievement of sustainable development. The limitations affecting sustainable development are broadly grouped into three categories: social, technological, and environmental. Sustainable development needs to ensure the equitable distribution of improvements that result from developments made within these constraints (Pretorius, 2001). The social limitations to sustainable development are critical because a large component of the issue of sustainability is human behaviour. In order to overcome this issue, human behaviour will need to develop and evolve. Technology is critical to overcoming the issue of sustainability. Technologies that do not even exist today will be developed out of necessity (Hart, 1997), and people will need to learn how to maximise the environment without impairing its ability to continue to provide far into the future.

The exponential population growth currently being experienced, particularly in developing nations, is putting serious pressure on the environment. The Earth has a finite carrying capacity and the closer to this level the population gets, the greater the pressure on the environment (Flora, 2010). Tangible examples of the increased pressures on the environment can be found in depleted farmlands, fisheries and forests, choking urban pollution, infectious diseases and environmental refugees (Hart, 1997). Governments and businesses have to delicately balance the increasing need for space, food, wealth, etc., with the pressures that the satisfaction of these needs places on both the environment and society.

There is an inherent tension between individuals, organisations and governments striving for self gain in the short-term and overall well-being in the long-term. It is this

tension between short-term gains and long-term sustainability that needs to be addressed (Hansen, 2004). Sustainability, then, is about establishing equilibrium between the needs of people, the state of the environment, the wellbeing of society, and economic growth and development.

## 2.4 Dealing with the Issue of Sustainability

The most appropriate method for understanding this delicate balancing act is through adopting a systems perspective. It is imperative to understand the interconnectedness of people, society, the environment, and growth and development. Adopting a systems approach underlines the interdependencies at play and allows for a more precise analysis of and approach to issues of sustainability (Hansen, 2004). It is this systems approach that will provide the platform for change.

In *Our Common Future*, the WCED (1987) lists the following requirements for the pursuit of sustainable development:

- a political system that secures effective citizen participation in decision making;
- an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis;
- a social system that provides for solutions for the tensions arising from disharmonious development;
- a production system that respects the obligation to preserve the ecological base for development;
- a technological system that can search continuously for new solutions;
- an international system that fosters sustainable patterns of trade and finance; and
- an administrative system that is flexible and has the capacity for self-correction (UN Documents, 2010).

These requirements illustrate the depth of the interconnectedness of the various components that are required for change to occur.

According to Walker (2008) society needs to change radically in order to achieve sustainability goals. Sustainability needs to become a social vision. There are many proponents in society that are painting a bleak picture of the future. It is crucial that

society regains its faith in the future and actively engages with the present to influence the future in a positive manner (Olson, 1995). The contemporary view of success is narrowly defined in economic terms. Sustainability needs to provide the basis for the development of a new concept of human aspiration and achievement, one that is not limited to economic metrics only, but one that incorporates general human and environmental wellbeing (Adams, 2006).

One of the best ways for this social change to happen is for sustainability to be seen as an opportunity and not a threat. The recent focus on sustainability offers a unique opportunity to rethink the prevailing patterns of global thought with regards the interplay between society, environment, and the economy (Adams, 2006). Individuals need to recognise the imperative for behavioural change and understand that the issue of sustainability offers just such an opportunity to move away from the consumptive behaviour patterns that are dominant today. To quote a global thought leader in social issues, "*You must be the change you want to see in the world*" (Mahatma Gandhi, 1869–1948, Indian political and spiritual leader). Social change needs to be driven from the bottom of the pyramid; in other words, it must start at the level of the individual. Overcoming the problem of sustainability requires changes in behaviour which must necessarily be driven by changes in attitude.

The issue of sustainability has permanently changed the competitive landscape within which businesses operate, redefining the existing threats and opportunities. It is imperative for industry to view sustainability as an opportunity. There needs to be some form of economic incentive for business to engage in more sustainable practice (Berns *et al*., 2009). This incentive could be in the form of increased market share due to the appeal of a new, more sustainable, product or corporate image. It might come in the form of increased productivity by workers due to changes in corporate policy aimed at community upliftment or the elimination of disease. Technological innovation presents perhaps the most exciting and important avenue for overcoming issues of sustainability. Organisations should see the development of new technologies as an opportunity not only to change the world for the better, but also to grow market share and profitability.

Technological innovation has a major part to play in rectifying both social and environmental issues. Technologies that can reduce the environmental impact of

various human activities, whilst simultaneously improving the lives of humans and boosting economic growth, are the key to solving the current crisis. Technological advancement however, comes with risks. The development of new technologies may in fact do more harm than good, particularly in the event of technologies being utilised incorrectly or by the wrong users (Adams, 2006).

Overcoming the issue of sustainability requires systemic change in society incorporating individual attitudes and behaviours, corporate governance and national governance. This change needs to be motivated by the notion that the issue of sustainability presents an opportunity for individuals and businesses alike. Sustainability has different impacts on different industries. This research concerns sustainability in agriculture. It is therefore necessary to gain insight into the interactions between agricultural systems and the economy, society, and the environment.

## 2.5 The Issue of Sustainability in Agriculture

Sustainability, as previously defined, pertains to equitable economic, social and environmental wellbeing and development over the long-term. There is an imperative for all business sectors to evolve their processes and functions so as to be more sustainable. In considering which industry might be most interesting to study, agriculture presented a logical choice. Agriculture can have immensely profound effects on the environment, the economy, and human health and social order (Horrigan *et al.*, 2002). It is therefore a vital component of any drive toward sustainability.

For almost 40 years after World War II, agriculture in the USA set the example on a global stage. Records for crop production were set on an almost annual basis. The farms in question were characterised by a high level of mechanisation, dependence on fossil fuels for vehicles and machinery, borrowed capital, and extensive use of chemical fertilisers and pesticides (Reganold *et al.*, 1990). From the preceding description of the state of affairs, it is clear that the farming methods employed are unsustainable. From an economic standpoint, the business model is unsustainable due to the high reliance on borrowed capital. Socially, the high level of mechanisation means that fewer people are involved in the production process meaning fewer jobs and higher levels of unemployment. This social unsustainability is coupled with environmental

unsustainability insofar as environmental degradation has a direct effect on human health. The extensive use of chemical fertilisers and pesticides invariably has a detrimental effect on the environment through biodiversity eradication, groundwater contamination and soil degradation (Tenkorang and Lowenberg-DeBoer, 2008). In all three categories of sustainability, the farming model employed to increase yield and generate large profits is inherently unsustainable.

