Choosing between Agricultural Development Projects in the North West Province: A Multiple Criteria Analysis

by

Johannes Daniël van der Merwe

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Degree:	M.Com (Agricultural Economics)
Department:	Agricultural Economics
Supervisor:	Prof. H.D. van Schalkwyk
Co-supervisor:	Dr. P.C. Cloete

Abstract

Large amounts of taxpayers' money have been invested in agricultural development initiatives in South Africa, but unfortunately most of these initiatives have not been successful. This has increased pressure on government departments to deliver on their promises, as more and more productive agricultural land has been virtually taken out of production. Most of the past development initiatives have simply become poverty traps, which has added to the economic hardship already experienced by most people in the rural regions of the North West Province.

Based on the afore-mentioned, the need for a framework or decision support system that will improve the success of agricultural development in the province is acknowledged. Several studies have concluded that the development of workable business plans can serve as a means to improve the success of agricultural development, provided that it gives a guideline that

will incorporate policies, institutions and mobilise resources that will improve the success of agricultural development.

Thus, the first part of the study entails the identification of agricultural opportunities in the province. A detailed review of the study area provides the basis for the identification of agricultural opportunities in the province. In addition, field workshops that were arranged according to the SWOT methodology were held in each of the local municipalities. This was done to obtain a better perspective of the potential opportunities as well as factors inhibiting agricultural development in the province. The workshops were also used to determine which business concepts could be employed to successfully exploit the identified opportunities. From this, a business plan for each opportunity could be drafted.

However, workable development plans can only improve the success of agricultural development once they are implemented. This turns the attention to another dimension of agricultural development, with government that are often faced with strict budget constraints. Thus, budget allocations to agricultural development initiatives should be done in a way that will yield the highest economic, social and environmental returns. A multiple criteria analysis (MCA) model was developed in the second part of the study to assist government with budget allocation towards the identified opportunities.

Following the principles of the MCA, the identified opportunities are ranked according to a set objective i.e. to improve the welfare of the province and at the same time conserve the natural resources of the province for future use. From the results, it is concluded that beef production is most likely to yield the highest return in terms of the set objective, followed by vegetables and goat meat production.

It could be concluded that MCA is a decision support tool that can assist government in its budget allocation decisions. Moreover, the identified agricultural opportunities namely Goat Hotel, Milk Cow Hotel, Goat Meat, Broilers, Beef Production, Animal Feed, Eco tourism, Veldt Management, Taung Irrigation Scheme, Vegetable Management, Grain Production and Perennial Crops are likely to improve the success of agricultural development in the province.

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List of Acronyms

AET	Agricultural Education and Training
AF	Animal Feed
Agri-BEE	Agricultural Black Economic Empowerment
AgMRC	Agricultural Marketing and Research Council
AHP	Analytic Hierarchy Process
AMP	Agricultural Master Plan
ARC	Agricultural Research Council
ASGISA	Accelerated and Shared Growth Initiatives
B	Broilers
BDM	Bojanala District Municipality
BP	Beef Production
CAM	Conflict Analysis Method
CASP	Comprehensive Agricultural Support Programme
DAFF	Department of Agriculture, Forestry and Fisheries
DBSA	Development Bank of Southern Africa
DM	Decision Maker
EC	Eco-Tourism
FAO	Food and Agricultural Organisation
GDP	Gross Domestic Product
GFI	Gross Farm Income
GGP	Gross Geographical Product
GH	Goat Hotel
GM	Goat Meat
GMO	Genetically Modified Organism
GP	Grain Production
HSRC	Human Science Research Council of South Africa
IFAD	International Fund for Agricultural Development
KKDM	Kenneth Kaunda District Municipality
KZN	KwaZulu-Natal
LBS-Discreet	Light Beam Search-Discreet
LRAD	Land Redistribution and Development

MCA	Multiple Criteria Analysis
MCAT	Multiple Criteria Analysis Tool
MCH	Milk Cow Hotel
MGK	Magalies Graan Koöperasie
MOCO	Multi-Objective Combinatorial Optimisation
MVP	Marginal Value Product
NGO	Non-Governmental Organisation
NMMDM	Ngaka Modiri Molema District Municipality
NSDP	National Spatial Development Perspective
NWDACERD	North West Department of Agriculture, Conservation, Environment and Rural Development
NWP	North West Province
PC	Perennial Crops
PGDS	Provincial Growth and Development Strategy
PIR-test	Preference, Indifference and Incomparability test
PPP	Public Private Partnership
PROMETHEE	Preference Ranking Organization Method for Enrichment Evaluations
PSA	Pareto Simulated Annealing
SAB	South African Breweries
SAMIC	South African Meat Industry Company
SARPN	Southern African Regional Poverty Network
SMDM	Dr Ruth Segomotsi Mompati District Municipality
StatsSA	Statistics South Africa
SWOT	Strengths, weaknesses, opportunities and threats
TIS	Taung Irrigation Scheme
UN	United Nations
VM	Veldt Management
VP	Vegetable Production
WDR	World Development Report

Chapter 1
Introduction

1.1 Background

South Africa is a unique country that was shaped by its past political landscape. Despite being a democratic country for almost 16 years, the effects of the apartheid regime can still be seen in many parts of the country. In the midst of political stability and strong economic growth, post-apartheid South Africa is still faced with a stubborn reality of widespread poverty, unemployment and growing income inequalities (Smit, 2007). Smit elaborates by arguing that economic empowerment and expansion have mainly benefited the urban black middle class, with the majority of people that continue to live in poverty and mass unemployment. Thus, as the country's transition to democracy unfolds, millions, both urban and rural are trapped on the margins of society, contending with the multiple crises of unemployment, landlessness, homelessness, lack of basic services, HIV/AIDS and food insecurity (Smit, 2007).

Moreover, in 2005, South Africa's leading marketing insights company conducted two surveys and concluded, amongst others, that government is not doing enough in terms of creating employment opportunities (Research Surveys, 2005). While it is not only the responsibility of government to create employment opportunities, there is no doubt that government plays a major role in creating the necessary climate for economic growth and subsequently the creation of employment opportunities. Furthermore, the survey concludes that the rural regions of the country are mostly poverty stricken (Research Surveys, 2005).

The situation shifted government's focus away from the sanctions that was the main concern before 1994, towards the upliftment of the poor and rectifying the injustices of the past. In an attempt to address the afore-mentioned, government introduced the so-called "national imperatives". According to the imperatives government will attempt to reduce unemployment and poverty with 50% by 2014 as well as redistribute 30% of all productive agricultural land

to previously disadvantaged people by 2014. However, targets were deemed not achievable and an amendment was made to the imperatives extending the target date to 2025. As a result, national government increased pressure on the provincial government to increase service delivery (North West Provincial Government, 2007). The agricultural sector was targeted as the main sector for achieving the national imperatives. The same applied to the North West Province (NWP), with the local government emphasising the important role that the agricultural sector must play in the province if the imperatives are to be reached (North West Provincial Government, 2007).

However, the marginal success rate of past agricultural development initiatives revealed that the success of agricultural growth and development is inhibited by several factors in the province. Cloete (2009) reports that these include, amongst others, the lack of post-settlement support, lack of capacity within governmental departments, lack of training and of access to inputs, markets and credit, as well as poor infrastructure. Other authors including Eicher (1999), Magingxa and Kamara, (2003), Poulton *et al.* (2006) and Magingxa *et al.* (2009) are of the same view, arguing that a lack of adequate skills and knowledge, access to inputs and market information, credit availability, inadequate extension services and insufficient training can be blamed for past development failures. In addition to this, Nel and Davies (1999) consider droughts, lack of access to land, shortage of funds, limited access to external markets, failure to penetrate established markets and insufficient marketing as restraining factors towards the success of agricultural development. Thus, one might conclude that the failure of past agricultural development initiatives revolve around human, institutional, infrastructure and natural resource endowments, with most of these factors being interrelated. Munro (1999) is of the same view, suggesting that most factors that inhibit agricultural development are integrated.

In its framework for action on agriculture, the United Nations (2002) suggests that in order to address interrelated factors that inhibit development, a co-ordinated response that draws on the strength of all stakeholders, is needed. This requires putting in place a framework that incorporates appropriate policies, institutions and the mobilising of resources at national, provincial and regional levels (United Nations, 2002).

Against the backdrop of afore-mentioned constraints and opportunities, the North West Provincial Government initiated the development of a comprehensive agricultural

development framework, also better known as the Agricultural Master Plan (AMP). The main objective of the AMP is to address national imperatives through means of the agricultural sector. [1]The AMP was created to address two essential elements of agricultural development, i.e. the creation of an enabling environment and the identification of workable development plans/projects (Van Schalkwyk, 2009). However, to address, improve and efficiently utilise the human, institutional, infrastructure and natural resource endowments of the province, extensive capital inputs are required. As with any institution, government is also faced with a budget constraint and needs to apply resources efficiently when choosing between agricultural development projects. Taking into account that government is already under pressure to achieve set targets with a budget constraint, budget allocations to agricultural development initiatives should be done in a way that will yield the highest economic, social and environmental returns. Such decisions can become extremely complicated, especially when in search of optimal allocation of limited resources.

With this in mind, a decision support system that will choose between agricultural development projects and therefore guide budget allocation for agricultural development initiatives is sorely needed. Therefore, this study focuses on the identification of agricultural opportunities, the development of business plans/concepts to exploit these opportunities as well as the development of a framework that will ensure optimal budget allocation for agricultural development in the North West Province (NWP).

1.2 Motivation and problem statement

The predominant rural nature of the NWP and its close proximity to the major metropolis markets and international markets in Botswana, make agriculture the ideal sector to address national imperatives through economic growth and development. In addition, most of the people residing in the rural regions of this province depend on agriculture and agricultural activities as a means of livelihood. Thus, the unlocking of opportunities within the agricultural sector of the NWP has the ability to directly address the concerns of unemployment and poverty (North West Provincial Government, 2007).

[1] The AMP forms the basis for this study. One of the project outcomes specified that development alternatives must be ranked in order to improve budget allocation towards agricultural development in the NWP. Consequently, this study aims to fulfill that need.

Consequently, the agricultural sector is targeted as the main sector in the NWP to achieve the set imperatives (i.e. 50% reduction in unemployment and poverty and the redistribution of 30% of all productive agricultural land by 2025). However, the success rate of past development initiatives have proven to be marginal. This is due to several factors, most of which was discussed in the previous section. However, for government to achieve or reach their imperatives, the success rate of development in the province needs to be improved.

According to Magingxa (2006) the formulation of workable development plans/projects can serve as a means to address the interrelated factors that inhibit the success rate of agricultural development. In other words, the formulation of development plans can provide a guideline that will incorporate policies and institutions and mobilise resources to a degree that will improve the success of agricultural development. The Agricultural Marketing Resource Centre (AgMRC) makes a similar observation, suggesting that development plans could improve the success of agricultural development if it provides a "blueprint" on how to create a viable business enterprise (AgMRC, 2010). Magingxa (2006) elaborates by arguing that development projects will ensure better governance and monitoring, which will consequently result in higher levels of success. Consequently, in an attempt to address the marginal success rate of agricultural development initiatives in the NWP, agricultural development plans are developed for the NWP as part of the AMP .

However, workable development plans can only address the factors inhibiting agricultural development once they are implemented, and implementation requires funding. Government often faces strict budget constraints. For example, only 3.66% of the total annual budget available to the relevant study area is destined for agricultural development (North West Provincial Government, 2008). Thus, to ensure that the success of agricultural development is improved in the province, funds should be allocated to the opportunities that are likely to yield the highest returns in terms of the set objectives.

Before funds can be allocated, however, agricultural opportunities that are most likely to be successful in the province need to be identified. In order to indentify these opportunities, factors, which include amongst other the natural resources, supporting institutions and infrastructure, knowledge and experience in the specific region etc., need to be considered. All of these factors will influence the success of a specific opportunity and need to be incorporated into a decision support framework to assist agricultural development.

Thus, against the backdrop of past development efforts that have mainly failed to deliver and government investing substantial amounts of money in failed development efforts, a need has developed for a comprehensive decision support system that will assist government in making challenging decisions and guide budget allocation. The extent to which government will achieve their imperatives will depend on their ability to channel resources (i.e. funds) to the identified opportunities which are likely to yield the highest returns.

1.3 Objectives

The main objective of this study is to identify agricultural plans/projects that will realise the highest returns in terms of set criteria, thereby improving the success rate of agricultural development in the NWP. This will assist government with decision making as far as budget allocation towards agricultural development in the province is concerned. In order to achieve this main objective, the following secondary objectives need to be achieved:

- Review literature on potential factors that might influence the success of agricultural development in the NWP as well as mechanisms that could be used to determine the returns of agricultural plans/projects. This includes a review on current agricultural development projects in the province as well as methodologies used to rank development initiatives.
- Present an overview of the study region which will assist with the identification of agricultural opportunities in the province.
- Develop business plans/concepts for each of the identified agricultural opportunities that will serve as a guideline for both government and prospective beneficiaries in their quest to exploit these opportunities.
- Develop a model that could be used to rank the identified agricultural opportunities. This will determine which opportunities are likely to yield the highest returns.
- Rank the identified agricultural opportunities against set criteria.
- Based on the results of the afore-mentioned sub-objectives, guide government with regard to budget allocation in order to improve the success of agricultural development initiatives in the province.

In achieving the above-mentioned objectives, the study will give recommendations with regard to budget allocation for agricultural development in the NWP and by doing so, improve the success of agricultural development initiatives in the province. An improved success rates for agricultural development in the NWP will significantly contribute towards the prosperity of the rural poor.

1.4 Data used and methodology

Primary data was gathered in order to achieve the objectives of the study. The primary data was obtained through workshops that were held in each of the local municipalities in the NWP. In total, 21 workshops were held throughout the province. These workshops were structured in the form of panel discussions for all role-players in the private/commercial agricultural sector, followed by workshops for role-players from the public/small-scale sector. In general, the field workshops were attended by representatives from organised agriculture, farmers' unions, cooperatives, input suppliers, banks, government officials, NGO's, commercial farmers, small-scale farmers, etc. The sessions were guided by a discussion leader who facilitated the discussion according to the SWOT methodology. Data obtained from the workshops were primarily used for information purposes in the process of opportunity identification in the NWP as well as to determine which business concepts could be used to exploit the identified opportunities. In addition, the data obtained from the field workshops was also used to determine the preferences of the various role players in terms of which outcomes i.e. economic, social and environmental is regarded as the most important when implementing the proposed projects. In other words, the data was used to determine the ranking order for the criteria used in the Multiple Criteria Analysis (MCA).

The criteria used in the MCA are structured according to the objective set by local government, namely to improve the welfare of the rural poor and at the same time conserve the natural resource base of the province for future use. This objective reflects directly on the national imperatives i.e. 50% reduction in poverty and unemployment as well as the redistribution of 30% of productive agricultural land by 2025. Following the structure of the criteria, ranking order values based on the preference indicators of participants from the workshops, were assigned to each factor that forms part of the different criteria. The criteria, with their respective ranking order values, were subsequently used in the Conflict Analysis Method (CAM), which is a version of the MCA, to rank the different opportunities.

The basic aim of using MCA in this study is to rank the options available to solve a problem to which several alternatives with conflicting choices exist. In other words, the MCA assists in determining which agricultural opportunity is likely to yield the highest returns in terms of the set objective i.e. welfare improvement and at the same time the conservation of the natural resources for future use. Results from this analysis could be used to guide government in choosing which development initiatives in the province to fund.

1.5 Outline of the study

Chapter 2 consists of a literature review on the development projects in the NWP. These include development projects that have used an MCA as a preferred method of research, and the factors that affect small-scale participation in the mainstream economy of the province. Chapter 3 entails a thorough discussion and description of the study area, including the geographical, social and economic state of the province. This overview provides basic, but vital information for the identification of potential agricultural opportunities in the province.

In Chapter 4, the identified agricultural opportunities in the province are discussed. The chapter also elaborates on potential business models/concepts that could be used to exploit the identified agricultural opportunities, whilst shedding light on current development initiatives in the province and newly identified opportunities that might be incorporated into the existing ones to improve the success of agricultural development in the NWP.

Chapter 5 provides an overview of the criteria development. This includes a detailed discussion on the description of the different criteria. In addition, the chapter deals with the development of the MCA model, which includes the assignment of ranking order weights to each factor included in the different criteria as well as a description of the CAM, which form part of the MCA. Chapter 6 encompasses the results of the MCA. In chapter 7, conclusions are drawn based on the results of the study and recommendations were made with regard to the allocation of funds towards the identified agricultural opportunities.

Chapter 2
Literature Review

2.1 Introduction

As mentioned in the previous chapter, the agricultural sector of the North West Province (NWP) holds vast potential to alleviate poverty and create job opportunities for the people residing in the province. However, it was not until recently that greater emphasis has been put on agricultural development as a means of improving the livelihoods of people through the empowerment of small-scale farmers in the province. The recent focus on agricultural development projects for small-scale farmers can be attributed mainly to the end of the apartheid era - a period which had an extremely negative effect on the ability of many black farmers to develop through agriculture (Hart, 2009). The exclusion of black farmers from the mainstream commercial agricultural sector and state support services were the main reasons why black communities were not involved in successful commercial farming operations. Subsequently, following the 1994 elections, the state, parastatal research and extension services were given the mandate to transfer technology and resources to these farmers in order for them to fully develop their commercial potential. Except in a few rare cases, this has not materialised (Hart, 2009).

Thus, against the backdrop of past failures, various studies have been done to identify specific problems encountered by small-scale farmers when attempting to access the mainstream economy, i.e. the commercial agricultural sector. From this, research and development organisations have concluded that enhancing the ability of resource-poor farmers to produce beyond subsistence levels and improving market access for their produce is critical for the success of agricultural development, especially in developing countries (Magingxa, 2006). Agricultural development projects can serve as a means to stimulate production and improve market access. Furthermore, development projects can also ensure better governance and monitoring, consequently ensuring a higher success rate and

sustainability of agricultural development efforts (Magingxa, 2006). In this study a problem was encountered with regard to choosing the best alternative amongst development initiatives. The need for choosing between development initiatives has developed as a result of local government facing a number of resource limitations, of which a limited budget is the most immediate and severe.

Consequently, this chapter reviews various types of methodologies that have been used by previous authors, like Balyamujura (1995), Van Huylenbroeck (1995) and Hajkowicz (2007) in an attempt to determine and solve conflicting decision-making choices with regard to economic development (i.e. agricultural development), and other social and ecological issues pertaining to development. Moreover, the issues that affect successful development, and that can assist in determining the criteria for ranking development initiatives, will be discussed by reviewing various studies abroad and locally that have shown successes in agricultural development. Studies that used certain methodologies in an attempt to rank different development alternatives are also discussed, as well as the methods used for ranking. This includes a detailed discussion of the Multiple Criteria Analysis (MCA), coupled with a discussion of the results that can be achieved through the application of this methodology. However, in order to determine the appropriate criteria for the MCA, factors affecting the participation of small-scale farmers in the mainstream economy must be discussed and analysed. These factors, which will be incorporated into the MCA criteria, will provide the foundation for ranking the development plans/projects and will thus be an essential element in improving the efficiency of budget allocation for agricultural development in the NWP.

2.2 Factors affecting participation of small-scale farmers in the mainstream economy

It is an unfortunate fact that only a small number of small-scale farmers actively participate in the mainstream economy of the NWP's agricultural sector. Therefore, it is vital to identify factors affecting participation of small-scale farmers in the mainstream economy, in order to improve the success rate of agricultural development - and as a result increase the efficiency of budget allocations in the NWP. From the previous section, one could argue that the factors influencing successful development are somewhat homogeneous across provincial and even country borders. The following are some of the challenges that will continue to affect the performance of farmers in general (North West Provincial Government, 2008):

- There is a scarcity of skilled experts such as economists, environmentalists, air quality specialists and engineers, who all play a crucial role in the efficiency and sustainability of a farming business.
- Changing weather patterns increase the risks associated with farming businesses, especially with regard to crop production.
- The agricultural sector is generally not seen as a good investment for external investors, which makes equitable funding for the sector difficult.
- Infrastructure backlogs are a great concern for the development of the agricultural sector, especially in the rural areas.
- Inequitable access to and participation in the sector.
- Land degradation, particularly in communal areas, plays a significant role in the sustainability of any farming business.
- Poor implementation of the supply chain management framework.
- Soaring food and agricultural input prices make it increasingly difficult for farmers to produce at a profit, especially considering the competitiveness of the agricultural sector.

A review of studies pertaining to agricultural development led to the identification of specific factors affecting the small-scale farmer's participation in the mainstream economy. The following sections provide an overview of the specific factors that need to be taken into consideration if participation of small-scale farmers in the mainstream economy is to be increased.

2.2.1 Farmer training

Farmer training can be summarised as the transfer of knowledge and skills to small-scale farmers, either from commercial farmers, agricultural businesses or training institutions. Knowledge acquired will include methods to increase production as well as a general understanding and improvement of marketing, record keeping and entrepreneurial skills. Coupled with the improvement of general farming skills is the increase in overall output, which can be linked to an increase in income (Cloete, 2009).

A study done by Montshwe (2006), which mainly comprised the identification of factors affecting small-scale farmer participation in the economy, anticipated that there would be a

positive correlation between farmers' participation in the economy and farmer training. The author believes that training will generally improve farmers' skills in marketing, record keeping and entrepreneurship, as well as their ability to increase their farming production. The study by Montshwe (2006) reveals that the partial effects for the significant discrete variables of the standardised logistic regression model of farmer training has a significant impact on farmer participation. Table 2.1 shows that a unit change in the level of training increased the probability of a small-scale farmer participating in the economy by 60.07%.

Table 2.1: Partial effects for the significant discrete variables (farmer training)

Determinants	Probability of participation	Change in probabilities between a person that is not trained and a person that is well trained
○ Not trained	0.0685	0.6007
○ Well trained	0.6692	

Source: Montshwe (2006).

In addition, a case study by Stevens (2007) concluded that a lack of farmer training could be ranked second in importance after poor maintenance of infrastructure and equipment when it comes to major problems affecting small-scale farmer participation.

A study by Magingxa (2006) concluded that farmer skills and thus farmer training forms part of the six principal components necessary for farmer participation. He supports this statement by concluding that a 50% increase in farmer skills and knowledge will lead to an 11% increase in the probability of small-scale farmers accessing the market (Magingxa, 2006).

Magingxa (2006) also found that farmer training and skills are essential in the process of incorporating small-scale farmers into the mainstream economy. According to him, this area should receive greater attention when dealing with the problem of smallholder market access.

2.2.2 Size of operation

Total herd size and total number of hectares cultivated can be described as the size of the output realised from production on a specific farm unit. Logically, bigger herd sizes or more hectares cultivated are associated with higher outputs and in turn are expected to lead to higher farmer participation in the mainstream economy, and a positive correlation between the two variables is in fact likely. Montshwe (2006) concludes that a 50% increase in herd

size will increase the probability of selling cattle and thus participating in the economy from 8,66% to 17,70%. Increasing the size of the farming operation will enable the farmer to spread his risks and this makes the market more attractive to newcomers, which in turn will increase the probability of farmer participation.

