THE ROLE OF DEVELOPMENT PLANNING FOR FOOD SECURITY IN THE SUGAR INDUSTRY OF KWAZULU-NATAL

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ABSTRACT

The challenges of development planning for food security are analysed, using the case of the sugar cane industry of KwaZulu-Natal as a crop producing unit of analysis for the study. The impact analysis of climate and environmental changes appear to be detrimental to crop production. This has affected output and thus the sustainability of food production and security. The research methodology engaged experts in the field of sugar cane farming though questionnaires, books and journal articles. The analysis of data used a mixed methods approach. This assisted in identifying the current driving forces in the sugar cane industry as an agricultural crop producer. The identified trends were in line with global trends, identified as anthropogenic threats of a deteriorating environment which intimidates the global food production system.

The research findings revealed that the existing planning methods used by the sugar cane industry focused on short term and production planning, limiting the analysis of the driving tools of food production and crop farming. To further engage the findings, the research analysed the identified trends and further applied future research methods of Scenario Planning as the proposed development planning tool. This applied method of forecasting assisted in identifying and projecting mitigating methods for acute threats that arise as the driving trends, such as climate change, the environment and the evolving of population dynamics. The research objective and anticipated outcome is to develop a food production system that is resilient and adaptable to the changing climate and agricultural environment.

This research is a fundamental contribution to the development of methodology for a proposed policy strategy and framework because it demonstrates the possibility of the development of a food production system that is resilient and adaptable. This translates into informing forecasting methodology, which is projected through strategic policy development for the desired future outcomes. This presents an opportunity for further research and contribution to sustainable methods that develop agricultural systems and protect human security against food insecurity.

DECLARATION

I declare that this report is my own unaided work, except where authors have been acknowledged. It is submitted in partial fulfilment of the requirements for the degree of Masters in Public Policy to the Faculty of Commerce, Law and Management of the University of the Witwatersrand. It has not been submitted before for any degree or examination in any other university.

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CHAPTER ONE
INTRODUCTION TO THE RESEARCH

1.1 INTRODUCTION

Agricultural futurists and international governance structures have, through the analysis of current global trends, warned that in the future and, most likely, specifically by 2050, the modern food production system is under threat of a crisis which will likely lead to food insecurity and famine. These global trends are an analysis of various driving forces such as the rate of the growing population, the effect of a growing population on consumer demand in food and energy, climate change, and the current global economic trends.

Critics such as Wu (2013) argue that the technological revolution has been able to resist the threats that emerge in the food market system from as early as 1798, as explained in the Malthusian Theory of Population (Malthus, 1978). However, if technology was efficient and sufficiently useful, the food shortages experienced in the world might not exist. The United Nations Food and Agricultural Organisation (FAO) notes in the State of Food Insecurity in the World Report of 2015 that statistically about 795 million people were undernourished in 2015 with the Sub Saharan African region being the most affected, with one in four people undernourished (Food and Agriculture Organization of the United Nations, 2015).

These global trends are seen in regions such as Southern Africa, which has recently experienced drought conditions that contributed to critical challenges in the agricultural sector and ultimately food insecurity. As a result of these trends, the researcher is of the opinion that risks that surface due to the imminent threats to food security can be mitigated if adequate and appropriate planning measures are taken through research and

development, which will ultimately dilute the spillover effects of food insecurity.

1.2 INTRODUCTION OF THE RESEARCH CONCEPT

This thesis proposes that a deeper examination of the past theorists, an analysis of the revolutions for survival of humankind, the current trends in the environment and the food market system need to be analysed in depth in order to understand the future revolution of food using futurism techniques in planning, through the forecasting tools. It is the view of the researcher that if food security in all its aspects is left unlearnt it poses a threat to basic security of society and thus human survival.

The thesis aims therefore to highlight the use of concepts of security, the concept of population growth and its effects on natural resources, as well as the concepts of futures research and techniques through the analytical use of Scenario Planning which is a valuable tool to analyse future projections for long term strategic planning.

This is also to emphasize the importance of evolving the approach to policy which aims to provide advance warning that agricultural and policy institutions should be planning and strategizing towards the vision of mitigating the dangers of food insecurity through the innovation of forecasting policy. It is also intended to sensitise the African continent regarding the threat inherent in the unsustainability of food productivity in the African region, the Southern African Development Community (SADC) region, South Africa and its provinces.

Scenario planning is an important tool in the evolution of approaches in policy making and development planning. The importance of scenario planning in development planning is that it gives policy makers the ability to forecast and visualize the future while also preparing for a risk analysis by analyzing all driving forces, trends, the environment, and food production

systems. Scenario planning as a strategy therefore not only allows for the preparation of a high road approach and idealistic policy outcomes, but also allows for preparation should there be any risks and wild cards at play.

In this research, the researcher aims to advocate for the importance of the technique of scenario planning, its contribution in the development of policy to address the threat of food insecurity and thereby to highlight the significant role that development planning can play in mitigating food insecurity. This position is based on the identification of driving forces and the most important factors of influence, which in this case would need to be addressed when dealing with the modification and development of policy and preparation for the future.

The ability for policy makers, agricultural scientists and contributors to the global food market to be able to identify threats and address them by having a futuristic approach to food would be of benefit in promoting the sustainability of food security. Kahan (1992) observes that scenario planning is a tool that can be used strategically within the private and public sectors to plan for the future.

1.3 INTRODUCTION OF THE RESEARCH THEME

The South African sugar industry has been selected as the area of study because of its contribution to the food production system, rural development, and economies of scale. Sugar cane production is an important sector at international, continental and national levels, and is a basic commodity in use in all sectors of society and the world. According to Mnisi and Dlamini (2012), “it is an important industrial crop of tropical and subtropical regions and is cultivated on about 23.8 million hectares in more than 90 countries.” South Africa, being one of these countries, is an economy that is highly dependent on rural agricultural development. Agriculture is important in South Africa because rural development is a government priority and has a pivotal role in trade within the African

continent and internationally. According to Conningarth Economists, “Small scale farmers are a priority for government; as a result, the sugar industry has actively put programmes together to facilitate the process of supporting small scale farmers into the industry. (Conningarth Economists. 2013: 31). This has been put in place particularly to support the emergence of new farmers, to support not only the growth of the industry but also economic empowerment linked to agricultural development.

There are challenges identified by the South African Sugar Association (SASA), one of them being the poor maintenance of the commercial aspect of sugar cane farming. Although the sugar industry is doing well in terms of large scale trading, farmers are not adequately equipped with sustainable sugar cane farming strategies. As a result, SASA has developed SUSFARMS to mitigate this issue and maximize efficiency (South African Sugar Association, 2017). This is in itself a threat to the sugar cane industry production system in comparison with other countries in the world. As defined by Mnisi and Dlamini (2012: 433), “sustainable agriculture is not a return to pre-industrial methods but a combination of traditional and modern techniques”.

These are some of the reasons for the importance of the sugar cane industry and the case sample for the study. The future studies sustainable strategy can be used in examining international trends and ultimately to contribute to the modern food system by effectively analyzing the sugar cane industry as a component of crop food production in order to understand the future revolution of food using the tools of Scenario Planning. This will ensure that threats to the food system will be better identified and prepared for by the participants of the food production system. Analysis and understanding one crop production industry will assist and strengthen mitigation approaches to the common threats posed to all crop production.

Based on the above, this is an industry and production industry that is consistently affected by driving forces such as climate change, urbanization

and population growth, as well as the principle of sustainable growth methods. Pearce and Warford (1993) are in agreement with this analysis and elaborate upon it by stating that increasing human population, decreasing resources and environmental degradation pose serious threats to the natural processes that sustain the global ecosphere and life on earth. The findings of this study will also contribute to the study of other crop and food production systems within South Africa.

The method of study is chosen because the possibility of a food crisis is a future projection that has to be prepared for as a serious threat. It has not happened yet, but it is envisaged, drawing on the analysis of past trends and current views, to take place by 2050. Scenario Planning is therefore a tool that can effectively contribute towards supporting the projection of the future by understanding the current driving forces of the food production system as the area of study and identifying the threats to food insecurity and crop production in order to forecast probable futures. Scenario planning also allows for the analysis and development of a desired outcome to serve policy makers and strategic decision-makers by outlining long-term tactics, thus allowing for planning to envision and aim for the best possible outcomes. This future focused approach, however, cannot be completed and achieved if all the components and threats have not been identified and planned for. According to the Association of Professional Futurists, institutionalized forecasting has occurred through the five ages of futures, mapping out ideas and strategy for future researchers. This has been done through the oral tradition wave of mystics, the early written wave of mystics, the extraction and enlightenment age, the systems and cybernetics age which embraces science, technology and complexity, and the emergence age which is the rationalism wave which has led to the Futures studies institutions. This area of study has seen the development of a systematic methodology that aims to demystify the future, whilst also preparing for it (Schulz, 2012: 3).

Taking all of the above into account, it becomes apparent that using future studies to observe and analyse food security would not only create a tool for policy makers to use in their methodology towards strategic planning but would also add to the existing literature regarding future studies.

1.4 BACKGROUND TO THE STUDY

Environmental and climate change issues affect countries across borders and should be of importance in every country's domestic policies, also because "the number and scope of trans-border environmental problems has increased, but a new category of global environmental issues has emerged, and it is this global character that is the most distinctive feature of the present era". As explained by Hurrel and Kingsbury (1991), "humanity is now faced by a range of environmental problems that are global in the strong sense that they affect everyone and can only be effectively managed on the basis of co-operation between, or at least a high percentage, of the states of the world" (Hurrel & Kingsbury, 1991: 2). The emergence of these issues brings an urgency to the evolution in the approach towards policy in order for meaningful contributions to solutions and engagements to be made that will allow for the sustainable preservation of the environment, the mitigation of risk, and increased probability of food security and food production.

The change in the environment has seen an approach which has required the inclusive involvement of international states guided by domestic policies that highlight their national interests and a need for survival of humankind. There is a high demand for political and policy co-operation and co-ordination between states and institutions, for an effective approach to these issues of the environment, particularly in food security.

These engagements and policy innovations could be limited by historical relations and past conflicts between states. According to Fisher and Green (2004: 65), “As political boundaries become more permeable, multiple social actors work on the national and international levels to negotiate regulations that affect many of the countries in the world. States come to the table to discuss what rules should be made and what policy outcomes are desirable. At the same time, a host of non-state actors vie to make their voices heard. Within this context, the different levels of influence among nation-states and others involved in the negotiations of international treaties and policies have become readily apparent”.

Levels of influence and interrelatedness towards policy have become visible in the achievement of objectives. This is why it is important to analyse all driving forces that contribute towards food production limitations which could detrimentally contribute to a potential food crisis. This is particularly important in research that involves futurism and the study of forecasting for policy development planning.

Food security has been defined by various institutions and academics. The World Bank defines it as, “Access by all people at all times to enough food for an active, healthy life” (World Bank, 1986). Maxwell (1988) explains that, “A country and people are food secure when their food system operates efficiently in such a way as to remove the fear that there will not be enough to eat”. The United Nations Food and Agricultural Organisation (FAO) explains that, ‘Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO, 1996). For the purposes of this research, the definition of food security used will be that of the United Nations Food and Agricultural organization.

The international food status according to the Food and Agriculture Organisation of the United Nations is that, “about 795 million people are undernourished globally, including 780 million in the developing regions.” (FAO, 2015) Food security is a fundamental issue for Africa, particularly in underdeveloped or developing countries.

In the African continent, food insecurity has largely been addressed through the Sustainable Development Goals, as the second development goal known as “Promote sustainable agriculture and achieve food security and adequate nutrition for all” (United Nations Economic Commission for Africa, 2015). This is in accordance with the vision of the Africa post-2015 goals.

According to the Africa Regional Report on the Sustainable Development Goals (2015), agriculture and food security remains highly underdeveloped in the continent and the sub regions. The key containing factors, amongst others, are limited access to international markets and poor linkages between research and development (United Nations Economic Commission for Africa, 2013: 2015). This is an indication of how development planning through scenario planning can contribute to stronger research and development that will contribute to improving food security in the African continent.

The Southern African Development Community (SADC) developed a Regional Indicative Strategic Development Plan (RISDP) to attain various goals set for the region. The framework uses good governance principles to influence the various governments to work towards achieving them. The intention is to promote sustainable access to adequate food at all times for all people within the SADC region; the main focus is to improve accessibility and the nutritional value of food, to achieve minimal food losses and to further prepare for the impact of climate change through mitigation strategies and recoveries. The goals

to be achieved are crop and livestock productivity, promoting irrigation and appropriate agricultural production technologies, promotion of trade, and strengthening of the early warning systems (SADC, 2004).

The report highlights the end goals, the ‘high road’ that the RISDP would like to achieve for food security in the region but does not explain the plan which Scenario Planning processes and methods highlight. This has caused the RISDP to celebrate lesser achievements than anticipated, in the context of driving forces in international food security, which leaves the southern region of Africa still struggling to achieve goals such as the eradication of poverty, alleviation of food insecurity, and sustainable and adequate food production.

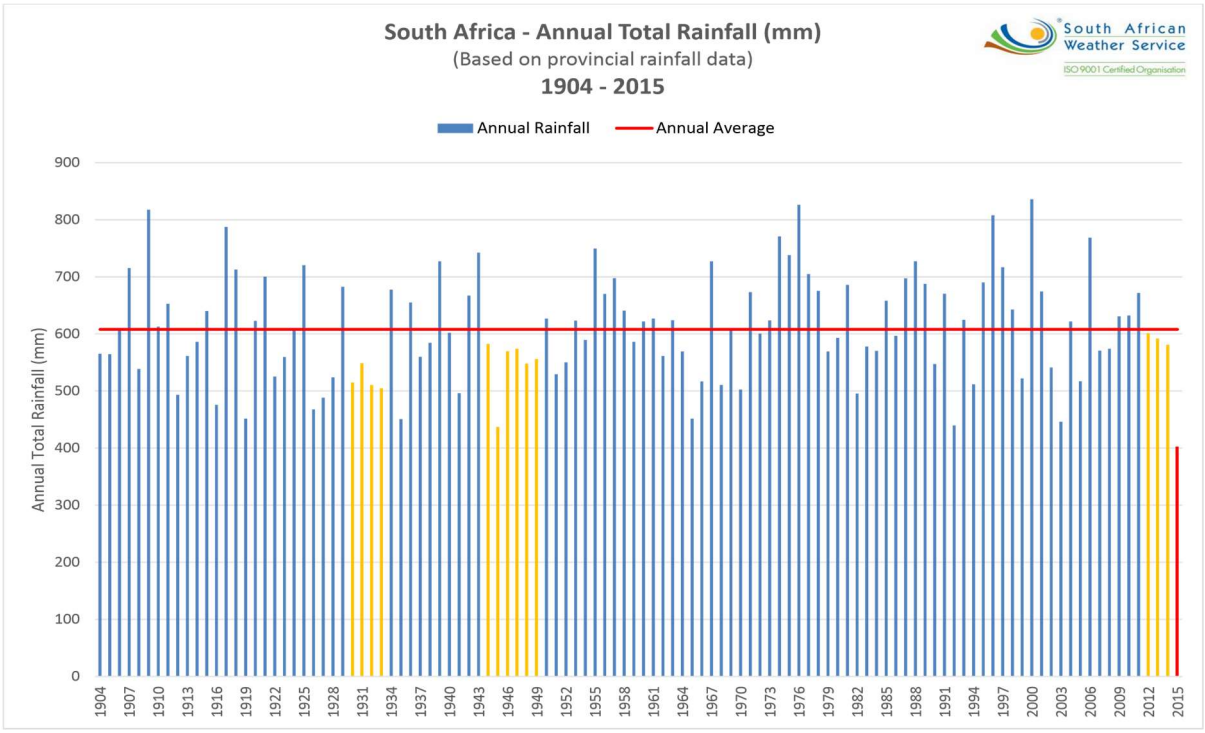
The SADC region and ultimately South Africa has experienced severe drought, according to the World Food Programme (2016), Southern Africa was impacted by unprecedented El Niño-related drought which triggered shocks around the harvest and affected weather conditions, causing severe drought conditions in Southern Africa. According to the World Food Programme, “El Niño conditions have caused the lowest recorded rainfall between October 2015 and January 2016 across many regions of Southern Africa in at least 35 years. The period also recorded the hottest temperatures in the past 10 years” (World Food Programme, 2016).

As a result, the World Food Programme (WFP) recommended that the Southern African governments need to take more precaution in preparing and planning to determine safety nets to prevent the devastation that has been experienced due to the El Niño-related drought. Furthermore, this development planning should be directed not only towards risk mitigation but at greater preparedness for climate change adaptation that will require policy commitment, national and international resources in order to see it succeed (WFP, 2016).

The status of food security in South Africa is categorized into two areas by the Department of Agriculture, Forestry and Fisheries, namely the national and household levels. These are further divided into three dimensions, namely food availability, food access, and food use. The levels of food insecurity are interrelated with poverty, income and unemployment, as defined by the Food and Agriculture Organisation (FAO). The analysis of food security is indicated through the analysis of a temporal and intensity dimension, using determinants of long or short term periods of food scarcity, while the intensity measures the magnitude of food insecurity (Department of Agriculture, Forestry and Fisheries, 2011).

In 2016 the South African Weather service announced that South Africa experienced its lowest rainfall in 110 years as depicted in Figure 1 below (South African Weather Service. 2016). This affected the farming sector and has been one of the concerns of the FAO and the government of South Africa. This has also been evident in the sugar industry in the South African province of KwaZulu-Natal, where over 80 percent of South Africa's sugar is grown (Crowley, 2015). In this context, the sugar industry will be used as a unit of analysis in the research.

Diagram 1: Annual Rainfall South Africa



Source: South African Weather Service (2016)

The South African Government's National Development Plan (NDP) has envisioned the agricultural sector as a tool to be utilised in alleviating poverty and increasing job creation. It is therefore important to find futuristic planning tools that will assist in protecting and also contribute to resisting threats to the sector.

1.5 PROBLEM STATEMENT

The problem with food security in South Africa is that the sector is expectant of risks but is not sufficiently prepared to mitigate them, and the El Niño effects on the agricultural sector is a clear indication of that. According to the President of AgriSA, Johannes Moller, "the current drought in South Africa is of such magnitude that it was beyond any farmer's planning ability regardless of their resource base'' (AgriSA Status Report, 2016). This is a clear indication of the lack of skills in futuristic development planning that could improve forecasting and analysis of driving forces in food security.

This could, for example, predict threats and promote greater preparedness and further mitigation in food production.

1.6 PURPOSE STATEMENT

The purpose of this research is to:

- Investigate the problem and lack of proper planning of food security in South Africa;
- Present findings on food security threats in South Africa;
- Interpret and analyse the outcomes of the study to contribute to futuristic planning strategies for food security in South Africa;
- Highlight the urgency of food security in policy and research.

1.7 RESEARCH QUESTIONS

1.7.1 Primary Question

The primary question that the research aims to examine is the following:

a) What is the problem in development planning for food security in South Africa?

1.7.2 Secondary Questions

The following are the secondary questions that will inform the research:

b) What are the trends in planning for food security in South Africa?
c) What are the sectors leading in food security in South Africa?
d) What are the driving forces in planning for food security in South Africa?