From an environmental perspective there are a number of issues relating to "standard" agricultural practices. Fertilisers present a major environmental problem as far as run-off is concerned. Researchers estimate that fertiliser consumption for the world will have increased from 153.8 metric tons in 2005 to 187.7 metric tons in 2015, and to 223.1 metric tons by 2030 (Tenkorang and Lowenberg-DeBoer, 2008). This equates to a 22 percent increase in 10 years (2005-2015), and a staggering 45 percent increase over 25 years (2005-2030). The danger that fertilisers pose to the environment is that they cannot be wholly absorbed by plants and vast quantities of concentrated chemicals, primarily Nitrogen (N), Phosphorous (P) and Potassium (K), are washed into dams and rivers and can do irreversible damage to the biodiversity in these water systems. Furthermore chemical fertilisers gradually increase the acidity of the soil; farmers therefore have to lime the soil in order to decrease acidity and increase nutrient uptake by plants (Horrigan *et al.*, 2002).

According to research conducted by the World Health Organisation (WHO), acute pesticide poisoning will affect three million people and will account for 20 000 deaths per year, especially in developing countries (Pesticide Action Network, 2010). Aside from negative impacts on human health, pesticides are detrimental to the wellbeing of the environment. The amount of pesticide, in the form of both insecticide and herbicide that actually reaches its intended target is very low. Most of the pesticide lands up contaminating the environment rather than doing what it is supposed to do. One of the major issues associated with pesticide use is the decline in the bee population worldwide. Bees play an essential role in pollinating almost a third of the total food production for the world. Use of pesticides has had serious impacts on the global bee population, (Horrigan *et al.*, 2002). As with fertiliser, the use of pesticides is increasing.

Between 1999 and 2008 there was a 33% increase in the value of global sales from US$30bn in 1999 to US$40,4bn in 2008 (Pesticide Action Network, 2010).

Soil degradation presents a major challenge to Earth's burgeoning population. Unsustainable farming methods have led to a considerable decrease in both quality and availability of arable land. The natural formation of soil is a slow process, taking anywhere from 20 to 1000 years for a centimetre of soil to form (Horrigan *et al*., 2002). 70% of the 5.2 billion hectares of dry land crop production are degraded, with as much as 24 billion tons of topsoil lost annually (Fowler and Rockstrom, 2001). Overgrazing, over-cultivation, deforestation and overuse of water can lead to erosion and in some cases to desertification, an extreme form of land degradation. The annual cost of desertification has been estimated at US$42.3bn (Horrigan *et al*., 2002). Desertification leads to a reduction in the total area of arable land, which puts further pressure on the remaining land.

Agriculture affects water quality and supply in two ways. Firstly, some agricultural practices divert the water supply so as to irrigate crops. Agriculture uses about two-thirds of the water used worldwide. This means that the water that is used for irrigation cannot be used elsewhere such as in industry for production, or for drinking water (Horrigan *et al*., 2002). The second impact that agriculture has on water is the runoff of fertilisers and pesticides. These chemicals can cause an imbalance in the downstream ecosystems, resulting in loss of biodiversity (Moore *et al*., 2008). The chemicals in the water can also have detrimental effects on communities living downstream who drink, bathe and subsist off rivers and dams. Furthermore, irrigation can lead to salinisation of the soil due to salts contained in water being deposited in the soil over time, making it less fertile and productive (Horrigan *et al*., 2002).

The use of fossil fuel energy in agriculture occurs primarily in the use of mechanised equipment such as tractors and trucks to carry out tasks on farms. The emissions from these vehicles contribute to the total $CO_2$ output. Transporting produce from producer to retailer also contributes dramatically to $CO_2$ output (Horrigan *et al*., 2002). Irrigation pumps and the use of nitrogen-based fertilisers are also major contributors the total green house gas (GHG) emissions from farming systems. Together, mechanised vehicles, pumps and nitrogen fertilisers make up 90% of the energy inputs of a farm

(Pretty *et al.*, 2002). According to Horrigan *et al.* (2002), agriculture is directly responsible for about 20% of the human generated emissions of GHG's.

Loss of biodiversity is inextricably linked with agriculture, with human food needs competing with many species for their natural habitat. The growing population of the world is applying immense pressure on the natural habitat of a multitude of species of plants and animals as ever-expanding agriculture wipes out natural biodiversity. Furthermore, adoption of genetically engineered crops has eliminated local cultivars. (Horrigan *et al.*, 2002).

Agriculture has various impacts on society. The major social role that agriculture plays is ensuring food security in the world. Maize, particularly in South Africa, is the most important agricultural product. It is the staple food of the overwhelming majority of the population. Reduced production or high costs of production can have detrimental effects on the poor who are unable to afford expensive food or alternate staple foods. Nutrition is a major issue in sub-Saharan Africa. Malnutrition affects millions of people. Efficiency in agricultural production is of paramount importance in overcoming this problem (Pinstrup-Andersen, 2000).

In South Africa one of the burning social issues is land distribution and ownership rights. During the colonial and apartheid eras, indigenous people were moved off their land and were concentrated in the homelands. Part of the reason for this, particularly in the colonial era was to make space for commercial farmers. This issue was exacerbated by the discovery of diamonds and gold in the interior, which led to mass urbanisation and a steep increase in the demand for food. The indigenous people were often put into areas with low soil fertility and the burgeoning population placed tremendous pressure on the local soil to produce crops (Fowler and Rockstrom, 2001).