However, an increase in the size of the operation must not be confused with an increase in the probability of a successful farm unit. An increase in stock numbers with disregard for any of the other factors such as grazing capacity, water availability, etc., will reduce the long-term sustainability of the farm. Better access to information regarding factors that might determine the optimal size for an operation in a specific area can potentially reduce or even eradicate the problem.

2.2.3 Access to market information

Increased access to market information will enable farmers to make more informed production decisions and will most likely increase the participation of small-scale farmers in the mainstream economy. However, information acquired must be incorporated into the production decisions of the small-scale farmer in order to have a positive impact on farmer productivity. Table 2.2 shows that a unit increase in receiving market information, defined by the shift from non-receivers to receivers, increases the probability of participation in the mainstream markets by 30.37% (Montshwe, 2006).

Table 2.2: Partial effects for the significant discrete variables (information access)

Determinants	Probability of participation	Change in probabilities between a person that receives market information and a person that does not
◦ Non receivers	0.2093	0.3037
◦ Receivers	0.5129	

Source: Montshwe (2006).

2.2.4 Infrastructure

Under-investment in agricultural infrastructure, especially rural infrastructure, poses a serious threat to the livelihood of small-scale agriculture throughout South Africa. Infrastructure such as roads, transport and communication networks need urgent attention. Access to both

input and output markets is seriously curtailed by poor rural infrastructure, and has a severe impact on the small-scale farmer's ability to produce profitably, as it considerably increases production- and transaction costs. Investment in rural infrastructure will reduce the transaction costs for services and technology, which will in turn increase small-scale farmers' competitiveness and bring about lower agricultural input prices (Hart, 2009).

Magingxa (2006) identifies physical access to markets, and thus adequate infrastructure, as the single most important factor affecting small-scale farmer participation in the mainstream economy. It is thus imperative to find solutions for the ever-growing problem of small-scale farmers' inability to access markets, as it is a crucial component affecting their participation. Findings from Magingxa's study that address this problem include financial support to small-scale farmers, enabling them to overcome constraints in terms of location and market access.

Financial support will enable small-scale farmers to reduce their transportation costs and to upgrade infrastructure such as roads, storage facilities and transportation networks. Upgrading of infrastructure will enable farmers to have easier access to markets and market information. Government is already subsidising transport operators in rural areas, keeping the costs of accessing the major centres affordable, which is a step in the right direction (Magingxa, 2006).

2.2.5 Support services

The availability of grants and subsidies (any assistance from government) to small-scale farmers will most probably decrease their dependency on farm income, since these provide another source of income for the farmer to rely on. On the other hand, it could be argued that a lack of grants and subsidies would force farmers to participate more actively in the economy through the selling of their commodities. However, Montshwe (2006) hypothesises that a lack of grants and subsidies would lower the probability of a small-scale farmer participating in the mainstream economy. Results from his study shows, in fact, that a small-scale farmer who receives a grant or subsidy is more likely to participate in the economy than the small-scale farmer who relies on his/her own income source only. Montshwe further states that a unit change, defined by the shift from not receiving to receiving grants or subsidies, increases the probability of participation in the mainstream economy from 19.45% to 30.37%.

An essential element in the success of small-scale farmers is the quality of grant extension services in an area. Generally, small-scale farmers have a lack of farming skills and market information. Extension officers can assist these farmers to produce in the most efficient manner and thereby increase profits. Among many activities in which extension must be involved, there are a number of priorities that need to be realised (FAO, 2009), including:

- technology transfer;
- offering economic advice (including book-keeping);
- developing agricultural markets and informational systems;
- developing small enterprises and discovering new alternatives for generating profits;
- participating in the implementation of rural development; and
- advice in legal and social fields.

Most of the above factors are either absent or ineffective in the South African context although they form an essential element of agricultural development activities.

2.2.6 HIV/AIDS

The South African public health situation is largely overshadowed by the HIV/AIDS pandemic, with statistics showing South Africa to be the country with the greatest number of infections in the world. This will probably make HIV/AIDS the single most important driver that will shape future social and economic developments and trends in the NWP (Cloete, Van Schalkwyk & Carstens, 2009)

HIV/AIDS infection has a serious effect on small-scale farming. Households with infected members are unable to use their land effectively, as members with farming skills are too weak to farm and often die from the disease (Ortmann & Machethe, 2003). Moreover, the South African Regional Poverty Network (SARPN, 2009) indicates that over 7 million farmers and agricultural workers have died in the last two decades in the most affected countries worldwide, significantly reducing the productive capacity of farming households.

HIV/AIDS has significantly increased the difficulty of establishing development projects, mainly because of the detrimental effect of the disease on skilled, willing and knowledgeable

farm workers. Likewise, development projects to incorporate small-scale farmers in the mainstream economy are becoming increasingly difficult, as the selection process is very stringent in order to ensure success of the project.

2.2.7 Lack of access to credit

One of the biggest problems identified over the last decade when it comes to problems faced by small-scale farmers is their lack of production capital. According to Van Schalkwyk (2009), production capital is absolutely essential for any farming business, mainly because it forms the base from which inputs are acquired and outputs are eventually realised. Necessary start-up capital can be acquired through initiatives such as the Land Redistribution and Development (LRAD) and Comprehensive Agricultural Support (CASP) programmes, and usually does not pose such a big problem as lack of production capital does. A number of reasons can be linked to this ever-growing problem, with lack of access to credit being the most significant. Because small-scale farmers do not have collateral, they find it difficult to acquire credit. Financial institutions, such as the Land Bank, numerous commercial banks and other money-lending institutions, consider small-scale farms as high risk enterprises. Moreover, micro-financing, when available, involves high interest rates, caused by high administration costs, opportunity costs and a high risk premium. All things considered, small-scale farmers are labelled as a high risk from the perspective of financial institutions, who find it financially unsound to provide credit to small-scale enterprises (Van Schalkwyk, 2009).

2.2.8 Ownership

Ownership is a factor that is often underestimated in terms of what makes a small-scale farmer successful. Lack of ownership often leads to the demise of a development project. Ownership can be summarised as the state or fact of exclusive rights and control over property, which may be an object, land/real estate or intellectual property. Ownership can create an incentive to produce as well as a sense of responsibility amongst owners. Moreover, lack of ownership affects factors like access to credit, which as mentioned, poses a serious threat to the livelihood of small-scale farmers. Previously, development projects have concentrated on leasing or providing agricultural land to small-scale farmers without giving them property rights to the land. The AMP for the North West Province emphasises the

importance of small-scale farmers' access to property rights, identifying it as one of the most important factors to ensure the success of various development projects (Cloete *et al.* 2009).

2.3 Development projects

Development projects have had different outcomes right across the world, with some countries, like India, showing enormous improvement in agricultural and rural development over the last three decades (Tripathi & Prasad, 2009). However, in contrast to India, most other countries have not reported such notable improvements - posing the question on what India did right. An evaluation of the success factors that shape the success of development projects in countries such as India, and how these differ from those in South Africa, might be able to give a good idea of what is currently lacking in the local development framework and its projects. These success factors will contribute to the development of a framework that will assist local decision makers in making the best possible decision amongst a number of alternatives.

Lessons learned from previous local development projects must also be taken into consideration when constructing such a development framework. The incorporation into the development framework of relevant experiences and lessons learned from local development projects could substantially increase the potential for local agricultural development success. The following section provides details on global projects and the success factors that contributed towards their successes. These success factors will subsequently be used to develop an effective development framework. Thereafter, local development projects will also be discussed to give a local perspective on agricultural development efforts.

2.3.1 Global studies

Many development initiatives world-wide are driven by the International Fund for Agricultural Development (IFAD), which is a specialised agency of the United Nations (UN). Development projects under the IFAD programme are in place all over the world where rural poverty is of concern. IFAD was established as an international financial institution dedicated to the eradication of rural poverty in developing countries. IFAD's goal is to empower poor rural men and women in developing countries to realise higher incomes and improve food security. Subsequently, an evaluation of current strategies and projects

followed by IFAD can give a good indication of potential strategies or mechanisms that can contribute towards development success. Table 2.3 lists 11 development projects that were evaluated under the IFAD programme during 2008.

Table 2.3: Project evaluations undertaken in 2008 by IFAD

Country	Project title
Nigeria	◦ Katsina State Agricultural and Community Development Project ◦ Sokoto State Agricultural and Development Project ◦ Community Based Agricultural and Rural Development Programme ◦ Roots and Tubers Expansion Programme
Sudan	◦ North Kordofan Rural Development Programme ◦ South Kordofan Rural Development Programme
China	◦ Qinling Mountain Area Poverty Alleviation Project
Korea	◦ Uplands Food Security Programme
Guatemala	◦ Rural Development Programme for Las Verapaces
Argentina	◦ Rural Development for the North-eastern Provinces
Madagascar	◦ Upper Mandrare Basin Development Project

Source: IFAD (2008)

According to the annual report by IFAD in 2008, 82% of the projects evaluated were assessed as moderately satisfactory or better, with four projects being particularly effective. Of these four outstanding projects, the Qinling project in China stands out. This project has seen substantial changes in farming systems and practices that have resulted in greater land productivity and increased yields. Roads and power lines were installed and village planning and extension services have improved. According to the report, the major reasons for the success of the project can be attributed to a combination of positive policy changes, a favourable economic context, and project investments. IFAD focuses specifically on the regulation of policies relating to:

- Small-scale financial institutions (assisting organisations like the African Rural Credit Association supplying financial aid to the rural poor).
- Water-use.
- Resource management and equitable access to and the protection of natural resources.
- Inter-district trade (assisting in reaching agreements between countries to promote trade).

An example of a project that can easily be related to the South African rural situation is the study by Datt and Ravallion (1997), which investigated why certain Indian states have done better than others at reducing poverty. Long-term progress in raising rural living standards have been diverse across the different states of India, and the study by Datt and Ravallion (1997) attempted to explain and identify factors assisting or prohibiting rural development. In explaining the deviations, they found inflation and fluctuations in average farm yields and per capita non-farm output, to be the main factors that impacted on the success of the rural poor in the short term. Another factor they identified was differences in the growth rate of average farm yield amongst farmers.

However, these are not the only impacting factors. Initial resources, in the form of infrastructure and human capital, are also believed to play a significant role in explaining why certain states have performed better than others over the long run, resulting in long-term progress in raising rural living standards being diverse across the different states of India. For example, states with initial higher farm yields, irrigation intensity, literacy rates and lower infant mortality have had higher rates of poverty reduction over the long run when compared to others, especially in the rural areas (Datt & Ravallion, 1997). Their study concludes that improving irrigation intensities, as well as raising literacy rates and lowering the infant mortality rate can significantly increase the chances of reducing poverty.

Gardner (2003) reports that the success of economic development is dependent on growth in the agricultural value-added sector as well as an increase in rural household income. He suggests that this could be achieved through: (i) macroeconomic and political stability, (ii) institutions establishing property rights and incentives, (iii) access to competitive input markets and remunerative output markets, (iv) adoption of productivity-enhancing technology, and (v) real income growth in the non-agricultural economy.

Another example includes that of China. However, there is a lot of controversy around China and its development efforts as a result of extreme demands and limited land availability. Consequently people are being placed under great economic pressure to produce effectively and sustainably through agriculture to ensure healthy economic growth for the country (Xu *et al.*, 2006). Nearly 70% of China's 1,3 billion people reside in rural areas, which creates vast challenges in terms of both global economic integration and global changes in the natural environment of the country. As a developing country with limited land, China must build up

a good understanding of sustainable development, and develop scientific methods for evaluating the sustainable capability of its agricultural land. It must also deal with the issues of regional differences and imbalance in levels of agricultural development in order to devise strategies to achieve the goal of sustainable development throughout the country (Xu *et al.*, 2006). Furthermore, the study focuses on the integrated effects of different supporting systems for sustainable agricultural development. The supporting systems include:

- agricultural resources;
- agricultural development;
- the environment and ecosystem;
- tural society; and
- science, education and management.

Xu *et al.* (2006) use the zoning method in order to promote sustainable development throughout China. Zoning is a system of spatial classification allowing each region to be sustainable with the ultimate aim of promoting sustainable development for the country as a whole. Zoning is based on three principles, namely the principles of integration, relative consistency, and the integrity of provincial units. According to Xu *et al.* (2006), the zoning scheme can be used to guide sustainable agricultural development at provincial and regional levels. Results from the zoning system suggested that Eastern China needs to increase the input of science and technology as well as adjust internal structures so as to develop intensive, commercial and green agriculture. On the other hand, Mid- and Western China should put their efforts into ecological protection, increase inputs of agricultural resources, improve rural development as well as promote science, technology, and management.

Zoning is also applied in South Africa, but is better known locally as Spatial Economic Development. The National Spatial Development Perspective (NSDP) initiative is based on the fact that government is constituted of national, provincial and local spheres of government, which are distinctive, interdependent and interrelated. The national government initiated the development of this strategy and it was developed in order to achieve the objectives set out by the national imperatives. It will subsequently assist with the development of business plans for the Agricultural Master Plan (AMP) (KZNPG, 2005).

2.3.2 Regional studies

Consensus has been reached between most sub-Saharan African countries that a significant investment is needed in key areas such as roads and communication infrastructure, agricultural research and water control if the success of agricultural development is to be increased. However, another factor of concern is agricultural markets, taking into account the difficulties facing decision makers on what needs to be done to improve agricultural markets in sub-Saharan countries. A study by Poulton, Kydd & Dorward (2006) on market constraints on pro-poor agricultural growth in sub-Saharan Africa attempted to answer these pressing questions. Poulton *et al.* (2006) acknowledge that investment in the agricultural sector could be regarded as one of the foremost factors for ensuring improved agricultural markets and pro-poor growth, but at the same time they emphasised that poor co-ordination, opportunism, rent-seeking costs and risks are regarded as serious threats for investments in agricultural development. Besides, large seasonal variability in demand and supply of agricultural produce, degraded roads, and lack of telecommunications and information systems are the foremost contributors to the poor co-ordination and widespread rent-seeking that negatively affect investment. Poulton *et al.* (2006) emphasise that there are three broad types of functional intervention that could address co-ordination failure in poor rural economies. These are described as follows:

- "Supply chain co-ordination" - this involves the development of an effective system to support and co-ordinate decision making by different players across the supply chain.
- The second function for development intervention, "pump priming investment", seeks to provide a higher investment base through many initiatives.
- "Threshold shifting", the third intervention type constitutes an upward shift of the marginal value product (MVP) curve, which can be achieved through technical change.

Furthermore, Poulton *et al.* (2006) identified additional factors that need to be addressed in order for the rural poor to overcome market constraints. These factors are:

- First, the developments of efficient local and regional markets for African produce. A vibrant market for African produce can potentially stimulate an increase in local production and thus stimulate domestic economic growth and poverty reduction.

- Secondly, market efficiency plays a significant role in the sustainability of small rural farms. An effective market can lessen the degree of price fluctuations experienced by both producers and consumers, thus significantly decreasing the associated risk levels. Stimulating the market for indigenous foods, improving support services and giving producers greater security are all factors that will contribute to a more efficient market.
- The third factor includes the promotion of basic financial services for the poor. In addition, development of input markets, increased accountability of rural policy and institutional development and performance are also factors that need to be addressed in order for the rural poor to overcome market constraints.

Eicher (1999) adds to the work of Poulton *et al.* (2006) by suggesting a number of further challenges that need attention in order for African farmers to operate successfully. These are to:

- create a "good institutional environment";
- set up agricultural knowledge triangles;
- give long-term scientific assistance;
- expand aid agendas;
- change the roles of public and private institutions and NGOs;
- practice institution building instead of marginal approaches; and
- educate farmers.

The education and training of small-scale farmers is becoming an increasingly pressing matter if sustainable rural development is to take place. Spielman *et al.* (2008) review the role of an innovation systems perspective on strengthening agriculture through education and training in sub-Saharan Africa. They examine the role of post-secondary agricultural education and training (AET) in the context of the region's agricultural innovation systems. Specifically, the paper looks at how AET in sub-Saharan Africa can contribute to agricultural development by strengthening human capacity and promoting an entrepreneurial way of thinking. It also gives recommendations for improving the effectiveness of AET for pro-poor agricultural innovation and development. Furthermore, the authors argue that while AET is crucial for agricultural development, it also plays a significant role in building the capacity of organisations and individuals to transmit and adapt new applications of existing information, new products and processes, and new organisational cultures and behaviours.

The study of Spielman *et al.* (2008) make a number of recommendations that have the potential of strengthening AET in sub-Saharan Africa. These include:

- Realignment of visions and mandates.
- Development of the human capital base by enhancing innovative capabilities.
- Facilitating the flow of information and technology.
- Inducing change in organisational cultures, behaviours and practices.
- Creating an appropriate policy environment.
- Monitoring and evaluating the AET system.
- Adopting a long-term outlook.

In conclusion, Spielman *et al.* (2008) state that continued analysis of AET from an innovation systems perspective is needed. More specifically, the authors suggest that further discussion is needed on how to bring about more efficient human capacity in order to facilitate and promote the innovative systems approach.

A case study in the Eastern Cape by Nel and Davies (1999) examined the obstacles and opportunities facing the two predominant farmer groups, namely, white commercial farmers and emerging black farmers. The main aim of the study was to sustain the resettlement of people previously excluded from the land market on racial grounds. The study area was selected due to the difficult social and economic conditions associated with the rural regions of the former homelands. Rural life in the former homelands was found to have become a degraded mode of existence, associated with high dependency on government handouts and remittances from those working away from home (Nel & Davies, 1999). The authors also conclude that entrenched rural poverty and marginalisation appear to stimulate stock theft in the rural areas, which further restricts farming potential. Nel and Davies (1999) identify additional hindering factors, which include droughts, lack of access to land, shortage of funds, limited access to external markets, failure to penetrate established markets and insufficient marketing.

Further evidence from the Eastern Cape (Nel & Davies, 1999) suggests that rural development will require considerable back-up in terms of finance and technical know-how in order to succeed. Some of the opportunities for rural development that have been

identified are the development of cooperatives among small-scale farmers themselves, where they would pool their resources together and consequently create larger economies of scale. Another possibility is to entice successful private entrepreneurs to invest in development initiatives.

However, it would be nearly impossible for government to address each of the above-mentioned problems individually, and therefore a broad "plan" is needed, one that incorporates and addresses all of the problems that are faced by small-scale farmers. Given the situation, the AMP that was developed for the North West Province (NWP) suggests as a first measure, that business plans that focus specifically on rural development in the NWP should be developed. These business plans will operate through agricultural activities that have the potential to be expanded and that will then be able to provide for the basic needs of the rural poor. This type of business plan is seen as a mechanism that would address many factors constraining small-scale farmer participation in the mainstream economy.

Unfortunately, with the current economic, social and environmental situation in the NWP, serious resource limitations have been identified. This emphasises the fact that those development projects that show the greatest potential should be implemented as a priority, in order to ensure efficiency. Business plans will therefore have to be ranked in terms of their economic, social and environmental capabilities in order to identify the best alternatives. The following section will discuss studies that have been done using different methodologies to rank agricultural development alternatives.

2.4 Methodology

A large number of methodologies have already been developed and used to rank alternative but conflicting choices in agricultural development. The following paragraphs provide a review on some of the most important methodologies used by other authors.

2.4.1 Different methodologies used to rank development alternatives

Because of a large number of real-life applications in civil engineering, agriculture, software engineering and other areas, project scheduling problems are common and project scheduling is therefore one of the most often used operations research models (Hapke *et al.*, 1997).

Hapke *et al.* (1997) did a study on the interactive analysis of multiple-criteria project scheduling problems. In this paper, the multiple-criteria project scheduling problem with multiple activity performing modes, under multiple-category resource constraints is considered. A Pareto Simulated Annealing (PSA) procedure, which is a metaheuristic procedure, was used in order to solve the problem (first stage). The reason the procedure was used is because it finds a good approximation of the set of non-dominated solutions in a relatively short time.

However, PSA is not a complete method for solving multi-objective combinatorial optimisation (MOCO) problems but just a tool for generating approximation of the set of non-dominated solutions. The interactive Light Beam Search-Discrete (LBS-Discreet) procedure is then applied in order to allow the decision maker (DM) to carry out both free scanning of the whole set of approximate non-dominated solutions and iterative improvement of the currently considered solution (second stage).

According to Hapke *et al.* (1997), in the first stage, PSA uses some ideas known from two existing single objective metaheuristic procedures namely genetic algorithms and simulated annealing to accomplish the generation of an approximation of the non-dominated set. These ideas are appropriately adapted to the MOCO problem.

Hapke *et al.* (1997) further state that the second stage requires input from the DM. The DM learns about the possible trade-offs as well as about preferences and selects the best compromise. The LBS-Discreet interactive procedure is used in order to provide some support for the DM at this stage as the multiple-criteria project scheduling problem may have a large number of solutions. Moreover, a number of advantages were identified when the LBS-Discreet interactive procedure was used:

- In a single iteration the DM is required to supply relatively simple preference information.
- The DM is involved in the decision process, which increases his/her confidence in the final solution.
- The DM is supported in learning about his/her preferences and about the possible trade-offs.

The following describes the general scheme of the LBS-Discreet method:

Step 1: The DM is presented with the ideal and nadir point, i.e. the points making up the best and worst values of the objective functions.

Step 2: Ask the DM to specify a reference point or make the ideal point the reference point.

Step 3: Find a starting current solution by projecting the reference point.

Step 4: Ask the DM to specify the preferential information defining the size or vicinity of the current solution.

Step 5: Present the DM with a sample of the solution coming from that vicinity.

Step 6: Allow the DM to see other solutions in the vicinity.

In conclusion, the paper by Hapke *et al.* (1997) describes an interactive procedure for solving multiple-objective project scheduling problems, consisting of two main stages, namely a multi-objective metaheuristic procedure known as the PSA and an interactive procedure known as the LBS-Discreet procedure.

Marinoni *et al.* (2008) investigated the possible utilisation of a compromise programming method which uses ideal values, both positive and negative, as reference points. This method makes its choices based on the distance between decision options and the ideal option, i.e. the closer a decision option is to the ideal, the higher its utility will be. The mathematics behind the method is not too complex and is calculated as:

$$u(j) = \sum_{i=1}^{m} [w_i \left(\frac{f_i^+ - f_{ij}}{f_i^+ - f_i^-}\right)$$

Where:

f_i^+ = *The best score for criteria*

i and f_i^- = *the worst for criteria i*

c is a parameter that reflects the importance of maximum deviation from the ideal solution

w_i is the weight for criterion i, and m is the number of criteria (Marinoni *et al.,* 2008).

However, the researchers also needed the ability to use non-linear transformers of the raw scores. The compromise programming method was not sufficient when a variety of criteria (e.g. biodiversity measures, water quality) were used. Therefore another methodology to

assist decision makers, which can operate under a variety of criteria was also investigated. This brings us to the Knapsack problem, which can best be described as a situation where a "backpack" must be filled with items that have a specific utility and volume. The "backpack" must be filled in such a way that best advantage is taken of the volume of the "backpack" while the total value of the packed items is maximised at the same time. The mathematical equation of the Knapsack problem is as follows:

$$\textbf{Maximise} \sum_{j=1}^{n} f_j x_j$$

$$\textbf{Subjected to} \sum_{j=1}^{n} a_j x_j \leq b$$

Where:

x_j is the decision variable included in the knapsack,

f_j is the utility of included item j in the knapsack,

a_j is the cost of item j, and

b is the capacity of the knapsack/budget (Marinoni *et al.,* 2008).