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is fundamental as it is the engagement of the foundations of the study. Hart (1998) describes it as. “the use of ideas in the literature to justify the particular approach to the topic, the selection of methods, and demonstration that this research contributes something new”. The engagement of the literature is therefore a systematic evaluation, deep analysis and comparative study of previous knowledge on a topic. This stage of engagement is valuable as it assists the researcher to identify new areas of the research and how best to focus the study and align it with the purpose of the research. The literature review assists in focusing the research on a particular area of study, by engaging the various aspects of the research, thus outlining the crux of the area of research making it refined and centralized, this process has been particularly important for this research because, the unit of analysis that is analysed is dynamically comprised of various aspects. Webster and Watson (2002) explain that a literature review is “creating a firm foundation to enhancing knowledge”.

This is particularly important for this research paper because, for a satisfactory analysis of the study, various knowledge sources including literature from books, the internet, journals, newspapers and various articles were engaged as reflected within this chapter, to obtain a deeper understanding of the future of the food security systems, crop production, sugar cane, and most importantly, the future impact that the current driving forces have on the future of its development, sustainability and planning methods. This chapter is thus a deep engagement of literature that draws from a broad to a narrow analysis and perspective of the problems and

discourses in development planning in the sugar cane industry in the KwaZulu-Natal Province. This may contribute to or undermine future prospects for food security in terms of development methods for food production systems using crop production and the overall impact of these methods, their threats and the consequent impact on the future of food security.

2.2 FOOD SECURITY

The definition and measurement of food security and the understanding of food security and insecurity has been based on the extraction of food which is centred on the availability of resources and the degree of nutrition thereof (Pinstrup-Anderson, 2009). While these are important aspects of food production, this research argues that the understanding of food security does not guarantee access to, or the sustainable production of, food as a basic commodity of human survival. The researcher is of the opinion that once the food security theory is understood within the context of security as a potential security threat, and as a threat to national resources and human survival, this would improve the approach towards ensuring the sustainability of food and the lack thereof as a danger to the very understanding of human existence.

2.3 BRIEF HISTORY OF FOOD

According to various authors such as Higman (2012), the documentation of the history of food by historians lacks record, however, it is understood that anthropologists have documented food use in the study of anthropology. Further research indicates that the history of food has two major strands, the first being relates to the pleasures that the history of food has contributed to, such as the taste, celebrations and the contributions that food has made towards attaining that ‘pleasure’. The second strand to the history of food is an analysis of the conflict, economic and social problems that the lack of, or the accessibility of, food has the potential to cause. These are reflected

in the historical writings of anthropology, archaeology, sociology, geography and psychology (Higman, 2012).

The history of food highlights two themes based on the existence of food, joy and pain which coincide in the history of food production. What is reflected in this is the fundamental role that food plays in the development of anchoring social systems, such as the development of culture in social, economic and political change. In Africa, one can go as far as arguing that the infiltration of the continent through colonialism plays a fundamental role in the history of food within the continent and therefore sub-regions based on who the former colonialists were or who has infiltrated the region. This is important because as Higman (2012) highlights, food is both a central driving force and a central part of life that responds and transforms in turn.

The current status of food within the continent of Africa is well defined by the Intergovernmental Panel on Climate Change (1997), which notes that, “800 million people are malnourished; as the world’s population increases and incomes in some countries rise, food consumption is expected to double over the next three to four decades.” This has not shifted in 2015, as the continent seeks to address the post-2015 Agenda, where it evaluates what it has achieved thus far in its Millennium Development Goals and especially in relation to food security, nutrition, the alleviation of poverty, and mitigating hunger is paramount.

Food security is a critical aspect of human survival and its study is important because of the vulnerability that the lack of food security engenders. Elements such as hunger, malnutrition, and poverty as outcomes and contributors of food insecurity pose a serious threat to development and its sustainability.

2.3.1 Brief overview of sugar production

The history of sugar resembles that of food as explained above, and is a relationship of trade, culture and historical complexities. Mintz (1987) notes that sugar was unknown until the Middle Ages as a result, only honey was employed for sweetening. However, a close study of accounts shows that sugar was in continuous use in wealthy households by the middle of the thirteenth century (Mintz,1987: 83)

Mintz (1987) highlights the elaborate evolution of sugar from historical discovery to a class-based commodity within Asia and imported into Europe. The historical expansion of sugar as a sweetening agent increased the trade of sugar as a household commodity. This also historically contributed to the use of sugar for cultural and medical uses: “The usage of sugar as spice may have reached some sort of peak in the sixteenth century. Soon thereafter, prices, supplies and customary uses began changing rapidly and radically” (Mintz, 1987: 86). This suggests the importance of the influence of sugar on the economy as well as on culture.

The use of sugar in medical as well as household consumption contributed to what Mintz (1987: 99) calls a ‘drug food’. This has been consistent with recent studies which suggest that the consumption of sugar has the same effects as the consumption of drugs. As stated by Liester and Moore (2015), excessive sugar consumption causes changes in the mesolimbic pathway (MLP) in the brain that mimics the effects of drugs or abusive substances. This is despite authors such as Schorin, Sollid, Edge and Bouchoux (2012), amongst others, arguing that the high consumption of sugar does not indicate a poor diet and therefore the effects of sugar are dependent on nutrient density of sugars consumed. They further argue that moderated sugar intake does not cause diseases such as diabetes. Where other lifestyle choices are monitored, excessive intake of sugars can be a contributing factor to chronic diseases such as Type-2 diabetes.

South Africa produces close to 20 million tons of sugar cane annually, the main producer being KwaZulu-Natal (DAFF: 2014). Sugar cane as a crop and later as a refined product has a significant impact on the South African economy and also the culture. The industry, according to the Department of Agriculture, Forestry and Fisheries (2014), is estimated to provide 79 000 direct jobs and 350 00 indirect jobs. This makes sugar cane plantation a fundamental crop production in South Africa, one that is rich with historical and cultural significance for the country, beyond its economic importance. It is also important to note that according to the International Plant Biotechnology Outreach (2017) in the Sugarcane in Africa series, "While sugarcane was first dedicated to sugar production, advances in technology have ensured that nowadays, all parts of the sugar cane plant can be converted into energy. To date, producing bioethanol from the sugar in sugar cane (first-generation biofuels) has been one of the world's most commercially successful biofuel production systems". This is important to note because, although there may be negatives in unguided consumption of sugarcane, there is a clear benefit to its sustainable and increased production, also within the energy production of biotechnology research.

The production of sugar has importance in the cultural and historical overview of sugar as a crop production. Despite sugar production increase having the potential to affect health negatively, the increase of sugar production and its sustainability is important for increasing economic and social engagement. It could further make a fundamental contribution to research and development to enrich policy, infrastructure and environmentally sustainable production.

2.4 THE POLITICS OF FOOD

History indicates that in 1972 a food crisis was experienced as the global food system saw a shift in the power of negotiation in the production of food and the financial structures in international relations, due to consumer

demands from countries such as the United States of America and the European Union. This increased the price of grain and rendered it unaffordable for developing countries, leading to the developing countries being dependent on food aid from the developed states. This afforded them undue control in the balance of power between developed and developing states. Balaam and Vaseth (1996: 391) observe that, “food was used as a weapon in many wars, including Ethiopia and the ‘killing fields’ in Cambodia”. This highlights the extent to which food insecurity can be used to manipulate and control within governance, power struggles in the use of famine and food shortages as a man-made phenomenon. Hazell (2009) suggests that agricultural advances and public investments in agronomy were slower in reaching developing countries as the colonial powers invested little in food production systems but focused largely on their own countries. Hazell (2009) further states that these countries grew in population due to independence and therefore saw a rise in malnutrition and poverty.

The politics of food and the understanding of the global food system is a matrix of power dynamics that needs to be understood and considered as such. The researcher suggests that it is therefore important for African states to approach food production from the continental perspective rather than individual states, as this will give the continent the political will and power to systematically reduce the remaining influence of former colonial powers and thereby reduce dependence on the developed states for food and survival should the need arise, as it did in 2008, by taking greater control of the food production system. Balaam and Vaseth (2011: 465) elaborates on the politics of food that, “the International Political Economy of hunger helps explain how a combination of political, economic, and social factors affects national and international food and hunger issues. Realists view the world as a self-help system in which nation-states must compete for power and wealth to improve their relative security.” This is thus an elaboration of the interdependence of dynamics that affect, and therefore effect, the need

for food security to be viewed as a fundamental aspect of food; the existence of food insecurity poses a threat to economic stability and is a reflection of the lack of this stability. It is also a serious threat to governance and political stability, exposing governance institutions to the vulnerability of dependence and infiltration by other governments and institutions that have the ability to use the lack of food security as a tool to manipulate power and influence governance.

It is important that the continent aims to achieve food sovereignty independently and that it views the lack of this sovereignty as a threat to national and regional security. National food sovereignty is explained by Pinstrup-Anderson (2009) as follows: “National food sovereignty was and still is used to measure the extent to which a country has the means to make available to its people the food needed or demanded, irrespective of whether the food is domestically produced or imported. A country that does not produce the food it needs or its population is prepared to buy, and does not have the hard currency to import what is missing, would not be food sovereign (Pinstrup-Anderson, 2009: 5).

The 2008 food crisis also saw a shift in the interest of wealthier countries purchasing land for farming in poorer countries in order to produce crops for export. Daniel and Mittal (2009) define this as, “the ‘land grabbing’ trend; this refers to the purchase or lease of vast tracts of land by wealthier, food-insecure nations and private investors from mostly poor developing countries in order to produce crops for export” (Daniel & Mittal, 2009: 1).

This has been argued by various authors such as Kuegelman and Leensein (2009) as well as Daniel and Mittal (2009) as being a method of controlling food processing lands for investment purposes. This therefore not only contributes to the wealthier countries securing their food security, should another food crisis occur, but also keeps the poorer countries dependent and destitute despite owning the land which is a fundamental resource for

food security. Hall (2017) argues that the farming mode pursued is fundamental to local economies; this plays an important role in institutional arrangements as stakeholders who contribute to the development of policy that informs the farming models of agricultural development. Hall (2017) further argues that this exclusion has resulted in deepening inequalities and social exclusion in commoditisation, market liberalisation and globalisation.

This alternative argument highlights a different aspect to the food crisis and its agenda, one of economic indulgence from developed countries, thereby perpetuating the enhancement of the dependency theory. Furthermore, it is important to note because it contrasts the argument by Malthus which is elaborated below, it argues that population growth is the main driving force of food scarcity. In contrast, the promotion of economic interests has been a driver of a food crisis which may seem convenient for economic growth and interests, despite the social, economic and political disparities it has contributed masked as a positive contribution to agrarian change.

The importance of institutional and stakeholder participation in contributing to the development of policy and tools to omit risks for local economies as well as to resist agricultural dispossession of local commercial and sustenance farming can be consistently done through the identification of these surfacing threats and the creation of policy modifications for agricultural development and protection, which should be the objective of evolution of policy for agrarian development planning.

The researcher is thus of the opinion that, should Africa as a continent could take a lead in policy, its implementation and development towards securing food security, it would also be able to take a leading role in establishing commodity prices and regulate societies; therefore, it would be leading the world in other aspects since food security cannot be approached alone due to other factors that directly affect it. As Balaam and Vaseth (1996: 393) observes, “Those who profit from market transactions are less likely to go

hungry, while those who do not are more likely to feel the effects of poverty, malnourishment, and even starvation." This is important because Africa is rich in raw resources that afford it the ability to lead in policy as it has shown in its policy development such as Agenda 2063, which continues to strengthen the strategic implementation of sustainable development. Africa also has the ability to establish and develop the use of its raw resources, and more importantly promote their sustainability for use by future generations.

2.5 THE FUTURE OF FOOD SECURITY IN THE LONG TERM

The future of food security cannot be determined or confirmed; however, looking at the past and the present, the future can be reflected. According to Sedar and Asan (2007), "The future can never be accurately or completely known". When Food (in)Security has been contextualized and understood as a potential security threat, then the techniques provided by Scenario Planning can be used to assist in providing a long view of the future of food security, thus contributing to mitigating factors that can influence the resistance or reduction of risk factors that come with food insecurity.

Scenario Planning is an important tool in the evolution of approach towards policy making as an apparatus for planning and problem solving. The researcher advocates its importance in the modification of policy when addressing the threat of food insecurity. This weighting is within the identification of driving forces and the most important factors of influence, which in this case would need to be addressed when dealing with the modification and development planning for policy. The ability for policy makers, agricultural scientists and contributors to the food market to be able to identify threats and address these through a futuristic approach to food would be beneficial for the sustainability of food security. Kahan (1992) observes that scenario planning is a tool that can be used within the private or the public sector strategically to approach the future.

Schwarts (1996) in the “Art of the Long View: Pathfinder’s Tale” describes scenario planning as a tool that gives people a long view of the possible future scenarios, leading to better informed decision-making despite the uncertainty of the future. This allows for the ability to identify warning signs of a possible threat and thus formulate realistic risk mitigating strategies. Schwarts (1996) and Kleiner (1996) concur that scenario planning assists in distinguishing the important aspects of the future and therefore identifying the key factors that need to be identified in order to influence decision-making for the future. Kleiner (1996) further elaborates that scenario planning is an exercise that assists in the development of a response towards possible future scenarios. This, Schwarts (1996) argues, assists in preparation and rehearsal of implications through the possible scenarios presented. Ruitje (1999) describes scenario planning as a tool to develop strategy through the analysis of driving forces and stakeholders. The strategy highlighted by Ruitje (1999) is based on the identification of stakeholders; the identification of the uncertainty; the developing of scenarios and debating the implications of each scenario; the identifying and developing of options; and the developing of strategy and deciding on a strategy.

Wilkinson (1995), in agreement with Miles (2003), argues that scenario planning is a tool that assists with preparation of the future in the midst of constantly changing circumstances which are influenced by external driving forces. Miles importantly elaborates the principle of Normative and Exploratory Scenario planning. In an analysis of food security and in view of the driving forces, it is important to understand futurism techniques in planning and strategizing. Ideally, a food secure and sustainable market is the desired outcome. In spite of all the threats, it would therefore be favourable to focus on Normative Scenario planning, which is the highlighting of a desired outcome, and in light of the driving forces, is the opposite of the possible low road of food security.

The reason this is the most favourable option in relation to this research is because it allows the strategies to work towards a best possible outcome and is the closest in achieving the outcomes that will demonstrate success because the reflections of development will be visible. Miles (2003) further elaborates on the single or multiple vision of scenario planning. The understanding of the threats presented by food insecurity makes it fundamental for the approach to be a multiple vision, giving the ability to address different opportunities that emanate from the challenges presented in scenario planning, and thus choosing the most appropriate and sustainable strategy in development planning.

This creates a sense of safety and strategy around the vulnerability of institutions, through the development of alternative strategies that avoid tunnel vision and influence the development of more informed and developed decision-making that identifies current and future threats, weaknesses and strengths of food security.

The reason this has become such an important factor in the field of food security is because food security has been predicted to be under a serious threat in its production. Futurists, agricultural specialists, demographics and economists have highlighted, using the tools of futures research, that there is likely to be a food crisis in the near future, specifically by 2050.

2.6 FOOD PRODUCTION IN THE LONG TERM

Cribb (2010) in his research forecasts that in 2050 there will be a food crisis based on a collection and variance of factors such as economic and climate changes. This aligns with the views of institutions such as the FAO that has begun discussing the threat of food security using 2050 as the year of endangerment. Cribb (2010: 3) argues that in 2001 the world began to experience a shortfall in food production as it began to consume more grain than it produced. He further argues that in 2008 the world saw a recession

and a steep rise in food prices. There was no clear explanation for the sudden emergence of food scarcity and a concomitant rise in food prices. Cribb therefore suggests that the predicament that the world witnessed in 2008 is a precursor of what lies ahead with regard to food insecurity (Cribb, 2010).

Cribb (2010) in his research and analysis of driving forces contributing towards the anticipated food crisis of2050, considers various factors as mentioned above, and argues that within climatic challenges, biofuels play a role in the rise in food prices. Other research and analysis in the field concurs, and further argues that the rise in oil prices, and extreme weather changes such as droughts and floods, have threatened the production of fruits, vegetables and livestock, ultimately causing a shortage in the production of food and causing a shock in the global food system (United Kingdom Government Office for Science, 2011).

Cribb (2010) highlights other contributing factors within the climate change and energy segment. He further suggests that the water crisis is also a contributing factor and that humanity is running out of fresh water. Farmers use about 70% of the global fresh water supply to produce food, including animal production; the competition between food production and water supply could by 2050 result in a 50% reduction in available water sources. He further notes that a contributing factor is land scarcity; the world is running out of good arable land to maintain food production due to the degradation of land, resulting in much land becoming unproductive. Urbanization is a contributing factor to this crisis due to its spillover effects such as industrialization, which sees an increase in toxic pollution. Another contributing factor which is important is that due to the degradation of usable arable land, the annual soil erosion exceeds the nutrients applied as fertilizer, which means that the fertilizer used is being wasted; this has led to the global nutrient cycle which has sustained human capacity throughout history being broken down.

Alexandratos and Bruinsma (2012) supports Cribb's (2010) argument that energy is a contributing factor which continues to raise concerns of climate change in relation to the suggestion that the world is likely to burn about 400 million tonnes of grain as biofuels by 2020. Further to this, environmentalists and marine scientists have warned that fish productivity could collapse due to accelerated deterioration and exploitation of the oceans (Bourne & Collins, 2009: 114).

Cribb (2010) argues that a driving force contributing to the food crisis is the global recession of 2008, which saw the cost of food production affected, in particular farmer's fuel, fertilizer and transportation costs. This meant that farmers could not afford to maintain their production due to the high output prices. Economically, another effect of production, according to Cribb (2010: 8), is protectionism that has hidden trade barriers, farm subsidies, food price controls and taxes. This has resulted in a spill-over effect on environmental health which undermines the production of goods for farmers, thereby discouraging production. These economic factors strongly discourage investment in agriculture and farming, affecting the potential in productivity and sustainability for the maintenance of food production.

Cribb (2010: 9) further highlights the political implications of a food crisis, where in 2008, the G8 countries that drive the international economy and governance in the United Nations, and which developed the United Nations Developmental Goals in 2000, admitted that they were unaware of the food crisis that hit the world in 2008, and were therefore unprepared for the sudden emergence of food scarcity and the hike in food prices.

The third fundamental driving force in relation to the predicted food crisis in 2050, is the strong shift towards urbanization, which means that there is less farming and agricultural engagement. Cribb (2010) further argues that the current trend of population growth is 1.5% per annum and if this trend

continues, the global population is expected to reach 9.2 billion in 2050. This expansion is highly anticipated in developing countries, although Cribb explains that the demand for food will be 70% to 100% greater than at present, and for these increased demands to be met, food production will have to increase by 2% per annum, from the current 1% per annum.

The United Kingdom's Government Office for Science suggests that the world should be investing more in research and development on the maximisation of food productivity, stating that the maintenance and increase in food productivity cannot be done independently through policy changes in one particular country. The Office for Science further contends that institutions are important in assuring food security for the future; such as regional and international governance institutions, while not removing the responsibility of all governments to amplify issues of food security.