Agriculture is the primary economic activity in poor countries and as a result is often the primary source of employment. In some developing countries, agriculture provides as much as 80% of the total employment. In South Africa, the most recent statistics indicate that approximately 814 000 people were employed in the agriculture, hunting, forestry and fishing sector. This comprises around 10% of total employment (NDA, 2010). However, during the 11 year period from 1988 to 1998 the commercial farming sector shed an astounding 140 000 jobs, almost 20% of the workforce (Simbi

and Aliber, 2000). The primary factors influencing this were the move toward mechanisation and away from labour intensiveness, and the increased cost of labour and stricter labour regulations. To compound the issue, there has been a trend to employ more people on a casual rather than full-time basis. This means that jobs are scarcer, workers have fewer rights, and wages are typically lower. There are also non-economic factors that have contributed farmers' decisions to shed jobs in the agricultural sector. These include the fear of losing one's land to workers under land redistribution policies, and the notion that under current labour legislation, farm workers are more difficult to manage than prior to 1994 (Simbi and Aliber, 2000).

Human health and wellness are critical social factors to consider when discussing agriculture. Agriculture forms the basis of the supply of food to households. However, there are numerous negative impacts associated with industrial agriculture including diet, nutrition, and disease. Predominantly meat-based diets are widely associated with affluent nations. The cost of meat-based diets in terms of disease is something that is seldom discussed. Meat-based diets can cause and contribute to serious illnesses such as cardio-vascular disease, diabetes, and cancer (Horrigan *et al.*, 2002).

Pesticides can have detrimental effects, not only on biodiversity, but also on human health. The ill effects of pesticides are particularly severe on impoverished subsistence farmers who have insufficient knowledge or capital to protect themselves effectively. Aside from direct exposure, pesticides enter into our systems through consumption. Pesticides cause an array of undesirable effects, including elevated cancer risks and the disruption of the reproductive system and immune system (Pesticide Action Network, 2010).

From an economic perspective, one of the biggest issues in agriculture is the degree of risk experienced in the marketplace. Commodity prices in general are prone to volatility, which is why speculators enter the marketplace. The South African Futures Exchange (SAFEX) is the market exchange through which agricultural products are traded. Due to the inelastic nature of the supply and demand curves for agricultural products, changes in production conditions such as varying rainfall patterns, as well as in consumer incomes and the consumer's resultant ability to pay leads to large fluctuations in prices. This leads to high volatility in farm incomes. The supply of

agricultural products is highly dependent on climatic conditions, which increases the risk for farmers (Geyser and Cutts, 2007).

In summary, it is evident that standard agricultural systems have many undesirable impacts on the environment and society and are subject to high economic risk. In order to mitigate these adverse conditions, it is necessary to pursue alternate agricultural systems. Much has been written about the capacity of sustainable agricultural systems to address the concerns discussed in this section. What follows is a discussion of the concept and methodology of sustainable agriculture.

## 2.6 Sustainable Agriculture

When engaging with the question of sustainable agriculture it is important to understand it in terms of the world context of food security. Commercial agriculture as it stands is not feeding the world. This is evidenced by the increasing number of food insecure people across the globe. Sustainable agriculture does not simply involve the substitution or replacement of certain inputs or changes in methodology, but requires system redesign (Flora, 2010). Sustainable agriculture represents a move away from the systems and methods associated with conventional agriculture. The aim of sustainable agriculture is to improve the overall sustainability of the farming process by reducing economic risk, improving environmental wellbeing and eliminating social conflict associated with poverty, hunger, land use, and unfair labour practices. Sustainable agriculture is not a specific farming strategy or set of farming practices per se, but is a system-level approach aimed at understanding the complex interactions between the various components of the agricultural system (Reganold *et al.*, 1990).

Sustainable agriculture is, as with sustainability itself, a difficult concept to define. According to Ervin *et al.* (2010) the United States Department of Agriculture (USDA) defines sustainable agriculture as “an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

- satisfy human food and fiber needs;
- enhance environmental quality and the natural resource base upon which the agricultural economy depends;

- make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- sustain the economic viability of farm operations and
- enhance the quality of life for farmers and society as a whole."
  (Ervin *et al.*, 2010).

This definition supports the definition of sustainability given earlier, in that it assumes a long-term view and is concerned with economic, social and environmental prosperity. This definition does not, however, address the means by which this end will be achieved, but simply alludes to "plant and animal production practices". In Ervin *et al.* (2010), Harwood identified three specific actions that need to occur in order to be more agriculturally sustainable:

- agriculture must be increasingly productive and efficient in resource use;
- biological processes within agricultural systems must be much more controlled from within (rather than by external inputs of pesticides);
- nutrient cycles within the farm must be much more closed;
  (Ervin *et al.*, 2010).

In order to gain more insight into the concept of sustainable agriculture, it will be necessary to unpack this definition and operationalise it into actual activities and practices. For the purposes of this thesis, the term agriculture is loosely used to describe the more specific concept of crop-based agriculture.

Increased production and efficiency in resource use are critical elements of any farming operation. A farming operation that has poor production and inefficient use of resources is clearly unsustainable. One of the most hotly debated components of agriculture is the use of genetically modified (GM), also known as genetically engineered (GE), crops. GM crops are aimed at improving the production of the farm as well as reducing the use of resources, both internal and external. GM crops are bred to be stronger, produce bigger yields, require less or no fertiliser, require less soil tillage resulting in lower emissions from vehicles, and be pest resistant and thereby reduce pesticide use. It is evident that GM crops can play a huge role in reducing environmental damage through the reduction of soil tillage and chemical use and improve economic performance through ensuring larger yields with lower input costs.

However, there is little to demonstrate any direct social benefit, aside from a healthier environment. In fact, research has indicated that GM crops might have negative social effects. The production of GM seeds requires the application of specialised, intellectual property that results in monopolistic behaviour by seed producers. This can lead to greater imbalances in economic equity across the world as producers who cannot afford GM crops will be unable to compete with those who can. This is in contradiction to the holistic, all inclusive, equitable approach of sustainable agriculture (Ervin *et al*., 2010).