The complexity of the above method increases as the number of decision variables increases. An extension of the Knapsack problem that was subsequently used is the Multi-Criteria Knapsack problem and according to Marinoni *et al.* (2008) the equation needed the following adjustment to be functional:

$$\textbf{Maximise} \sum_{i=1}^{m} w_i \sum_{j=1}^{n} f_{ij} x_j$$

Where:

f_{ij} is the score of item j against criterion.

In the following section, a detailed review is provided on previous studies that have made use of the Multiple Criteria Analysis (MCA). The advantages of the MCA are also stipulated and are considered as the best method to use when compared to other methods.

2.4.2 Multiple criteria analysis

The MCA deals essentially with complex decisions that involve a large amount of information, a number of alternative outcomes, and criteria to assess these outcomes.

Moreover, MCA can be utilised to identify a single preferred option, to rank options, to short-list a number of options for further investigation or simply to distinguish between acceptable and unacceptable alternatives (Kuyler, 2006).

Kuyler (2006) identified several important advantages of the MCA over informal judgements that are not supported by such an analysis. These advantages are:

- The MCA is an open, transparent and explicit process.
- The choice of one or more objectives as well as the criteria used by the decision-making group are open to examination.
- Scores and weights are explicit and used according to established techniques.
- Scores and weights can be cross-referenced to other sources of information on relative values and can provide an audit trail (Kuyler, 2006).

According to Kuyler, (2006) the following are well-known approaches of the MCA to use:

- Direct analysis of the performance matrix:

As the name suggests, it is the direct analysis of the performance matrix and indicates whether certain options/alternatives are dominated by others. However, this method yields a limited amount of information regarding the merits or value of options.

- Multi-attribute utility theory:

The multi-attribute utility theory is divided into three stages, with the establishment of a performance matrix as the first stage. The second and third stages consist of the determination of inter-dependence of criteria and a mathematical estimation of the "weight" of a decision regarding the performance of an option on each of the separate criteria. This approach is well-known for its effectiveness, but is relatively complex and more appropriate for implementation in major projects where time and expertise are readily available.

- Linear additive models:

Linear additive models are relatively simple methods to use and are therefore widely applied in MCA approaches, with the models assuming that criteria are preferentially interdependent. The main feature of these models is that they express the combination of an option value as an overall value through value scores that are multiplied by weights to give it an overall value. The arithmetic is, however, only appropriate if criteria are mutually independent.

- Outranking method:

The outranking method evaluates alternative options and then uses outranking to eliminate alternatives that are dominant. Kuyler (2006) stated that all options are assessed in terms of the extent to which they exhibit sufficient outranking with respect to the full set of options being considered, as measured against a pair of threshold parameters. Kuyler (2006) further states that concerns about the outranking approach are that it is dependent on arbitrary definitions and can be manipulated by decision makers.

- Analytic hierarchy process (AHP):

The AHP was originally developed by Saaty (1977) and is still a popular process used in many fields. According to Kuyler (2006), AHP has three important components constituting the structuring of a problem into a hierarchy which consists of a goal and subordinate features, pair-wise comparisons between elements at each level and the development of level specific priorities for the local to the global. The AHP offers a variety of advantages from the viewpoints of multiple uses and participatory planning, which explains why it has become such a popular approach. These advantages, amongst others, are that objective information, expert knowledge and subjective preferences can be considered together, and that qualitative criteria can be included in the evaluation of alternative plans. Most processes do not allow for the inclusion of qualitative criteria, making the AHP superior in that sense. However, there are also problems with the AHP that make many researchers sceptical of the process. Criticisms have been that the original comparison scale does not allow for the expression of any hesitation regarding the comparisons and that the AHP does not provide any tools for in-depth analyses of the comparisons (Kangas & Kangas, 2004).

A study by Hajkowicz (2007) compared MCA decision-making against unaided approaches to environmental decision-making. It involved 55 decision makers in Australia, who used and evaluated the MCA approach as opposed to their own intuitive approaches. Furthermore, the study attempted to establish the usefulness of applying the MCA and what impacts the MCA had on decision makers' choices.

Hajkowicz (2007) held a series of workshops in order to explain the MCA to the decision makers, as very few of them were aware of the method. Afterwards, five projects in each

region were selected to test the differences between MCA and unaided approaches in the decision making process. Decision makers ranked the projects in their area using both the intuitive approach as well as the MCA. Hajkowicz (2007) also identified the project evaluation criteria through a series of interviews with the decision makers. Hajkowicz (2007) then conducted a survey to obtain all the information needed for the unaided ranking and MCA model, along with decision maker feedback about the merits of both approaches.

Some results from previous MCA studies showed signs of producing different, albeit often similar, results when applied to the same decision-making problem. In this study, a total of 16 methods were applied to ensure that all biases were removed. An MCA method comprises a ranking algorithm as well as a criteria weighting method to obtain complete or partial priority ordering of project performance. The 16 methods were based on combinations of four ranking algorithms and five weighting methods.

Ranking algorithms include:

- Weighting summation – involves transforming performance measures into commensurate units, multiplying by weights, then summing to attain an overall score for each project.
- Lexicographic ordering – involves ranking projects against the most important criterion.
- ELECTRE (concordance-disorder analysis) – involves comparing every pair of projects to compute an overall performance score.
- Evamix – involves making paired comparisons for the projects and combines the ordinal and cardinal scores to attain an overall performance score.

The weighting algorithms include:

- Ranking by ordinal specification of criteria importance – decision makers rank the criteria in terms of importance.
- Rating, involving unconstrained point allocation – point scores are attached to the criteria to indicate criteria importance.
- Fixed point scoring, involving constrained point allocation (percentages were used) – percentage points, adding to 100%, are assigned to the criteria.

- Graphic scales, where importance is indicated by marking a continuous scale from low to high – a measurement was made to determine the weight.
- Paired comparisons, based on the analytic hierarchy process – involves expressing the importance of each criterion relative to every other criterion on a nine-point scale (Hajkowicz, 2007).

Results from the study show that a comparison between the MCA techniques and the decision maker's unaided evaluations were significantly different. However, even with structured decision support in the form of MCA, decision makers were still typically unwilling to revise their unaided evaluations. According to Hajkowicz, (2007) this is central to arguments that the MCA is robust, transparent and accountable.

Moreover, from a procedural perspective a decision is considered good if the process was also good. On the other hand, from a substantive perspective the decision is good if the result was good. According to the paper, the MCA succeeded on procedural rationality but failed on substantive grounds. Furthermore, Hajkowicz (2007) states that as a general rule an MCA cannot be used to make a choice; but rather to inform choices. There is always some aspect of the decision choice that escapes the MCA model.

Marinoni *et al.* (2008) commented that the multi-criteria analysis tool (MCAT) well combines aspects of MCA and optimisation techniques. Furthermore they state that the compromise programming method has the advantage that the user can define ideal and anti-ideal values, and is thus well suited when provided guidelines or expert-defined best and worst values have to be taken into account. According to Marinoni *et al.* (2008), the MCAT provides the possibility of bypassing the compromise programming method by directly importing external computed benefits and costs of a whole set of projects and directly accessing the optimising routines.

2.5 Conclusion

This chapter discussed various factors that need to be considered if an effective and sustainable development framework is to be constructed for the ranking of development alternatives and ultimately to improve budget allocation for agricultural development in the

NWP. Factors that have been identified by previous authors locally and abroad will form part of the criteria that will assist in ranking the different development alternatives. However, the identification of the factors that will assist in the development of the criteria is only part of the challenge. The ranking of these different development alternatives will be done through a Multiple Criteria Analysis (MCA). The MCA will incorporate the criteria and subsequently rank the alternatives according to the set criteria. According to previous studies, the MCA is a well known methodology and is one the best methods to use in attempting to rank different alternatives when numerous external factors have to be taken into consideration.

The following chapter will discuss the relevant province, being the North West Province (NWP) in which agricultural development efforts pertaining to this study will take place. The NWP is a severely poverty stricken province and problem-causing factors need to be addressed if a successful impact on agricultural development is desired.

Chapter 3

Description of Study Area and Development Initiatives

3.1 Background

The North West Province (NWP) in South Africa is a medium-sized province, covering 11.6 million hectares or 9.7% of the total surface of South Africa. This province was created in 1994 by the merger of Bophuthatswana, one of the former homelands, and the western part of Transvaal, one of the four former South African provinces. The province is mostly rural in nature and is regarded as one of the poorest in the country, with areas that are characterized by high levels of food insecurity and poverty.

The main economic activity in the poverty stricken rural areas evolved around agriculture, which make agriculture essential for the survival of the people that reside in these regions. Agricultural development projects are therefore regarded as a means of improving the livelihoods of these people. However, past experiences revealed that the benefits from these projects have not been transferred to the intended beneficiaries. This is mainly due to the low level of success of development projects. The high failure rate of these projects have increased the pressure on government to deliver on their promises. This highlights the need for better resource utilisation i.e. pertaining to both natural and financial resources.

Improved resource utilisation can be achieved through proper development plans/projects and sensible budget allocations towards the implementation of these plans/projects. The overview provided in this chapter is therefore important for understanding the interrelated links between the natural resources, economic performance and socio-economic status of the province. In other words, a review of these factors will identify the types of agricultural projects that could be pursued in the province as well as the extent to which it will improve the livelihoods of the rural poor in the province. A review of the current development initiatives in the province will also be provided. Understanding these relationships will

enable decision makers to improve resource utilisation, and subsequently improve the level of success of agricultural development initiatives.

In the next section, a geographical overview of the province will be provided, followed by a discussion on the primary infrastructure that supports agricultural development and an economic overview of the province. This should provide the reader with a better understanding of the agricultural contribution towards the economy of the province. The fourth section focuses on the socio-economic demographics of the province which is followed by a review of current agricultural development projects underway.

3.2 Geographical overview

The NWP is situated in the north western parts of South Africa with Botswana forming the immediate north border. Bordering provinces include Limpopo, Gauteng, Free State and the Northern Cape (see Figure 3.1). The province's rural nature and its proximity to the major metropolitan markets make it ideal for agricultural development.

The NWP is known for its diverse climate, which differs significantly between the western and the eastern parts of the province. The western part of the province is arid, with an average annual precipitation of less than 300mm per year. This part of the province is also host to the eastern part of the Kalahari Desert which is not suited for intensive agricultural production practices. The central part of the province is typically semi-arid, with an average rainfall of 500mm per year. The eastern part is more temperate with an annual precipitation of 600mm (Davis, 2008).

The significant variance in climate and rainfall from east to west in the NWP also sees a corresponding gradation in vegetation types. In total, ten different types of vegetation are recognised in the NWP, with the four major vegetation types being the Kalahari Savannah, Grassland, Bushveld and Mountain Bushveld. The largest part of the province (71%) falls within the Savannah Biome with its associated Bushveld vegetation. The remainder falls within the Grassland Biome, which contains a wide variety of grasses which is typical to arid areas. The vegetation of the arid and semi-arid western region largely comprises of Kalahari Thornveld and Shrub Bushveld, while the central region is dominated by dry Cymbopogon-

Themeda veldt. The eastern region is characterised by a number of mixed Bushveld types (North West Provincial Government, 2007).

The different vegetation types in the province support a wide variety of livestock production practices. Livestock is therefore an important part of the agricultural sector in the NWP. For instance, some of the biggest cattle production units is found in the NWP, with the Vryburg and Stella areas being known as the Texas of South Africa. The same applies to subsistence and small-scale farmers in the NWP, with the majority of these individuals owning a number of cattle or goats for either commercial or own consumption. Small-scale and subsistence farmers owning cattle or goats can be found all over the province. Commercial production by these farmers is, however, more concentrated towards the western parts of the province. Thus, based on the above, livestock production initiatives towards the western parts of the province could be pursued as an option to attempt to improve the success of development in the NWP.

Arable crop production is another important part of the agricultural sector of the NWP. However, the type of crops that could be produced will depend on the soil potential and rainfall of a specific region. As a result, arable crop production is mostly concentrated to the eastern parts of the province, with the climate and soil quality being favourable for crop production. Moreover, the climate and soil in most of the eastern parts of the province support the production of a wide variety of crops and commodities, ranging from maize to paprika. Thus, crop production development initiatives should be focused, though not limited to, the eastern parts of the province, with irrigation schemes in other regions of the province that may also support crop production.

Not only the natural resources itself but also the state of the natural resources need to be considered when determining the agricultural production capability/potential of a specific region. A global concern that will have an effect on the state of the natural resources and subsequently the agricultural production capability of the NWP relates to climate change. Climate change has the potential to impact on biodiversity, change ecosystems; reduce the availability of agricultural land and water for irrigation etc. Therefore, the rate and impact of climate change in a specific region is an important consideration when deciding on a specific agricultural initiative, as it will have an impact on the success of the initiative and subsequently on development in the province.

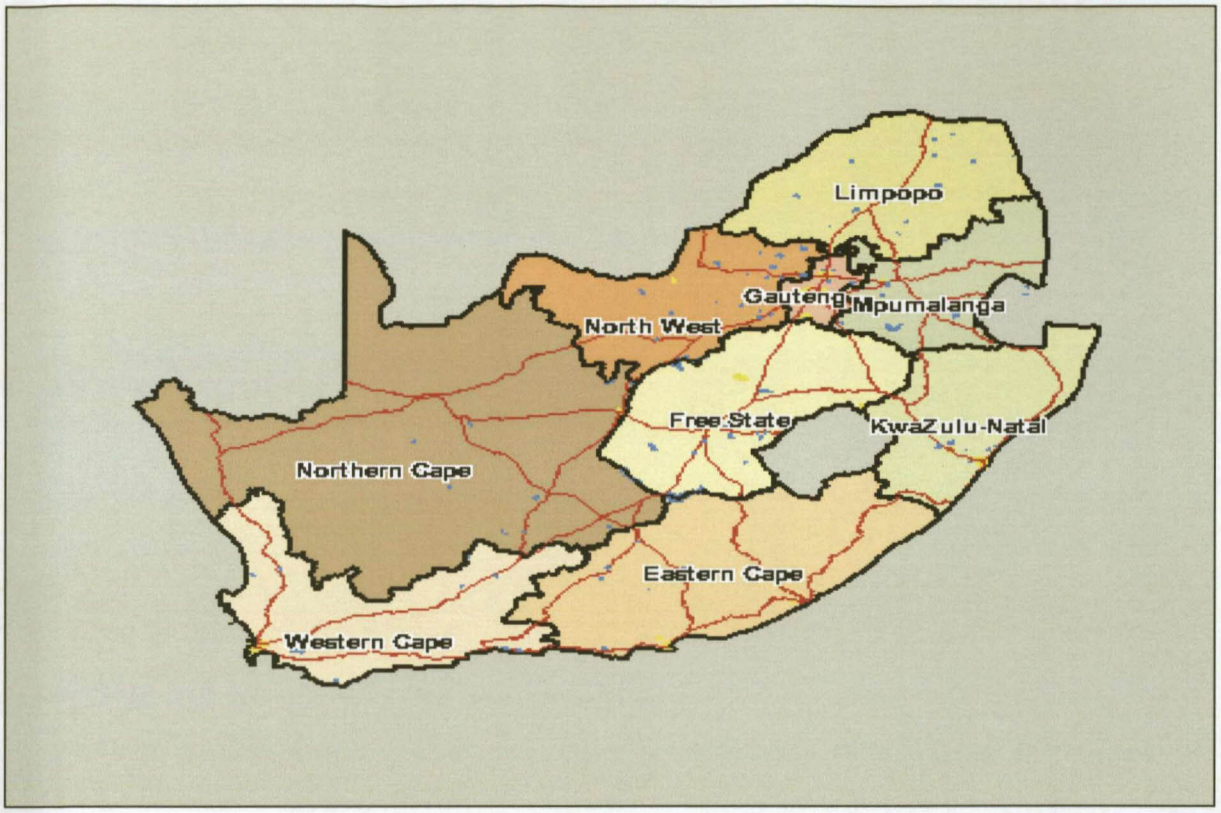

Figure 3.1: Provinces of South Africa.

Source: North West Provincial Government (2007).

Another important consideration, especially in the NWP, is the extreme levels of soil and land degradation. The NWP is listed fourth out of nine provinces in terms of the collective soil and land degradation index (see Figures 3.2 and 3.3). The level of degradation seems to be even worse in the communal areas, with the combined degradation index being approximately 2.5 times higher than in the commercial areas (North West Provincial Government, 2007).

When comparing commercial to communal areas, it is found that degradation is more severe in the communal areas. The degradation index for soil in the commercial and communal areas is 4.4 and 6 respectively (see Figure 3.2). Moreover, the northern parts of the province experiences the highest degree of soil degradation.

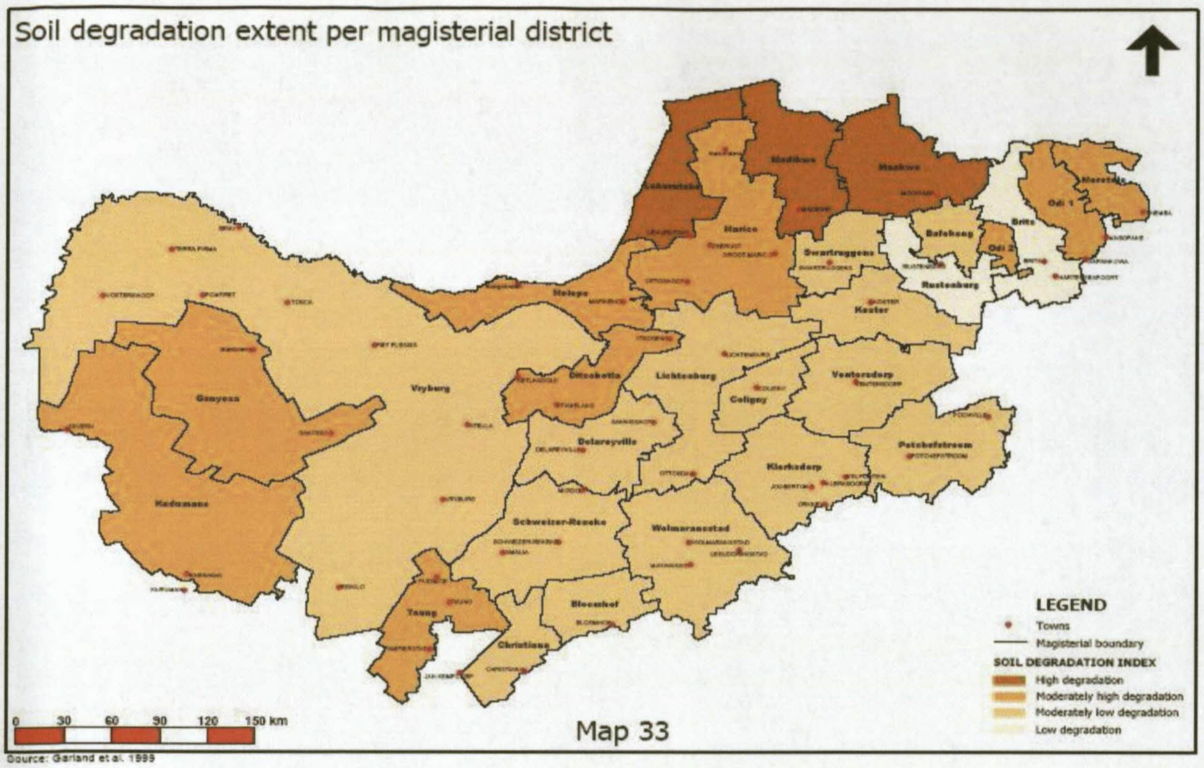

Figure 3.2: Soil degradation per local municipality of the NWP.

Source: North West Provincial Government (2007).

The NWP also has a fairly high land degradation index, with the severity of the degradation again significantly higher for communal areas (2.54) than for the commercial areas (1.47) (North West Provincial Government, 2007). Similar to soil degradation, the northern part of the province is also experiencing the highest level of land degradation. Jordaan *et al.* (2006) suggest that the increased rate of degradation in the province is due to overstocking, poor camping systems which resulted in poor veldt management, poor water reticulation and natural phenomena.

Overstocking and the lack of a proper camping system resulting in poor veldt management is especially applicable to farmers in communal areas. This might also be the reason why the degradation index of communal areas is higher than that of commercial areas. Overstocking and the lack of proper camping systems is a result of the lack of proper education and training, theft of fences, traditions of subsistence farmers, etc. (North West Provincial Government, 2007). However, the communal population is largely dependent on their natural surroundings for their livelihood and is severely influenced by the extreme levels of soil and land degradation. Thus, attempts to rectify this growing concern should be a high

priority in an attempt to develop agriculture in the NWP and subsequently increase the living standards of the rural poor.

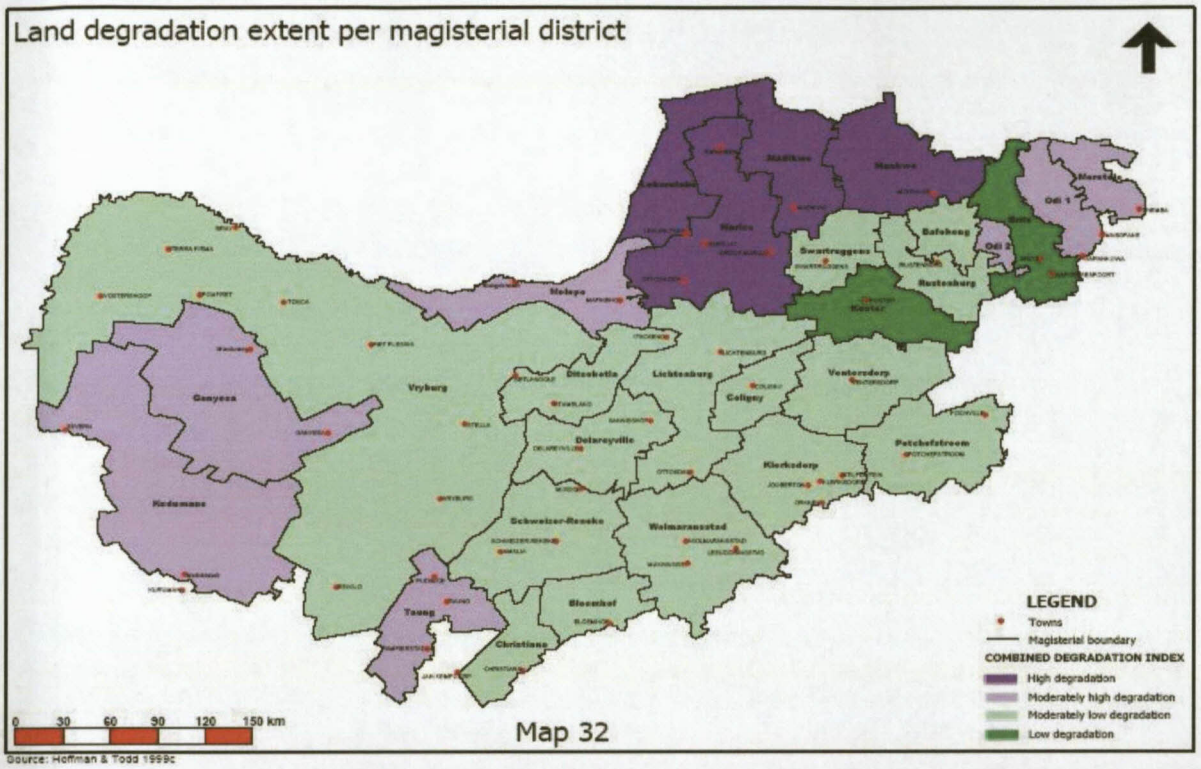

Figure 3.3: Land degradation per local municipality of the NWP.