The Food and Agricultural Organization in its study on "How to feed the world in 2050" (2009: 2) observes that the population will reach 9.2 billion people in 2050, with the steepest growth in developing counties. This will require an increase of 70% in the net food used for biofuels. The report notes "that in anticipation to 2050 an increase in food production can be achieved if the necessary investment is taken and policies conducive to agricultural production are put in place, but it must be complemented by policies to enhance access by safety net programmes." The report further highlights the importance of public and private trade and investment, the reallocation of budget, and use of donor programmes in agricultural investment (FAO, 2009).

The report (FAO, 2009: 4) further highlights that the sharp food price increases have resulted in increased malnutrition and hunger. This has in essence sharpened the awareness of policy makers and the public regarding the fragility of the global food system, that food scarcity and threats to food can cause. The report argues that systems need to be better

prepared to respond to the long-term demand for growth and greater resilience against various risk factors that confront agriculture.

The report highlights that “action is needed now to ensure that the required 70% increase in food production is achieved, and that every human being has access to adequate food. First, investment in developing country agriculture has to increase by at least 60% over current levels through a combination of higher public investment and better incentives for farmers and the private sector to invest their own resources. Second, greater priority has to be given to agricultural research, development and extension services in order to achieve the yield and productivity gains that are needed to feed the world in 2050. Third, global markets have to function effectively as food security for an increasing number of countries will depend on international trade and access to a stable supply of imports (FAO, 2009: 15).

Roberts (2008), in an analysis of similar current trends and driving forces such as Cribb suggest, argues that the simultaneous emergence of so many food threats, its safety, and its declining productivity is a clear signal that industrial agriculture has nearly exhausted the underlying systems that restore its capacity. Roberts (2008) argues that “even conservative estimates of the combination of rising temperatures and shifting patterns in rainfall and storm frequency will push down total global food output, and this while demand is rising. By the year 2070, the African continent, already on the brink of a food system collapse, may be entirely unable to produce certain crops such as wheat” (Roberts, 2008: xix). Roberts further argues that the contributing factors in a food crisis are the rise in petroleum prices, which in effect affects the fuel expenses in productivity and transportation since petroleum also forms the chemical base for fertilizer. Roberts (2008) concurs with Cribb (2010) that water scarcity is a contributing factor as agricultural demand for water is high, and therefore, if there is a scarcity

now, the sustainability of the water supply in order to sustain food production will present a challenge.

Roberts argues that the food economy is highly resistant to sudden change, despite, “there being a growing awareness amongst some consumers, policy makers, and even industry executives that our food and food systems are flawed and that these flaws show every sign of developing into serious destabilization (Roberts, 2008: xxiii).

Roberts (2008: xxiii) argues that the world needs a new agricultural system that is conscious of the earth’s natural limits and seeks to moderate the human obsession with technological fixes. This research argues that there needs to be an alternative, visionary and all-inclusive food system developed in order to prepare for and resist the anticipated food crisis, and this food system should be able to survive within the disparities of climate change and its potential threats. The system should be a fair, inclusive and policy driven system that uses the driving forces of climate change, the economy and the growing population to create change, innovation and vision, especially for Africa, in order to make it the leading continent in productivity, trade and sustainability of food security and management of the global food system.

A study undertaken in 2014 by the Department of Environmental Affairs of South Africa to establish how the agricultural systems and the food system could be affected under various climate change scenarios from an economic and social perspective, revealed that climate change has an impact on the social economy and threatens food security in South Africa, although the study is limited to the production of wheat and grain and therefore does not provide an objective overview on the complete impact on productivity for food security. The study coherently with other authors emphasises that the climate scenarios affect economic impacts because they influence the decision to produce. The study recommends that policy proposals should

enable and encourage adaptation and mitigation of producers within the food production system. The study highly recommends the development of infrastructure in order to encourage production costs and transportation of products (Department of Environmental Affairs, 2014).

The University of Stellenbosch through the food security initiative highlights five key areas as stipulated by the Department of Agriculture in the food security strategy for South Africa, namely: “inadequate safety net; weak support networks and disaster management systems; inadequate and unstable household food production; lack of purchasing power; and poor nutritional status” (University of Stellenbosch Food Security Initiative, 2010). These key areas are of importance in the development of a sustainable strategy and policy for food security within South Africa. These are the impacts of food insecurity and will be exacerbated should a solution not be found to curb the anticipated food crisis, which a number of authors have proposed as a possible scenario of the future of food production. Public policy and scenario planning have an important role to play in the development of a strategy in futures research that will potentially address the anticipated food crisis, but these techniques and strategies need to be used immediately in order to allow for monitoring and evaluation and also the modification of institutions in order to allow for the necessary support, decision making and the influence of outcomes that are favourable to South Africa, the continent and all humankind.

This makes it important to emphasise the urgency of developmental planning and policy modification in engaging food security. This is especially important because literature, futurists and scenario planners all foresee developing countries being affected the most by population growth, food insecurity and production shortages, and this means the continent of Africa, which already experiences high levels of poverty and malnutrition, is likely to be highly affected by a food crisis. It is important therefore that policy modification and institutional unity is emphasized, communicated and

effected in order to ensure that the African continent begins to protect itself and its natural resources in the global food production system, thereby ideally contributing towards eradicating poverty and ensuring survival. Equally important is the enlightenment of development planning and futures research in the different sectors of agricultural institutions such as the sugar industry, from a policy perspective, because this in essence allows for the preservation of natural resources, and therefore the sustainable development of production.

2.6.1 Wild Cards

The term ‘’wild card’’ was introduced by Rockfellow (1994) who defined Wild Cards as “an event having a low probability of occurrence, but an inordinately high impact if it does.” Wild Cards are a sudden incident or change that influence a trend. Authors such as Mendoca, Cunha, Kaivo-oja and Ruff (2004: 4) suggest that a methodological and systematic approach towards the preparation of wild cards as a sudden incident that is consequential to an organisation is important. They elaborate that “doing too little too late and losing control of the situation can significantly damage the organisation, especially when information flows rapidly through the media and the Internet. For these reasons, conceptual analysis of discontinuities is important, empirical evidence is fleeting and policy recommendations urgent. Up to now, research into this problem has been ad hoc”.

The proposed methodology by Mendoca; Cunha, Kaivo-oja and Ruff (2014) is illustrated below as the tool of analysis of the findings from the questionnaires, which can be anticipated through the scanning of the environment. It is thus important for any organisation to be able to identify wild cards, in order to anticipate, prepare and provide risk mitigating factors should these wild cards occur. The difficulty in analysis of wild cards lies in

the fact that they are improbable, yet their probability has detrimental consequences to the systematic order.

Mendoca; Cunha, Kaivo-oja and Ruff (2004) propose a 'Wild Management System'; this system is sub-divided into two strategies, namely the Weak Signal Methods approach which is the approach that has been taken through this research that identifies and anticipates certain wild cards, while the second approach is the Nurture of Improvisations Capabilities, which is the systemic approach towards an immediate crisis should a wild card occur. This area of wild card management is an area that has not been well researched or discussed; as a result, the systematic analysis of the identified wild cards will follow the methodology that is provided through the Wild Management system as discussed by Mendoca; Cunha, Kaivo-oja and Ruff (2004).

2.7 THE FUTURE OF FOOD SECURITY IN THE LONG TERM

The future of food security cannot be determined or confirmed; however, looking at the past and the present, the future can be reflected. According to Sedar and Asan (2007), "The future can never be accurately or completely known". When Food (in)Security has been contextualized and understood as a potential security threat, then the techniques provided by Scenario Planning can be used to assist in providing a long view of the future of food security, thus contributing to mitigating factors that can influence the resistance or reduction of risk factors that come with food insecurity.

Scenario planning is an important tool in the evolution of approach towards policy making as an apparatus for planning and problem solving. The researcher advocates its importance in the modification of policy when addressing the threat of food insecurity. This weighting is within the identification of driving forces and the most important factors of influence, which in this case would need to be addressed when dealing with the

modification and development planning for policy. The ability for policy makers, agricultural scientists and contributors to the food market to be able to identify threats and address these through a futuristic approach to food would be beneficial for the sustainability of food security. Kahan (1992) observes that scenario planning is a tool that can be used within the private or the public sector strategically to approach the future.

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2.8 FOOD PRODUCTION IN THE LONG TERM

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The United Kingdom's Government Office for Science suggests that the world should be investing more in research and development on the maximisation of food productivity, stating that the maintenance and increase in food productivity cannot be done independently through policy changes in one particular country. The Office for Science further contends that institutions are important in assuring food security for the future; such as regional and international governance institutions, while not removing the responsibility of all governments to amplify issues of food security.

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The report (FAO, 2009: 4) further highlights that the sharp food price increases have resulted in increased malnutrition and hunger. This has in essence sharpened the awareness of policy makers and the public regarding the fragility of the global food system, that food scarcity and threats to food can cause. The report argues that systems need to be better prepared to respond to the long-term demand for growth and greater resilience against various risk factors that confront agriculture.

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the brink of a food system collapse, may be entirely unable to produce certain crops such as wheat" (Roberts, 2008: xix). Roberts further argues that the contributing factors in a food crisis are the rise in petroleum prices, which in effect affects the fuel expenses in productivity and transportation since petroleum also forms the chemical base for fertilizer. Roberts (2008) concurs with Cribb (2010) that water scarcity is a contributing factor as agricultural demand for water is high, and therefore, if there is a scarcity now, the sustainability of the water supply in order to sustain food production will present a challenge.

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Roberts (2008: xxiii) argues that the world needs a new agricultural system that is conscious of the earth's natural limits and seeks to moderate the human obsession with technological fixes. This research argues that there needs to be an alternative, visionary and all-inclusive food system developed in order to prepare for and resist the anticipated food crisis, and this food system should be able to survive within the disparities of climate change and its potential threats. The system should be a fair, inclusive and policy driven system that uses the driving forces of climate change, the economy and the growing population to create change, innovation and vision, especially for Africa, in order to make it the leading continent in productivity, trade and sustainability of food security and management of the global food system.

A study undertaken in 2014 by the Department of Environmental Affairs of South Africa to establish how the agricultural systems and the food system could be affected under various climate change scenarios from an economic

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The University of Stellenbosch through the food security initiative highlights five key areas as stipulated by the Department of Agriculture in the food security strategy for South Africa, namely: “inadequate safety net; weak support networks and disaster management systems; inadequate and unstable household food production; lack of purchasing power; and poor nutritional status” (University of Stellenbosch Food Security Initiative, 2010). These key areas are of importance in the development of a sustainable strategy and policy for food security within South Africa. These are the impacts of food insecurity and will be exacerbated should a solution not be found to curb the anticipated food crisis, which a number of authors have proposed as a possible scenario of the future of food production. Public policy and scenario planning have an important role to play in the development of a strategy in futures research that will potentially address the anticipated food crisis, but these techniques and strategies need to be used immediately in order to allow for monitoring and evaluation and also the modification of institutions in order to allow for the necessary support, decision making and the influence of outcomes that are favourable to South Africa, the continent and all humankind.

This makes it important to emphasise the urgency of developmental planning and policy modification in engaging food security. This is especially important because literature, futurists and scenario planners all foresee developing countries being affected the most by population growth, food insecurity and production shortages, and this means the continent of Africa, which already experiences high levels of poverty and malnutrition, is likely to be highly affected by a food crisis. It is important therefore that policy modification and institutional unity is emphasized, communicated and effected in order to ensure that the African continent begins to protect itself and its natural resources in the global food production system, thereby ideally contributing towards eradicating poverty and ensuring survival. Equally important is the enlightenment of development planning and futures research in the different sectors of agricultural institutions such as the sugar industry, from a policy perspective, because this in essence allows for the preservation of natural resources, and therefore the sustainable development of production.

2.9 MALTHUSIAN THEORY: NEO-MALTHUSIAN THEORY

Thomas Robert Malthus was the first economist to propose a systematic theory of population, these were articulated in Malthus book published in 1798, “Essay on the Principle of Population”. Malthus espouses the principle that human populations grow exponentially while food production grows at an arithmetic rate, thus while food output was likely to increase in a series of twenty-five year intervals in the arithmetic progression, the population was capable of increasing the geometric progression. The theory presented by Malthus proposes a future where the population growth will outgrow the natural resources for human survival. Ehrlich (1968) in agreement with Malthus (1798) wrote about the “population bomb” and argued that the rate of population growth was exceeding agricultural growth and the capacity for renewal of earth’s resources. Ehrlich using the analysis of driving forces of the effects of population growth and resource production predicted a certain demographic disaster in response to eventual food shortages and disease. For the purposes of this research, the Malthusian theory is appropriate to incorporate for analytical purposes and reflection as one of the main driving forces that contribute towards the urgency of development planning towards food security; an elaborated analysis will be reflected in the theoretical framework.

2.10 BRIEF OVERVIEW OF FUTURES RESEARCH

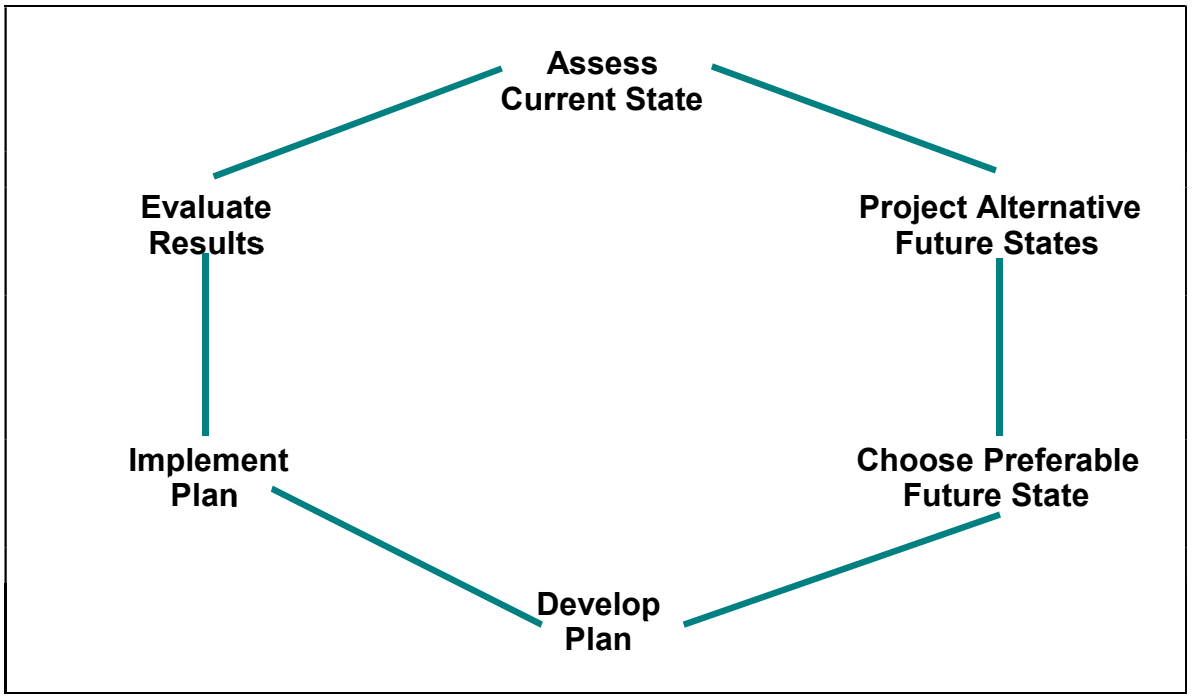
Futures research has been described by Mills and Bishops (2000) as ‘‘a discipline that systematically explores what we can know about the future of human systems, and how we can use that knowledge to attain desirable futures.’’ Amara (1991) describes the area of study as a technique that “helps inform perceptions, alternatives and choices”. Easton and Tongson (2000) elaborate that futurism involves an analysis of systems, and a system could be almost anything. Futurism is therefore a systematic exploration and strategic planning towards the future, using the knowledge attained to accomplish desirable futures. It is a planning strategy that

exposes all likely and possible outcomes. This is the crux of policy making, which is a resolution to current and future human systems aimed at improving human life. The use of futuristic approach to research is dependent on the futures uncertainty and allows for the strategic development and direction for policy planning.

According to Lang (1994) “the origin of modern futures research can be found stretching back to the 1950s and 1960s. Although in the West it was first associated with the military industrial complex, the benefit of such research was soon realised and the tools spread quickly to the private and government sector.” Although the structure is not always the same, the idea is to engage complex issues and prepare for strategy and planning towards future expected outcomes. This approach to planning has developed and it has found its use as a development strategic approach for the development of policy and risk mitigation approaches.

The approach to planning and problem solving follows the methodology outlined by Mills and Bishop (2000) and can be used to plan and create a system change, the methodology of future studies is not based on prediction but on using futurism tools to, ‘map out the possibilities that the future may hold, in order to make decisions. Mills and Bishop (2000) further elaborate that “open human systems Assessing alternative plausible futures and selecting a specific preferable future are both necessary steps in preparing for uncertain futures in open human systems” this methodology is critical in futures planning as it allows for a critical assessment of the current state of a situation like food insecurity, it then allows for a projection of the future, the development of a plan towards the future and finally an implementation of the results.

Diagram 2: Applied Futurism Methodology



Source: Mills and Bishop, 2000, p. 32

Mills and Bishop (2000) further highlight steps in futurism as guided by this systematic approach which allows for a vigorous engagement on the assessment of the current state of an area of study – such as food security:

- Define the system of interest
- Identify the domain of observation
- Identify the current state -- when did it start, how was it different from previous states?
- Identify the major players (stakeholders) and their relationships
- Identify what is changing (trends and potential events)
- Identify current issues and potential outcomes

Mills and Bishop (2000) further identify the tools and theories of Futures Research as:

- Cross Impact Analysis
- Decision Modelling

- Delphi Technique
- Environmental Scanning
- Futures Wheel
- Gaming and Simulation
- Genius Forecasting
- Relevance Trees
- Scenarios
- Systems Dynamics
- Trend Impact Analysis
- Visioning.

The techniques and theories relevant for this research have been elaborated on in the theoretical framework. However, it is important to highlight that for the use of this research, a futuristic approach is important in preparation and strategic planning because it allows for the vigorous engagement of current state of food security but also engages strategy for the future and its sustainability on a complex multifaceted level.

2.11 THEORETICAL AND CONCEPTUAL FRAMEWORKS

2.11.1 Theoretical framework

A theoretical framework allows the researcher to engage various theories which lead to a critical analysis of the area of study. Tavris (2001) discusses the importance of critical thinking and highlights that it allows for the asking of questions, defining terms, examining of evidence and a critical analysis of assumptions. This process also allows for the grouping of driving forces and causal effects of situations through the use of critical evidence and analysis. Below is an analysis of the theories that have surfaced during this study, and that are critical to the outcome of the research. Based on the area of study of the paper, various aspects of theories arose, all of which contribute towards development planning in Food Security.

The Malthusian theory written by Thomas Malthus in 1798 in his *Essay on the Principal of Population* allows for an analysis of the population, resources and the environment which are fundamental aspects of the of food security. (Ehrlich, 1968: 63). This argument and theory have evolved and was developed further by Ehrlich in 1968 towards being the *Population Bomb*, which communicated the core message of the danger of having more than a certain number of people alive at the same time.