The potential exists for agriculture to play a role in reducing GHG emissions not only by reducing direct and indirect energy consumption, but also by providing the biomass to act as carbon sinks which remove $CO_2$ from the atmosphere (Pretty *et al*., 2002). GHG emissions from agriculture can be reduced by decreasing the use of machinery. Adopting conservation tillage or zero tillage methodologies involves maintaining a permanent or semi-permanent organic layer on the soil. This not only reduces the machine hours required to till the land, but also increases the carbon content of the soil, acting as a carbon sink. Conservation tillage has other direct benefits. The cost of tilling the soil is high, whether in the form of the cost of fuel, or labour, or the care of animals used in tillage. Reducing tillage has a direct cost-saving benefit for farmers (Hobbs, 2007). Conservation tillage is also beneficial in conserving water by reducing runoff, and consequently reducing erosion and topsoil loss, and increasing the rate of water infiltration. This means that less water is required to cultivate crops, and more water is absorbed into underground reservoirs (Fowler and Rockstrom, 2001). Conservation tillage is also associated with greater biodiversity above and below the soil. There tend to be greater numbers of beneficial insects in the biological layer on the soil, and these can help keep pest insects in check. There are also healthier microbial populations in the soil that can help prevent crop diseases (Hobbs, 2007).

Reducing the use of Nitrogen (N)-based fertilisers is a means of reducing the indirect energy consumption of the farm. The production of N-based fertilisers is a highly energy intensive process. Farmers can directly affect the total energy consumed by the agricultural supply chain by replacing inorganic fertilisers with organic fertilisers (Pretty *et al*., 2002). The substitution of fossil fuels with locally produced biofuels is another method of reducing energy consumption and emissions. It is, however, imperative to

ensure that the production of biofuels is not in direct competition with the need for the production of food. If biofuel production takes precedence over feeding humans or animals, the whole system is fundamentally flawed and inherently unsustainable.

Cropping methods are an important role-player in sustainable agriculture. Crop rotation is an important policy for a number of reasons. Firstly, rotating crops interrupts pest insects' breeding cycles, which helps to reduce the need for the spraying of insecticides. Secondly, crop rotation can reduce the need for fertiliser, as certain crops can provide nutrients for a second set of crops and vice versa (Horrigan *et al.*, 2002). Thirdly, crop rotation can help combat plant disease by ensuring biodiversity within the field. Finally, crop rotation can increase yields by ten to fifteen percent, improving profitability and efficiency (Reganold *et al.*, 1990).

Cover cropping involves the planting of crops such as legumes during the off-season (Francis and Madden, 1993). Cover crops have a number of benefits including preventing soil erosion due to water runoff and wind erosion, reducing weed growth, reducing pest populations and providing organic material to revitalise soil nutrients. Cover crops can also be used a means of income supplementation outside of the growing season (Horrigan *et al.*, 2002).

Integrated pest management (IPM) is an approach aimed at reducing pest populations by interrupting breeding cycles. IPM makes use of the methods previously discussed such as crop rotation, cover cropping, and conservation tillage. An IPM methodology reduces the input of chemical pesticides, thereby increasing profitability and environmental wellbeing (Reganold *et al.*, 1990).

There are various farming practices associated with sustainable agriculture. These practices can improve environmental health, social wellbeing and economic prosperity of the agricultural industry. However, in order for sustainable agricultural practices to permeate the industry, there need to be incentives to encourage the adoption of these practices. Systemic change is required in terms of the trade and subsidisation of the production of commodities (Flora, 2010). It is also necessary to engage with the relevant stakeholders to enable policy makers to create policies that are complementary to the outcomes of sustainable agriculture. This research aims to engage with maize farmers in an attempt to better understand their realities and put forward suggestions for

systemic changes that are required. In order to understand the reality within which maize farmers make the decisions they do, it is necessary to gain a contextual understanding of the maize industry in South Africa. One needs to look at both the historical context and the current reality in order to gain a rich understanding of the factors that influence decision-making.

## 2.7 Maize Farming in South Africa: Historical Context – Regulation Era

The maize farming industry in South Africa has been defined by numerous political decisions, many of which have been highly controversial. Up until the deregulation of the agricultural sector in 1996, maize farmers thrived as a result of governmental policies aimed at removing price risk from the market. Farmers knew what price they would get for their maize and therefore only had to manage input costs to ensure profitability (van Zyl, 2010).

During the 1920's, one third of South Africa's maize crop was sold on international markets due to an oversupply on the local market. Farmers received good prices on both local and international markets. However, from 1929 onwards, there was a dramatic drop in maize prices across the world. This price drop continued unabated until the government of the Union of South Africa implemented the Maize Control Act (No 39 of 1931). The aim of this Act was to artificially inflate local maize prices to higher than import parity so that maize growers would be able to survive and continue producing food crops (Geyser, 2000). Farmers were given export quotas and were compensated for losses made on exported crops (van Zyl, 2010).

1935 saw the establishment of the Maize Industry Control Board as an advisory body on the marketing of maize. The establishment of this body was made possible by the Maize Control Act (No 89 of 1935). The Maize Board was comprised of eight maize producers and seven representative members from different economic sectors.

In 1937, the Marketing Act (No 26 of 1937) came into being. The main objectives of this act were to promote stability in the prices of agricultural products, to narrow the gap between the producer price and the consumer price by means of rationalisation, and to increase the productive efficiency of farming (Geyser, 2000). This Act gave the Maize Board significant power over the marketing system of the maize industry.

One of the direct results of the Marketing Act of 1937 was the single-channel fixed-price scheme. This scheme meant that maize producers were obligated to market their products through the Maize Board or its appointed agents and that the price of maize would be fixed for each season. This marketing model was introduced toward the end of World War II, in the 1944/1945 growing season. During the earlier war years, the War Act (No 20 of 1942) gave the Maize Board power to fix maize prices and to seize maize from anyone who was storing more maize than was necessary. They were also allowed to appoint agents to distribute and market maize on their behalf (van Zyl, 2010).

The trend of government intervention in agricultural controls was widespread after the end of World War II. The emphasis of most governments was on national food security. However, by the 1960's it became evident that government involvement was proving less successful than anticipated and a trend of deregulation began to spread around the world (Geyser, 2000). This, however, did not affect the South African agricultural sector until much later.

1968 saw the promulgation of the Marketing Act (No 59 of 1968). The Act divided South African maize production into three areas, Area A, Area B, and the exempted areas. Producers in Area A, which comprised the Transvaal, Orange Free State provinces and the magisterial districts of Bellville, Dannhauser, Dundee, Estcourt, Glencoe, Gordonia, Hartswater, Hay, Herbert, Hopetown, Kenhardt, Kimberley, Kliprivier, Newcastle, Paulpietersburg, Phillipstown, Prieska, Utrecht, Vryburg, Vryheid and Warrenton, had to sell their produce to the Maize Board. Producers in Area B could only sell maize to registered traders, and producers in the exempted areas were free to sell maize to whomever they liked. This created a more stable market and enabled technological and economic development, as well as the development of infrastructure (Geyser, 2000).