Source: North West Provincial Government (2007).

Accelerated rates of deforestation, desertification and increasing levels of air and water pollution are additional factors that will influence the success of agricultural enterprises in the province. Thus, the impact of all of these factors needs to be considered when identifying specific agricultural development initiatives in specific regions of the province. Including these factors as part of the natural resource audit for specific agricultural projects will improve the success rate of agricultural development and subsequently the livelihoods of those involved. It will also contribute towards addressing the national imperatives as set by government.

3.3 Land use patterns

As can be seen in Figure 3.4, the NWP is divided into four districts and twenty one local municipalities. These include: Dr Ruth Segomotsi Mompati District Municipality (SMDM)

to the west of the province, Bojanala District Municipality (BDM) to the east, Ngaka Modiri Molema District Municipality (NMMDM) to the north and Dr Kenneth Kaunda District Municipality (KKDM) covering the southern parts of the province. The use of district municipalities as a means to divide the province into different agricultural regions will assist in discussing the land use patterns in the province.

The land use patterns could also be linked to the geographical overview in an attempt to determine which agricultural initiatives will be best suited in the different regions of the province. This will also provide information for the identification of agricultural development initiatives, therefore business plans will be developed and ranked according to the set criteria.

Figure 3.4: District and local municipalities of the NWP.

Source: Agricultural Research Council (2008).

As mentioned, the NWP covers approximately 11.6 million hectares. Of this, approximately 9.6 million hectares (81.1%) is agricultural land. Agricultural land in the province can further be subdivided into 5.4 million hectares (56.3%) veldt, 3.4 million hectares (34.9%) arable lands and 764,500 hectares (7.9%) of conservation land.

The majority of the 5.4 million hectares of veldt in the province is used for the production of livestock. The major livestock producing regions in the province, located towards the

western and southern parts (i.e. SMDM and KKDM) account for an estimated 70% of all the livestock produced in the NWP. The main farming activities in these two regions include cattle, sheep, poultry and pig farming. Livestock produced to the northern and the eastern (NMMDM and BDM) parts of the province, is to a lesser extent and accounts for approximately 30% of all the livestock production in the province. However, the popularity of game farming has increased substantially over the past few years, with large amount of hectares that was previously used for cattle and sheep production being transformed into game ranches.

Arable land as a percentage of the total area in the NWP is estimated at 28.3% which is significantly higher than the national average of 13.7% (DAFF, 2010). This implies that a large part of the NWP is suitable for field and fodder crop production when compared to other provinces. Based on climates and soil suitability, it is evident that field and fodder crops are mainly produced towards the western (SMDM), northern (NMMDM) and southern parts (KKDM) of the province with maize production accounting for approximately 71% of all field and fodder crops produced. However, natural resources towards the western region (SMDM) of the province is not suitable for dry land field and fodder crop production and a number of irrigation schemes is situated in this area resulting in a higher than expected production (DAFF, 2010).

Based on the afore-mentioned land use patterns, the contribution of BDM towards the production of livestock, field and fodder crops are limited. However, the climate and proximity of BDM to large fresh produce markets in the metropolitan areas make it ideal for higher value crops like horticultural crop production. This is confirmed by the fact that approximately 79% of horticultural crops are being produced within BDM (DAFF, 2010).

Similar to other provinces, agriculture plays a significant role in the NWP, especially taking into account the rural nature of the province coupled with the favourable climate, sufficient natural resources and the fact that the NWP is currently the province with the second highest land utilisation in former homelands (DAFF, 2010). However, the natural resource base is only one of the factors that need to be considered. The following sub-section will detail on the infrastructure that supports agricultural production in the province - which is just as important for the success of agricultural development initiatives.

3.4 Infrastructure

Infrastructure contributes significantly to achieving economic growth, which in turn contributes towards poverty alleviation and the empowerment of rural communities (Kessides, 1993). Kessides is of the view that infrastructure contributes to economic growth, both through supply and demand channels by reducing costs of production, contributing to the diversification of the economy and providing access to the application of modern technology, raising the economic returns to labour. Additionally, infrastructure contributes to raising the quality of life by creating amenities, providing access to consumption goods (transport and communication) and contributing to macroeconomic stability. However, infrastructure does not create economic potential, it only develops an enabling environment for economic growth (Kessides, 1993).

A study done by Hemson, Meyer and Maphunye (2004) also concludes that rural infrastructure development is closely related to the empowerment of rural communities which has to include the encouragement of civil society, public participation in decision-making and a democratic culture. Therefore, to ensure efficient and sustainable agricultural development efforts in the NWP, adequate and reliable infrastructure is needed in order to establish physical links between small-scale farmers and markets (Fedderke & Garlick, 2008).

An analysis of the current infrastructure and the state thereof can help to describe the underlying reasons for the current economic performance of the NWP as well as the degree of support it can provide towards agricultural development initiatives (i.e. access to inputs, markets, etc.).

3.4.1 Transport

Historically, the railway system was used as the primary means for the transportation of agricultural products. The railway system is therefore well developed, connecting all the major areas in the NWP (see red lines in Figure 3.5). However, the current functionality of the railway system is questionable, since it is not managed properly and is ineffective in comparison with the road system, making it a less efficient means of transport. Despite being inefficient, the railway system is still used to transport a small percentage of the bulky items and commodities such as grains in the province. As a result, a lot of the focus has shifted

towards roads as the primary means of transportation, which again resulted in the rapid deterioration in the condition of the roads in the province. The deprived condition of the roads (especially the secondary roads) prohibits the people residing in the rural regions to ensure easy and frequent access to input and product markets (North West Provincial Government, 2007) .

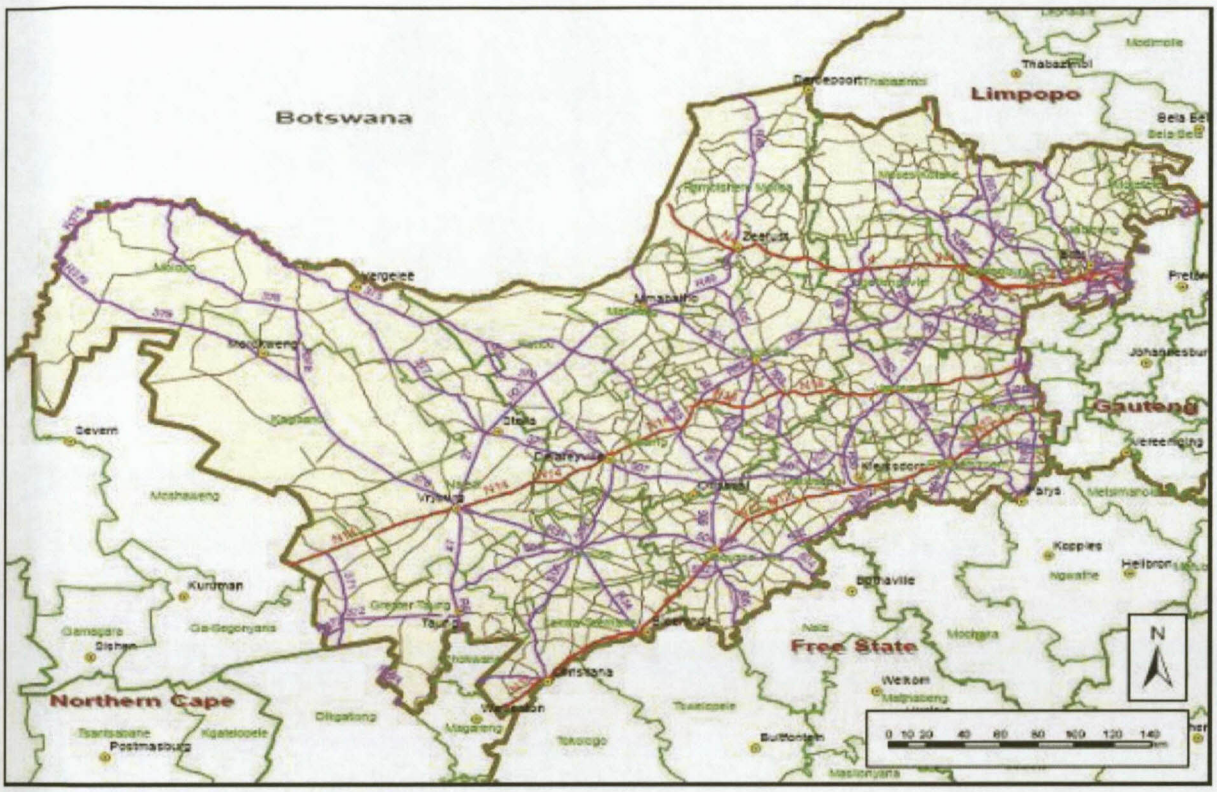

Figure 3.5: Railway and road infrastructure in the NWP.

Source: Agricultural Research Council (2008).

3.4.2 Electricity

Blackouts experienced in 2008 resulted in substantial losses for all businesses, negatively affecting the economic performance of the province. Intensive agricultural activities such as dairy parlours, irrigation, broilers etc. were also affected as a result of the blackouts. Due to a significant population growth experienced in the NWP, the development of electricity infrastructure is not able to keep track of the rapid growth in demand. The rural nature coupled with the swift uprising of informal settlements in the NWP makes it extremely difficult to supply everybody in the province with electricity (Cloete, 2009). From Figure 3.6, it is evident that electricity is available throughout most of the urban and semi-urban

areas of the province, supplying electricity to the major economic hubs. The red dots in Figure 3.9 represent the medium voltage distribution lines and substations in the NWP. As can be seen from Figure 3.9, the western part of the province is not as developed as the other regions. A lack of proper electricity supply to this region could have a severe impact on food production and food security. For instance, farmers lack the ability to produce perishable products due to a lack of electricity to operate coolers. Other intensive agricultural activities such as irrigation is also impossible as there is no access to electricity to operate the irrigation systems. This must be taken into consideration when projects are assigned to specific areas.

Figure 3.6: Medium voltage distribution lines and substations in the NWP.
Source: Agricultural Research Council (2008).

3.4.3 Agricultural markets

As mentioned, the natural resource base and diverse climate of the NWP enable producers to produce a wide range of commodities, which include amongst others the production of horticultural products. However, access to fresh produce markets is critical for the success of horticultural production enterprises. Figure 3.7 depicts the location of the major fresh produce markets in the province as well as surrounding areas (indicated as orange dots). The only fresh produce market in the NWP is situated in Klerksdorp. All the other fresh produce markets accessible to NWP producers are either in Gauteng or the Free State Province.

Supply to these markets means that income and job creation opportunities are lost to the province. The lack of a proper fresh market system in the NWP means that small-scale farmers situated in the north-western parts of the province are unable to get involved in horticultural production. Thus, the identification of agricultural development initiatives and the allocation of funds towards these initiatives must be allocated accordingly.

Figure 3.7: Fresh produce markets in and around the NWP.

Source: Agricultural Research Council (2008).

The predominant share of cash crops like maize, wheat and sunflower is marketed through agri-businesses (co-operations). Although the marketing of these crops is fairly straightforward, the bulk nature of these crops require that they be stored in enclosed areas such as silos. Thus, silo infrastructure can give a clear indication of the cash crop markets in the NWP. Figure 3.8 show the distribution of silos in the NWP (indicated as red dots). As can be seen, the majority of the silos are located in the central parts (NMMDM) of the province, with a few located in the north-eastern parts. Thus, cash crop production initiatives should be focused in these regions (i.e. provided that it is supported by the natural resources). This will enable small-scale farmers to be in close proximity to markets which will reduce

transportation and marketing costs. In areas where the natural resources support the production of field and horticultural crops but where the infrastructure is not available, government will have to find ways to stimulate the development of the necessary infrastructure.

Figure 3.8: Silos in the NWP.

Source: Agricultural Research Council (2008).

3.4.4 Water bodies

The NWP is known to have limited water resources. Figure 3.9 reflects the existing water bodies or catchment areas in the province. It is evident from Figure 3.9 that water bodies or catchment areas are concentrated towards the north-eastern parts (BDM) of the province. Projects which entail the production of water intensive crops should therefore be considered in these regions. However, as mentioned before, other factors also need to be considered before engaging in the production of water intensive crops (i.e. horticultural crops, perennial crops, etc). These include natural factors (land suitability and climate), road infrastructure, electricity, availability and accessibility of markets, on-farm infrastructure etc. All of these

factors influence the success of agricultural development in the province, which require a holistic approach before allocating any resources (i.e. financial, human etc.) towards development projects.

Figure 3.9: NWP water bodies and irrigation schemes.

Source: Agricultural Research Council (2008).

In contrast, fewer catchment areas are present in the western part of the province (SMDM), which coupled with the natural resources makes this region more suitable for animal production. However, due to limited surface water availability to the western parts of the province, livestock farmers struggle to provide their animals with sufficient water and mostly make use of underground water supply. In addition, small-scale farmers seldom have the necessary equipment (i.e. submersible pumps, etc.) to utilise underground water supplies.

3.5 Economic overview of the NWP

In this section, the different economic sectors of the NWP are discussed in order to provide a better understanding of the relative importance of the different sectors. Due to the focus of

the study on agriculture, more attention is given towards the different agricultural sub-sectors. This will assist in determining the role that each of these sectors could play in rural agricultural development in the NWP. The performance of the different agricultural enterprises will also shed some light on the extent to which the natural resource base and the infrastructure in the province is supporting specific agricultural enterprises. This will assist with the identification of agricultural development initiatives that have the highest potential of being successful in the province.

The economy in the NWP is regarded as one of the smallest compared to the other provinces in South Africa. The NWP contributed an estimated 6.4% to the total national gross domestic product (GDP) in 2007, compared to Gauteng (33.6%); KwaZulu-Natal (16.3%) and the Western Cape with 14.6% (see Figure 3.10). The NWP is the third smallest contributor, with only the Northern Cape (2.2%) and the Free State Province (5.4%) making smaller contributions towards the national GDP.

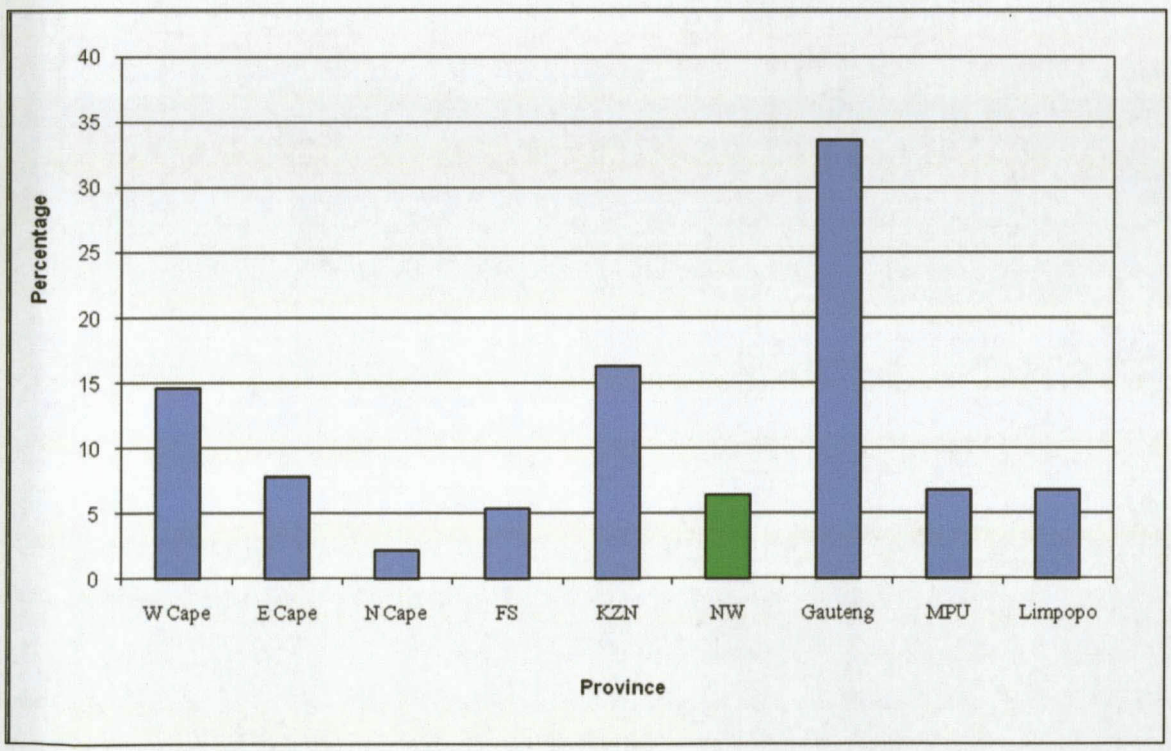

Figure 3.10: Provincial contribution to total GDP .

Source: StatsSA, (2007a).

Figure 3.11 shows the trend in the GDP growth rate of the NWP from 1996 to 2007. It is evident from Figure 3.11 that the provincial GDP have fluctuated from year to year; however, a positive trend can be seen from 2001 onwards. Considering the last year, the province reported a GDP growth of 4.4%. Although the NWP have realised an increase in the GDP growth rate from 2006 to 2007, it remained lower than the average national GDP growth rate of 5.1% (StatsSA, 2007a).

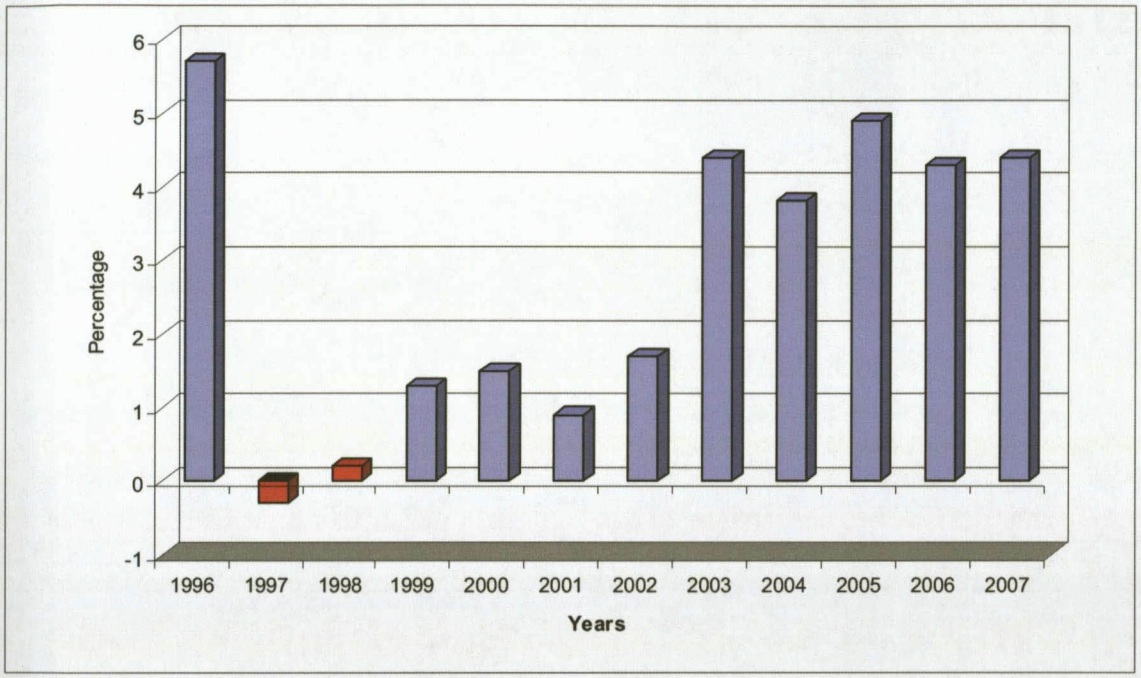

Figure 3.11: GDP growth of the NWP.

Source: StatsSA (2007).

The performance of the economy is also evident in some of the socio-economic indicators of the province. For instance, Cloete (2009) reports that 41 out of every 100 people in the NWP are economically dependent, making it one of the poorest provinces in South Africa. According to Cloete (2009), the high level of poverty impacts on a wide range of interrelated issues which include the level of education, level of employment, household income, disparities between urban and rural residences, population densities, health concerns and access to basic services. It will also negatively influence the performance of the economy, and subsequently the productivity of the agricultural sector.

Figure 3.12 illustrates the contribution of each district municipality in the NWP towards the provincial GDP as well as the average growth rate from 1996 to 2006. As can be seen from

Figure 3.12, BDM had the highest GDP growth rate (56%) from 1996 to 2006. In addition, KKDM revealed the smallest GDP growth rate, with a negative average annual GDP growth rate of minus 0.17%, indicating that the region's economy is growing slower than prior to 1996.

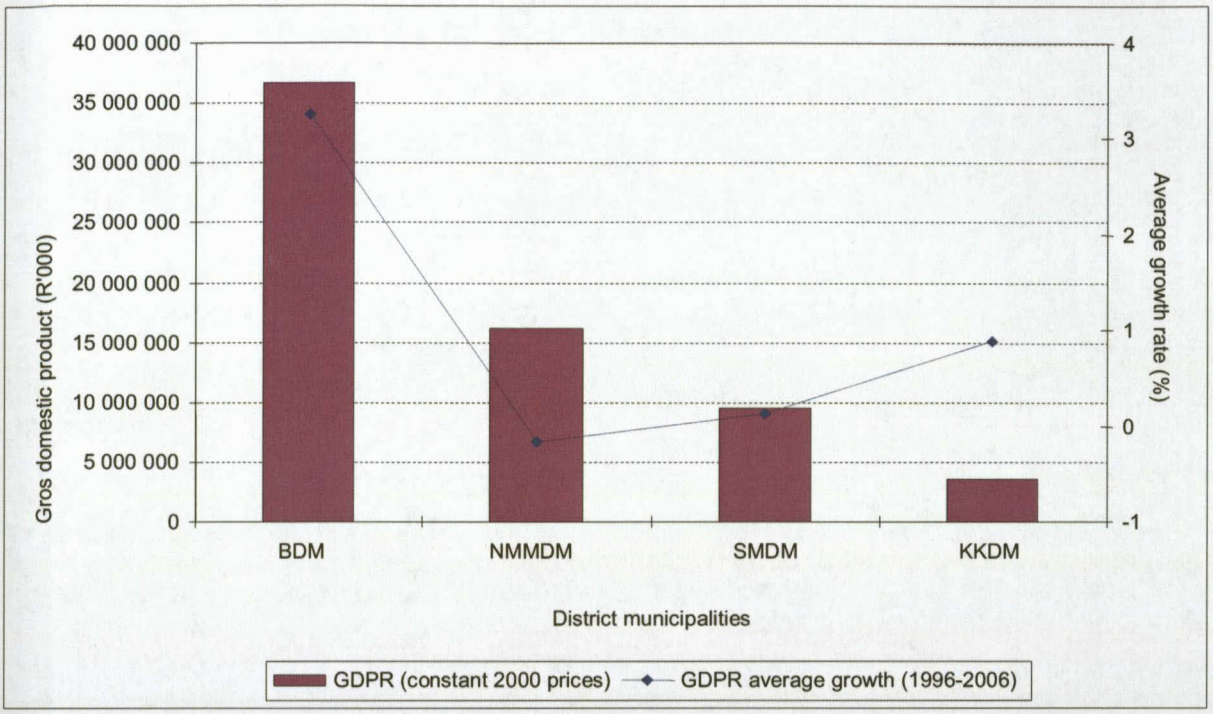

Figure 3.12: Gross domestic product per district municipality in 2006 and average growth rate (1996-2006).