The further development of the theory of the Population Bomb is embedded in Ehrlich highlighting further threats to food security of not only being overpopulation but also the maldistribution of resources which bring into argument the dependency theory. Kumar (2012) states that the 'Dependency Theory argues that developed countries constitute the core of the global system, while poor countries remain at the periphery. By employing a lethal mix of military, political and cultural strategies, core countries make sure that peripheral countries remain the source of cheap raw material and labour, as they have always been'.

The theoretical framework of the Malthusian and the Population Bomb theory is incapable of encapsulating the complete complexities of food insecurity. It focuses on the more social aspects and threats of food security through population growth and thus the demands made by man to the environment. Although these are important elements that contribute towards the analysis of futuristic studies of food insecurity, they are not the only driving forces that are needed for a realistic evaluation of food insecurity as an impending security threat to humanity. The environment and natural resources impact on historic and future population growth which will disrupt humanity if it remains unmonitored and under researched.

Although relevant to the study of food security, this theory is not relevant for the purpose of the study, because it speaks to elements of food insecurity

threats and does not address the holistic analysis of planning towards mitigating threats to food security, which is the main purpose of this study.

Climate change theories are exceptional at explaining the impact and role of climate towards food supply systems; however, it is an important element and driving force of understanding food insecurity threats. When the Population Bomb was written, it was thought that “Carbon dioxide was the only gas whose greenhouse effect might cause serious global heating, the roles of methane, nitrous oxide and chlofluorocarbons were not recognized until a decade or so later.” (Ehrlich & Ehrlich, 1999).

The most common theories of climate change are: Anthropogenic Global Warming (AGW); Bio-thermostat; Cloud formation and Albedo; Human forcing’s besides Greenhouse gases; Ocean currents; Planetary motion and Solar variability (Bast, 2010). The AGW theory is the most interconnected to the population bomb and the evolution of food security, as it holds that “man-made greenhouse gases, primarily carbon dioxide, are the predominant cause of the global warming that occurred during the past 60 years” (Bast, 2010: 4).

This theory as mentioned above has been highly questioned and disregarded in subsequent years, which has led to the realization that it is one of the driving forces of climate change which has led it to become a food security threat and not necessarily the prime cause. Through this, a realization that each climate change theorem has a contributing factor that has affected food security in general, but most importantly, they all bring in aspects that work towards the analysis of climate change as a holistic theory rather than a theory that has one factor such as carbon dioxide defining it, that is both biological and chemical in its impact and totality to its effect to the environment and ultimately food production.

Although relevant to the study of food security, this theory is not relevant for the purpose of the study, because it speaks to elements of food insecurity threats and does not address the holistic analysis of planning towards mitigating threats to food production security, which is the main purpose of this study.

The Trend Impact Theory is a concept in futures research that was developed in the 1970's by Theodore Gordon. It is based on quantitative methods through identifying a baseline scenario that is an analysis of historical data and trends used to forecast the future through trend extrapolation. According to Gordon (1994) Trend Impact method is a "simple approach to forecasting in which a time series is modified to take into account perceptions about how future events may change extrapolations that would otherwise be surprise-free". This provides an analytical instrument that is used based on a time series in an analysis of various events.

Agami; Omran; Saleh and El-Shishiny (2008) further describes it as a 'method to forecast the future, used to aid decision making and planning, it is a surprise free forecast modified to take into account expert's perceptions about how future events may change the surprise-fee forecast, it is a method of analysis on trends that allows for a systematic examination of trend effects towards future events based on probability of occurrence.'

Gordon (1994) describes two primary steps for trend impact:

1. A curve is fitted to historical data to calculate the future trend, given no unprecedented future events; and
2. Expert judgments are used to identify a set of future events that, if they were to occur, would cause deviations from the extrapolation of historical data. For each such event, experts judge the probability of occurrence as a function of time and its expected impact, should the event occur, on the future trend.

The gaps identified in the theory is that it focuses on historical data and is based on a baseline scenario, therefore it does not anticipate the probability of various scenarios, limiting attentiveness and readiness to forecast. This has also been the research gap in food security planning because it fails to anticipate wild cards that are not necessarily part of a historical trend of events and thus cannot be anticipated through the use of trend impacts. This limitation is the reason this theory is not relevant to this study and cannot be used in this research, because in food security, past present and current trends have played a significant role and cannot therefore be ignored in development planning.

Cross Impact Method Theory: According to Gordon (1994) this qualitative method and theory was developed by its pioneers Theodore Gordon and Olaf Helmer in 1966, its basic principle was based on perceptions about how future events may interact. The concept was developed into a game created for Kaiser Aluminum and Chemical Company in the 1960s (Gordon, 1994)

Turoff (1971) describes cross impact theory as a modelling tool for analysists and decision makers that allows for the incorporation of policy dependencies in large scale simulations. According to Sedar and Asan (2007). cross impact theory is a tool that reveals a characteristic role of a variable in relation to all other variables within a system that identifies those variables that play a significant role to the development of a system in the future. This is why the cross-impact theory is a contributor towards futuristic research.

This basic theory is based on events occurring by chance predetermined by probabilities and cross impacts, bringing about desired futures by thinking through cross impacts. The method of cross impact is to choose events at

the random order decided and the probabilities of cross impacted events then determined (Gordon, 1994).

The development of the theory was done by Julius Kane in 1972, where he explored a hypothesis that treated all variables as a “percentage of their time value and the cross impacts were used to adjust.” In 1974, Turoff further developed the hypothesis by generating scenarios from a cross-impact matrix by assuming that events with probabilities less than .5 did not occur and those with probabilities equal to or greater than .5 did occur (Turoff, 1972). The theory has seen each academic adding an element of interpretation and developing the theory further. According to Chao (2008) researchers have revised the method to be more applicable (Duperrin & Godet, 1975; Fontela, 1976; Helmer, 1977; Enzer & Alter, 1978; Sarin, 1978; Novak & Lorant, 1978; Wissema & Benes, 1980; Hanson & Ramani, 1988).

This method is an analytical approach focused on analyzing events instead of all contributing factors and driving forces leading to events, leading its interpretation based on probabilities of outcomes; as an analysis of causal links of events. According to Gordon, “Cross-impact studies focus on interactions between pairs of events. Yet, in the real world, the important interactions may involve not only pairs but triplets and higher-order effects. If such interactions were to be included, however, the complexity of judgment collection would grow tremendously” (Gordon,1994).

The gap in the theory has been identified by Gordon (1994): “The cross-impact method forces attention to chains of causality: x affects y; y affects z. If the input to a cross-impact matrix falls outside of acceptable probabilistic bounds, or if the result of a cross impact run is surprising, then the researcher is forced to re-examine his or her view of expected reality. The method shares this attribute with other approaches to simulation modelling” (Gordon, 1994). Further gaps are discussed by Serdar and Asan

(2007) as the theory inability to incorporate the time impact into consideration; which is a very important aspect within the analysis and planning of food security and its management for the future. Although the outcomes of this method can been convincing in development planning, making the theory solid, it is not necessarily suitable to be used for the purpose of this research study as it does not allow for the vigorous engagement and analysis of other aspects that contribute to outcomes with the use of time impact, this theory is also very open ended, it does not have a rigorous and systematic approach to future research methods, which makes outcomes dependent on the analysts and not necessarily on the data presented and researched, making the outcomes of the analysis and futures dependent on the researchers ability to estimate the probabilities of the futures.

2.11.2 Conceptual framework

The theory that is most related to this study is the theory of environmental conflict. Sprinz (1999) highlights the importance of expanding the concept of international security which was originally restricted research into the causes of wars. Sprinz (1999) further argues that environmental thresholds can be conceived of as a sufficient condition for the outbreak of violent conflict.

In this theory, Sprinz (1999) suggests that “environmental problems are normally the result of anthropogenic activities (such as the production and consumption of goods, population growth, etc) that damage the environment; but not every impairment of the environment is associated with severe environmental degradation that may increase the probability of armed conflicts.” The tool of analysis is based on a systematic approach towards the analysis of 1) Anthropogenic driving forces; 2) the exceeding of environmental thresholds; 3) environmentally induced violent conflict; and 4) instruments of environmental policy; conflict management strategies.

This process of evaluation allows for the analysis of all driving forces that contribute towards the environmental threshold which leads in evaluating the security threat towards food insecurity and the warnings that may be seen now for future dangers. This process also allows for the expansion of the driving forces that are directly linked with the contextualization of food security, therefore also expanding the definition of security.

Although this theory contributes significantly to the research, its limitations lie in the analysis of the environment as a condition for the outbreak of violent conflict. This eliminates fundamental elements that contribute towards food insecurity because it limits the security threat to hard power politics instead of expanding to soft power, it also sufficiently contributes towards the analysis of food security as a condition sufficient for the outbreak of conflict, this is why this thesis argues that throughout the research it will be discussed and proven how an anticipated food shortage and insecurity is a possible outcome for a security threat to humanity and to individual states, especially to the developing world that is capacitated with natural resources for survival.

In strengthening the theory and in the analysis of the Anthropogenic driving forces, a structured analysis provided by the methods of Scenario planning as a futures forecasting method will be used as stipulated below, to ensure accuracy and a clear observation of driving forces that in the past been overseen. Ruijte (1999) in *Against the Gods: Using Scenarios to Develop Strategy*; approaches the use of scenarios as a concept to develop strategy, he refers to the strategic process as a rethinking of strategy. He highlights the importance of identifying stakeholders, identifying the uncertainty, developing scenarios and debating the implications of each scenario, identifying and developing options and finally deciding on strategy. The methodology used here is highly reflective of the Wack Test principles developed by Pierre Wack and documented by Peter Schwarts (1996) in the Art of the long view. The importance of this method is based on its ability

to emphasize the use of scenario planning as a tool to develop scenarios into strategy, a development of a strategic response towards the highlighted possible scenarios identified through the process highlighted above. Scenario planning is identified as a summary the Wack Test is the basis of the principles of the basic outline of scenario planning. Scientifically and systematically in all the scenarios and 'stories' told above, emphasis is placed on the key factors such as:

- The identification of the focal issue;
- The identification of key factors in the local environment;
- Driving forces;
- Ranking them by importance and uncertainty;
- The process of deciding on scenario logics;
- The process of fleshing out the scenarios;
- The deciding and rehearsing of the implications presented by the scenarios;
- Selection of leading indicators and sign posts.

This tool of Scenario planning and strategizing has in the past proved to be a vigorous engagement of the facts, environmental scanning, trend analysis and therefore allowing for strategic conversation in development planning and preparing confidently for the possibilities that are presented by the scenarios. These scenarios can be in the context of this research be the analysis of driving forces that contribute towards food insecurity through the theory of Environmental conflict, which is consistently evident in recent events but has also been anticipated in 2050.

2.12 CONCLUSION

The analysis of literature allows for the development of theoretical and conceptual methodology. As discussed by Levy and Ellis (2006) "analyzing is demonstrated by activities such as separating, connecting, comparing, selecting and explaining" they further elaborate the importance of the

demonstration of the extraction of the main points of the literature to undertake analysis. (2006.203).

The chosen literature has demonstrated an alignment with the sentiments stated by Levy and Ellis (2006); by reflecting a methodical review of the historical background and experience of the topic. The selection of the literature has been done to draw a comparative understanding and engagement of previous discussions that have contributed to the development of the area of study. Importantly, the nature of the study is a correlated to various other aspects that are fundamental for analysis, strengthening and the development of the study. This has been systematically synthesized in this chapter and further engagement will be reflected and analysed deeper within the research and through the engagement of the central themes and a clearer focus and perspective of the research objectives.

Demonstrated above is the importance of this research through the engagement of literature. This is important because it allows for an analysis of driving forces that contribute towards threatening food security but also identifies key developments and trends that contribute towards developing food security. Its ultimate goal is to influence policy prioritization and mitigation of risk to food security, and furthermore allows for the vigorous preparation of threat mitigation.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 INTRODUCTION

The previous chapter provided a comparative analysis of the relevant literature and discussions that contribute towards development planning and the importance of analysis of all driving forces that contribute towards the process of analysis and outcomes of planning. This chapter explains the research approach and methodology of the study. The researcher outlines the research design which utilises data collection and data analysis of the identified driving forces and their impact. The researcher explains the importance of ethical considerations and discusses the research limitations and the significance of the study. The hypothesis of the research is tested. The research paradigm is based on both the qualitative and quantitative methods of research, the mixed method approach, which allows for the best exploration and analysis of the area of study.

3.2 APPROACHES TO THE RESEARCH

3.2.1 Mixed methods model

Mixed methods of research have become a common form of research which incorporates both the qualitative and quantitative structures of research. According to Johnson and Onwuegbuzie (2004: 17-18), “Mixed methods research is formally defined as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study. Mixed methods research is an attempt to legitimate the use for multiple approaches in answering research questions, rather than restricting or constraining researchers’ choices.” This is a creative method that allows for

accuracy and creativity in the interpretation of information and data and also leads to a more substantial and objective approach to the research by the researcher.

According to Harwell (2011), mixed methods are a combination of qualitative and quantitative methods in ways that ostensibly bridge their differences in the service of addressing a research question. According to Johnson and Turner (2003), the fundamental principle of mixed methods research is that multiple kinds of data should be collected with different strategies and methods in ways that reflect complementary strengths and expose weaknesses, allowing a mixed method study to provide insights that may not be possible when only qualitative or quantitative data are used. This insight would not be possible if an exclusively unilateral approach to the method of research is used.

Greene and Caracelli (1997) identify three uses of mixed methods study, namely:

1. Testing the agreement of findings obtained from differing measuring instruments;
2. Clarifying and building on the results of one method with another method; and
3. Demonstrating how the results from one method can impact on subsequent methods or inferences drawn from the results.

Harwell (2011) argues that some authors insist that a mixed methods study is any study with both qualitative and quantitative data, whereas other authors suggest that a mixed methods study must have a methods question, both qualitative and quantitative analysis and integrated inferences. Creswell (2003: 21) states that a mixed methods approach is where “pragmatic knowledge claims collection of both quantitative and qualitative data sequentially”.

For the purposes of this study and the interpretation of data, the researcher anticipates examining the interconnectedness of the data sources with scientific findings and driving forces whose impact is also measured scientifically. The researcher will therefore primarily make use of the qualitative method of research. For the interpretation of other scientific elements, the researcher will adopt the quantitative approach to interpret the data. This aligns with the views of Greene and Caracelli (1997) in their identification of the three scenarios above which use mixed methods. This will allow for more realistic interpretation of the data, as explained by Wheeldon (2010), who states that instead of relying on deductive reasoning and general premises to reach specific conclusions or inductive approaches that seek general conclusions based on specific premises, pragmatism allows for a more flexible adductive approach. Johnson and Onwuegbuzie (2004) argues that both methods can be used in approaching a research question and addressing it as is intended in this research paper.

Creswell (2003) identifies procedures which a researcher can use to elaborate on findings, namely sequential procedures; concurrent procedures; and transformative procedures. All these procedures aim to elaborate on a method and approach of research that involves both qualitative and quantitative methods of research in an interlinked manner for the researcher to be able to analyse, interpret and form a detailed testing of theories and integrate informed interpretation of data.

This method allows for the unrestricted analysis of data, which may also include expert views on the field. This is important for this area of research because it assists in identifying and engaging the driving forces that are influential but are not necessarily identified from the literature review alone.

3.2.2 Quantitative research method

According to Creswell (2003), quantitative strategies involve complex experiments with many variables and treatments; this includes structural equation models that incorporate causal paths and the strength of multiple variables. He further highlights two strategies of inquiry, one of which is most relevant to this research, being surveys, including cross-sectional and longitudinal studies using questionnaires and structured interviews. This is the method of data collection used in the identification of the driving forces of food production across the different sectors of sugar cane production in KwaZulu-Natal.

According to Harwell (2011), quantitative research methods are typically interested in prediction and are described as being deductive in nature, because calculations and tests of statistical hypotheses lead to general inferences about the characteristics of a population. This is an important element of the research, as population is one of the primary driving forces of food production and impact analysis.

3.2.3 Qualitative research method

Harwell (2011: 149) describes the qualitative research method as having "… a focus on discovering and understanding the experiences, perspectives and thoughts of participants", which is a reflection of the research through seeking answers using a systematic procedure in answering questions, and collecting and interpreting evidence. Creswell (2003) describes quantitative research as involving complex experiments that include structural equation models that incorporate causal paths and the strength of multiple variables through experiments and surveys.

In this research these will be explored through interviews, literature and the interpretation of data which will provide different perspectives of the

observers of food security using the sugar industry in KwaZulu-Natal as a unit of analysis in the field of development planning. According to Denzin and Lincoln (2005), qualitative research method is a form of social inquiry of things in their natural settings through various representations when attempting to make sense of them in the specific area of study. This is a reflection of complex environments using research methods to examine the opinions and socialization of people on an area of study. Furthermore, Lincoln and Guba (1985) argues that the importance of a research inquiry is that in areas of research there are multiple truths, which may be socially interpreted. Therefore, an interrogation of the research using a structured approach is important for the discovery and exploration of the area of study, especially in an area of study as complex as food security.

Creswell (2003) identifies strategies of inquiry in qualitative research as being Ethnographies; Grounded theory; Case studies; Phenomenological research; and Narrative research.

Crotty (1998) has contributed towards the framework of the inquiry and is the basis of Creswell's work in which he formulates a structure that informs the knowledge claims and strategies for enquiry.

This method is interconnected and linked for analytical outcomes of research. According to Creswell (2003), they are an indication of interrelatedness and flow towards the design of a research. This led to Creswell (2003) conceptualizing Crotty's model and addressing questions central to the research design, namely: What knowledge claims are being made by the researcher, what strategies of inquiry will inform the procedures, and what methods of data collection and analysis will be used?

The area of development planning and food security is broad and can be complex to research, especially in relation to the analysis of driving forces that affect and influence development planning. This research has chosen

to focus on sugar cane production as a unit of analysis of a plant product which is also affected by the complexity and varying modification of various and complex driving forces that are important for development planning. This makes it a common unit with all plants that are produced for consumption and thus relevant for the system of food security. This is evident in the analysis of different driving forces, which Yin (2009: 19) notes as, ‘‘one of the applications of case studies is to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies.’’ This is especially important in development planning, where forecasting methods use various elements to determine the systemic structure of the design of the planning, as well as identification of various elements that contribute both positively and negatively to the expected outcomes of forecasting.

3.3 RESEARCH DESIGN

The research design and choice are important in determining the approach to the research, since in qualitative research methods the strategy of inquiry has a fundamental role in the methods of data collection. This places an important responsibility on the researcher and is reflected through the choice of approach which could bring in the element of a perspective that is beyond the researcher’s expectations, thereby bringing the positive outcome of information that was unexpected based on the elements of the driving forces.

For the purposes of this research, sugar cane is treated as a single case study used for the understanding of its surrounding elements in its contribution towards agricultural development and future planning of food systems. This research aims to analyse the key driving forces that influence the food system by identifying them through external and internal elements of its production and scheduling. Zainal (2007) defines case study method as enabling, *“*… a researcher to closely examine the data within a specific context. In most cases, a case study method selects a small geographical

area or a very limited number of individuals as the subjects of study. Case studies, in their true essence, explore and case study as a research method investigates a contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions and their relationships.''