During the 1980's, profitability in agriculture began to diminish. This led to increased pressure from within the system to abolish policies that imposed strict regulation on the industry (van Zyl, 2010). This led to a reform of the marketing system in 1987. The reform made the Maize Board responsible for determining the maize price. However, pressure continued to mount within the industry due to an ever-widening gap between the Maize Board's buying price and selling price. During the early 1990's, things

deteriorated to such an extent that farmers were feeding maize to livestock as opposed to selling it to the Board in a bid to avoid paying the levies (Geyser, 2000).

### 2.8 Maize Farming in South Africa: Historical Context – Deregulation Era

In 1992, the Minister of Agriculture appointed Professor W E Kassier to head up the Committee of Inquiry into the Marketing Act (CIMA). The committee was tasked with assessing the extent to which the Marketing Act had succeeded in its aims of increasing efficiency in production. The committee concluded that the Act had not succeeded in its aim and that the marketing of maize should be more market-oriented (van Zyl, 2010).

This led to a new maize marketing scheme replacing the fixed one-channel grain marketing scheme, which resulted in the Maize Board being prevented from operating on the domestic market. The functions of the Maize Board were terminated entirely in 1996, leaving producers responsible for the marketing of their own maize (van Zyl, 2010). The 1996/97 season was the last season during which prices were fixed (Geyser, 2000). 1996 also saw the passing of the Marketing of Agricultural Products Act (No 47 of 1996). Maize is now traded on the South African Futures Exchange (SAFEX) and prices set on an open market basis. The price that farmers get for their maize, the producer price or farm gate price, is determined by the SAFEX price minus the average transport differential and the handling costs (NDA, 2004a).

The deregulation of agriculture in South Africa has had marked effects on the country's maize industry. Subsequent to South Africa becoming a signatory of the World Trade Organisation's (WTO) Agreement on Agriculture, South African commodity prices have been increasingly influenced by world prices and exchange rates. This increased price risk for farmers led to changes in production patterns. Farmers began planting higher value commodities such as soybeans and sunflower seeds to mitigate the increased price risks resulting from the lack of price guarantee by a board (Geyser, 2000).

The value of South African agricultural trade has increased, particularly in the form of exports. This is due to the increased effect of global prices on South African produce which means that local farmers are competing on price on a worldwide scale. Trade

within the Southern African Development Community (SADC) has also increased as a result of deregulation (van Zyl, 2010).

In order to properly understand the environment within which maize farmers in South Africa operate, it was necessary to provide a brief history of the maize industry in South Africa. What follows is a description of the current reality of the maize industry in South Africa.

## 2.9 Maize Farming in South Africa: Current Reality

Maize is the most important grain crop in South Africa due to the fact that it serves as the staple diet for the majority of the African population as well as being the major livestock feed grain (NDA, 2004a). South Africa produces both white and yellow maize. White maize is principally used for the production of white maize meal. Yellow maize is produced primarily for livestock feed. A large proportion of yellow maize is imported to be converted into feed. Large mills are located near the Durban and Cape Town harbours and it is more cost effective to import the maize rather than transport it from the inland growing areas (van Zyl, 2010).

South Africa is ranked between ninth and fourteenth in the world in terms of total maize production. The USA is the largest producer of maize and is followed closely by China. India and Brazil are also major role players in maize production. South Africa lags well behind the USA and China, not only in total production but also in terms of yield (van Zyl, 2010). This is an area that should be addressed to ensure efficiency of production.

Maize is planted during late spring and early summer and is primarily grown under dryland conditions, in other words, it is not irrigated but is rainfall dependent. For the 2007/08 growing season, the Free State was the country's leading producer of maize, contributing 38.8% of all the maize grown in South Africa. Mpumalanga contributed 22.6%, the North West 22.3%, the Northern Cape 5.2%, Gauteng 4.5%, and the rest of the provinces combined contributed 6.6% of the maize crop (NDA, 2009).

South Africa's maize marketing year runs from May to April. Maize is planted in late spring/early summer and is delivered between May and August. During this period, the amount of maize being delivered exceeds consumption. From September to April, the

growing season, maize stocks get diminished due to consumption being higher than production. Over the past few decades, there has been a trend towards fewer hectares being planted from season to season; however, production has decreased at a slower rate. This indicates the removal of unproductive hectares from the production area as well as an increase in average yield per hectare. South Africa is a net exporter of maize, with local production exceeding consumption in most seasons (NDA, 2004a). In surplus seasons, the primary export locations for South African maize are Kenya, Malawi, Mauritius, Mozambique, Zambia, Zimbabwe, and Japan. The export of maize is an important foreign revenue earner (van Zyl, 2010).

Maize is the largest contributor of gross value for all agricultural products. In the preliminary figures for the 2007/08 marketing year, maize contributed 17.3% of the total gross value of agricultural products with a gross value of R20.8 billion. Fowls slaughtered was the second largest contributor, with a gross value of R16.6 billion, which was 13.9% of the total gross value, Cattle and calves slaughtered contributed R12.9 billion, which was 10.8% of the total gross value of agricultural products (NDA, 2009). Although agriculture's contribution to the Gross Domestic Product (GDP) is diminishing as a result of South Africa's economic development, agriculture remains an important contributor to the GDP (van Zyl, 2010).

There are approximately 9 000 commercial maize farmers in South Africa. Collectively they plant almost 3.4 million hectares of land and employ about 150 000 farm labourers (NDA, 2004a). There is, however, a move toward further mechanisation, which is in direct opposition to job creation. This is one of the areas that needs to be investigated in order to understand the rationale of farmer's choices. It is evident that the maize industry in South Africa is a major role player both in terms of economic contribution and employment.