Source: DBSA (2008).

3.5.1 Economic sectors

In contrast to the rest of the provinces in South Africa, the NWP's primary sectors (i.e. agriculture and mining) contribute a noteworthy 28.5% towards the provincial GDP compared to the national average of 8.9%. The largest contribution towards provincial GDP is by the tertiary sector (trade, transport, finance and community services) with 50.6%. The secondary industry (manufacturing, electricity and construction) contributed the least with 9.5% (see Figure 3.13).

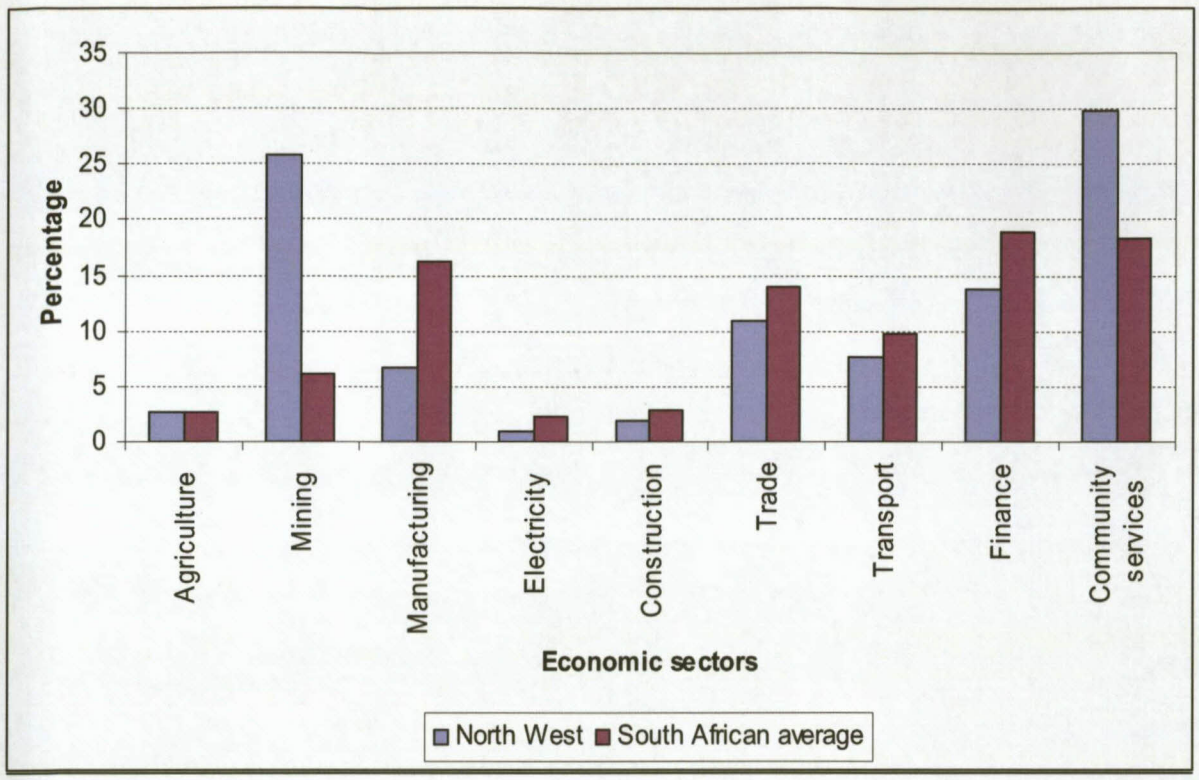

Figure 3.13: Gross domestic product per sector in the NWP.

Source: StatsSA (2007a).

The agricultural sector contributed 2.5% to the provincial GDP, with the mining and community services sectors having the most significant contributions with 30% and 26% respectively (see Figure 3.13). However, agriculture is a major source of food supply and household income in most of Africa's rural population. Besides, when considering backward and forward linkages, agriculture is contributing an important share to the provincial GDP (StatsSA, 2007a).

The agricultural sector in the NWP is one of the sectors showing the most potential for economic growth realising an impressive 5.1% growth rate in 2005 (Cloete *et al.*, 2009). The construction sector realised an 8.8% growth rate being the sector with the highest growth rate in the province and the only sector that achieved the targets set by the Provincial Growth and Development Strategy (PGDS) (see table 3.1). Although the agricultural sector realised a notable growth rate in 2005, it still did not achieve the targets set by the PGDS.

Table 3.1: Average annual sectoral growth rates (1996 to 2005).

Description	1996-2001	2001-2004	2005		Annual PGDS Target
	NWP		NWP	RSA	
	Percentage (%)				
Agricultural	0.4	2.2	5.1	4.1	6.6
Mining	0.3	1.6	3.2	2.4	7.4
Manufacturing	0.8	1.8	2.7	5.1	7.1
Construction	9.3	7.8	8.8	11.9	7.5
Trade	2.8	6.7	4.6	6.5	5.9
Transport	7.9	6.4	2.3	5.5	9.1
Finance	5.9	4.9	3.4	5.5	6.8
Community Services	0.3	2.3	4.1	4.4	4.6

Source: North West Provincial Government (2007).

3.5.2 Agriculture

The agricultural sector in the NWP consists of a well developed commercial sector and a predominantly subsistence sector mainly situated in the communal areas. Due to a combination of factors including ownership, overgrazing, lack of government support, leadership, social environment, lack of knowledge, etc. the majority of these communal areas are utilised in an unproductive manner. In addition, a large part of the NWP comprise the former homelands of Bophuthatswana (3.8 million hectares or 32% of the province), which also contributes to the limited contribution of the province towards the national agricultural GDP (DAFF, 2010). The contribution of the NWP to the national agricultural GDP is the fourth smallest with 6.9% (see Figure 3.14). Provinces making notable contributions towards national agricultural GDP in 2007 include KwaZulu-Natal (25.9%) and the Western Cape with 23.1% (DAFF, 2010).

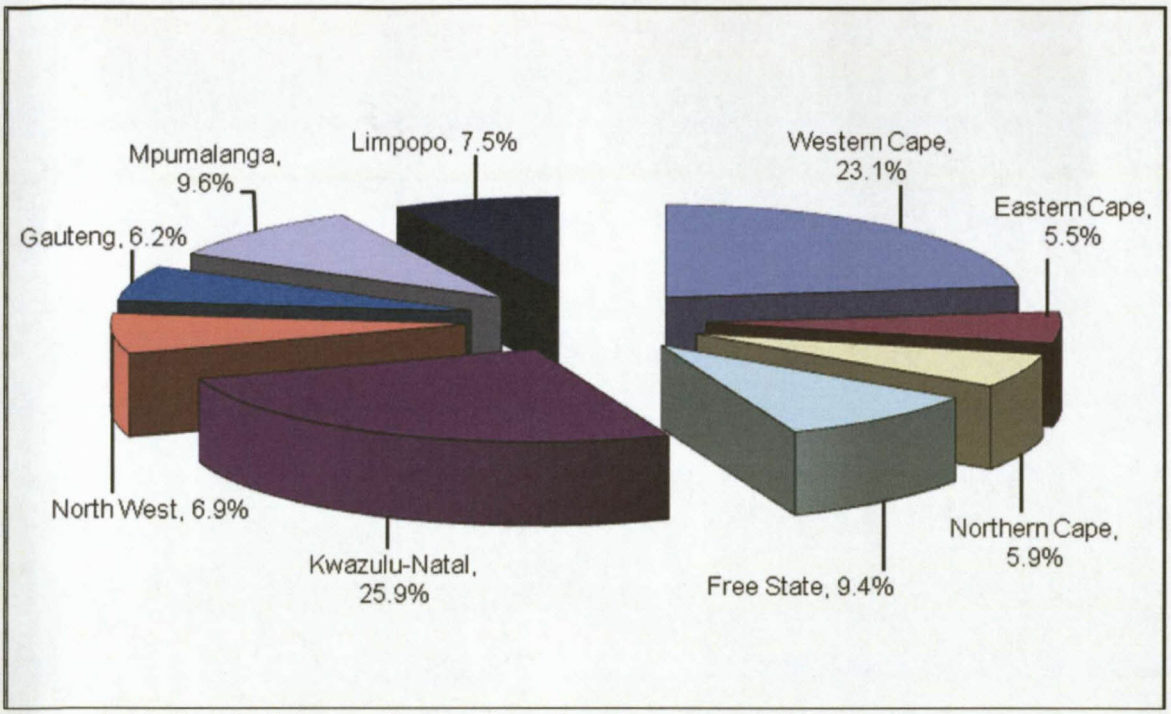

Figure 3.14: Provincial contribution to national agricultural GDP.

Source: StatsSA, (2007a).

3.5.2.1 Gross Farm income

As can be seen in Figure 3.15, livestock production is by far the biggest contributor to Gross Farm Income (GFI) with 51% followed by field crops (24%) and horticulture with 13.7%. Thus, livestock has proven to be the agricultural commodity showing the most potential and would be an ideal commodity for small-scale farmers to produce as it may increase the success of agricultural development. According to the GFI contribution, field crops are also a promising commodity for small-scale producers. Budgets allocated towards agricultural development projects should therefore concentrate on allocating its funds towards either livestock or field crop production in the province. However, as mentioned in section 3.3 the production activities are largely dependent on the natural resources of a selected region and must be incorporated accordingly.

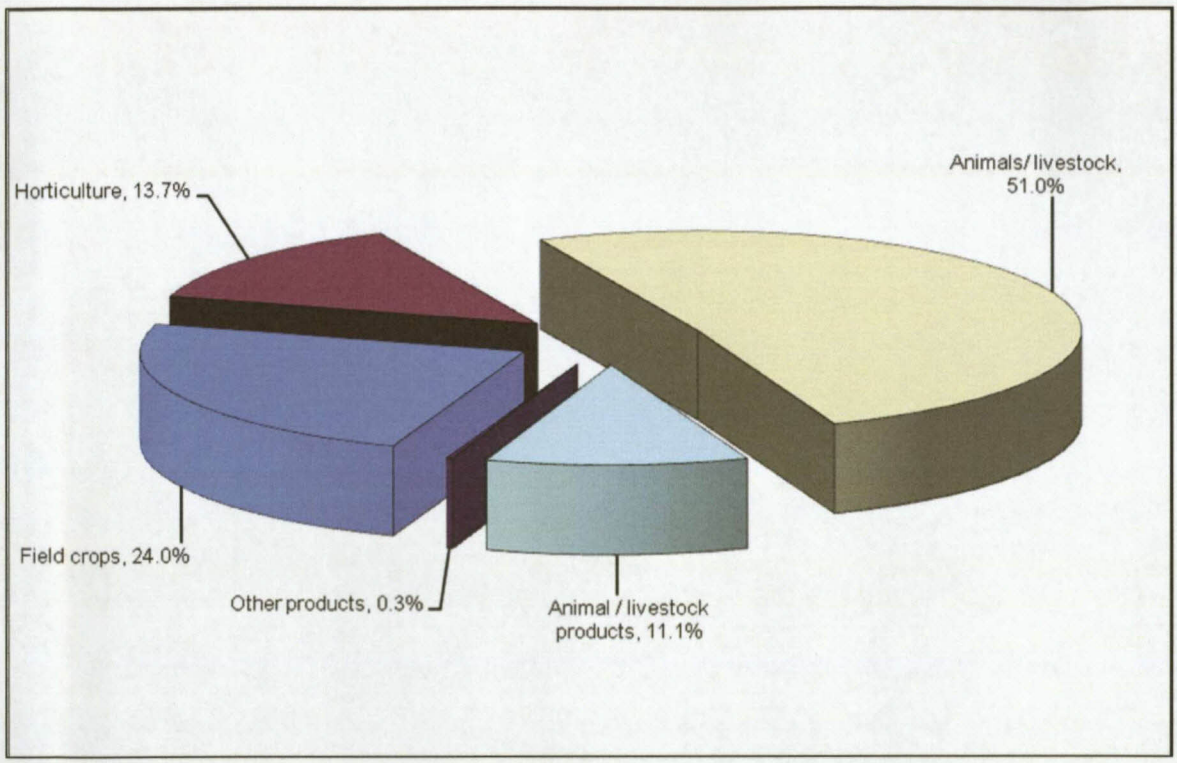

Figure 3.15: Breakdown of gross farm income for NWP.

Source: StatsSA, (2007a).

Livestock Products

Based on the livestock GFI contribution per region as shown in Figure 3.16, one could argue that livestock development initiatives should be concentrated towards the southern and western parts (KKDM and SMDM) of the province. Moreover, beef cattle accounted for the majority of livestock produced in the NWP (approximately 46.8% contribution). This implies that beef production must be considered as a development initiative with a high possibility of being successful in the province.

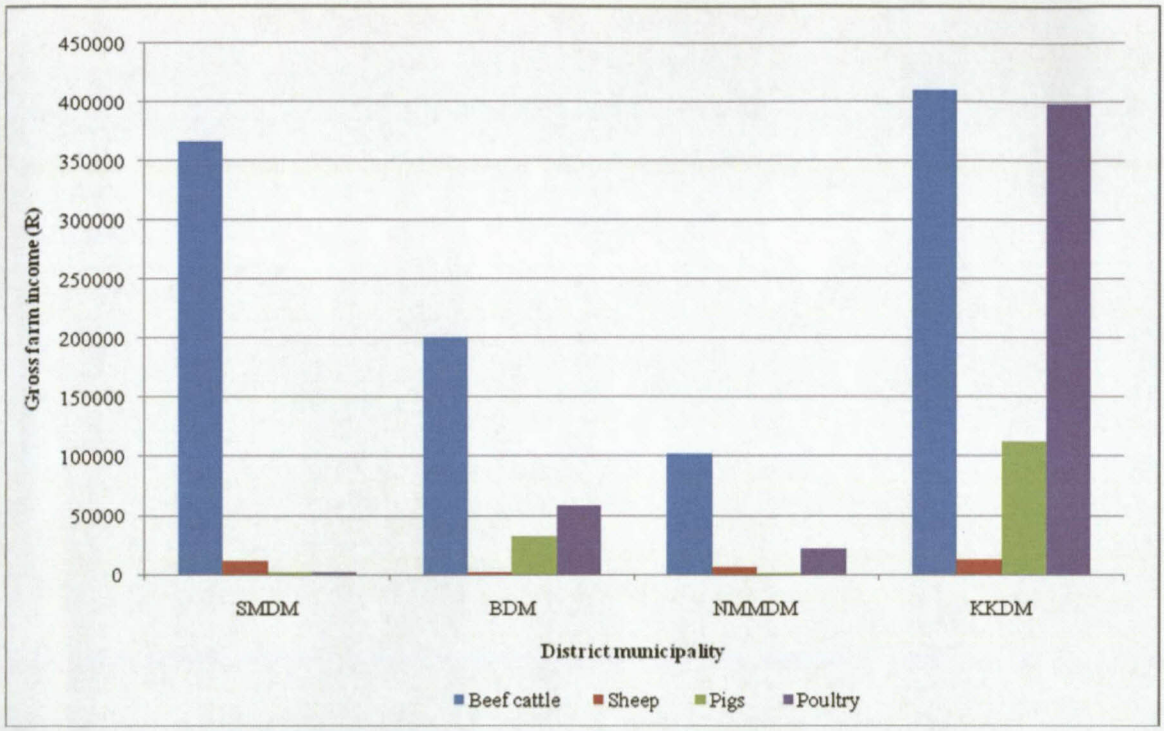

Figure 3.16: Livestock contribution to GFI per region in the NWP.

Source: StatsSA (2007b).

Field and fodder crops

As stated earlier, the most suitable regions for field and fodder crops produced in the NWP is concentrated towards the northern (NMMDM) and southern parts (KKDM) of the province. It is evident from Figure 3.17 that these regions are also the regions with the most significant contribution towards the GFI through arable crop production. The contribution of the western area (SMDM) to the GFI of arable crop production (see Figure 3.17) is mainly as a result of irrigation schemes in the area due to a good underground water supply. Thus, agricultural development projects should concentrate on arable crop production within the northern and southern parts of the province, while the western part is only suitable for crop production under irrigation.

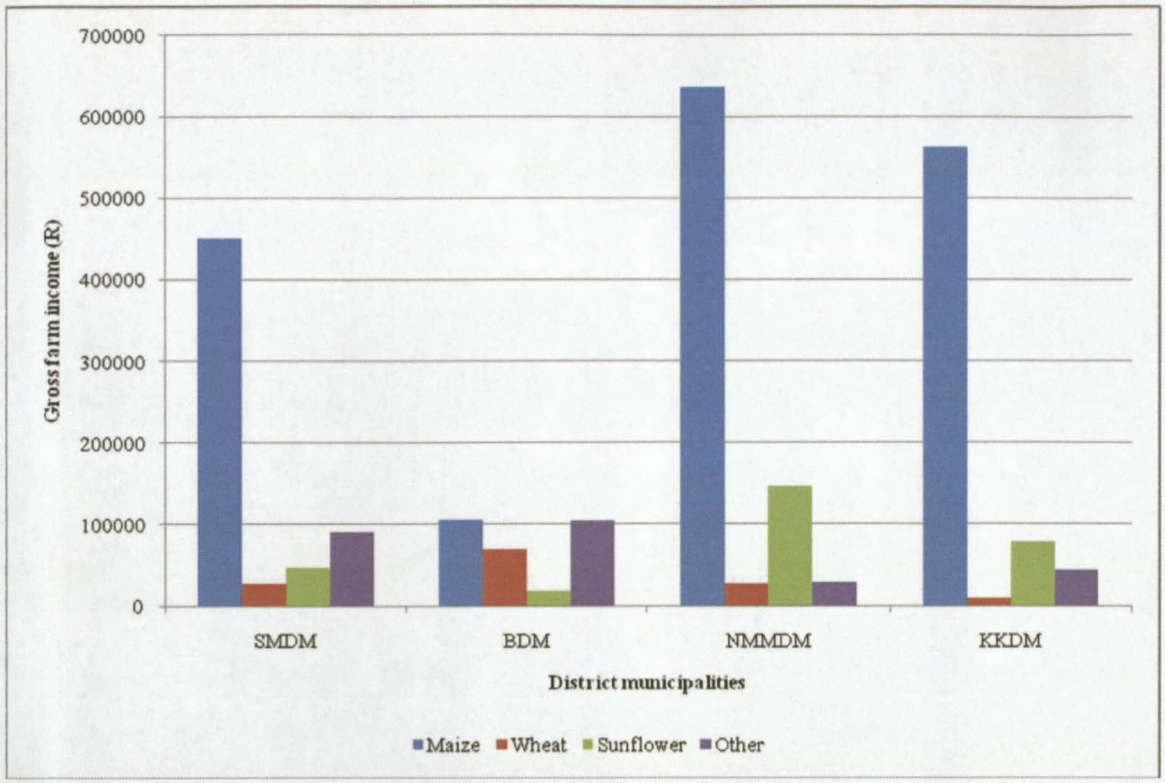

Figure 3.17: Regional arable crop production in the NWP.

Source: StatsSA (2007b).

Horticultural crops

The major horticultural crops produced in the NWP include onions and potatoes and to a lesser extent tomatoes, pumpkins, carrots, cabbage, green beans, beetroot, cucumber, peppers, lettuce and citrus. As mentioned, approximately 79% of horticultural crops are being produced within BDM. Figure 3.18 confirms the statement by illustrating the provincial contribution towards GFI through horticultural production. It is evident from the figure that the majority of horticultural crops are produced in BDM and SMDM. Thus, depending on the crop type, horticultural development initiatives should be restricted to SMDM and BDM in the NWP.

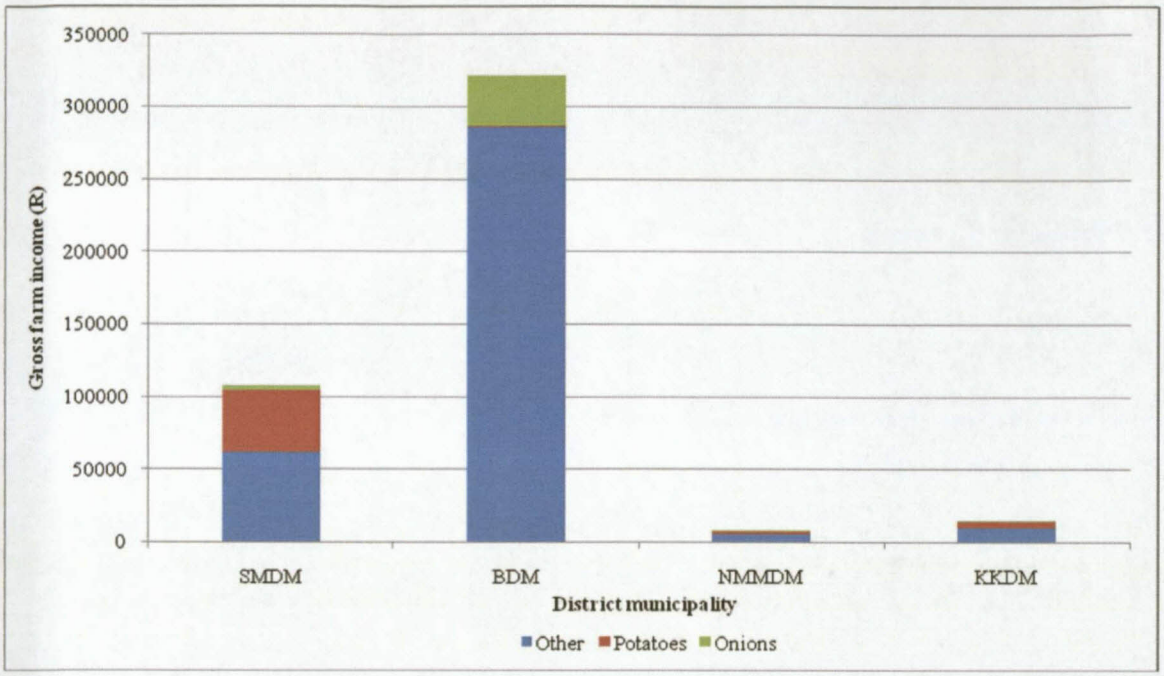

Figure 3.18: Regional production of selected horticultural products.