3.3.1 Case study methodology

Baxter and Jack (2008) defines qualitative case study methodology as a tool for researchers to study complex phenomena within their contexts. This method is intended to be applied in the process of evaluation of this research paper, as a tool to evaluate complex and causal relations within the environment of food production, through the analysis of sugar cane as a crop-produced product. Baxter and Jack (2008) explains qualitative case study as an approach of research that engages a variety of data through a variety of lenses. This approach is most relevant for future studies, as it analyses various complex driving forces, which through their engagement surfaces the importance of consideration of causal links in the creation of development planning policy.

As stated above, for this research a case study has been chosen. This is because of the need to identify driving forces that contribute to food and crop production, thus determining the need for development planning. The study also analyses the context of the research with a focus on development planning and its importance as part of the outcome of the research. It is within the accurate identification of driving forces that the decisions influencing policy development frameworks can be developed and used. This approach was identified by Yin (2003) who explains that a case study should be used to answer the following questions:

1. The focus of the study is to answer “how” and “why” questions;
2. You cannot manipulate the behaviour of those involved in the study;
3. You want to cover contextual conditions because you believe they are relevant to the phenomenon under study;

4. The boundaries are not clear between the phenomenon and the context.

The above is a guideline based on the importance of the analysis and engagement of various elements and lenses. The researcher utilised these by identifying the driving forces using various data collection methods which are explained below.

This case study is primarily based on the explanatory or causal case study; it is an analysis of driving forces and their causal effects on food security in relation to sugar production. Such analysis contributes to the understanding of the complex area of research through identifying the driving forces and the analysis of causal effects through impact analysis. Hancock and Algozzine (2006: 33) describes the causal case study which they state is also known as an exploratory design, as “a design that seeks to establish cause-and-effect relationships”.

The causal case study is further described by Baxter and Jack (2008: 548) as being a type of case study that would be used in seeking to answer a question that explains the presumed causal links in real-life situations. This study aims to explore the current trends in food security in South Africa through the analysis of the driving forces in development planning for food security, thus measuring the different dimensions that contribute to the future of the systems of food security and how that currently influences development planning for the future. Therefore, the identification of driving forces is a contribution to the overarching cause-and-effect relationship and is important in the planning.

The researcher selected the KwaZulu-Natal sugar cane industry as an attempt to bind the case, as explained by Baxter and Jack (2008. 547) who state that “binding the case ensures that the study remains reasonable in scope”. This is important for this type of research, the elements of which can be used with various other crop productions. This is an important

element in the research design, as food security is an extensive area of research. This has thus allowed for the unit analysis of the sugar cane production, in order to identify production driving forces via impact analysis, and thereby enable the development of policy that can be adapted to other areas of crop production.

3.3.2 Interviews

For the purpose of this research, the researcher used in-depth semi-structured interviews, guided by the principles of the research objectives and research questions.

McClure (2002) explains that there are various types of interviews, namely formal, informal, focus groups and semi-structured interviews, all of them being the basic method of fact-finding and investigation.

The researcher used a semi-structured questionnaire to guide the interview process, based on the research objectives. The questions intended to allow the interviewees the opportunity to provide more information that will add value to the outcomes of the process, in accordance with Creswell (2003) who explains that “qualitative researchers tend to use open-ended questions so that participants can express their views”.

In-depth interviews have been particularly chosen as the optimum method of data collection because of the complexity of food security in general and its interconnectedness to various driving forces, particularly in the sugar industry.

The personal and professional perspectives of the interviewees will provide a broad overview of the area of research, while drawing on various other aspects to make connections. According to Zhang and Wildemuth (2009), “Unstructured interviews are most useful when you want to gain an in-depth

understanding of a particular phenomenon within a particular cultural context."

The interviewees are a purposive sample identified because of their knowledge in the field of food security, public policy planning and the sugar industry. Participant interviews have been undertaken with officials who are active participants in the sugar industry and food security sector in South Africa. Participants have also been identified from the South African Sugar Industry and its various stakeholders as well as officials from the Department of International Relations and Co-operation dealing with Environmental issues and Food Security, and officials in the Departments of Agriculture and Environmental Affairs in South Africa. The research included in-depth interviews with non-governmental members of institutions that contribute towards the food production systems such as the South African Sugar Association, Tongaat Hulett, the South African Farmers' Association and DAFRA in the food policy unit (based in the United Kingdom), all of which are part of the food production system and provided an analytical view of food production expectations in the future and the relayed planning developments.

Silverman (2000) observes that, "qualitative research is often concerned with meanings – questionnaires or surveys are commonly designed to establish how people 'see' themselves or others. Qualitative researchers can be interested in behaviour as much as how people see things". It is this perspective that guides the selected approach of using interviews as part of the research design.

3.3.3 Data collection, presentation and analysis

As explained, the data collection method is based on questionnaires as well as interviews, and further data collection is through the interrogation of written texts such as journal articles, books and desktop research. The

objective of the data collection is to identify the driving forces in development planning within sugar cane farming which informs the categorization of the data collected. The data collected is intended to contribute to the identification of recurring themes of the research, thus allowing for an enriched impact analysis of the driving forces of the crop production system for sugar cane.

The anticipated outcome of the research data collection is to use scenario planning as a method of forecasting in development planning for sugar cane farming in KwaZulu-Natal as a tool of examination for the study.

The questionnaire was designed to be distributed to daily participants at different levels in the production cycle of sugar and was designed to respond to the research questions and identify the themes and sub-themes that recurred through the existing literature.

The data was analyzed and interpreted within written text and presented within the research outcomes. Reliability and validity of the research was based on theories and literature premised on credible data that has been interpreted to elaborate on the topic and on the other factors that directly contribute towards the social and security impact of food security and insecurity.

3.3.4 Thematic coding of data

According to Braun and Clarke (2006), thematic coding is a way of "identifying, analysing and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail. However, frequently it goes further than this, and interprets various aspects of the research topic." This form of interpretation of data is important because it assists in identifying the results in an accessible manner. It also allows for the analysis of large data into categories of data interpretation through

themes. Braun and Clarke (2006) further argues that it is a method of analysis and of interpretation of data that is a flexible method that can be used in all areas of research. This has been a fundamental aspect of this research, namely the thematic coding of the data which has contributed fundamentally in the process of scenario development, firstly through the identification of the driving forces, which contribute to the identification of themes in the research, thus allowing for a deep engagement of the causal impact of the driving forces towards data interpretation; and secondly, the development of projections, scenarios and development planning.

According to Saldana (2009), a code in a research inquiry is a word or short phrase that symbolically assigns a capturing or evocative attribute for a portion of language-based or visual data. The data can consist of interview transcripts, participation observation field notes, journal documents, documents and artefacts. Therefore, coding is a thematic analysis of data, and is a major contributing factor in the identification of the driving forces and the labelling of the identified scenarios through impact analysis.

3.4 RELIABILITY AND VALIDITY

The reliability and validity of research is the critical aspect that provides legitimacy for a research paper, where measurement can be made through the analysis against the chosen research design method outlines. This is further highlighted and clarified below through the analysis measures of Twycross and Shields (2004). According to Brink (1993), reliability is measured through its concern with consistency and stability, while validity concerns itself with the accuracy and truthfulness of scientific findings. According to Twycross and Shields (2004), validity means that a tool measures what it sets out to measure. They further highlight measures of the dependability and validity of a study as derived from Knapp (1998), Carter and Porter (2000), and Peat (2002). These are Content validity; Criterion validity; and Construct validity.

Brink (1993) explains the risks involved with validity and reliability as being the researcher; the subjects participating in the project; the situation or social context; and the methods of data collection and analysis.

The independence and objectivity of a research thus plays a pivotal role in the accurate outcome of the research project. The ethical characteristics of honesty and transparency of the researcher and also the subjects participating in the project are of importance. The choice of research design in the collection of data, and the correct and appropriate design tool also play a fundamental role in the validity and reliability of data and data interpretation. For the purpose of this research, the researcher engaged different research sources and interviewed different levels of the food security production system to ensure diverse levels of engagement that promoted accurate analysis of data and interpretation and thereby a more accurate outcome of analysis and themes.

3.5 SIGNIFICANCE OF THE STUDY

The significance of the study is entrenched in its intended contribution to future research studies into food security strategies that aim to benefit the development of policy and the use of futuristic techniques for development planning to realise improved food security. This will contribute to the research and development of the sustainability of food production for human survival and human security. The main advantage lies in the identification of threats and the development of mitigation strategies through an analysis of driving forces that contribute to food production in general and thus can be used by individualized sectors and institutions that contribute to, and participate in, the food production system.

3.6 LIMITATIONS OF THE STUDY

The research paper is premised on the expected findings of future studies that are technical and based on agricultural, trade and climate change

matters as key factors. The main limitation is therefore that the driving forces identified may not be indicating accurately what the outcome will be for food production and security in the future, nor reflect the possible outcomes for accurate development planning. Secondary to this is the potential inability to convert the scenario planning theories into practice, despite the identification of a viable forecast, which is a common limitation in policy implementation. However, this highlights the importance of the researcher analytically and accurately studying all the current and historical driving forces in order to achieve the best possible outcome in visualizing the future and thereby addressing it, based on a multi-disciplinary area of study that is not only scientific and technical but also touches on social issues of security and socio-economic and political science issues, amongst others.

A further limitation is that the researcher is based outside South Africa and thus has limited access to the institutions being researched.

3.7 ETHICAL CONSIDERATIONS

Harwell (2011) states that researchers need to design research in a way that protects participants of a study from harm. Bryman and Bell (2007) explains that the principles and ethical guidelines that they propose should be considered in research. These are:

1. Research participants should not be subjected to any harm;
2. The respect and dignity of participants should be a priority;
3. Full consent should be received from participants prior to the study;
4. The protection of privacy should be prioritised;
5. Anonymity of participants should be ensured;
6. Any deception or exaggeration about the aims and objectives of the research must be avoided;
7. Affiliations and sources of funding need to be declared;
8. All communication should be done with transparency and honesty;

9. Any misleading information, as well as representation of primary data findings in a biased way, must be avoided; and
10. Adequate levels of confidentiality of research data should be ensured.

Bryman and Bell (2011) explains four positions that can be taken on an ethical research issue when conducting social and business research, namely:

- Universalism;
- Situation ethics;
- Ethical transgression is pervasive; and
- Anything goes (more or less).

The above aspects emphasise the importance of ethical considerations in the procedures for approaching complex problems and issues in society. Bryman and Bell (2007), in their guidelines, emphasise the importance of respect for persons and institutions when allowing a researcher to use them as participants in a study, thus making respect, honesty and transparency important elements for the procedure and approach. Transparency is particularly important for full disclosure of the area of study to the participant, thus highlighting the benefits and risks involved with the interaction in order to solicit information for the research outcomes that will be useful and informative to the researcher.

Based on the above guidelines, the researcher is committed to minimize social harm to the participants of the research by being professional, honest and transparent during the research process. The researcher further commits to ensuring that all data is treated with appropriate confidentiality and that participants are protected from undue intrusion or any other harm.

3.8 CONCLUSION

This chapter has elaborated on the different methodologies and approaches used in this study in order to explain the research methods used in this research when seeking to attain the research objectives. The research data that was collected will be analysed and discussed in chapter four.

CHAPTER FOUR
RESEARCH FINDINGS

4.1 INTRODUCTION

This chapter analytically discusses the findings obtained through questionnaires. The participant responses have been transcribed to assist in identifying the driving forces of development planning within sugar cane farming which assists in the categorization of the data collected. This is later reflected through the recurring themes of the research. The questionnaire aimed to identify the driving forces of the crop production system for sugar cane, despite sugar cane being a secondary commodity within households; its planning methods for production are similar to crop production planning systems. The anticipated outcome of the research data collection is to use scenario planning as a method of forecasting in development planning for sugar cane farming in KwaZulu-Natal as a tool of examination for the study.

The questionnaire was designed and distributed to more than 50 participants, and 16 participants responded. Participants were from individuals of institutions such as the South African Cane Growers Association; the Department of Agriculture, Forestry and Fisheries; the KwaZulu-Natal Department of Agriculture; the South African Sugar Association and various units within it, such as International Affairs Relations, Nutrition Management and Natural Resources Management; with further participants from the Department of Environmental Affairs, Tongaat Hulett and various other stakeholders within the scope of the study. These participants and institutions were chosen because they deal directly with the system of sugar cane production. The questionnaire was designed to respond to the research questions and identify the themes and sub-themes that recurred through the existing literature.

4.2 TOOLS FOR DEVELOPMENT PLANNING

The research sample participants are specialists in the field of crop farming as an output and unit of analysis for the broader subject matter, which allows for an analysis of the driving forces that influence food production with an output. The questions were designed to solicit an expert specialized opinion on food production and its future interpretation, through the analysis of the sugar cane industry in KwaZulu-Natal.

Figure 1 below reflects responses from environmentalists, bio-scientists, policy makers and various sugar cane specialists in identifying existing tools for development planning that are used in the sugar cane industry, and this explains the industry's anticipatory level for normality and extremism that affects the output of the farming.

This was done by requesting the existing tools of development planning, where the questionnaire requested the participants to identify and rate the method of planning for food security and crop growth. The questionnaire gave an option relating to four common strategic planning methods that allow for short term planning and can also be used for long term planning, namely the affinity diagram method which is also known as brainstorming, where participants and stakeholders brainstorm a planning strategy based on their recent experience and ideas. The second was interrelatedness methods, which allows stakeholders to look at how elements are related to each other to form best planning. The third is the SWOT method of analysis, which identifies the strengths, weaknesses, opportunities and threats for any industry. The fourth is the process breakdown method using a tree diagram. Participants were given the opportunity to identify other methods related to the industry that were not otherwise mentioned in the questionnaire, none of which were highlighted.

This emphasises the importance of strategy in planning because, as elaborated by Scharmer and Kaufer (2013), strategic planning and identification of driving forces assists in the preparation of responses to current waves of change. However, all the methods listed above examine current influences and thus reactive responses to development planning, as opposed to the emerging future, through forecasting and thus long term planning and analysis.

Participants in the study of development planning for food security and sugar cane indicated that they did not subscribe to a specific planning tool. Instead a tool is chosen based on its particular relevance to resolve an issue at hand and depending on appropriateness and viability. This indicates that development planning is based on risks that have arisen and not as a risk mitigating plan.

Figure 1: Tools for development planning

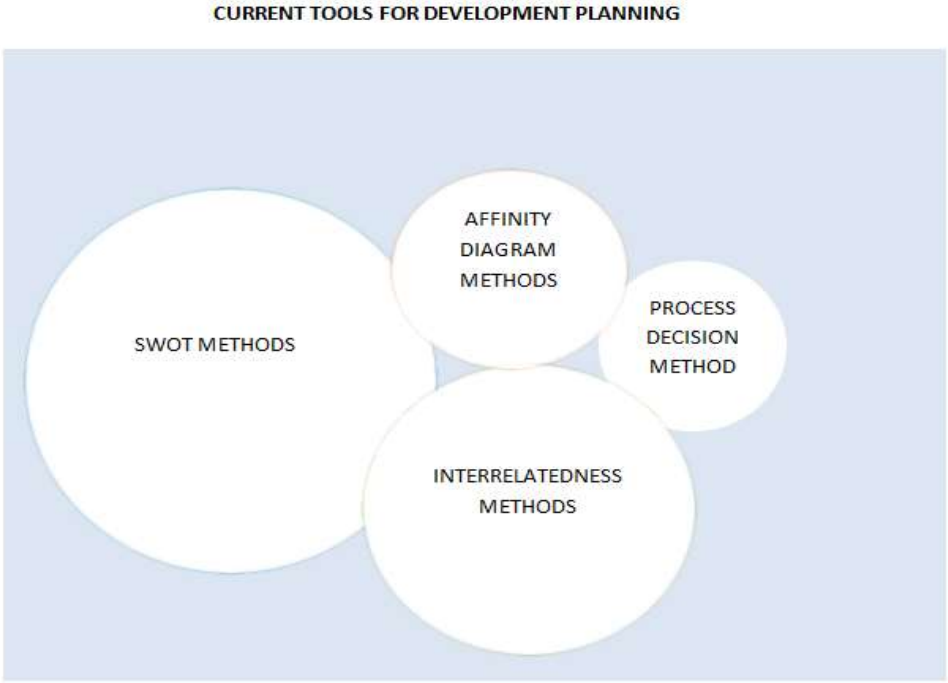


Figure 1: CURRENTLY USED TOOLS FOR DEVELOPMENT PLANNING

4.3 DRIVING FORCES

The second question is an indication of the identification of driving forces of crop and food security. A list of options was given to the participants with an option of the participants mentioning other driving forces. The options given were population and demographic changes, agriculture, global economy, environmental and climate change, globalization, resource implications, and other. These were selected to guide the questionnaire but have also been a recurring theme within the research. Kleiner (1989) explains the importance of driving forces by emphasizing that driving forces in scenario planning provide insight in the understanding of the forces that compel the outcome of the future. This is an important aspect in development planning as it assists in the analysis of perspectives that support the outcome of production.

The findings from the participants supported the premise that the population and demographic changes had played a significant role in crop and food security. This influences the themes of crop growth, which is strongly rooted in a supply and demand relationship, and which thus has economic influences on the outcomes that affect the global economy and globalization. This in turn has shown that the driving forces are interrelated. According to Schwartz (1991), “without driving forces, there is no way to begin thinking through a scenario, they are the device that assists you to see which factors are significant or not” (Schwartz, 1991: 107).

A recurring aspect in the responses related to land ownership. The regulators of food security in the area of sugar cane production are traditionally the land owners. The emergence of new owners is highly regulated by government, and favours previously disadvantaged citizens but is not affordable for easy access. Agriculture also plays a fundamental role as a driving force. It has resource implications and is highly influenced by environmental and climate changes, the spillover effects of which impact on the outcomes of crop and food security.