Maize farmers in South Africa are currently experiencing a cost squeeze effect with relation to input costs versus revenue generated. Input costs per hectare have increased from R3 000/ha in 2002 to a projected R8 000/ha in 2011. Between 2006 and 2008, the costs of fuel, requisites and intermediate goods almost doubled and the cost of fertiliser more than doubled (van Zyl, 2010). Due to the current free market dispensation, farmers are essentially price takers. They have to sell their maize at the

price that is generated by the market as a result of domestic demand and supply factors, world commodity prices, exchange rates and export tariffs (NDA, 2004b). Farmers are predicted to break even in the period 2009 to 2011 (van Zyl, 2010). This is a highly risky predicament for farmers to find themselves in and is likely to be a major factor in determining the behaviour and decisions that farmers make.

## 2.10 Conclusion

A move toward a more sustainable future is an imperative. The current situation faced by the globe in terms of rampant population growth, environmental degradation and the collapse of the economic system are clear indicators that life cannot continue on its current trajectory, at least not without a lot of suffering and potential global meltdown. In order to realise a more sustainable future, there needs to a collective social effort to address the current imbalances in the system. Individual behaviour is going to need to change, as are business practices and government policies. This change can only begin by increasing awareness and through the development of thinking on the subject.

In order to increase the knowledge base surrounding sustainability, it is necessary to break the problem down into bite-sized chunks, country by country, industry by industry, person by person. This research is being conducted to take an industry-sized chunk and begin to grapple with the issues that drive the individuals who are making the decisions that ultimately affect the overall sustainability of the system.

Agriculture has a critical role to play in ensuring a sustainable future. It affects people in terms of satisfying one of their most basic needs, the need for sustenance. This is the cornerstone of the social impacts that agriculture has. Inefficiency in production leads to food insecurity, which inevitably leads to social unrest. The equitable distribution of food and the economic capital earned from the production of food is a fundamental goal of sustainable agriculture. Agriculture also has a vital role to play in ensuring environmental sustainability. Current agricultural practices are placing an unsustainable burden on the environment. Through reviewing the agricultural system and practices, headway will be made in securing a healthy environment for the generations to come.

Maize farming in South Africa is the largest contributor to economic value added through agricultural products. Maize is the staple diet of the overwhelming majority of

the population and as such is a very worthy research subject. Maize farmers are responsible for making critical decisions that affect their own wellbeing, the wellbeing of their workers, the wellbeing of the local environment, the wellbeing of greater society, and the overall development of the South African economy. It is therefore essential to engage at the farmer level to better understand the rationale for the decisions they make. Only once the individual decision-making process and the individual context within which those decisions are made are better understood will systemic change begin to become a reality.

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# Section 3 – Research Methodology

## 3.1 Introduction to Social Research

Conducting research involves developing the theoretical context of the research, designing the research process, analysing the results, and writing up the findings and making recommendations where appropriate. Social research understands the contextual existence of certain existential truths about the research subject. It is the embeddedness of the social realm that is most challenging to understand and to research. The researcher needs to have a thorough grip on the subject matter, the goals of the research and the research process.

When undertaking research, there are three main philosophical questions that need answering, “Why research?”, “What to research?”, and “How to research?” (Remenyi, 1996). This chapter is concerned with the “How to research?” question. This question will be addressed by discussing the research design and the research methodology. These are integral components that ultimately guide and define the research process.

## 3.2 Research Design

There is a distinct difference between research design and research methodology. The research methodology is focussed on the process of the research, whilst the research design is more oriented towards the final product of the research, it can be thought of as being a blueprint for the research (Babbie & Mouton, 2003). The research methodology can therefore almost be understood as a component of the research design. It is important that the research methodology that is selected is a fit with the overall research design.

The research design of this study is based on a phenomenological approach. It aims to describe and understand the social phenomena, the farmers’ decision-making process, within the context in which it occurs. The research assumes multiple realities that may or may not be common to the farmers involved in the study (McMillan & Schumacher, 2001). The research aims to gather qualitative data through the use of one-on-one interviews in an attempt gain a subjective perspective of the farmers’ lived

experiences and thereby delve deep into the complexities of their decision-making process in light of issues of sustainability.

### 3.3 Research Methodology

All researchers approach their research with a particular set of beliefs about the research they are conducting. This belief system ultimately guides and influences their research (Fouche & Delport, 2002). When conducting any form of research, it is critical to select a research methodology that is appropriate for the type of research being conducted. The research methodology encompasses both the philosophical underpinnings of the research process as well as the tools and procedures that are used in conducting the research (Babbie & Mouton, 2001). The methodology selected will depend on a number of factors including; the type of data that will be gathered, the methods used for data collection, methodologies selected in prior research, and the researcher's beliefs about the nature of the phenomena being researched. It is the last of these points that ultimately determines the paradigm within which the research will be based.

A paradigm is theoretical framework within which the researcher organises and explains their observations (Babbie, 2008: 34). The paradigm serves as the philosophical underpinning of the research process, and is used to add credibility to the research process (Remenyi, 1996). It is therefore imperative for researchers to have a thorough grasp of the various research paradigms and the differences between them. This can be troublesome as these paradigms are often implicit and are simply assumed to be the "way things are" (Babbie, 2008). Through the evolution of scientific and social research, a number of paradigms have been developed. These will be discussed in a later section in this chapter.

### 3.4 Goals of the Research

The objective of this research is to gain insight into the complexities of the decision-making process of maize farmers in Western Mpumalanga, with particular focus on the effect of issues of sustainability. The research aims to investigate the extent to which

farmers account for issues of sustainability in making decisions and how the decisions they make impact on issues of sustainability.

Farmers need to make critical business decisions regarding crop selection, cultivar and seed selection, soil preparation, planting, harvesting, and marketing their produce (Geyser, 2000). This research aims to understand the rationale behind these decisions, particularly in light of issues relating to sustainability. In order to conduct this research it was necessary to spend time with farmers and discuss the choices they make. The aim of the study is not to make judgements about the sustainability/unsustainability of the individual farmers, but rather to gain insight into their decision-making behaviour.

The data that was collected was qualitative in nature and is aimed at unpacking the behaviour and thinking of farmers. The data will be analysed by picking out common themes that are contained within the transcripts of the interviews that were conducted. The process of this thematic analysis will be discussed later in this chapter.