Source: StatsSA (2007b).

3.6 Socio-economic demographics of the NWP

Interrelated links exist between the economic performance of a province and its socio-economic demographics. On the one hand it might be argued that the socio-economic demographics (level of educations, health status etc.) will influence the economic performance, however, on the other hand, it might be argued that the economic performance is directly responsible for the socio-economic status of the region. As it may be, the shortcomings and strengths with regard to the socio-economic demographics of the NWP is an important element in understanding the underlying reasons for the moderate performance in the NWP, consequently affecting rural agricultural development negatively.

3.6.1 Population profile

According to StatsSA (2010), 3.4 million people reside in the NWP. This represents approximately 6.4% of the total South African population. The relatively small representation of the national population can be ascribed to the rural nature of the province (StatsSA, 2010). As can be seen from Figure 3.19, the black population group is by far the majority,

accounting for 90.7% of the total population in the province. They are followed by the white (7.2%), coloured (1.6%) and Asian/Indian groups with 0.4%.

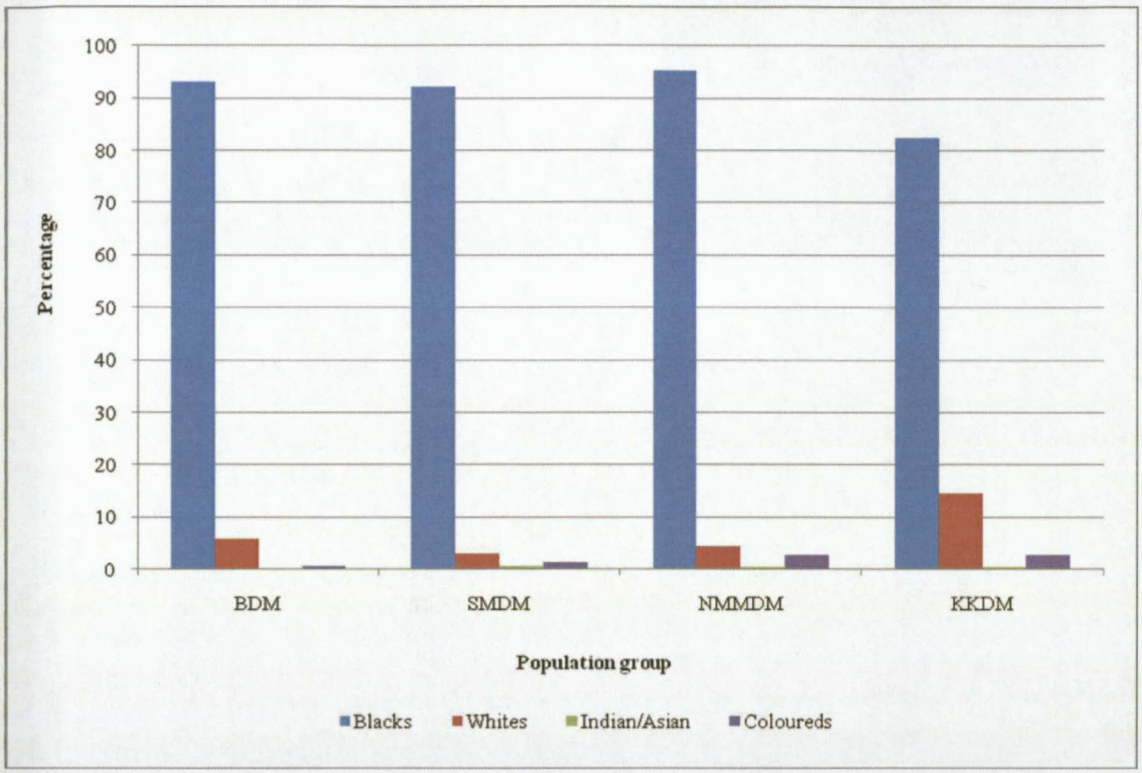

Figure 3.19: Population per district municipality of the NWP.

Source: StatsSA, (2007a).

The NWP population reportedly had an annual growth rate of 1% from 2002 to 2009 (see Figure 3.20). This is of some concern, with the number of jobs created that is not keeping trend with the population growth rate of the province. One way of addressing this concern is to promote and support projects that will ensure economic growth in the province. Given the rural nature of the province, the agricultural sector is targeted as the sector that could spur economic growth and by doing so, create more employment opportunities. Therefore, budget allocations should be concentrated towards viable agricultural development projects in an attempt to address the concern of population growth that's exceeding the amount of employment opportunities created in the NWP.

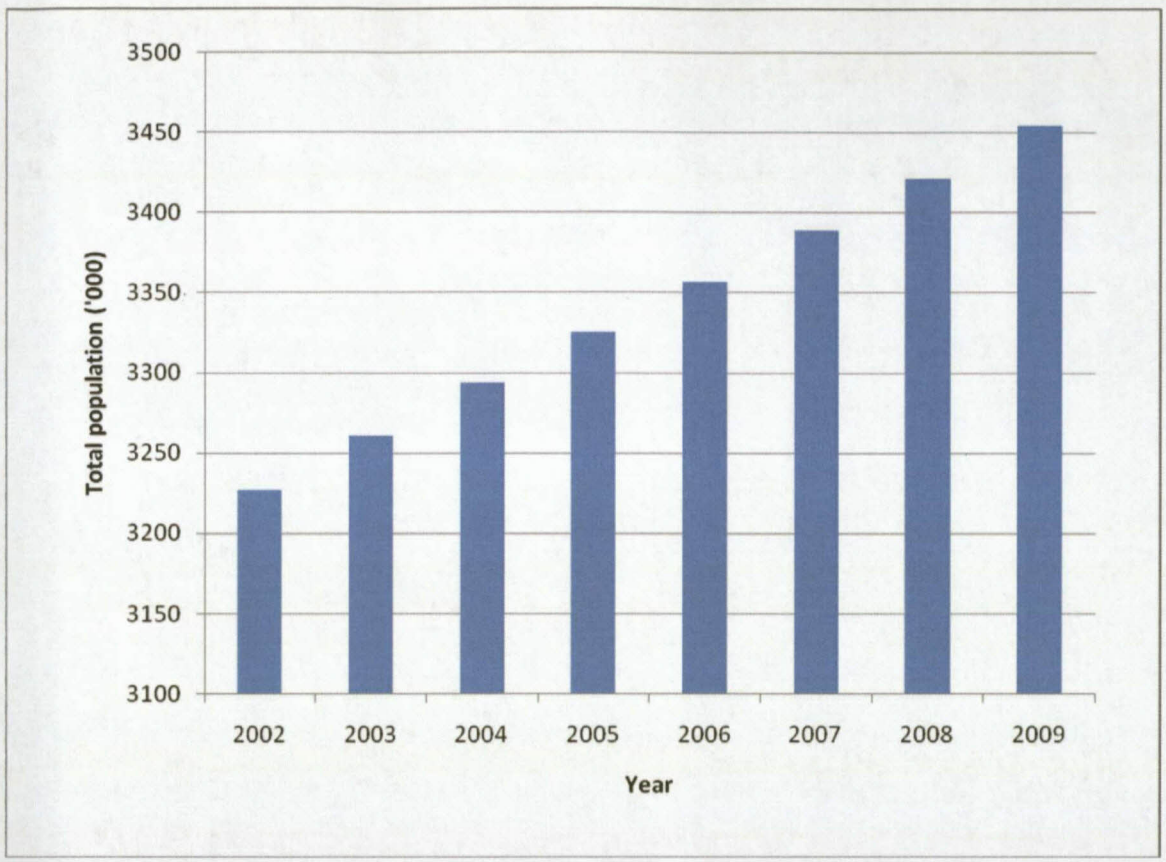

Figure 3.20: Number of people in the NWP from 2002 to 2009.

Source: StatsSA, 2010.

3.6.2 Age distribution

Figure 3.21 provides an overview of the age distribution in the NWP's population. From Figure 3.21, it can be seen that the majority of the population is currently younger than 39 years of age. Results from the SWOT analysis workshops revealed that younger people are not keen to get involved in agriculture. However, the fact that a large part of the population in the NWP is relatively young means that agriculture could be promoted amongst the youth through education and training programmes. This could make agriculture more attractive to the youth and ensure that the sector contributes towards the livelihoods of the rural poor.

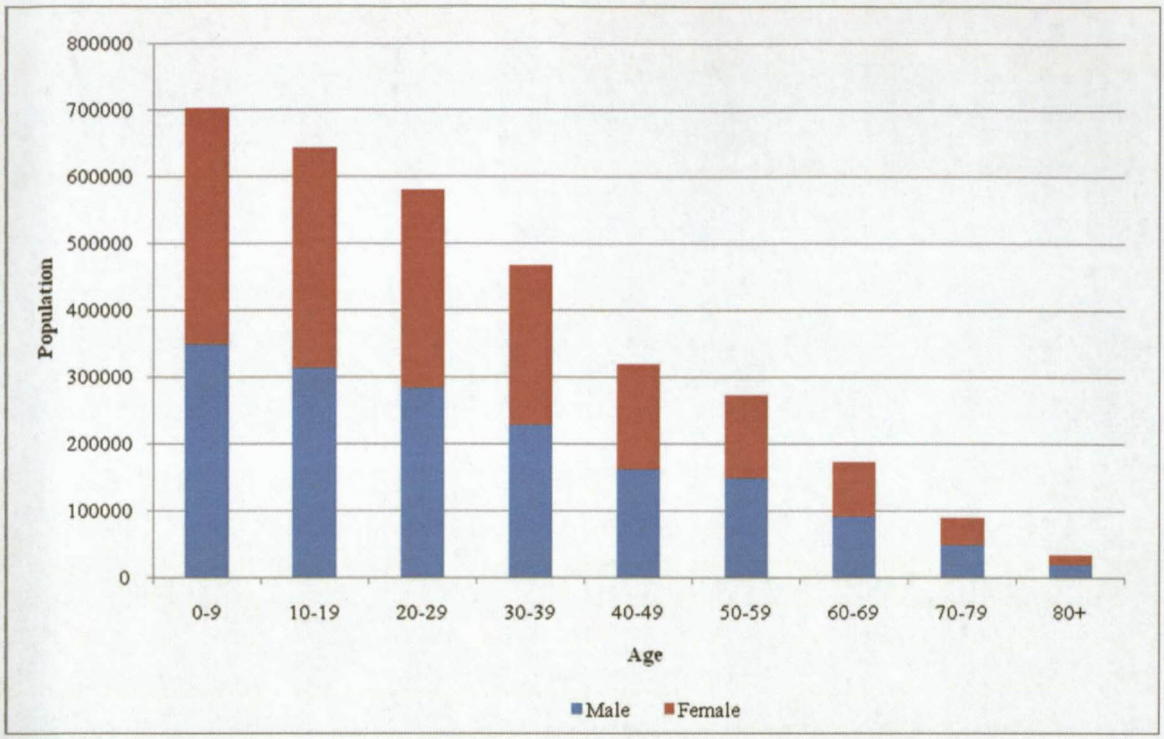

Figure 3.21: Population estimates by age and sex of the NWP in 2010.
Source: (StatsSA, 2010).

3.6.3 Employment

Unemployment is one of the most significant factors contributing towards poverty in the NWP. The last two decades have seen the overall unemployment in the province increase with 8.7% from 33% to 41,7% in 2006, making the NWP the province with the 5th highest unemployment level in the country. As mentioned, economic growth that is spurred by agricultural development has the ability to address unemployment. However, for agricultural development to be successful and to make a difference, the selection of appropriate beneficiaries will be just as important as the natural resources and other factors that influence success. Thus, adequate selection instruments need to be used to ensure that the correct people are selected to participate in the development initiatives.

Figure 3.22 illustrates the provincial GDP contribution per employee on the labour efficiency in the agricultural sector. From Figure 3.22, it is clear that KwaZulu-Natal has the highest GDP contribution per employee with R135,152, followed by the NWP (R108,117) and the Eastern Cape with R107,175. Limpopo reported the worst GDP contribution per employee

with only R53,741. Caution should however be taken when interpreting the results with high value crops that might have an influence on the value of production per employee.

Moreover, it is estimated that the agricultural sector in the NWP employ around 27,572 employees, which accounts for 5.5% of the total number of people employed by agricultural establishments nationally. This exemplifies the fact that the NWP is characterised by extensive farming practices rather than intensive practices. Thus, development initiatives that allow beneficiaries to be self-employed need be created to have a greater impact on agricultural employment and ultimately have a greater contribution to GDP. In doing so, it will address the national imperatives and increase the living standards of the people residing in the NWP.

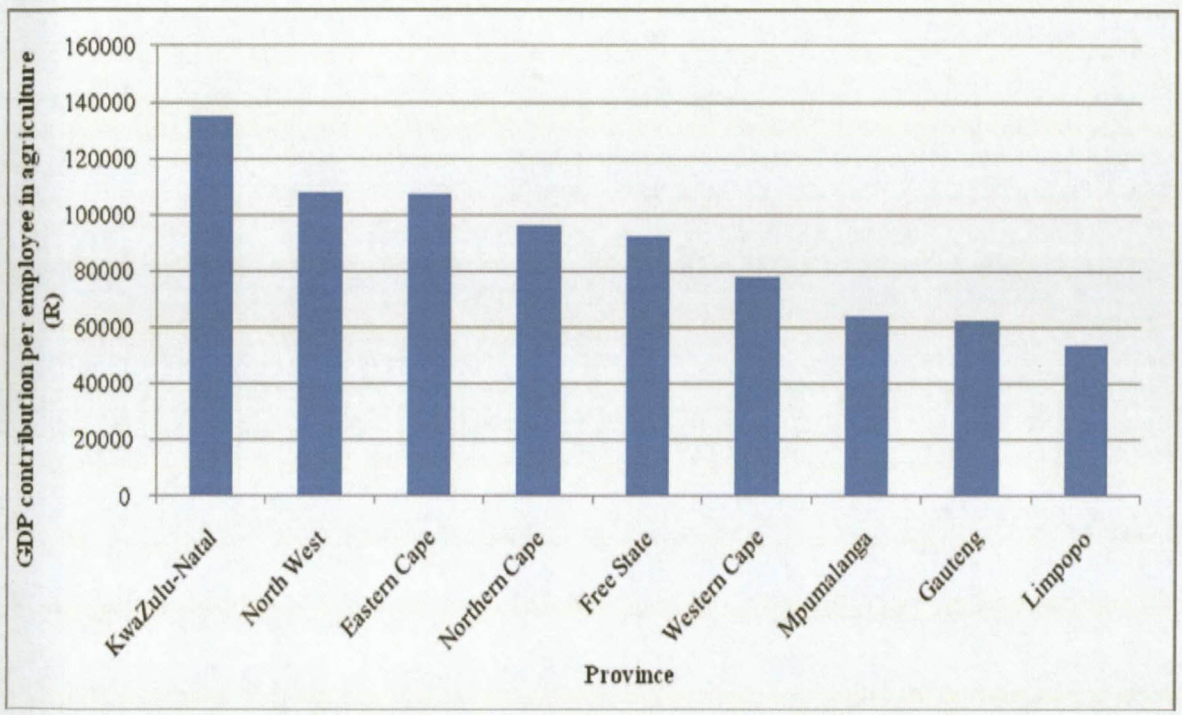

Figure 3.22: Provincial GDP contribution per employee in agriculture.
Source: (StatsSA, 2010).

3.6.4 Education

Employment opportunities are directly related to the level of experience, training and education, and so is the chance of making a success of agricultural development. In the case of agricultural development, education is not only about having theoretical knowledge, but

practical knowledge which is obtained over years of involvement within specific farming enterprises. The knowledge and education of the population/person in a province or the beneficiary of a development project should also be regarded as a resource, i.e. human capital. Aligning the most suitable beneficiary (i.e. the one with the required capacity in terms of experience, knowledge and education) with a specific project is essential for the success of agricultural development projects. It is therefore important to review the level of education of the inhabitants of the NWP.

The NWP is regarded as one of the worst provinces in the country in terms of its literacy and education levels. Cloete (2009) notes that low levels of education limit the percentage of the population who qualify for tertiary education, which in turn leads to greater inequalities in the distribution of opportunities and wealth. A lack of education can also be directly linked to a lack of skills in the agricultural sector, which, if improved, will significantly increase the contribution of the agricultural sector to the provincial GDP and improve the chances of success for agricultural development in the province.

Nationally 81.2% of persons aged 7 to 24 were attending educational institutions in 2009 compared to the 71.3% in the NWP (see Figure 3.23). Moreover, a lower percentage of persons compared to the national average are also attending schools (grade 1 to 12) and higher educational institutions in the NWP. This is also the case for the number of people enrolling for a tertiary degree or diploma, and for scholars that enrolled for agricultural degrees or diplomas at tertiary institutions. This is a concerning factor for the success of agricultural development in the province, with agricultural training and education in the NWP that might be behind the rest of South Africa. Moreover, the majority of the persons (42.6%) not attending agricultural institutions in the NWP blamed it on a lack of funding (DAFF, 2010). The success of agricultural development is highly dependent on supporting personnel i.e. agricultural specialist and knowledgeable extension officers in the province. The low rate of tertiary training in the province makes it less likely that a lot of these specialists will emerge from the current population.

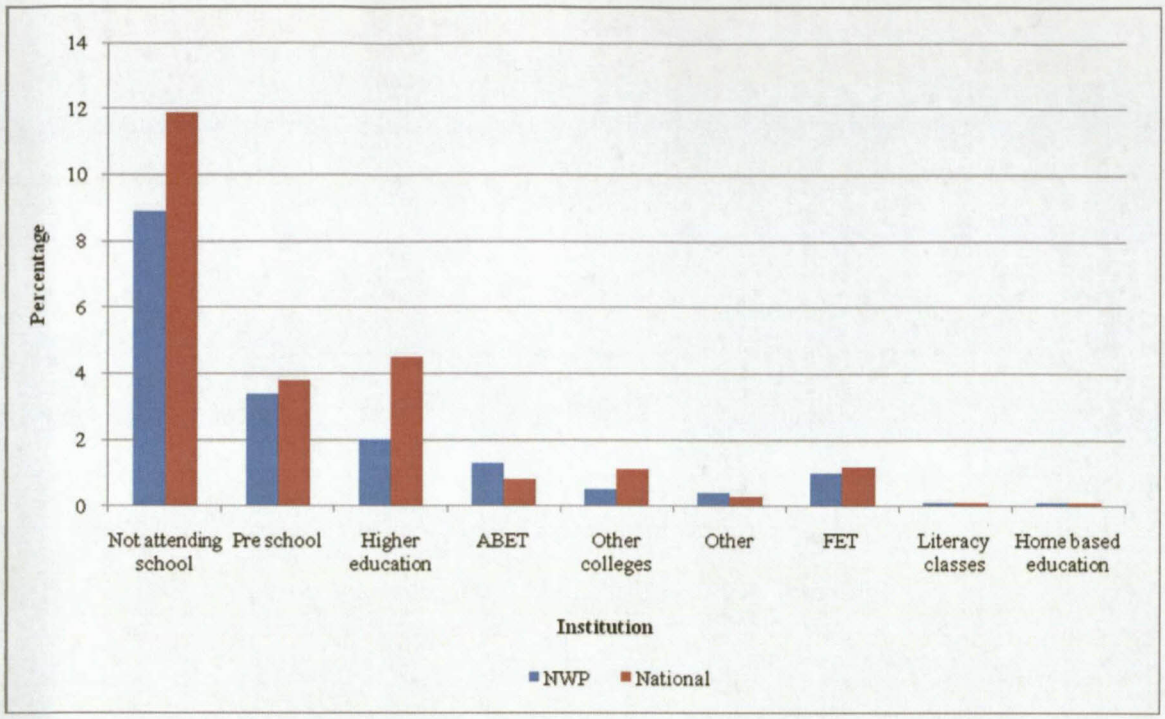

Figure 3.23: Attendance at educational institutions for persons aged 5 years and older in 2009 (percentage of the population that is able to attend the specific institution).

Source: (StatsSA, 2010).

The percentage of people aged 20 years and older with no formal education in the NWP is estimated at 11.3%. This makes the NWP the second worst, with only the Limpopo Province reporting a lower educational level when considering people aged 20 years and older. However, as can be seen from Figure 3.24, the percentage of people in the NWP with no formal education has steadily decreased from 2002 to 2009. It is essential that the agricultural sector will benefit from this decrease in persons with no formal education making the establishment of agricultural education and training institutions a necessity to promote agricultural development in the NWP. There is currently a lack of agricultural training institutions and this need to be addressed if a significant impact is to be made on the success levels of agricultural development in the NWP.

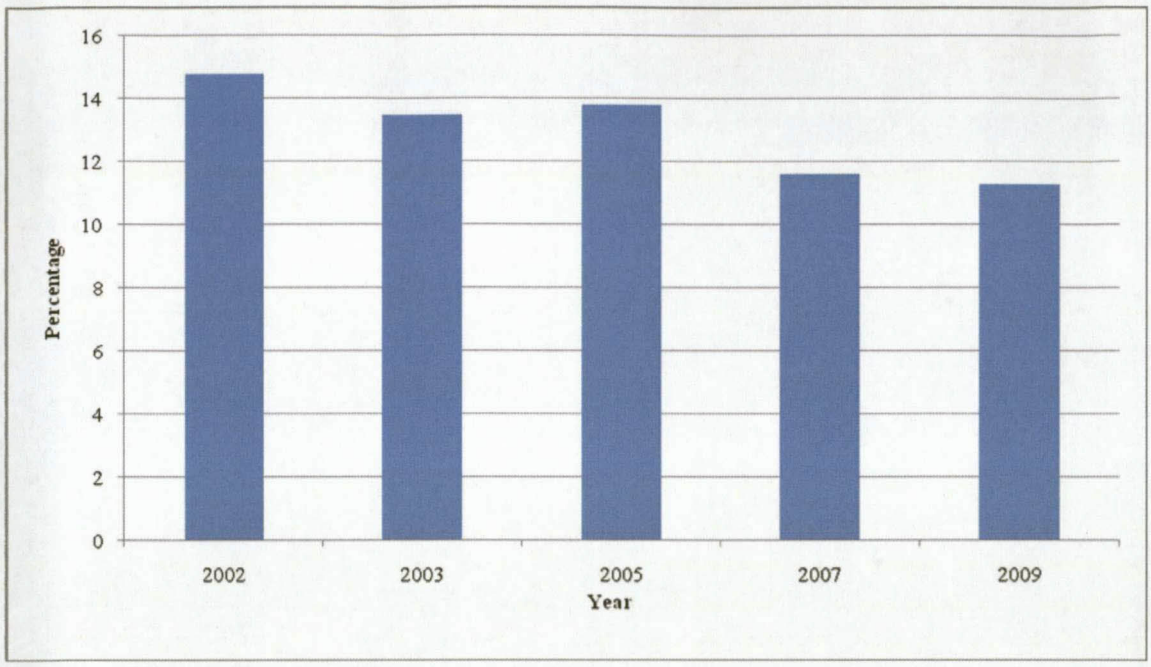

Figure 3.24: Percentage of persons aged 20 years and older with no formal education in the NWP from 2002 to 2009.