Figure 2: Identification & Analysis of Driving Forces

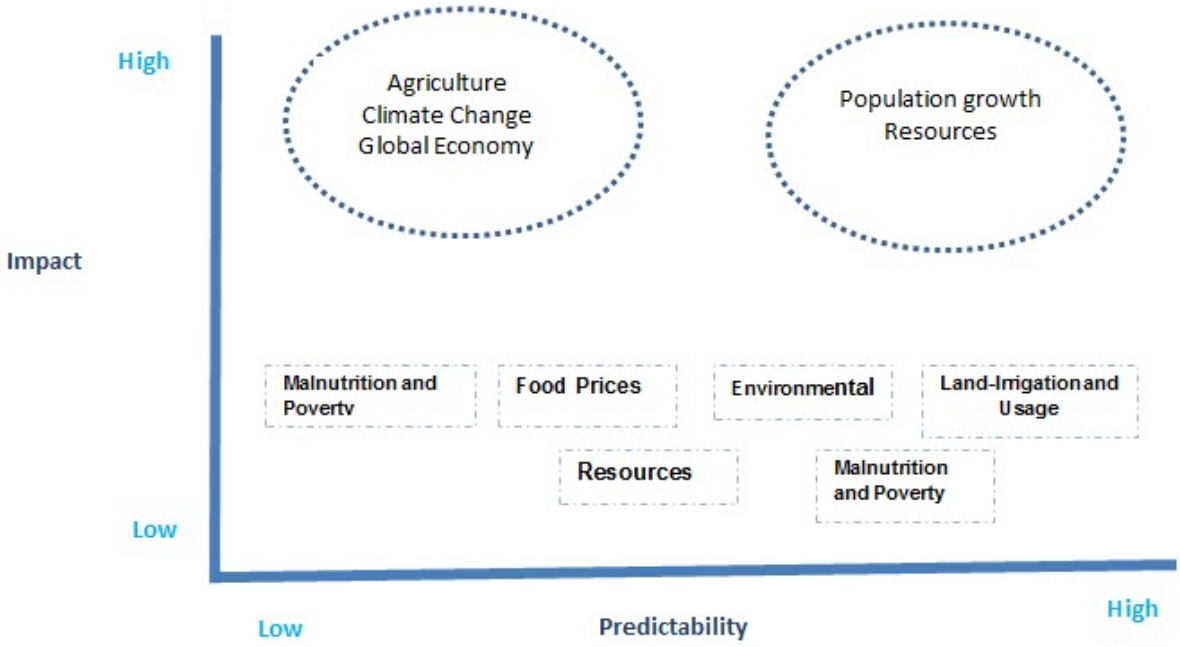


Figure 2: Identification and Analysis of Driving Forces based on participant responses

The study emphasises important aspects of crop growth, especially in sugar cane, and notes that new methods of planning have not yet been introduced, but that the old methods have been managed. This does not equip farmers and specialists but has instead managed the crisis instead of resisting it. This aligns with the futurists that have identified a potential food crisis in 2050. The view of the researcher is that policy and strategic intervention has been focused on profitability and economic principles rather than human survival and risk resistance.

Research findings indicate that forces of crop and food security are interrelated and manifest at different scales − locally, regionally and globally. Figure 2 above is a reflection of the level of impact and the level of predictability of each identified driving force, which contributes to the overall analysis of the study and its outcomes.

Table 1: Impact analysis of driving forces

CALCULATION IMPACT ON DRIVING FORCES FOR DEVELOPMENT PLANNING

	Population growth	Agriculture	Global Economy	Climate Change	Globalization	Resources
Food Prices	1	0.8	1	1	0.5	0.6
Environmental	1	1	0.5	1	0.5	1
Land-Irrigation and Usage	1	1	0.5	1	0.2	0.1
Malnutrition and Poverty	1	1	0.6	1	0.4	0.3
Resource scarcity	1	1	0.8	1	0.7	0.5
Total impact	5	4.8	2.95	5	2.3	2.5

Table 1: Impact analysis of driving forces

The above Calculation Impact Method has been extracted from the Myanmar scenario developed at the Delft University of Technology which suggests that “if a driving force does not influence a trend the cell is empty. If a driving force influences a trend, a weight factor from 0 to 1 is put in the cell, with 1 having the highest impact and 0 no impact at all. The weight factor in each cell is compared to the weight factor given to the influence of other driving forces and on other trends. The sum of all the impact factors of a certain driving force gives the total impact” (Deiana, Meijer & Kim, 2017). For the purposes of this research, the driving forces were listed and analysed against their ability to influence a trend, with the measurement from 0,00 to 1,00. Each cell was compared to the influence of driving forces in order to extract the level of impact for analysis in the study. This is important for the overall analysis of the impact of the identified driving forces. This is derived from interaction with the participants and also extracted from the analysis of the questionnaires.

The information reviewed above reflects that the highest impacting driving forces are Population Growth, Climate Change and Agriculture. This analysis is in agreement with various scholars such McMichael, Powles,

Butler and Uauy (2007) who observe that the “world’s agricultural sector, especially livestock production, accounts for about a fifth of total greenhouse-gas emissions, thus contributing to climate change and its effects on health, including on regional food yields. Policy responses to the connections between food production, energy, climate and health should include countering the world’s rapidly increasing consumption of meat, which poses health risks by exacerbating climate change and by direct contribution to the causation of certain diseases.”

It is important to note that although the outcomes of this study are limited to sugar cane farming, this is relative to the study because the driving forces are the same, making the common denominators similar for planning purposes and relative in the recommendations and outcomes. This is supported by Murtaugh and Schlax (2009) who argue for a direct link to population growth as a key component in climate change, which has been significant for the environment.

The study furthermore reveals that the three main driving forces, in relation to the other identified driving forces, have spillover interactive outcomes that may not be intended but have detrimental effects on the common good of society and thus form a considerably important part of the identification of driving forces, the blind spots and most importantly, affect the process of planning for the future.

4.4 LEADING INDICATORS OF FOOD INSECURITY AND CROP PRODUCTION

The third engagement through the questionnaire was an aim to access the secondary questions and identify the main threats to development planning for sugar cane crop production and food security. The identified indicators listed for the participants as indicators were food prices, climate change, land irrigation and usage; malnutrition and poverty statistics and resource scarcity. The participants were given an opportunity to suggest other

indicators that were not identified but which they considered relevant on the basis of their experience and expertise.

Participants' responses are provided below. These were influenced by the participants' end of the production system; for example, the farmers were highly affected by the output of profitability of crop production, which influenced their ability to decide on the type of crop production. However, it is also evident that the indicators were all interrelated, as land irrigation and usage also determined the production planning for the basic farmers.

Environmentalists and climate change experts, coupled with strategic planners, were more concerned with current indicators such as the environment, climate change and land and soil degradation. Agriculturalists in KwaZulu-Natal noted the influence of the political environment as an additional leading indicator. Sugar cane specialists suggested that imports and exports have influence as a blind spot to indicators. The most common indicators raised by participants included economic instability, poor government planning, and more recently the effects of the drought that has impacted on all farmers and producers of crops and is a significant threat to production.

4.5 CHALLENGES FOR CROP PRODUCTION

Section four of the questionnaire aimed to identify the problems with development planning for crop production and food security in South Africa. To achieve this, various statements were made relating to the research and based on the knowledge of the participants they were requested to agree, disagree or omit a response. Participants were also requested to support their responses with evidence. The findings revealed that a food crisis based on their identified driving forces was imminent in the near future. Participants also agreed that a food crisis is a threat to humanity. There was a split indication on the current farming methods being sufficient in preparation for a food crisis. This suggests that, despite the lack of forecast

in the planning methods, participants were of the opinion that the current farming methods used were sufficient to assist in mitigating a food crisis.

The participants were further engaged as to whether farmers were prepared for a food crisis; the majority of 72% agreed that farmers were unprepared for a food crisis while the remaining 28% of participants disagreed with the statement. These findings were in agreement with the statement by the President of AgriSA, Mr Johannes Moller, who stated that “the current drought in South Africa is of such magnitude that it was beyond any farmer’s planning ability regardless of their resource base’’ (AgriSA, 2016). This could also be due to the fact that the current planning methods are limited in forecast, and thus unable to assist in mitigating unexpected and unpredictable circumstances that are not necessarily easy to anticipate with existing analytical tools but would be identifiable when analysed with scenario planning because the continuous and vigorous analysis of a blind spot is used through the constant analysis of wild cards.

All participants agreed that climate change had a fundamental role to play in a food crisis, with 80% of participants agreeing that population growth also plays a fundamental contributory role in the risks that contribute to a potential food crisis in 2050.

The participants were split between 39% who disagreed and 61% who agreed when asked whether the planning tools used would be able to mitigate the risks of a food crisis should one arise. All participants agreed that the current drought conditions that were evident in parts of South Africa detrimentally affected crop production and farming methods and was thus evidence that risks were not sufficiently mitigated despite the use of planning tools.

4.6 FORCE FIELD ANALYSIS

Participants were requested to identify underlying factors that supported or hindered reform and development outcomes in the field of sugar cane farming over the past five years. Below is an indication of the positive forces and negative forces that have supported or hindered reform in development planning.

Kurt Lewin (1951) developed the Force Field Analysis tool as a tool to analyse opposing forces which try to bring about changes. In this study the tool of analysis is used to elaborate on the responses of the participants' observations, as depicted below in Figure 5, with the centre column being the ideal outcome for sugar cane planning methods. These factors have been grouped and will be discussed further in their groupings. Within the positive forces, the participants mentioned Government and Policy, Farmer Organisations, Research and Development, and Economic Factors.

Figure 3: Force Field analysis

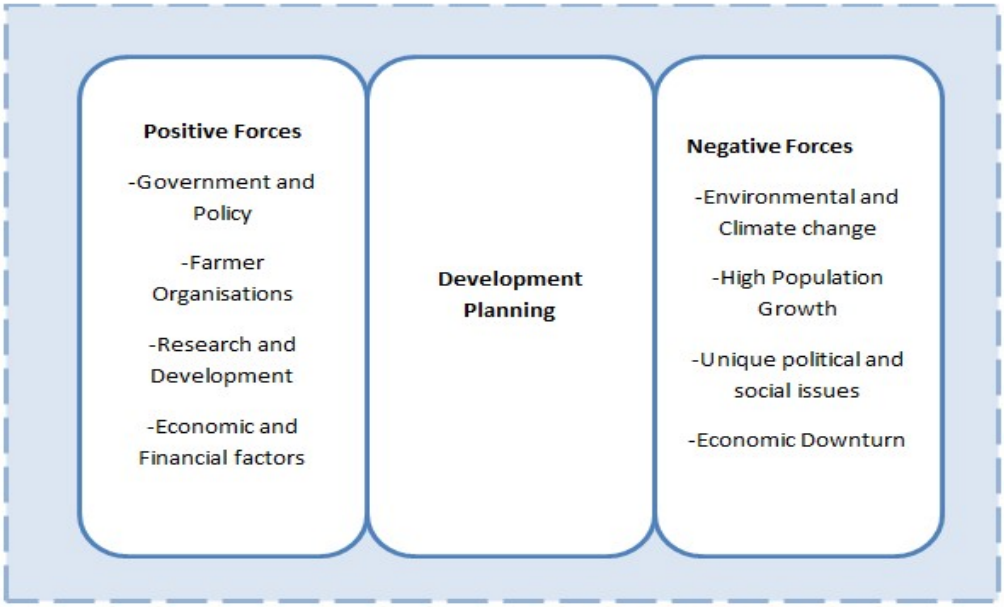


Figure 3: Force Field Analysis – This is based on the participant responses on the influences of change in development planning

Government and Policy:

Participants explained that gradual policy changes have supported reform in the field of agricultural farming in sugar cane in KwaZulu-Natal. Policy implementations such as the Land Reform and the Black Economic Empowerment policies have explored levelling the engagement of sugar cane farming.

Farmer Organisations:

The evolution and involvement of farmer organisations has been more cross-sectoral co-operation and farmers being engaged and involved in the development of sugar cane farming, and thus the planning for the production in the field.

Research and Development:

Various stakeholders and organisations such as the South African Sugar Association (SASA), South African Cane Growers Association (SACGA), Sugar Cane Research Institute (SASRI), and Tongaat Hulett have invested time and resources in supporting the research and development of the sugar industry and its farmers. This is a positive aspect of supporting sugar cane development in KwaZulu-Natal.

Economic Factors:

Participants noted that investment in regional markets provides support and engagement of the economy even by emerging farmers. There has also been extensive funding and support for the sugar cane industry which has seen a need for its development and evolution.

The factors were further grouped and the negative factors highlighted as Environmental and climate change, High population growth, Unique political and social issues, and Economic downturn.

Environmental and Climate Change:

The most consistent and common concern raised by participants was the shifts in the environment as a result of climate change. Participants raised concerns about the detrimental effects that climate change has had on their planning and output with unpredictability being a common thematic concern for all participants.

High Population Growth:

Although perhaps not a direct impact of sugar cane farming, global population growth has affected the overall production and output of sugar cane production and planning. It is important to mention that this is also a recurring to theme.

Unique political and social issues:

Participants highlighted concerns regarding corruption and the lack of strategy in the identification of recipients for funding. This is due to political interference, and a problematic approach to the restitution of land to dispossessed communities due the political history of South Africa. Other factors that were raised as social issues were the shortage of skilled labour and the ageing of a skilled population, largely due to a lack of interest in the development of young farmers or agriculturalists.

Economic downturn:

Participants highlighted the detrimental effects of economic downturns and instability. This is a recurring theme in the research and is mentioned in various contexts such as imports displacing local products, high unemployment rate, the effects of other economic conditions such as the United Kingdom's internal politics and its effects on the South African economy, and the overall impacts on production costs.

The points above are an elaboration of the causes related to resistance to optimal achievement of development planning and forecasting within the sugar cane industry.

4.7 WILD CARDS

As part of forecasting the participants, as specialists in their fields, were requested to identify a wild card. For the purposes of this research, it is important to mention that the researcher is in agreement with futurists such as Dawar (2003) who suggests the use of wild cards as a risk-averse strategic planning mechanism. Petersen (1999) and Rockfellow (1994) argue that a wild card is one single event; Hiltunen (2006), on the other hand, argues that wild cards are commonly gradual changes, whose outcomes usually cause an impact or event that changes the course of history. In development planning and preparation, it is thus important to obtain different perspectives on the different wild cards to be anticipated. Once identified, it is important to isolate the most important or influential wild card for anticipation and preparation.

The participants were thus engaged in identifying the wild card that food development planners in the food production system, and particularly in the sugar cane industry, should anticipate when planning for flexible and resilient risk mitigation in preparation for the future. Wild cards are defined by the BIPE Counsel as being a “future development or event with a relatively low probability of occurrence but a likely high impact on the conduct of business” (BIPE, 1992: v). In this instance, it is a future development of an event or development that could be caused by one of the driving forces or is independent of the driving forces, but could change the whole outcome of the projected futures, development planning or the outcome of the anticipated scenarios.

Participants raised various concerns in regard to wild cards; the 62.5% in agreement expressed that the current unpredictability of climate change

played a critical role in pin development planning in the farming industry in general, and the sugar cane industry in particular. Political stability is a concern that was raised by 12.5% of the participants who noted that a change in government often affected policy decisions, which mean priority areas where highly affected. Thus a wild card to be anticipated should be the effects of political instability, should it occur. Environmental issues, such as water sustainability, soil erosion and new diseases and pests, were mentioned as a possible wild card by 18.75% of the participants. Robotics and Data Farming was named as a wild card because of its ability to lead to improved production efficiency, thus lowering agricultural employment as agricultural equipment is becoming increasingly technological. This could in turn have spillover effects on the employment rate, skills development and rural development.

Climate Change as a trend is a major wild card that has been raised as a concerning trend by all participants. This is due to its unpredictability, and it is thus heightened as a high risk that has the potential to surface a low probability occurrence that could have a high impact on development planning for sugar cane farming in KwaZulu-Natal and potentially the entire food production system.

It is important to mention that wild card scenarios should not be used to guess probable futures but are an important tool for planning and identifying the probability of possible surprises that may occur and limit the implementation or the productivity of a development plan (Mehrabanfar, 2014).

Figure 4: Wild Cards

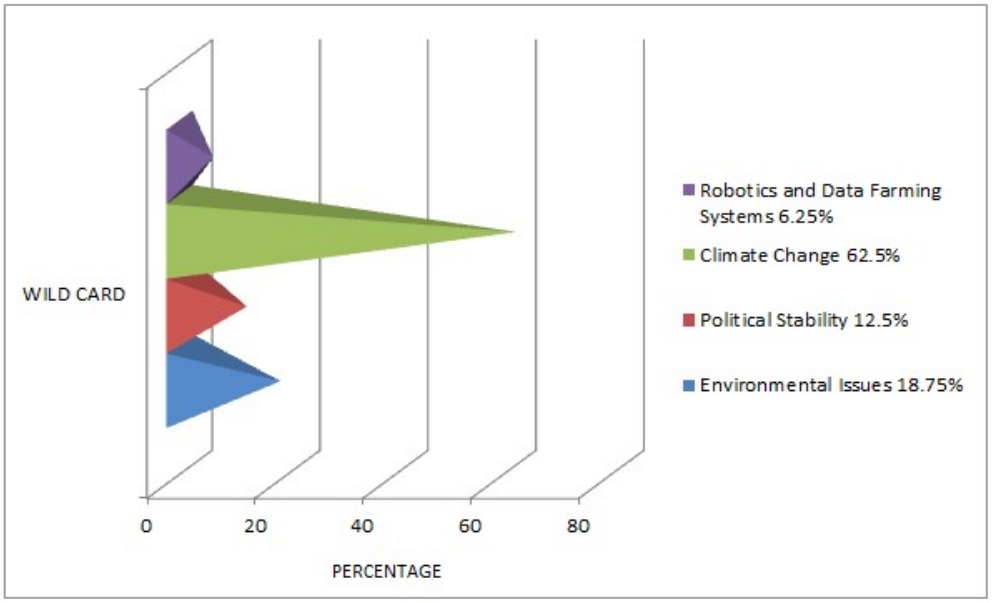


Figure 4: Diagram reflecting the wild cards based on responses of the participants

4.8 CONCLUSION

Schmidhuber and Tubiello (2007) state that the effects of climate change have a direct impact on food security and is projected to play a contributing role to food insecurity in the future. Driving forces such as climate change, when analysed and accessed, reflect a linkage with other problematic factors that limit planning. This influences the values of the society and the food production system industry, and thus directs policy and planning. Scenario Planning is a fundamental systematic structure to evaluate and develop a strategic approach to improve food production and food distribution within the broader context. Using the tool of analysis in a unit of analysis such as the field of sugar cane farming, allows studies to evaluate the possibility of a restructure and/or redesign in approach that will develop and enhance the ability of farming systems to manage productively in the midst of adverse circumstances that may result from different factors.

Gregory; Ingram and Brklacich (2005) state that “due to multiple socio-economic and bio-physical factors affecting food systems and hence food security, the capacity to adapt food systems to reduce their vulnerability to climate change is not uniform.” This is why it is important to study driving forces that are dominant and structure the response of systems to achieve this and to identify coping mechanisms for food systems to adapt to the rapidly changing systems. To achieve this for the sugar cane industry in KwaZulu-Natal, the above research system, using current planning and development tools, has enabled this research to identify and analyse driving forces, and assess their impact on the study sample. This has identified leading indicators of food security and crop production within the sugar cane industry, revealing the challenges of development planning and the factors that specialists in the field have named as areas that could cause a detrimental impact if not identified and mitigated.

The unit study of sugar cane reveals the complexities and definitive values of food production. The research findings have contributed to the assessment of various aspects of sugar cane farming and the identification and centralization of driving forces. Sprint’s (1999) theory of Environmental Conflict argues that environmental problems are a result of anthropogenic activities. This suggests that human activities, population growth, and agricultural techniques have contributed to additional stress on the environment, which is already compromised by climate change issues.

The exacerbation of climate change and the deterioration of environmental thresholds and agricultural outcomes is a serious concern that should be engaged and prepared for, to empower all stakeholders within sugar cane production and further strengthen resistance.