### 3.5 Research Paradigms

Research paradigms can be divided into two categories which are dependent on the type of data being collected and analysed. When collecting data, the researcher can collect either quantitative or qualitative data, this will determine the research paradigm that will be used for data analysis. Paradigms that fall into the quantitative category tend to be more focused on empirical enquiry via scientific and experimental investigation. Research that is quantitative in nature attempts to measure phenomena and make theoretical deductions from statistical analysis of the data. Qualitative research, on the other hand, deals in the world of subjectivity and theory. Results are distilled from the data, rather than the data confirming the expected outcome. It is critical to understand these categories not as distinct polar opposites, but as necessarily intertwined and complimentary of one another (Remenyi, 1996). As a researcher, however, it is imperative to root ones research within a particular paradigm so as to demonstrate sound philosophical knowledge and thereby lend credibility to the research.

Paradigms reflect the philosophical stance of the researcher with respect to the research process and the research subject. In order to better understand the nature of paradigms, philosophers have identified two philosophical concepts that explain the

nature of the paradigms; these are the ontological and epistemological components of the paradigm. Ontology refers to the nature of reality. It refers to what is philosophically assumed to be the nature of the world in terms of whether the world exists as an objective entity independent of observation, or whether the nature of the world can only be known through observation and is shaped by the beliefs of the observer and the very observation itself. Epistemology details the nature of the relationship between the observer and the observed phenomenon. Epistemology is concerned by how the observer can gain knowledge about the world and is also concerned about the nature of the knowledge itself. In observing a particular phenomenon, can the observer gain a complete and perfect understanding of the phenomenon, or can the observer only know the phenomenon in an imperfect sense due to the fact that observations of the same phenomenon may be interpreted differently by different researchers, depending on their experiences and philosophies? Due to the philosophical nature of the concept of paradigms, it is necessary to explore the philosophical implications of the various paradigms on the research process.

Denzin and Lincoln (1994) identify four main paradigms that underpin the research process, they are: positivism, post positivism, critical realism, and constructivism.

The research paradigm within which the research will be conducted is Critical Realism. Critical Realism understands the world in terms of “virtual reality”. The critical theory paradigm understands the world as being shaped by social, political, cultural, economic, ethnic, and gender factors. These factors are crystallised into a series of structures that are taken as “real”. The ontology of this paradigm is Historical Realism. This name is based on the understanding of the existence of historical factors that have shaped the current “virtual reality”. The epistemological stance of this paradigm is Transactional and Subjectivist. The values of the investigator influence the findings of the research due to interactive links between researcher and researched object. The findings are therefore said to be value mediated (Denzin and Lincoln, 1994).

Sustainability can be understood both as a human construct and as an objective fact about the world. The decisions that farmers make are shaped both by their perceptions of the world, but also by the external influences of society, the economy, and the environment. It would not be useful to analyse sustainability from a positivist or post

positivist perspective as the “lived” element of the farmer’s reality might fall by the wayside. Likewise, it would be unhelpful to analyse sustainability from a constructivist perspective as the objective truths about the state of the environment, state of society and economic pressures might feature less than the farmer’s own individual experience of their reality. It is therefore prudent to adopt a critical realist perspective to the research and adopt the methodological approaches associated with Critical Realism.

### 3.6 Qualitative Research

Qualitative research provides the capacity to develop a depth of understanding that is often lost by quantitative research. Due to the nature of the qualitative research process and data analysis it is possible to delve deeper into the research topic. This enables qualitative researchers to develop rich and thick descriptions of the phenomena.

Qualitative research, however, is less useful for developing statistical descriptions about a broad population. Due to the depth of the research and the understanding that the phenomena occur deeply embedded within the social context, extrapolating the results to a large population is less reliable for qualitative research (Babbie, 2008).

### 3.7 Scope of Research

Qualitative research generally focuses on small, non-random samples that are purposefully selected so as to provide a wealth of information on the research subject (Patton, 2002). This provides the researcher a better opportunity to delve deeply into the subject matter and develop rich descriptions and interpretations of the data. The research involved conducting in-depth interviews with three maize farmers in Western Mpumalanga. The meaningfulness and validity of qualitative inquiry relies more on the depth of information from the cases than the number of cases selected (Patton, 2002). It was necessary to limit the scope to farmers who farmed the same crop in the same area as this was most likely to provide a solid means of comparison between them as their lived experiences are more likely to be similar in terms of the parameters within which their decisions are made. Examples of these parameters include climate, distance from market, culture of workforce, as well as the farming legacy in the area.

Concerns about limiting the scope are that the findings of the research might not be applicable to other farmers in different areas, deciduous fruit farmers in the Western Cape, might, for example have very different experiences and might make very different decisions in light of issues of sustainability. There are, however, many similarities between farmers from multiple disciplines. Environmental factors, such as the use of chemical fertilisers, soil preparation, crop selection etc., that affect decision-making are prevalent in all crop farming. Likewise the social factors, such as labour practices etc., impacting on agriculture are for the most part true across the board. The economic aspects of sustainability are also common to all farmers who need to ensure that they can be economically sustainable in light of various market demands and input cost increases. These factors mean that the findings of this research will be able to be applied across agricultural sectors and bear relevance to overcoming the issue of sustainability in agriculture.

### 3.8 Data Collection

The research is qualitative in nature and the collection of data involved conducting interviews with farmers in Western Mpumalanga, more specifically in the Bethal area. Mpumalanga was chosen due to the fact that it is the second largest maize producing province and due to logistical reasons and geographic proximity to the researcher's place of residence in Gauteng. The interviews were semi-structured and the farmers were interviewed using questions developed out of the literature on sustainability and sustainable agriculture, with an emphasis on understanding their decision-making process and the factors relating to sustainability that impact on it. The data was collected in accordance with the three principles of case study research; multiple sources of evidence, creating a case study database, and maintaining a chain of evidence (Yin, 2003).

As a researcher conducting qualitative field research, it is important to remain aware of the various roles the researcher can play. Some researchers are researching as participants within a particular phenomenon, other times researchers are simply external observers (Babbie, 2008). This research was conducted from an external

perspective. The researcher was actively involved in the interview process, but was gaining insight into the field of research from an external perspective.