Source: (StatsSA, 2010).

3.6.5 Household income sources

The main source of income for the majority of households in South Africa is through salaries/wages (see Figure 3.25). However, concerns might be raised with regard to the number of households that rely on grants for their main source of income. In the NWP, 19.1% of the households rely on grants, exceeding the national average by 4%. Through agricultural development, the people reliant on grants can be significantly reduced which will free additional government funds. These funds can be reinvested into agricultural development or into factors relating to agricultural development to further increase the chances of successful agricultural development.

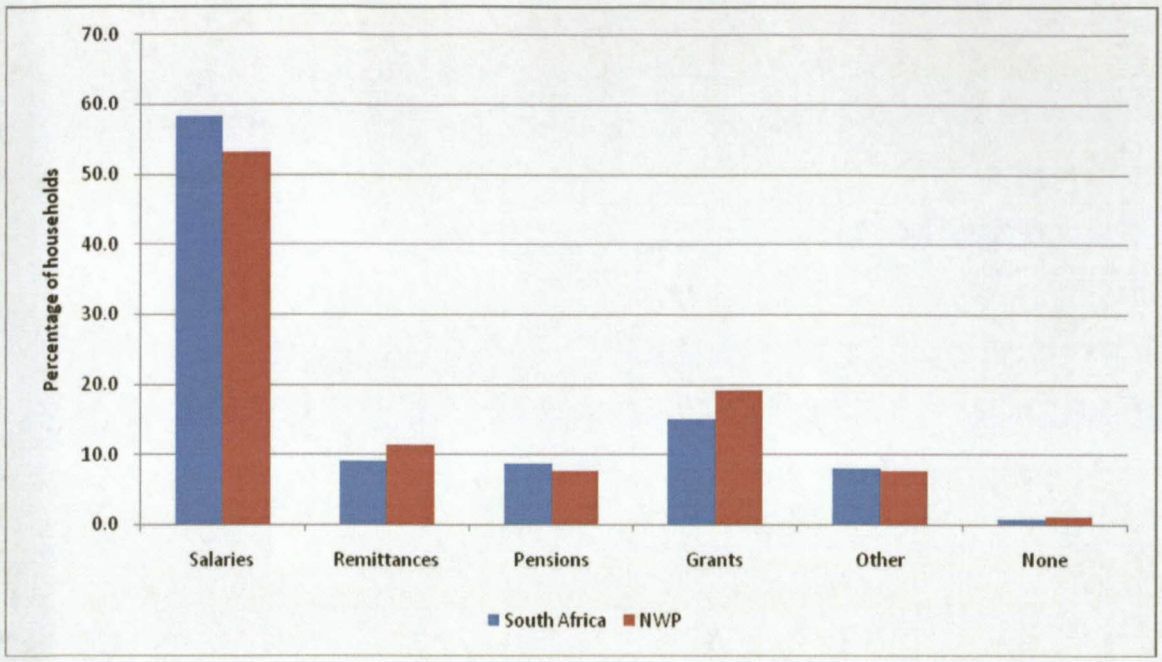

Figure 3.25: Sources of income for households nationally and the NWP in 2009.
Source: (StatsSA, 2010).

3.6.6 Access to food

An estimated 20% of South African households have inadequate or severely inadequate access to food. The proportion of households in the NWP with inadequate or severely inadequate access to food is estimated at 19.6% (see Figure 3.26). A high percentage of these households are also dependent on grants for their main source of income. Thus, creating an additional stream of income could improve their access to food. Agriculture is the most relevant sector to improve food access and would be ideal to address this problem. Not only will agricultural activities serve most of their basic needs, but it will also provide a source of income.

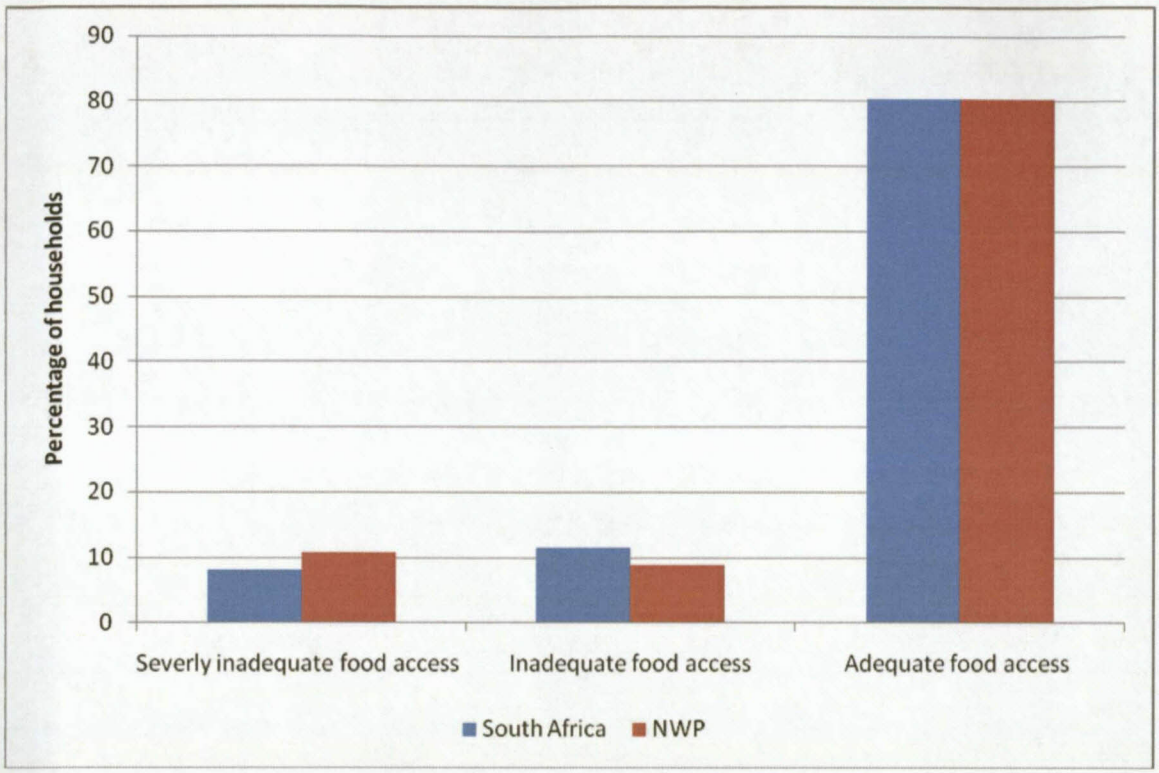

Figure 3.26: National and provincial access to food, 2009.

Source: (StatsSA, 2010).

3.7 Agricultural development projects in the NWP

Given the current economic, social and environmental situation in the NWP, a number of development projects have already been initiated by the provincial government. These projects were aimed at addressing the socio-economic status of the NWP.

Currently, there are a total of 247 development projects either in a planning phase, being implemented or evaluated for implementation in the NWP. The majority of these projects are driven and managed by the North West Department of Agriculture, Conservation, Environment and Rural Development (NWDACERD). However, the provincial government identified 10 projects that are part of the so-called flagship initiative and is driven through the Provincial Growth and Development Strategy (PGDS). This study discusses only 7 of these flagship projects due to a lack of information. The PGDS is primarily responsible for the implementation at provincial level of the three core sustainability concepts comprising of economic development and infrastructure, social development, and governance and administration. Thus, agricultural development projects that have the potential to address

these concepts are a high priority for the PGDS. However, the alarmingly high rate of failures of previous projects raised concerns with regard to their long term sustainability. This raises the question whether funds for agricultural development initiatives are correctly allocated.

The following sub-sections will provide more detail on the 7 flagship programs of North West Provincial Government.

3.7.1 Taung Irrigation Scheme

The Taung Irrigation Scheme is situated in the Taung Local Municipality with its main aim being the incorporation of small-scale farmers into the barley and maize industries. This initiative was pursued with the assistance of the South African Breweries (SAB). SAB support these farmers by providing them with production contracts as well as to ensure easy and frequent access to inputs. With the initial implementation phases of the project, the necessary infrastructure was developed. Large amounts of capital was invested into the project through the establishment of infrastructure, however, the infrastructure was not maintained and is currently in a deprived condition. Thus, the current emphasis of the project is to restore and improve the required infrastructure in order for the beneficiaries to be viable in their farming practices. This includes the reparation and upgrading of the current drainage system of the irrigation scheme (Van Schalkwyk, 2009).

An estimated R11 million was initially budgeted to fund crop production inputs as well as the maintenance and replacement of poor infrastructure. This project has received an additional R40 million from the National Department of Agriculture for infrastructure revival (Van Schalkwyk, 2009). Thus, after the completion of the infrastructure reparations and upgrades, crop production under the Taung Irrigation Scheme initiative could be pursued as a means of addressing poverty in the province.

3.7.2 Western Frontier Beef Beneficiation Programme

The Western Frontier Beef Beneficiation project was conceptualised as one of the Accelerated and Shared Growth Initiatives (ASGISA). The main aim of this specific project is to assist in the economic development of the southern regions of the NWP through beef

production (Scientific Roets, 2007). Certain regions within the NWP (Vryburg, Stella etc.) are renowned for their beef production capabilities, hosting a large number of successful commercial beef producers. Consequently, this region was targeted to serve as the hub for the proposed project. The main focus of the Western Frontier Beef Beneficiation project is to involve small-scale farmers in all aspects of the beef supply chain and subsequently assist in the economic development of the province.

Initially, R4 million was budgeted for the start-up of the project, however it is estimated that an additional R96 million is required for fencing, planting pastures, fire belts, fire equipment and livestock handling facilities (North West Provincial Government, 2008).

3.7.3 Mechanisation Programme

The main aim of the Mechanisation Programme is to provide small-scale farmers with a crop production mechanisation package. A result of the global increased demand for food coupled with land that is becoming a scarce resource, this programme will focus on utilising agricultural land that is currently not efficiently used. Subsequently idle, fallow land will be brought back into production, increasing the production yields and volumes.

According to the North West Provincial Government (2008), R1.4 million has been spent on this project since November 2006 with a total of twenty cooperatives, trusts and CPA's already benefitting from this project. The programme is set to continue its support to small-scale farmers during 2008/2009 through a total of six mechanisation programmes distributed to a number of CASP beneficiaries.

3.7.4 Nguni Cattle Development Programme

This programme is based on a "pay it forward" system, which basically means that small-scale farmers receive a number of cattle, but is expected to give some back over time. In this specific case small-scale farmers received 10 pregnant cows and two bulls – to allow them to build up a nucleus herd. After five years, they were expected to give back five heifers and two bulls to the project. According to The Beef Site (2007), the project was so successful that an investigation was launched to determine the probability of creating an international niche market for Nguni beef.

Nguni cattle were targeted for this project as it was the only cattle breed that was bred in Africa. Moreover, Nguni cattle have a high fertility rate, with a short calving time and long reproductive life span, thus making it the ideal breed for the project (North West Provincial Government, 2008).

3.7.5 Multi-Purpose Livestock Handling Facilities

One of the most important factors prohibiting participation in the agricultural sector for small-scale farmers is their lack of access to the relevant markets. An initiative was therefore created to bring the market closer to the small-scale farmer, rather than to attempt to bring the small-scale farmer closer to the market. This initiative required the establishment of multi-purpose livestock handling facilities. A total number of four facilities have been issued for construction, one in each district municipality. An amount of R4 million has been budgeted for this project in 2008/2009 (North West Provincial Government, 2008).

3.7.6 Fencing Programmes

The fencing programme aims to establish fences in villages and communal areas in order to manage grazing. The main aim of the programme is to conserve natural vegetation and avoid degradation in rural areas which is more than often severely affected. Additionally, fencing will create a more structured way of farming in these areas, thus increasing the productive capacity of the land. In the past financial year, with a budget of R6 million, the programme managed to establish 754 kilometres of fencing as well as training 683 people in the trade of fencing (North West Provincial Government, 2008).

3.7.7 World Heritage Sites

The NWP contains a total of three world heritage sites which represent a significant source of income to the province if utilised correctly. The Taung and Vredefort heritage sites were targeted for development and are seen as one of the province's anchor development projects. These heritage sites have the potential to create significant external investments into the province, providing a considerable financial boost to the local communities. According to North West Provincial Government (2008), significant progress has been made regarding the

two world heritage sites. Although this project is not directly related to agriculture, it can indirectly affect agricultural development initiatives by increasing the demand for agricultural produce in the province. Moreover, the tourists that will visit these sites also provide the opportunity to promote and grow the agri-tourism industry of the province, which could ultimately benefit the rural poor. Thus, linking the world heritage site project with agri-tourism opportunities is an agricultural development opportunity that could be pursued in the province.

3.8 Conclusion

The NWP is known for its diverse climate and natural resources, which varies significantly from the western to the eastern parts of the province. This allows for the production of a wide variety of agricultural products. However, the status of soil and veldt degradation in the province limit the extent to which these opportunities can be pursued. This is especially true for the communal regions in the province, with the degradation index that is reportedly higher. Another limiting factor in these regions is the lack of proper infrastructure, with communal regions that are often characterized by infrastructure that's not functioning properly. The afore-mentioned not only limits the extent to which some of the agricultural opportunities in communal areas could be exploited, but it also hampers current production practices.

Furthermore, it is evident from the socio-economic profile that a large part of the population in the NWP find themselves in economic hardship. This is also evident from the high level of unemployment in the province. However, the agricultural sector, through development projects, is ideally suited to address unemployment and poverty in the province. This is also evident from past and current government development programs and projects that focus on the agricultural sector as a means to address the socio-economic status of the province.

In addition, it is evident from this chapter that certain factors need to be addressed for agricultural development to be successful in the long run. Foremost among these is the level of education of farmers. Although a fairly large percentage of people are attending primary and even secondary schools, only a small number enrol for tertiary education. The number of scholars that enrol for diploma or degree in agricultural study is even less. This is due to several reasons, one of which relate to the exposure of scholars to agriculture on a primary

and secondary level and the other to a lack of proper agricultural training institutions on a tertiary level.

Government programs, like the ones discussed in the chapter, are aiming at improving the current situation in the province. The economic performance and especially the contribution of agriculture towards the economy of the NWP, highlight the important role of this sector in the province. Thus, successful agricultural development will contribute towards an increase in the economic performance and subsequently an improved socio-economic status.

To ensure that agricultural development is conducted in a sustainable way, projects that are most likely to be successful need to be identified. Moreover, part of ensuring the success of these projects is the development of workable business plans. The development and ranking of these business plans according to set objectives will also assist government with the allocation of their budget. This means that money could be channelled to the initiatives that would yield the best returns in terms of economic growth and the upliftment of the rural poor.

Chapter 4

Agricultural Development Business Plans

4.1 Introduction

In the light of past development failures coupled with increased pressure on government to deliver on promises made, the need for improved resource utilisation was recognised. This need is intensified by the social inequalities and economic hardship that is experienced by most people residing in the rural regions of the province (see Chapter 3). Moreover, past development failures have rather contributed towards social inequalities and economic hardship than towards the prosperity of people residing in the rural regions.

Magingxa (2006) reported that the formulation of workable business plans can serve as a means to address the factors that inhibit agricultural development. In other words, the formulation of business plans can provide a guideline that will incorporate policies (i.e. national imperatives), institutions and mobilise resources to a degree that will improve the success of agricultural development. The AgMRC (2010) made a similar observation, suggesting that the development of business plans can improve the success of agricultural development if it provides a "blueprint" on how to create a viable business enterprise. Magingxa (2006) elaborates by arguing that business plans will ensure better governance and monitoring, which will consequently result in higher levels of success. Consequently, business plans are developed to promote agricultural development in the NWP.

The chapter will firstly discuss the process of identifying agricultural development opportunities for the different regions of the NWP, whereafter attention will be given towards the different business plans or concepts that could be used to exploit the identified opportunities. Finally, some conclusions will be drawn.

4.2 Identification of development opportunities

As mentioned, the formulation of workable business plans can serve as a means to address the factors that inhibit agricultural development, and by doing so improve the success of agricultural development and subsequently the livelihoods of the people residing in the rural regions of the province. The formulation of workable business plans is one of the key elements of the Agricultural Master Plan (AMP) that was developed for the North West Province (NWP). However, before business plans can be developed, the project team of the AMP first needed to identify agricultural opportunities that can be successful in the context of the NWP. In order to identify these opportunities, workshops were held throughout the province. This was done to obtain a better perspective of the potential agricultural opportunities in the different regions of the province. A total of twenty-one field workshops were held throughout the province. These workshops were structured in the form of panel discussions for all role-players in the private/commercial agricultural sector, followed by workshops for role-players from the public sector. In general, the field workshops were attended by representatives from organised agriculture, farmers' unions, cooperatives, input suppliers, banks, government officials, NGO's, commercial farmers and small-scale farmers. The sessions were guided by a discussion leader who facilitated the discussion according to the SWOT methodology. From this, factors that need to be considered when identifying potential agricultural development opportunities were identified.

Foremost amongst the factors that need to be considered when identifying possible agricultural opportunities for new development projects is the natural resource base of the province. Based on the natural resources in the province (also provided in the previous chapter) it can be concluded that the diverse natural resource base of the province combined with its climate allows for a wide range of agricultural enterprises. This is supported by the available infrastructure i.e. road, water, electricity, markets etc. in most regions of the province.

In addition to the natural resources and infrastructure, one also needs to consult with role players/industry experts that are involved with agriculture in the different regions of the province. Their knowledge, experience and lessons learned over time is critical in identifying agricultural opportunities that are most likely to succeed. Moreover, the knowledge of these

role players is also vital in determining the different business plans or concepts that is needed to effectively exploit the identified agricultural opportunities.

Following the identification, the AMP project team developed business plans or concepts that would ensure that the identified opportunities are successfully implemented and managed. This will ultimately contribute towards the success of agricultural development.

The main agricultural opportunities that were identified include: the production of beef, goat meat, milk (both cow and goat), broilers, grain and oilseeds, vegetables and various citrus and sub-tropical fruits. Some of the agricultural opportunities identified extended beyond the primary production and include processing of raw materials into animal feed, the promotion of eco-tourism activities and the improvement of veldt management in the province. The different opportunities were linked to business concepts in order to exploit the above-mentioned agricultural opportunities.

4.3 Business concepts and agricultural opportunities

In order to exploit the afore-mentioned agricultural opportunities, the correct business concept needs to be employed in each case. Based on the result of the field workshops, the a few business concepts were identified as possible vehicles for exploiting the identified opportunities. These include a milk hotel concept (i.e. outsourcing scheme) for exploiting the opportunities surrounding goat and cow milk production in the province. A Public Private Partnership (PPP) business concept will be linked to the goat meat, eco-tourism, animal feed and perennial crop opportunities. In addition, equity shared schemes was identified as an alternative business concept that could be used to successfully pursue perennial crop production in the NWP. A contract farming business concept was developed for broilers, vegetables, Taung Irrigation Scheme as well as for veldt management. Beef production will be linked to the Western Frontier Beef Beneficiation scheme and is based on a joint venture business concept. Finally, a joint venture scheme is also proposed for grain and oilseed production in the province.

For the ease of the reader, Table 4.1 reflects on the proposed business concepts and their associated agricultural opportunities. Some of the identified opportunities are linked to development projects and concepts that are already being implemented in the province.

Table 4.1: Business concepts and associated agricultural opportunities.

BUSINESS CONCEPT	AGRICULTURAL OPPORTUNITY
◦ **Milk Hotel or Outsourcing scheme**	◦ Goat hotel
	◦ Milk cow hotel
◦ **Public Private Partnership**	◦ Goat meat
	◦ Eco-tourism
	◦ Animal feed
◦ **Public Private Partnerships or Equity schemes**	◦ Perennial crops
◦ **Contract farming (outsourcing)**	◦ Broiler
	◦ Vegetable production
	◦ Taung Irrigation Scheme
	◦ Veldt management
◦ **Joint Venture**	◦ Grain and oilseed
	◦ Small-scale beef production

In must, however, be emphasised that the AMP will first launch pilot projects of each of the above-mentioned plans.

4.3.1 Milk hotel business concept

Vorley *et al.* (2007) is of opinion that emerging farmers' participation and incorporation into the mainstream dairy production cycle has been very limited, and generally has been restricted to "projects" driven by Government programmes. According to Vorley *et al.* (2007), the absence of small-scale or emerging dairy farmers can be ascribed to the high entry barriers, which include the high capital outlay for land, breeding animals, dairy parlours and equipment, as well as market access, quality standards, skills in producing milk and managing a dairy producing unit, the poor quality of animals, infrastructure and access to finance. Additionally, the current competition in the global market, limited government support and the cost-squeeze phenomenon are also prohibitive for emerging farmers intending on entering the dairy industry (Vorley *et al.*, 2007).

The milk hotel concept is based on an arrangement between farmers and a dairy parlour. The arrangement normally entails that farmers will lease their stock to the milk parlour. This arrangement will result in the increase of production (i.e. economies of scale) and income for both parties involved. Thus, the introduction of the milk hotel concept in South Africa presents a business model that could reduce the entry barriers for new entrants in the dairy industry (Fausett & Dhuyvetter, 1995). Furthermore, farming in general requires large

amounts of capital to be operational. This is a concern for small-scale farmers and new entrants, as they do not always have the necessary collateral to obtain or borrow the required funds from financial institutions (Fausett & Dhuyvetter, 1995). Fausett and Dhuyvetter further argues that the leasing of livestock is a form of borrowing capital. Jones (s.a.) is of the same view, arguing that the economic environment within which dairy farmers operate has limited the amount of capital at their disposal which makes the use of a leasing agreement an ideal option to gain additional capital. Thus, by introducing the milk hotel concept, the farm operator acquires the use of capital and pays a rental fee or shares the costs and returns of the operation.

Leasing can also be advantageous for the livestock owner. Some of these advantages include (Fausett & Dhuyvetter, 1995):

- Allowing an owner to maintain a breeding herd, even though labour cannot be provided.
- Providing a source of rental income.
- Providing an opportunity for returns on capital investments.
- Providing a means of transferring ownership over a period of time.
- May have income tax and social security advantages.
- Eliminates the inability of small-scale farmer's lack of access to markets.

However, the identification of a viable milking parlour is an important element in ensuring the success of the proposed initiative in the NWP. The parlour will form the base from where the whole enterprise will be operated. Another important element is the identification of farmers willing to participate in the initiative. Moreover, these participants (small-scale or subsistence farmers in the province) must be willing to trade their existing stock for better quality animals that is more suitable for milk production.

As mentioned, two of the identified agricultural opportunities were linked to the milk hotel concept, namely goat and cow milk. The following sub-section will provide more detail on the specific business plans for goat and cow milk production by making use of the milk hotel concept.