CHAPTER FIVE
INTERPRETATION AND ANALYSIS

5.1 INTRODUCTION

This chapter comprises the presentation, analysis and interpretation of the research findings. It elaborates on the patterns and observations that were made through the process of data collection in accordance with the research aims, through theoretical engagement and analysis of the findings.

5.2 THE PROCESS OF ENQUIRY

The process of qualitative research is described by authors such as Denzin and Lincoln (2005) as a process of social enquiry of things in their natural settings. It is a reflection of the complex environment, through vigorous analysis and examination within an area of study. Creswell (2003) describes the process of research as a process of making claims and then refining or abandoning some of those claims. This chapter will focus on using the core questions by Creswell (2003) which were conceptualized by Crotty's model of enquiry, to address the system of the research design and allow for the interpretation and analysis of the study. The following questions need to be addressed in the process:

1. What knowledge claims are being made by the researcher?
2. What strategies of inquiry will inform the procedures?
3. What methods of data collection and analysis will be used?

This research knowledge aimed to assess the challenges of development planning within the field of sugar cane farming in KwaZulu-Natal and to contribute to the research and development of crop farming for secure methods of sustainable food security production planning for preparedness and risk mitigation. The researcher posits that the lack of elongated

foresight through the study of the current driving force is limiting the vision and security of food production and thus limiting the opportunity to lead the food production system.

The advantage of this prerogative is based on, and in agreement with, the principle of the resource capture, which is defined by Percival and Homer-Dixon (1998) as being, “the state when increased consumption of a resource combines with its degradation: powerful groups within society – anticipating future shortages − shift resource distribution in this favour, subjecting the remaining population to scarcity.’’ The lack of forecasted planning, to envision the future using an analysis of the current driving force, eliminates this competitive advantage of being able to lead, determine and drive production from the front in times of crisis. This resource capture is an element of the theory of environmental conflict, an extension of the measure of resource protection and of the use of soft power tools to remain in the forefront of research, development and planning which has been identified through the research findings as a limitation to the development of unexpected risk in the food security of South Africa. This has been determined through the analysis of the driving forces in sugar cane production.

The method of inquiry committed to strengthen the process of investigation and to assess the current planning methods and leading trends in production, in seeking to support the research objective through the conceptual structure that outlined the importance of monitoring, measuring and evaluating the findings against the theory of ‘environmental conflict’. This systematic approach challenges the researcher to analyse the findings against the guidelines stipulated by Sprinz (1999), which are:

1) Anthropogenic driving forces;
2) The exceeding of environmental thresholds;
3) Environmentally induced violent conflict;

4) Instrument of environmental policy; conflict management strategies.

The use of sugar cane farming as a unit of analysis was due to its nature of being crop farmed in production and also its diversity in farmers and accessibility. Its farming methods make sugar cane similar to other crops, yet one of the most resistant because of its nature as a plant. This qualitative aspect of the approach to data collection contributed to gaining knowledge, and the systematic procedure allowed the researcher to collect the relevant information with a questionnaire and through literature engagement. This has led to the interpretation of the data, while the diversification of the participants allowed the findings to be enriched and thus more strategic.

This research used a mixed methods approach based on a qualitative and quantitative methods approach, described by Johnson and Onwuegbuzie (2004) as “the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods and approaches”. This was necessary and important in the sugar cane industry, where the measure of success is productivity at socio-economic and also economic and production levels, thus enriching the quality and method analysis of the study.

As part of the research design, this research followed a grounded theory approach, engaging the topic in accordance with the research objectives, through the collection of data by use of questionnaires, desktop research through journals, books and other sources. This was undertaken as an integral process of identifying, comparing and analyzing patterns and themes.

5.3 THEMES AND TRENDS

The process outlined above allowed for the identification of driving forces and their measurement of the impact analysis. This methodology is the key aspect of the research to analyze the driving forces and their impact on possible scenarios of the future, but also as tools that have the ability to influence trends. As stated in chapter 4 within the research findings, the highest impacting driving forces in the field of sugar cane farming are population growth, climate change and agriculture, while the global economy and economic relations are also important driving forces.

This finding is in agreement with Cribb (2010) who notes that driving forces such as climate change play a fundamental role in threatening food production and farming due to the extreme weather changes, such as droughts and floods. Furthermore, authors as Osberghaus (2013) state that "Climate change is one of the most pressing challenges in current environmental policy". Additionally, the National Research Council of the National Academies (2012), as well as Bast (2010) and Cribb (2010) concur on scientific and environmental evidence that climate change is the result of human activities. This is in agreement with the conceptual framework; when engaging the theory of environmental conflict, the first measure of the theory is 'anthropogenic driving forces' (Sprinz, 1999). Systematically throughout the research, climate change has emerged as the most unpredictable and impactful driving force in the challenges faced by all stakeholders in the field of sugar cane farming, and it has consistently emerged as a limitation, a risk and its unpredictability a blind spot to planning.

Cribb (2010) further notes economic changes and environmental and agriculture as factors, arguing that land and water scarcity detrimentally affects the environment and agricultural productivity. Cribb (2010) notes that in relation to economic factors, the cost of food production has a direct impact on the maintenance and production, thus discouraging production. Lastly, in agreement with Cribb's analysis and also the FAO (2009),

population growth is one of the highest driving forces found in the research findings through the impact analysis, urbanization and the demand for crop production, which directly affect agricultural engagement. Equally important to mention is the extent of the causal links to anthropogenic effects, population growth, agricultural challenges and their influence on economic instability, which are all as a result of human activity and have a direct link with human activity. Sprintz (1999: 6) states that, 'Environmental problems are usually the result of anthropogenic activities, such as the production and consumption of goods, population growth and other activities that damage the environment." Furthermore, Mazo (2010: 19) states that "earth scientists and climatologists agree that human activity is a significant contributing factor in changing global temperatures." This further affirms the second analysis of the conceptual framework theory of environmental conflict that these identified threats to planning which have surfaced as driving forces ultimately, if not mitigated through forecast and planning, pose a threat not only to crop farming, the output of production, but also threaten human security. The Intergovernmental Panel on Climate Change in its fifth assessment report states that "human security will be progressively threatened as the climate changes" (2014).

The identified driving forces are a serious threat and are detrimental to the future of the environment, agriculture and food production. They continue to contribute towards the dilapidation, threats and effects in relation to the social and economic environment as identified through the outcomes of the research findings. It is evident that if the continued lack of analysis and deep engagement of the driving forces of the food production system continues, their impact and trend analysis present a danger to the production outcomes. Furthermore, in times of crisis the developing countries will be left at a grave disadvantage in a state of 'resource capture' which will further expose the 'growing population' to environmentally reduced violent conflict, which will lead to preventable development of conflict management strategies. The research analysis thus highlights an urgent need for the use

of forecast methodology to assess and analytically engage fundamental elements that are driving food production. Also of importance is the development of environmental policy that emphasizes the threats that expose the dangers of environmental conflict and thus ultimately threaten human survival, its security and sustainability.

It is important to mention that although these driving forces have been identified within the research outcome in assessment of the research objectives, they are identified in the context of sugar cane farming; however, they are relative to other forms of crop production, which is important for the overall study of food security in relation to primary and secondary crops. This is necessary for the development of planning methods, systems and strategies as they can be used within all crop production with the aim of food production outcomes.

5.4 LEADING INDICATORS OF FOOD PRODUCTION THREATS

The researcher through the use of the questionnaire assessed the threats of development planning within the sugar cane industry. The research identified food prices, climate change, land irrigation and usage, malnutrition and poverty statistics and resource scarcity. However, as seen in the research findings, the environmentalists and climate change experts were more concerned with the environment, climate change, land and soil degradation. KwaZulu-Natal agriculturalists and sugar cane farmers indicated that import and export relations, poor government planning and the recent El Niño drought played a detrimental role as a threat.

This is in line with forecasters such as Cribb (2010) regarding the forecasted and anticipated 2050 food crisis. Other authors such as Roberts (2008) and the FAO (2009) highlight international trade and the supply of stable imports as an important factor in the stability of food production, meaning the unpredictability of international trade is a subtle threat to agricultural systematic production. Furthermore, they state that the combination of

rising temperatures and shifting weather patterns will ultimately detrimentally affect the output of food production, which is in agreement with the research findings that have highlighted that these elements mentioned have already begun to affect the output of sugar cane production. In accordance with the Malthusian theory it is important to mention that his identification of population growth as a threat is a factor that has been raised systematically through the research and also in the research findings. However, the sugar cane industry has not reached a level where the crop production supply is threatened by population growth. Population growth is an important trend in food production systems and is also important in the analysis and evaluation of the current state for future planning. As highlighted by Mills and Bishop (2000) it is important to evaluate results and assess the current state of an area of study in order to develop a plan and identification of major trends and thus potential outcomes. As explained in the theoretical framework, the Malthusian theory, although supporting fundamental aspects of the research, is unable to provide a diversified analysis of the complexities of sugar cane production and in a broader analysis, which is what the research objectives aim to contribute to, crop production in light of food security for all types of crop production. As mentioned by Arizpe (1994: 5), “Curbing wasteful consumption in the economically advanced societies may be as important for a successful human future as curbing birth rates and population growth in less developed societies”. Therefore, all the stated driving forces and threats to production are important and their impacts detrimental.

5.5 CHALLENGES OF CROP PRODUCTION

The research findings through engagement of the participants, revealed that with all the driving forces that have been identified, namely Climate Change, Agriculture, Population Growth and the Global Economy, and their elements which affect other sub-forces, it was revealed that a food crisis is imminent in the near future, and that the current planning methods are not developed enough to resist a food crisis from occurring. The United Nations in 2008

observed that the world was unprepared for a food crisis in 2008, and the recent El Niño drought in KwaZulu-Natal revealed the lack of preparedness of the farming industry for a sudden extreme change of weather and dynamics that include threats to their crop production and are poorly prepared to withstand a food crisis. This was further supported by the farmers who were interviewed and also the institutions that directly support farmers of sugar cane in KwaZulu-Natal. Furthermore, the findings revealed that the farming methods needed to develop dynamics of resistance, as defined by the Africa Agriculture Status Report (2017) and it is important to learn from the past, evaluate and learn for the future. The objective of this research is thus, in part, to propose a systematic method of future research to do so.

The findings further highlighted that the positive involvement of government, farmer organisations, research and development through various institutions such as the sugar producing companies, would positively contribute to the development of a systematic tool of planning that will strengthen resistance to severe shocks and stresses to the industry. This accords with literature as stated by the University of Stellenbosch through the food security initiative which highlighted five key areas as stipulated by the Department of Agriculture in the food security strategy for South Africa, namely, 'inadequate safety net; weak support networks and disaster management systems; inadequate and unstable household food production; lack of purchasing power and poor nutritional status' (University of Stellenbosch Food Security Initiative, 2010). These highlighted aspects need a network of institutions to address them as their spillover effects affect various aspects of development planning.

Lewin (1951) developed the Force Field Analysis tool as a Tool to analyse opposing forces that limit and resist change. For the purposes of this study, the outcomes of the use of the force field analysis revealed the factors that have contributed to the resistance. Kaufer (2013) identifies these as the big

divide and observes that, “the structures used are designed to operate through delayed or broken feedback loops, that prevent decision-makers from experiencing and feeling the impact of their decisions” (Kaufer, 2013: 7). This is in agreement with the findings of the research which has revealed that for instance, Government and Policy has had an impact on the conditions of sugar cane farming in KwaZulu-Natal. However, the process has been slow and incomplete. This process has also met with resistance and has its own challenges in the implementation of reforms in the farming of sugar cane. Another important structure is Research and Development which has seen various stakeholders and organisations such as SASA, SACGA, SASRI and Tongaat Hulett investing time and resources in the development of the sugar industry and its farmers. However, access to this support is only received if one is associated with farmer associations that have built relations with these institutions. This is disadvantageous to independent and emerging farmers.

The findings identified the political and social issues as contributing to the challenges and resistance, while a recurring theme is the economic downturn and its effect on the individual farmer, the province and the country, especially in the output of production which has sometimes caused farmers to stop farming sugar cane and venture into more profitable crops such as macadamia nuts.

Development and policy planners need to be constantly mindful of these challenges because they are a consistent threat and a challenge to development planning in forecast methods, the outcomes and after-effects of these problems may change the course of the system of production if forecasted.

5.6 WILD CARDS IN THE RESEARCH

According to Peterson (1999), in a process of strategic planning one can ask three questions with respect to wild cards. Peterson (1999) argues that when an organisation can answer the three questions below, it may be able to avert materialising or create tools to mitigate the risks from detrimentally affecting the organization:

- Which are the most important wild cards for an organisation?
- Can we anticipate their arrival?
- Is there anything we can do about them?

In accordance with the above strategy, the researcher questioned the specialists in the field of sugar cane farming in KwaZulu-Natal through the questionnaire. Participants highlighted the wild cards and their percentages as a cause for concern:

- Climate change − 62.5%
- Political environment – 12.5%
- Environmental Issues – 18.75
- Robotics and Data Farming systems − 6.25%.

The unpredictability of Climate Change played a critical role with difficulty in planning and was the most significant wild card, as it was the most unpredictable when compared to the others raised. It is also important to mention that the wild cards identified above are all related to climate change issues, although the political environment on a multilateral sphere has begun conversations on climate change issues, which have left governments in disagreement in this regard. Environment issues are directly related to Climate Change issues and Robotics and Data Farming systems have been created because of the growing challenge of climate change and its evolving nature. The identification of the most important wild card for the sugar cane industry and perhaps the food production system of KwaZulu-Natal and South Africa in general would be Climate Change issues

in this regard, based on the outcome of this research. The anticipation of an acute climate change that could affect the environment should therefore be expected. The Weak Signal Methodology thus plays a fundamental role in assisting in this identification and mitigation. Mendoca; Cunha, Kaivo-oja and Ruff (2004: 9) define the Weak Signal Analysis as “information on the likelihood of events whose probability is estimated to be very low, but to which is attached a high uncertainty concerning the impact of those events and the trends that can develop afterwards”.

The Weak Signal Methodology by Mendoca, Cunha, Kaivo-oja and Ruff (2004) is outlined below:

1. Surprise Metrics:
    i. As unimaginable surprises;
    ii. Imaginable surprises that are improbable (like a global nuclear war);
    iii. Imaginable surprises that are probable (like an oil price shock and an invasion of environmental refugees); and
    iv. Certain surprises (like earthquakes).

2. Observation of Wild Cards:
    i) Categorization of wild cards into sub-themes:
    ii) PESTE framework analysis:
        - Political Military factors
        - Economic factors
        - Social factors
        - Technological factors
        - Environmental factors.

3. Classification of the nature and impact of the Wild Card.

The above analysis allows for any organisation to determine the wild card, to analyse and to assess the level of impact a wild card could have, for

example, in the sugar cane industry, Climate Change and its effects has the potential of being both an unimaginable surprise and an imaginable surprise that is improbable. As already discussed in the research, the potential of the outcome of analysis of the trends of food production threatens human security. These outcomes therefore create both the potential of imaginable and unimaginable outcomes and surprises. The observation of the wild cards highlights a political military factor – which is the redefinition of security threats, economic factors and environmental factors. When these are analysed they can reveal the level of impact of Climate Change as a wild card, but also as a threat to the production of sugar cane and other crops within food security productivity.

For the purpose of analysis for this research, it is important for the researcher to be mindful of the two arguments made. As mentioned above, Hiltunen (2006) argues that wild cards can be gradual changes whose outcomes are neglected and change the course of history, while the other significant argument is made by Mendoca, Cunha, Kaivo-oja and Ruff (2004) that suggests that a wild card is an unknown element that can change the course of driving forces, and it is therefore important to provide guidelines to policy makers using a methodological and systematic approach to it. The researcher is of the opinion that both of these opinions are important; a wild card as identified within this research as Climate Change has the potential of consequently being affected by one big event, or the gradual change that has been evident and noted caused by climate change is in fact the main driving force. It is thus important for driving forces to be planned for, prepared for, and to be escalated in any development planning in the field of food security studies and in any element of the food system so as to be more prepared. This is also a way to be ahead in the leadership of food production, policy implementation and innovation methods, thus maintaining a competitive advantage in production, sustainability and trade. Furthermore, the role of the identification of wild cards is to inform the organisation about the probable threats in the

immediate future, which thus need to inform and be strategically placed within the foresight of development and planning, to advise on policy and influence innovation methods.

As part of the Wild Card Management system by Mendoca, Cunha, Kaivo-oja and Ruff (2004), the Nurture of Improvisations capabilities are outlined below:

1. It is not possible for all crises to be averted;
2. Crisis management systems teach the organization, in advance and in a general way, how to combat a potential crisis;
3. However, every crisis develops in a unique way and thus needs to be dealt with accordingly;
4. The lack of detail of crisis management plans needs to be complemented with action based on local knowledge, acquired and processed on the spot – in other words, via improvisational abilities.

The above suggests that the most important process of wild card management is the identification of wild cards and the ability of any organisation to have an impact analysis of the wild cards. This provides the ability to have a perspective and an analytical view of the imaginable, unimaginable, probable and improbable surprises. Such analysis appraises the management of all possible probabilities when planning and thereby contributes to an atmosphere of control, strategy and tactics when faced with an acute crisis.

The importance of this in the sugar cane industry is that it assists the research and development to shift a favourable focus on strategy towards mitigating climate effects to the environment and creates an atmosphere of anticipation that guides interaction between stakeholders of sugar cane production as a tool of analysis, but also towards food production system stakeholders, in KwaZulu-Natal, South Africa, the Southern African Development Community and in continental Africa. This should be used to

inform the strategy for dealing with the anticipated food crisis in 2050 and in the event that it does not occur, the idealistic futuristic strategy of protection and strategic development of all the raw resources that are part of the food production system.

5.7 SCENARIO PLANNING AND DEVELOPMENT PLANNING

The systematic identification process as explained above of the driving forces, dangers to sugar cane crop farming production and their impact analysis which ranks them by importance and uncertainty is an important step in the process of evaluation and planning for the future. Historical moments and the detrimental effects of the risks that have been suffered and identified as threats is a fundamental analysis of the revelation of the future of human systems (Mills & Bishop, 2000). As mentioned within the overview of futures research and elaborated and in agreement with Easton and Tongson (2000) and Lang (1994), futures research is the study and analysis of systems and the elaborative and deep inquiry of complex issues that assists in the planning for future expected outcomes. This makes a strong contribution to risk mitigating approaches and the creation of a system change. It is important to reiterate that future studies are not based on prediction but precision in analysis and allows for the use of systematic approaches to plan for the future.

Mills and Bishop (2000) provides a systematic approach of applied futurism which was used to guide the researcher in identifying the research sample, research participants and also addressing the primary and secondary research questions of the researcher.

The system of interest identified was sugar cane farming, and although sugar cane farming is not a primary food production need, the principles of production are similar to other crop productions, namely, that sugar cane is farmed on land, it is dependent on weather patterns for its profitability, and the production process needs planning and output as a measure of success.