### 3.9 Data Analysis

Qualitative data analysis refers to the "non-numerical examination and interpretation of observations, for the purpose of discovering underlying meanings and patterns of relationships" (Babbie, 2008: p415).

In order to successfully conduct qualitative research, it is necessary to be familiar with the theory that relates to the research topic, as well as the theory that pertains to qualitative inquiry itself. If the analysis of the data is not linked to theory, then the results can easily be called into question. Theory in this instance refers to plausible relationships between concepts or sets of concepts (Babbie, 2008).

The researcher will attempt to distil common themes between the cases so as to gain a more holistic perspective of contextually entrenched behavioural phenomena pertaining to issues of sustainability in agriculture. The research will endeavour to develop "thick and rich descriptions" of the phenomena being investigated (Remenyi, 1996). These thick and rich descriptions will then be analysed according to a theory driven code approach (Boyatzis, 1998). In analysing the data, it will be necessary to look for patterns in the data. This will enable the grouping and coding of certain patterns that occur in the transcripts of the interviews (Babbie, 2008).

In developing a theory driven code for exploring the meaning of the descriptions of the data, it is imperative to remain cognisant of the fact that the value of this type of code is highly dependent on the theoretical sensitivity of the researcher. This refers to having insight, the ability to give meaning to data, the capacity to understand, and the capacity to separate the pertinent from the impertinent (Strauss and Corbin, 1990).

The steps involved in this approach are a) generating a code, b) reviewing and revising the code, and c) determining the validity of the coders and code (Boyatzis, 1998). Generating the code refers to collecting and grouping certain patterns within the data and assigning a specific code to similar patterns. This will allow thematic identification of the data. Once the themes that evolve out of the coding process have been identified, they will be fleshed out using examples from the interviews and

consolidating them within the theoretical grounding from the literature review. The codes that are generated will then be reviewed and revised before being committed to paper in the form of the themes of the data. Once the data has been coded, it will be linked to and analysed according to the theoretical propositions of the case study as described in the literature review (Yin, 2003).

### 3.10 Validity and Reliability

In order to ensure validity in the research it is important to satisfy four criteria; credibility, transferability, dependability, and confirmability (Trochim, 2006).

Credibility must be ensured by accurately representing the views of the participants, in this case the farmers (Babbie, 2008). It is imperative that the issues facing farmers are discussed in an objective manner and that the ethical issues are understood and dealt with appropriately. It is important to present an unbiased description of the farmer's insights into the decision-making process; the accurate representation of their reality is what will ultimately determine the credibility of the research. In order to ensure credibility, it is important that the interviews are conducted in such a manner so as to elicit responses from the farmer's without "putting words in their mouths".

Transferability is dependent on the degree to which the findings of the research can be generalised to a greater population (Trochim, 2006). Due to the different characteristics of different forms of agriculture, transferability of this research will more than likely be limited to staple food crop producers in South Africa. It is unlikely that the findings of this research will have significance for cattle producers in Australia for example. This is due to the unique set of political and social influences relating to food production and land use in South Africa. As discussed previously, the findings of this research are highly likely to be transferable to food crop producers in South Africa due to the commonality of the context. Although differences exist between crops and between geographic locations, the social, political, environmental, and economic circumstances are reasonably standard.

Dependability is concerned with the capacity of the research and researcher to adapt to the changing context within which the research occurs (Babbie and Mouton, 2001). Awareness of the research paradigm as well as awareness of the political context in

South Africa is key to achieving dependability. Every farmer that is interviewed will have a slightly different context to the others. This is due to personality, life experience, farm specific factors etc. It is important to understand this and to ensure that these differing contexts are linked back to the theory to enable pattern mapping between them.

Confirmability refers to the extent to which another researcher might come to the same conclusions. It is therefore imperative to remain impartial and be guided by theory (Trochim, 2006). The accuracy with which the farmers' responses are analysed, and the linking of these responses to theory, will contribute largely to the extent to which other researchers will draw the same conclusions.

### 3.11 Ethical Considerations

The most critical ethical consideration for this research was ensuring the confidentiality and anonymity of the sources. Due to the nature of the research, it was clear that the individuals concerned did not want their identities revealed. It is of utmost ethical consideration to ensure the meticulous respect of this request (Remenyi, 1998). When conducting face-to-face interviews, it is often difficult to elicit honest comment from the interviewee unless their identity remains concealed. In this case, to get farmers to speak about the environmental and social impacts of their decisions is incredibly difficult without ensuring them that their identity will not be revealed.

Confidentiality and anonymity was not the only ethical consideration for this research. It was also important, in the first place, for the researcher to identify himself as such and be open and explain the goals of the research to the research subjects. Had the researcher engaged with the research subjects under different auspices and extracted the information from them, this would have cast the ethics of the research into doubt. Identifying the purpose of the research in this context also allowed the farmers the opportunity to state their case with the knowledge that the researcher did not intend passing judgement on them as being sustainable or unsustainable but rather to understand the context within which they operate. Furthermore, it was ethical to declare that the interviews were being tape recorded. Had this not been openly stated, the ethics of the study would have been compromised (Babbie, 2008).

### 3.12 Research Limitations

As discussed, one of the major limitations of this study is as a result of the scoping of the research. The research population has been limited to three farmers. It is possible that these farmers are extreme outliers in the world of sustainability in agriculture and that their views are incongruent with the views of the greater population. It would be useful to conduct the same research on different farmers, cultivating different crops in different areas to see how much of the findings of this research still ring true.

Another limitation of the research is related to the goals of the research. The goal is to better understand the decision-making process. It might be useful to first analyse, through quantitative analysis, the extent to which the farmers in question are or are not sustainable. Once the analysis of how sustainable the farmers are is completed, then the analysis of their decision-making process might be more useful.

### 3.13 Conclusion

It is clear that qualitative research has its own benefits and drawbacks. The qualitative research process is more suited to the exploratory, descriptive purpose of this research. The data that is collected might be from a smaller population, but delves to greater depths than a quantitative study of the same type would do. The ultimate success and credibility of the research hinges on the linkage between data and theory. If the data that is gathered is not analysed in relation to the theory, the findings of the study will be questionable.

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