This therefore centralizes the area of study in food security and also methodologically contributes to the research and development of food security and crop production studies in relation to futures research. The domain of observation used is the engagement of specialists within the field of sugar cane farming and production, who could assist in a deep analysis of the field and also contribute significantly in the identification and analysis of driving forces of sugar cane farming. This has allowed for a methodical and comparative analysis and observation of trends and thematic identifications within the research. These have been identified as contributing to the identification of common occurring themes from previous literature, the further identification of the major stakeholders and their relationships, such as the farmers as the primary producers of the crop production, the significant role that the government has in elevating the industry, the scientific, environmental and private sector stakeholder relationships that have contributed to the development of the sugar cane industry in KwaZulu-Natal. The relationship of the stakeholders is a reflection of the network of major players that are affected at different levels when climate change, agriculture, population growth and global economic trends are affected, thus ultimately affecting the output of production and its networks such as the cost of production, the cost of sugar for the consumer, its affordability, its use as a secondary crop production, and its trade and marketability. These are the aspects that render the research findings and analysis useful.

The process of analysis using futurism has allowed for the identification of the trends and potential threats as identified within the wild cards, with climate change and its networks continuously being the most unpredictable, unreliable and unforeseeable threat to the existing common liabilities and perils of planning. This has assisted the researcher in identifying the current issues and potential outcomes of sugar cane production, the most concerning being the lack of preparedness of planning and mitigating of risks in light of a food security production threat and anticipated crisis in

2050, as outlined by authors such as Cribb (2010), Alexandratos and Bruinsma (2012), and Roberts (2008), who warn that the current trends in energy, climate change, population growth and consumption, as well as global economic trends around the world and within the industries of agriculture, institutions of environmental and population management should anticipate a food crisis in the future.

Based on these findings, it is important to engage the methodology of Shwarts (1996) who explains the Wack Test principles, which place emphasis on the systematic key factors, namely:

- The identification of the focal issue;
- The identification of key factors in the local environment;
- Driving forces;
- Ranking them by importance and uncertainty;
- The process of deciding on scenario logics;
- The process of fleshing out the scenarios;
- Dciding on and rehearsing of the implications presented by the scenarios; and
- Selection of leading indicators and signposts.

This aspect of the analysis is to process the scenario logics. As discussed, the impact analysis revealed that the highest impacting driving forces are Population Growth, Climate Change and Agriculture. The fourth most impacting driving force according to the analysis is the Global Economy. These driving forces are fundamental in deciding on scenario logics and creating scenarios. The driving forces are all interrelated, which is also an important aspect in relation to forecasting and development planning. It is equally important to note that all these driving forces are anthropogenic, meaning that they are on varied levels, as a result of human activity, which is a primary relation to the engagement of the theory of environmental conflict.

Figure 5: Driving forces for Scenario Building

Figure 5: Driving forces: for scenario building

For the purposes of the research, the researcher has given descriptive names to the best scenario as well as the worst scenario; this has been done to elaborate on the analysis of the findings which are provided above. The best possible scenario is the "Harvest Plantation" with its name being symbolic of the best possible outcomes, which will be profitable and beneficial to all stakeholders. The worst possible scenario is "Deserted Seeds 2050". These scenarios are clarified below.

5.7.1 Best Scenario

"Harvest Plantation 2050"

The use of scenario planning to identify the driving forces to create control and influence towards them would result in the development of a plan that mitigates threats that are created by climate change, thus affecting the environment. The plan would provide measures for extreme weathers whilst developing climate models; this will create a vigorous interest in the agricultural sector, promoting entrepreneurship and investments as well as skilled farmers and government political will and support. This would result in the control of the food production system, in all and any crop production; its output, economic engagement, competitive advantage and food system

economies. This would be reflected through supported by government policy, youth development agencies and land redistribution and reform strategies.

The development plan would comprise:

1. The finalization of the land redistribution policy of South Africa.
2. Development of young skilled farmers, to ensure continuation of skills.
3. Investment in new knowledge in the agricultural sector, promotion and creation of incentives through funding, scholarships and programmes that enhance interest and financial social responsibility by the companies that directly gain from the profitability of the sugar cane production.
4. Tax remission, proportionally based, by the government supporting the company and subsidizing the employment, training and structural developed programmes while making sustainable food production policy a priority.
5. The use of technological and robotic design to create long sustainable farming methods, as well as the development of research design in climate models and other inter-disciplines such as biosciences, ecology and environmental studies.
6. Stakeholder empowerment, which would reduce volatility of the farmers, markets and the general population.

Although perhaps not the most accurate scenario, the point that the “Harvest Plantation 2050” scenario is illustrating is the capability that the use of forecasting can have in sugar cane production and all other crop production industries in South Africa. Its potential lies in the development of current development planning and thus the development of current policy to support the findings of forecasting.

5.7.2 Low Road

"Deserted Seeds 2050"

This scenario is the worst possible scenario. It is a reflection of the worst possible outcomes, where the production of food systems remains unchanged by 2050 and beyond, the population demands grow which affects the demand of food consumption, primary and secondary crop productions are detrimentally affected by environmental degradation and climate change sees extreme, acute and erratic consequences. This leaves farmers vulnerable and desperate, causing them to abandon the agriculture industry as a source of sustainable living, choosing to farm more profitable crops, or choosing to engage international markets as the first preference of trade. This would also make the developing farmers abandon their craft, as their lack of methods to resist threats and mitigate acute weather conditions would be inadequate to resist an environmental, agricultural and climate threat environment.

This scenario would see the governments desperate to fight against poverty and malnutrition, but because of the global market trends, only the wealthiest of states would be able to manipulate the economic trends of the food production system, while developing countries would be at a disadvantage as reflected in 1972, as Hazell (2009) states that colonial powers focused on their own population's demands for food production, and this led to a rise in malnutrition and poverty in the developing countries. Therefore, agriculture would decline due to environmental problems, the global economy would become a stress to the agricultural industry, population growth and demands would increase to a system that is constantly and consistently threatened by erratic climate change issues. This would result in threats to social and national security, caused by the vulnerability of basic needs for human survival.

These scenarios are important for planning, as these are the visions of the best and the worst case scenarios, which highlight the importance of developing tools that will address and strengthen the agriculture industry to resist climate change and use it as an opportunity to develop more complex approaches to resolving the complex envisioned problems.

To achieve this, all stakeholders such as government, companies that are excelling in research and development such as the South African Sugar Association, biotechnologists specializing in farming methods, agricultural economists, farmers, commercial sugar analysts, agriculturalists and environmentalists need to be unified in approach and planning. This is important for the development planning of short term goals which can be achieved through the use of tools presently in use, such as SWOT methods, affinity diagram methods, Process Decision methods and interrelatedness methods, but with a further extension of the complex view of all driving forces. This can be achieved through the engagement of future studies and the use of analysis through utilising the tools and theories of future studies, which allow for a multifaceted and complex engagement with difficult realities.

5.8 CONCLUSION

The above is an elaboration and analysis of the findings of the study. This analysis reveals that the threats to sugar cane farming and thereby crop production and food systems is climate change, environmental degradation and threats and also the land and agricultural degradation. These in principle are all in alignment with the statements made by the forecasters that have claimed that in analysis of the current driving forces, a food crisis is imminent in the near future. The data analysis thus interpreted that the main problem with development planning in the field of sugar cane production in South Africa is the lack of forecast; this is also in effect applicable to other crop productions and therefore the food production system of South Africa. Sharmer and Kaufer (2013: 19) observe that, “most

of the existing learning methodologies relied on learning from the past", and they further argue that for progressive research, development and effective planning and forecasting, it is important to "learn from emerging futures''.

Planning in reference to the research findings is limited to the current needs of production, does not extend to the further future and thus does not allow for the identification of driving forces, the identification of themes, wild cards and the impact analysis of such. This has been evident in the outcomes of the El Niño drought in the region and is in accord with the analysis illustrated above. The implications of the lack of forecast go beyond current production and systems. Its spillovers are in economic factors, political military factors, social factors and environmental factors. The determination of the values of the sugar cane production industry, crop production and food production systems will therefore assist in the exposure of the important future of food security systems.

Political philosophy is argued to be the basis of the study of futures; this is as a determination of the ideal society which is the measure of the desired outcomes. Bell (2017) in particular observes that the ideal became the standard by which social structures were analyzed and measured. Bell notes that, "Utopia became a model for a vast literature exploring the ideal society in which scenarios of desirable or undesirable societies were constructed" (Bell,2017: 14). The importance of this background in the development of planning tools and the use of scenario planning as a tool of forecast and analysis is because it insists on and emphasizes the determination of a value in order to create a desirable future.

The overall objective of the study has been the assessment of the fundamental problems in development planning in food security in South Africa, with a particular focus on the analysis of sugar cane production. The outcomes on a small scale are elaborated above through the analysis of current status, trend and driving forces; however, the bigger picture is

concerning, since the findings have been in agreement with the analysis of futurists that have stated that there will be a food crisis in the foreseeable future.

The link in the findings of this research with the future of food security is premised on the common factor of sugar cane as a crop production; therefore, the fundamental principles of production that are highlighted as being threatened throughout this research are common in most crop produced foods. This research therefore supports the hypothesis of a foreseeable food crisis in the future, and provides findings and recommendations to use in other crop produced foods to ensure that planning tools are developed that can mitigate food crises in the future.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

The intention of this study was to investigate the problem of development planning of food security in South Africa, using sugar cane crop farming as a unit of analysis. Through the investigation, a trend analysis of food security threats was undertaken which contributed to the development of the use of the future studies methodology for sugar cane farming. This has reflected urgency in the strategy and analysis of crop farming, food security and also the development of long term future studies methodology for development planning for the future of crop production systems.

6.2 FOOD SECURITY CHALLENGES AND SOLUTIONS

The findings of this research have raised serious concerns for food production stakeholders. The literature reviewed revealed a consensus from global institutions such as the FAO (2008) and the Intergovernmental Panel on Climate Change (2014) that the current driving forces are indicative of a detrimental outcome for food production if the warning signs through the driving forces are ignored. The effects on the rise in food prices has a direct impact on the grass root communities and civil society, causing vulnerability and instability in relation to the basic human need for food.

This research built on previous findings with different analysis on various driving forces with diversified knowledge of the analysis of these driving forces. These have revealed that a critical time for planning has been reached. The directive that is implemented now will have a direct impact on the future of food, agriculture and the environment, which is already showing

signs of frustration and limitation. The performance of agriculture also has a direct impact on economic development and stability.

This research emphasises the importance of values, as Bell (2017.23) states that, “a system of reciprocal causation is established that enhances human survival and well-being on the one hand and that further validates the underlying values that support them on the other”. It is thus imperative that values that enhance human survival are determined so as to address threats to those values. Simplistically, the study of food production systems is important because of the value it represents, that is the value of food security, which is a basic human necessity for human survival, the lack of which threatens human survival and human security. This value, when measured through the current driving forces, is under immense threat of deterioration, and to respond to this at the level of its value ability, the use of planning is fundamental where the limitations of planning are adjusted through the introduction and the use of future planning methods. This strategy, if utilized, provides alternatives to the primary problems of development planning to the leading sectors that drive food production and further capacitates development planners with the tools to influence trends and respond to acute challenges that may arise.

This research has highlighted previous studies that identified the food production systems as being under threat in the analysis of what drives food production systems at present. The study further analysed this contribution through the engagement of theory and specifically the contextual theory, which identified Climate and Environmental changes as driving forces with trends that had negative and sometimes unexpected outcomes for production in the short and even more in the long term. As observed by the Department of Agriculture, Forestry and Fisheries (2016) in their trend analysis with regard to the unfavourable climate conditions, “The country has experienced the worst drought in 30 years and most agricultural commodities will produce less due to the prevailing drought. Weather

experts have attributed the dry and persistent heat to the El Niño phenomenon. The South African Weather Services reported that the country received below average rainfall of 400mm during 2015 as compared to 600mm in 2014. Many irrigation sugar cane farmers did not have sufficient water to meet the high rate of evaporation" (DAFF, 2016: 44). In agreement with the publication and the research findings, this resulted in the low profitability of sugar cane production while faced with high production costs. The analysis of driving forces also revealed that despite the uncertainty of the future, the drought that affected the sugar cane industry could have been projected and forecasted and the impacts of the risks mitigated. This would have been done through the use of forecasting and preparedness of any impending threats to the production of sugar cane and its profitability.

According to futurists, the driving forces of food security as seen in this research are under threat, and this research, in seeking to interpret this, has proposed the need to break down all driving forces of the production system, making use of the outcomes of the study to contribute to futuristic planning strategies for food security in South Africa. Once disaggregated from a general analysis of crops, whether they are winter or summer crops, the direct impact to field crops allows for a general analysis of driving forces contributing to field crops and thus the outcome of analysis that allows for the modification of the framework to suit all types of crop production, as required by the institutions involved in the production process.

The predominant driving forces in sugar cane production are Climate Change, Agriculture, Environmental and the Global Economy, which are all interrelated. They are all fundamental to the analysis and development of food security but primarily to the productivity of crop production and, in relation to this study, sugar cane production.

The findings of the study, using sugar cane as a unit of analysis, revealed that due to the lack of forecasting as a planning tool and the limitation of the development of risk mitigating factors, planners are unable to anticipate threats because they plan for the current output and not the long term output of food production. As a result, productivity of the year is measured against previous years and not based on the driving forces of the current environment and its factors and trends. In the sugar cane industry productivity is a fundamental aspect of production and is thus a driver rather than a tool for sustainability and the consistent decrease in production reflected in the trend analysis of the agricultural sector is reflective of the outcomes of the research. The research also revealed that the lack of forecast is exposing the industry to acute and rapid changes and does not allow for detailed planning, which makes the industry reactive instead of proactive.

The lack of forecasting based on driving forces and trend analysis is a weakness in sugar cane production, where instead planning is based on anticipated outcomes. This as a result caused a blind spot in relation to current climate change and environmental effects such as the El Niño, which, if anticipated, could have been planned and prepared for in terms of mitigation. This has left farmers vulnerable as their food production methods are rising in cost and are thus becoming difficult to maintain and sustain. The barriers experienced by farmers such as a lack of enabling government policies contribute significantly to the obstacles that limit planning and forecasting.

Force field analysis which was discussed as part of the tools of analysis in the research findings revealed a lack of integration between all stakeholders, which supports the above outcome. One such example is based on the trends in the agricultural sector, such as the proposed sugar tax, where the South African government proposed a Sugar-Sweetened Beverages (SSBs) Tax with the aim being to combat obesity. The South

African sugar industry has a view that insufficient consideration has been given to the full impact of the imposition of sugar tax. It was reported that the SSBs sector purchases 620 000 tons of sugar annually, making it the leading buyer of locally produced sugar. Furthermore, the Beverage Association of South Africa (BevSA), as the main role-player in the market, has warned that the proposed sugar tax could trigger at least 72 000 job losses and undermine the industry's ability to compete globally (DAFF, 2016: 44). This is an example of a lack of stakeholder engagement, a lack of trend analysis and furthermore, a lack of forecast. Had a trend and forecast analysis been done by the proposing party, it would have understood the implications of implementing policy without consultation, where the spillover effects are detrimental, and are also limited to sugar cane farmers and the development of sugar cane farming, which faces external export bans and also domestic policy limitations such as those outlined above.

The overall implications of the study suggest that the consultation of future studies methodology such as scenario planning would add significant value in the development, planning and productivity of the sugar cane industry. The outcomes of the study would add value to the study of food security and other interdisciplinary fields that work within the food system. This is important for the contribution of new knowledge on food security, agriculture and crop development. As stated by Beddington (2011: 34), "Invest in new knowledge: There is a consensus among the results of food system models that one of the most critical drivers of future food supply is the rate of growth of yields due to new science and technology. New knowledge is also required for the food system to become more sustainable, to mitigate and adapt to climate change, and to address the needs of the world's poorest". The expansion of the study into climate models and farming systems with the use and assistance of technology to develop further and create resilient production systems is critical.

6.3 RECOMMENDATIONS

While the study was limited in scope and analysis, the importance of further engagement of the thematic areas of the study must be emphasised. The contextual theory is limiting because when applied, it is reflective of the potential of a scenario that is negligent in regard to the above findings, and thus systemically engages the potential of the outcomes of anticipated food shortages, should the current driving forces not be analysed, addressed and prepared for through planning and policy development.

It is important to mention that food security has many perspectives to it. The perspective of food insecurity as a potential trigger of environmental scarcity is one of the various aspects of this research that can be examined and analyzed further. This would require the engagement and further research of the definition of security and a deep analysis of soft power and soft threats, contributing significantly to the literature that has argued for the redefinition of security and its expansion towards soft threats instead of the military definition of security. Other aspects of food security include environmental externalities, as stated by De Wilde (2008) in the "Environmental Security Deconstructed" Hexagon series, and also elaborated on in the "Final Report of the Foresight Global Food and Farming Futures Project, where it is noted that, "negative environmental externalities: there needs to be much greater realization that market failures exist in the food system that, if not corrected, will lead to irreversible environmental damage and long-term threats to the viability of the food system. Moves to internalize the costs of these negative environmental externalities are critical to provide incentives for their reduction (Beddington, 2011: 33). This reiterates the importance of an analysis of all driving forces, as each force has its own contribution to make to the bigger picture, a decentralization of the driving forces, an analysis and breakdown of each impact and its contribution, is a potential elaborative area to be studied towards food security, crop production and the system of food production.

The second area that is recommended for further research is the relationship of forecasting and decentralized aspects of the methodology of future studies. This is important for social studies as future studies began primarily as a methodological study on mathematical forecasting. As a result, the analysis and measurement for risk impact methods is underutilized and not well developed for study purposes in social studies. This would significantly contribute to strengthening the culture of monitoring and evaluation, impact and learning in agriculture. As explained by Beddington (2011), “Mixed-method approaches to agricultural measurement and evaluation are available. They must be used to understand what works, why, how and when. Agricultural organisations need to be incentivized to use these methods and to learn from them.” Because of the nature of future studies methodology, it is one of the mixed-method approaches of analysis that could be utilized for the development of agricultural studies.

The current driving forces are also evolving, for example the impact of Climate Change a decade ago was not as erratic as it is now. It is thus important to emphasize the importance of the continuous study of the driving forces, as part of policy development. This is particularly important for developing countries that are always highly affected when any of these driving forces deteriorate. Furthermore, the continuous study of the driving forces opens up opportunities for the development of new diversified approaches to the evolving challenges that are faced by farmers, where the analysis of driving forces and forecasting assists in the development of a tailored approach that considers geographical, economic and cultural aspects within the approach. This is fundamental because it allows for the inclusiveness of all stakeholders and contributors such as the small-scale farmers as part of the stakeholder engagement process, who are often the first to feel the progression and regression impacts of policy and environmental changes.

6.4 CONCLUSION

Regional and global lessons have been reflected within the theoretical framework of the research. These emphasize the impact of the identified driving forces contributing towards a food shortage in the future. If the futuristic planning methods of forecasting are not used, both on a domestic and institutional level, as well as on a global and multilateral level of analysis and engagement, the anticipated systematic deterioration of the food production system will remain a threat.

The research has shown that the global community is heading towards a food crisis in the future and likely by 2050, as reflected in previous studies. The use of future studies as a field of research needs to be engaged through further research and the future advancement of development planning tools to assist with creating sustainable methods of production and also for the continuous analysis and acknowledgement of current threats to agri-food systems especially in Africa, the Southern African Development Community, South Africa and its provinces.

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