4.3.1.1 Goat Hotel

The stimulation of goat production and subsequently goat products was targeted as a visible opportunity since several of the small-scale and subsistence farmers already own goats. Another important consideration was the farming knowledge that these farmers already have based on their years of farming experience with goats. However, most of the small-scale farmers and to a larger extent the subsistence farmers only use their goats for own consumption. Therefore, with the introduction of the correct management and support systems, the existing goat population can be better utilized which will subsequently improve the living standards of the farmers involved.

Over the past three decades, consumer preferences have contributed towards a change in the global demand for goat milk as consumers generally seek to follow a healthier lifestyle. This trend is likely to follow in the South African market. However, a number of challenges occurred as goat's produce and especially goat's milk is a relatively unknown product to the South African market. Factors such as lacking infrastructure and absence of sufficient markets play a determining role in the goat milk industry of South Africa. Subsequently, the introduction of the so-called goat hotel concept (similar to the milk hotel described above) presents a business concept that addresses these constraints through the establishment of infrastructure and markets surrounding the goat milk industry. As a result of the perishable nature of milk, the regions selected for the implementation of the specific business plan should be in close proximity of major towns.

Furthermore, it is determined that a goat milk hotel will need at least 1,000 head of animals in order to be financially viable. For beneficiaries to receive at least the minimum wage, each beneficiary will be required to provide 90 head of animals. This reflects a capital investment of approximately R121,951 per beneficiary. It is foreseen that government should assist with the necessary funding to ensure the success of the initiative. Based on the estimated size of the pilot project (1,000 head), 11 beneficiaries are likely to benefit directly from the initiative. Considering the average household size in the province, an additional 41 people is likely to benefit indirectly from the initiative. The number of beneficiaries will increase once the initiative is duplicated in other parts of the province.

The risks associated with the implementation of this specific initiative are relatively high with supporting infrastructure and markets that still need to be developed. Besides, the goat industry is relatively unknown, which means that an aggressive promotion campaign might be needed. It is, however, important to realize that opportunities for goat milk and milk products do exist, especially considering the changing consumer preferences and their quest for a healthier lifestyle.

4.3.1.2 Milk cow hotel

The milk industry in South Africa is under extreme pressure from both the input and market sides, with inputs constantly on the rise and the milk industry under numerous suspicions of illegal market activities (Comins, 2007). These factors significantly impacted on the industry and forced small-scale producers to combine their practices to remain profitable and to ensure an equitable market share. Developments such as these, coupled with the current economic climate make it nearly impossible for new entrants, and especially the emerging sector, to engage in dairy production. The milk industry is divided into two main sections namely the milk production and milk processing sections. As a result of the monopolistic nature of the milk processing section, this business plan targets the milk production section with the aim to incorporate small-scale producers into the milk industry. To ensure that this is successfully implemented, the necessary infrastructure (i.e. fences, water etc.) should be constructed. Based on the resource availability in the NWP, a business plan to ensure a viable small-scale milk production sector had to be identified. Similar to the goat hotel business plan, the milk cow hotel business plan is based on an arrangement between dairy cattle owners (farmers) and a dairy parlour.

Similar to the goat hotel, 1,000 head of cattle will be required to ensure that the initiative will be finically feasible. An estimated 33 households or 123 individuals are likely to benefit from the initiative. Moreover, the investment required from government will equate to R80,000 per person. This investment will ensure that the 33 households will earn a wage that is well beyond the national poverty line. Moreover, 123 potentially benefiting individuals does not include the employment opportunities that will be created at the milk cow hotel itself.

In addition, the prospect of duplication is another important aspect of the proposed business plan. Duplication possibilities are endless and can create numerous opportunities in the

province, especially taking into account the low risk involved with the implementation of the initiative i.e. well established markets and supporting infrastructure.

It is also foreseen that the impact on the environment will be minimal. This is because the damage caused by the pollution that might be created by the milk parlour will be less than the benefits of the parlour in terms of a reduction in the number of stray animals, prevention of overgrazing in especially communal areas etc. However, community development and interaction potential will be limited with the beneficiaries that will not actively participate in the production process.

4.3.2 Public Private Partnership business concept

The role of the state in the provision of public services in South Africa continues to be an ongoing debate. Even pro-Private Public Partnerships (PPP) advocates concede that the outsourcing of state services needs to be supported by sound regulatory practices which promote key public policy objectives, such as curbing monopolistic practices and promoting universal service access (Schonteich, 2001). Additionally, Farlam (2005) is of opinion that government is looking at PPP's to radically improve infrastructure networks and enhance service delivery to the people. According to Farlam (2005), PPP's have the potential to solve sub-Saharan Africa's profound infrastructure and service delivery backlogs through the improvement of services, while avoiding some of the pitfalls of privatisation i.e. unemployment, higher prices and corruption. According to James (1996), the current challenge posed by global food security provides an excellent incentive for collaboration between the public and private sectors in agricultural research and development.

Therefore, PPP's have been identified as a practical business concept to incorporate developing farmers into the mainstream economy. Moreover, it is seen as a viable way of ensuring successful agricultural development. PPP's refer to the outsourcing of public service responsibilities in terms of service delivery to the private sector or companies. In a development context, PPP's can best be described as a cooperation agreement between the public and the private sector. Schonteich (2001) supports this view, by describing a PPP as a contractual arrangement between the public and private sector, where the representatives from the private sector performs or assist with what is normally regarded as government's functions or responsibility. He elaborates by arguing that in the afore-mentioned

situation/agreement, the risk of the transaction is vested with the private sector's representatives. In return, the private party receives a fee according to the predefined performance criteria. Schonteich (2001) further states that the essential aspects of a PPP arrangement is focused on the services to be provided, and a shift of the risks and responsibilities to the private sector's representative.

Mr. Trevor Manuel, the previous South African minister of finance, stressed that properly conceptualised and negotiated PPP's should enhance the standards and quality of public service delivery. The same argument should hold for the success of agricultural development. Given that government is struggling with basic service delivery, which is its primary responsibility, it is not a surprise that government does not have the capacity to orchestrate and manage agricultural development in the province. Moreover, government itself has acknowledged that it is lacking the technical capacity to ensure the success of agricultural development in the province (North West Provincial Government, 2008). Government has also acknowledged that, despite the efforts to increase the capacity of local governments by creating larger and more resourceful entities through the merging of districts and local municipalities, it still lacks the technical capacity and resources to address agricultural development in the respective governmental areas. Therefore, government highlighted that in order for agricultural development to be successful in the NWP, cooperation between government and the private sector (PPP's) is required (North West Provincial Government, 2007).

According to Schonteich (2001), the benefits or strengths of PPP's, over traditional public service delivery mechanisms, provided the PPP process is adequately regulated and managed include amongst other:

- Public private partnerships require outputs and service level standards to be specified clearly and transparently, together with identification of costs and risks.
- Efficiencies arise from the integration of the design, building, financing and operation of assets that is intrinsic to a well-structured PPP.
- The private sector tends to bring higher levels of innovation to planning and project delivery, and has a sharper and timelier engagement with technology, with significant spin-offs for skills transfer in the public sector.

- The introduction of enhanced management skill into public service delivery through the PPP process is of considerable benefit in service quality and effectiveness.
- The contractual assurances of specified service standards and affordability of PPP agreements bring about a stricter and more effective management of risk.

PPP's have been successful in several areas of society. Farlam (2005) identified eight successful case studies ranging from areas such as transport, prisons, telecommunication, water and sanitation, power and eco-tourism. Thus, PPP's have proven to be a globally successful business concept to improve efficiency through private and public sector collaboration. The same applies to PPP's in the field of agricultural development with James (1996) reporting on twelve successful case studies using PPP's as the primary business concept for improving the success of agricultural development. It can thus be concluded that PPP's are a practical and efficient concept to be used in an attempt to improve the level of success of agricultural development in the province.

Based on the field workshops results, it was concluded that PPP's business concept will be the best approach to exploit the agricultural (goat meat, eco-tourism and animal feed production) opportunities present in the province. The following sub-section will give a brief description of each of these opportunities.

4.3.2.1 Goat meat

Currently, a high percentage of the South African goat population is owned by non-commercial or small-scale farmers, implying that the true potential of the meat goat industry is still unexplored and numerous opportunities exist for new entrants into the market. The great adaptation capacity of the animals contributes to its popularity especially amongst farmers with less production capabilities. However, certain market and marketing constraints exist for the goat meat industry as goat meat is still relatively unknown to the South African market. In order to overcome this problem, a business plan (which forms part of a bigger project which is not discussed in this study) was developed to integrate farmers into the goat value chain. This business plan was based on the principles of PPP's and include activities such as branding, brand management, quality control and marketing of goats and goat products.

The plan focused on the establishment of a commercial goat farm that can produce large quantities of goat meat, subsequently creating a situation where farmers can benefit from economies of scale. It is proposed that the supply base is built from emerging goat producers in the surrounding areas. The main aim of the proposed initiative is to assist small-scale goat meat producers to manage their existing stock under the supervision of an established and experienced producer.

The business plan is based on a minimum of 5,000 goats and is estimated to benefit approximately 100 households or 370 people residing in the NWP. Moreover, the investment required by government will equate to approximately R92,509 per person. Based on the assumption that each beneficiary will own 50 goats, an average annual income of R2,500 per household per month will be realised. Numerous additional advantages and opportunities are created by the project. For instance, the improvement of infrastructure will not only benefit the beneficiaries of the project but will have a positive impact on the entire community. Another major advantage of the project is that it uses mostly existing stock from the farmers (which also contributes to the farmers' investment) keeping the investment from government relatively low when considering the number of beneficiaries. Moreover, goat production is relatively less complicated compared to beef, sheep or pig production, which will substantially increase the chances of success.

The environmental impact of the business plan is believed to be low. The project is likely to reduce overgrazing and erosion in communal areas through the introduction of production farms. The potential of community development and interaction is high, with beneficiaries that will directly be involved with the production practices.

4.3.2.2 Animal feed

Essentially, the value chain of the animal feed manufacturing industry is divided into two parts, i.e. a primary production and a secondary or processing part. This phenomenon is distinctively manifested in all sectors of agricultural production, and the ultimate financial success or viability of primary agricultural production depends almost entirely on the value chain or ensuing level of integration. Therefore, the proposed business model for an animal feed manufacturing unit or mill will strive to integrate the primary production with the secondary production/processing through a PPP concept. This will enable participants to

have better control over the value chain of their produce. The entire integration process will be built around the feed mill itself, with commercial and small-scale grain producers supplying part of the required raw materials, while broiler growing units and feedlots in the region will serve as the main markets. Additionally, small-scale livestock farmers will also have an opportunity to become part of the value chain, as they could link to feedlot operations in the region to fatten their animals.

The establishment of a feed mill (500m²) is estimated to benefit approximately 41 households or 152 people residing in the NWP, at a total investment per person required from government of approximately R180,921. It is estimated that the monthly income generated by each household involved in the business plan will equate to R 2,500. Additional advantages of the proposed business concept include, amongst others, the suggestion that private institutions provide 50% of the initial capital outlay with government only liable for the remaining 50%. Additionally, the beneficiaries will receive training from established producers in order to enable them to produce effectively and independently in the near future. The impact on the environment is relatively small compared to the other business plans.

4.3.2.3 Eco-tourism

Studies conducted by the Human Science Research Council of South Africa (HSRC) suggest that the volume of international and domestic tourists have been growing at impressive rates over the past few years. Figures for the period 1996-2000 suggest that the volume of international tourists grew at an annual rate of 17% over the period (Erasmus, 2003). The same applies to the NWP, which is one of the most popular tourist destinations in South Africa. Attractions like the heritage sites, Sun City, national parks, activities around the Hartebeespoort dam etc. attracts a large number of foreign and local tourists to the province. Most of the economic benefits of these attractions have traditionally not been destined for the rural poor. However, recent developments in especially the game industry in the province provide several opportunities for the upliftment of the poor. For instance, the growth in the game industry has seen a number of new game ranches, lodges, guest houses etc. being erected/established in the province. This provides several opportunities for the local communities to get involved, ranging from just providing local hawkers with a stand to sell their crafted products at the local game ranches, lodges, guest houses etc., to being partners in tourist developments.

The primary goal of this business plan is to link the tourism industry with the agricultural sector and in the process, incorporate small-scale farmers and entrepreneurs into the mainstream economy. This has the ability to improve the livelihoods of the rural poor through job creation. The PPP concept has been identified as a mechanism that could be used to link agriculture (i.e. local producers) with local communities. Provided that newly developed tourism ventures in general require large amounts of capital which is not always accessible to the farmer himself, it is proposed that local developers/farmers should engage government as a partner. The business concept foresees that commercial farmers and government engage into partnerships in an attempt to exploit the tourism opportunities present in the province. For instance, the farmer can provide the land, movable assets etc., with government that could assist with the provision of capital for infrastructure, fixed assets, training, etc. The contribution of government should be regarded as the contribution on behalf of beneficiaries from the local community to the newly formed venture. Based on this, beneficiaries from the local community could obtain shares in the newly formed ventures. Also, the participation of farm workers or people from local communities as guides, instructors etc. provide additional employment opportunities. Based on the agri-tourism opportunities in the NWP, it is estimated that on average a capital investment of R248,000 is likely to support a total number of 5 households or 19 people residing in the NWP. Therefore government is required to invest approximately R13,052 per person in order to realise an average monthly income of R3,500 per household.

The environmental impact of the business plan is believed to be low, as suggested eco-tourism opportunities are recommended to mostly make use of the natural resources in the province. The potential of community development and interaction is high, with beneficiaries that will be directly involved with the tourism practices. Additionally, beneficiaries will gain entrepreneurial skills.

4.3.3 Share equity schemes

The concept of equity share schemes was identified as an alternative business concept that could be used to exploit the agricultural opportunities in the province, especially for perennial crop production. Tom (2006) describes 'ownership economics' or economic democracy as focusing on the questions of who owns the productive assets of society and the manner in which ownership can be better distributed. Therefore, shared ownership is a concept which

broadens capital ownership among the workers. Tom (2006) argues that shared ownership concepts and similar financial mechanisms create access to productive credit for employees who normally do not have such access due to lack of collateral. Furthermore, the concept allows employees to purchase shares with no money, no salary deduction, no commitment of the employees' pension fund and no personal liability. According to Fast (1999), farm equity schemes have become a favoured and widely publicised option of the land reform programme.

The outline of the structure of share equity schemes is based on farm workers using their land reform grants to buy shares in the farm they are working on. Their grants are invested in the operating company of the farm in return for a share of dividends. This arrangement is predominant in the high value agricultural sectors such as fruit and wine (Tom, 2006).

4.3.3.1 Perennial crops

In addition to the PPP concept that can be used to exploit the opportunities that surround perennial crop production in the NWP, equity share schemes was identified as an alternative business concept that can be used. This concept foresees that a commercial farmer will allocate a piece of his land for the establishment of an orchard. This land will be owned by a separate business entity, which in turn is owned by the commercial farmer and his farm workers in an equity share scheme. In the development phase of the perennial crop, the commercial farmer will bear most of the investment cost and the farm workers will provide the human resources (both labour and intermediate management). To ensure ownership transfer to small-scale farmers, the farm workers will use their land grants to buy shares in the enterprise. These land grants will also be used to finance the investment costs. As the production phase begins and the enterprise becomes profitable, the farm workers will share in the dividends and become more actively part of the management structure.

The main advantage of this model is that it forms part of a diversification strategy, which enhances the farm's risk portfolio. Furthermore, the new business unit will become Agri-BEE compliant, which will have positive marketing implications.

Income from the regular farm activities as well as the land grants can be invested in the development of the orchard. In this way, the capital requirements for the development phase

can be totally or largely financed by the enterprise itself. Finance from other sources will be limited, which will enhance the revenue earning capacity of the enterprise.

Perennial crop production is a very risky enterprise, especially when pursued by small-scale farmers who do not have the necessary experience or capital. High risks can be ascribed to the fact that income will only be realised after a few years of the initial investment, prohibiting the farmers to make repayments on loans. The number of beneficiaries of the proposed project will depend on the type of crop produced ranging between 1.7 and 7.7 people per hectare. However, based on the case study approximately 40 households or 148 people residing in the NWP will benefit per project. An investment of approximately R15,793 per beneficiary by government is needed to realise an average monthly income of R3,300 per household. As with all the projects that is concerned with cultivation, perennial crops will have a significant impact on the environment. However, it holds massive potential for community development and interaction.

4.3.4 Contract farming business concept

According to Kirsten and Sartorius (2002), contract farming is one of the systems with the highest potential for providing small-scale farmers with a way to integrate into the modern economy. Likewise, Glover (1987), as cited by Kirsten and Sartorius (2002), were of the view that contract farming will ensure self-sustained development and help farmers by providing them with new technology, ready markets and secured inputs and prices. Thus, contract farming could be the answer to empowering poor small-scale farmers, by providing them with rewarding markets. The concept 'contract farmer' has drawn renewed attention as one of the potential answers to future integration of small-scale farmers in the current state of global economic reform (Kirsten and Sartorius, 2002).

Additionally, the World Development Report (WDR) rates contract farming as a potential way to reduce poverty in developing countries. The WDR holds the viewpoint that contract farming provides a structure which enables small-scale farmers to participate in the mainstream economy. Hazell *et al.* (2006), as quoted by Prowse (2007), support the viewpoint of Kirsten and Sartorius (2002) as well as the WDR, but adds that contracting might hold additional opportunities and risk, which, amongst others, include the following:

- Contract farming offers great potential for poverty reduction.

- Contract farming also offers the opportunity for small-scale farmers to integrate with high-value markets.
- Contract farming can assist small-scale farmers to overcome capital constraints and capacity to advance technologically.
- The firms have a comparative advantage in market and technical knowledge, as well as in traceability and quality.
- The firms have the advantage in that economies of scale will result in lower production cost.

Therefore, contract farming seems to be an effective business concept for the introduction of small-scale producers in the NWP. Contract faming entails a contractual agreement between the small-scale producer and a company or agri-business firm. The company or agri-business engages in a contract with the small-scale producer, that specifies the terms and conditions for production. Moreover, contract farming has a range of options, with different tenure and financial agreements. It is suggested that contracts are signed with groups of small-scale farmers rather than with individual farmers. This will ease transaction and administration cost, with a group of farmers that will be able to produce larger quantities of the specific produce.

The following sections detail on the agricultural opportunities associated with contract farming. These agricultural opportunities include the broiler outsourcing scheme, vegetable production plan, Taung Irrigation Scheme and veldt management plan. However, the veldt management plan, also based on the contract farming concept, is not a conventional agricultural opportunity in the sense that it is more concerned with improving the natural resource base of the NWP than with producing an agricultural commodity.

4.3.4.1 Broiler outsourcing

The broiler industry is rapidly changing and is highly technical. Most companies are vertically integrated, meaning that they are involved down the supply and value chain of their produce.

Today, the broiler industry in South Africa has three distinctly separate branches, namely, the day-old chick, broiler and the egg industry. Broilers are the fastest growing of the three branches, and hold vast opportunities for new entrants that want to engage in poultry production. This is especially true in the NWP, as the province is within the vicinity of an international market in Botswana, as well as some of the major metropolis markets in Gauteng. Moreover, the natural resource base of the NWP is sufficient to support the industry, with it being host to one of the major crop producing regions in South Africa. The establishment of broiler operations in selective nodes (i.e. the proximity to markets and feed manufacturers) will reduce operational cost, enhancing the sustainability of such operations.

A broiler outsourcing scheme is proposed. However, the broiler industry in South Africa is dominated by a small number of large corporations, making it near impossible for small-scale farmers to engage in broiler production individually. Therefore it is suggested that the project incorporates the contract farming concept, subsequently enabling the small-scale farmer to do on-the-job-training and still realising an income to sustain his/her household. The project is flexible as to where in the province it needs to be implemented; however it is proposed that the project must be implemented in regions near major markets as well as feed-producing regions.

It is estimated that the broiler outsourcing scheme will accommodate approximately 20 beneficiaries with it having an indirect impact on 74 people, not taking into account the additional employment opportunities of the project. Furthermore it is estimated that each beneficiary requires 1,000 chicks per badge in order to be feasible and will generate approximately R3,420 per month per beneficiary. The proposed investment by government per beneficiary will amount to approximately R130,000. Additional benefits include the potential for community development and interaction. Moreover, the environmental impact is expected to be relatively low compared to other proposed business plans.

4.3.4.2 Vegetable production

Although the NWP has a relatively vibrant economy, poverty and unemployment continues to be rife amongst a large portion of the province's population - especially evident in the rural areas of the NWP. Innovative measures to enhance job creation and poverty alleviation have therefore been identified as a priority so as to rapidly transform the province and place it on

the path of successful development. Vegetable production has been recognised as an area that could have a significant impact on the provincial socio-economic conditions, and could improve the unemployment and poverty rates, especially as it is highly labour intensive and easy to rotate different crops.

Therefore, this business plan is concerned with unlocking the potential opportunities that lie within the production of vegetables on land previously marked for development, for instance land where irrigation development programmes have failed. The proposed business plan's main aim is to link the small-scale producers with larger firms that are already established in the market. This link can be administrated through a contract farming concept. The major reason for contract farming is to ensure small-scale farmers are guaranteed a market for their produce. Moreover, contract farming is also a means to address the concern of operation cost. The principles of contract farming normally suggest that the contracting party be responsible for the provision of the required production inputs. This holds a significant financial advantage for especially small-scale farmers, who in most instances find it difficult to obtain the necessary production capital.

However, a major risk for vegetable production in the province is the availability of water. Vegetable production needs excessive amounts of water and the success of the enterprise will largely depend on the availability of water. Subsequently, the business plan proposes that vegetable production be pursued near sources of sufficient water such as the Crocodile, Harts and Vaal Rivers. Another concern is that consumers demand high quality products and farmers with minimum experience may not be able to comply with the consumer demand in terms of quality. Therefore, the contractual company needs to ensure that the small-scale farmers get the necessary assistance to produce the required quality products.

The production plan identified 980 hectares as potential land for the implementation of the business plan. Based on the identified hectares, the vegetable production plan is estimated to attract a massive 210 direct beneficiaries having an indirect impact on approximately 777 people residing in the NWP. Furthermore, an investment of approximately R65,917 per beneficiary is required by government. This investment will realise an average monthly income for each beneficiary of R1,984.

4.3.4.3 Taung Irrigation Scheme

The Taung Irrigation Scheme (TIS) is an established project in the NWP. The success of the project has proven to be marginal with deprived infrastructure that presented producers with additional challenges. However, a project has been launched, focusing on the upgrading and improvement of the infrastructure in the TIS. This will surely contribute towards the level of development success in the specific scheme. Moreover, a detailed infrastructure maintenance plan was compiled as part of the production plan for the TIS. The main aim of the plan is still to facilitate contract farming between small-scale grain producers and the South African Breweries (SAB). The contract agreements involve small-scale farmers obtaining contracts to produce barley and maize for SAB.

SAB will assist small-scale farmers to participate in the scheme by means of the following:

- Provide finance for the production of especially genetically modified organism (GMO)-free maize and barley in the TIS which enable small-scale farmers to produce a crop all year round.
- Serve as a secure market for the produce of small-scale farmers that participate in the scheme. This will also imply that SAB will be responsible for the transportation and storage of grain produced by small-scale farmers in the scheme.
- Provide small-scale producers with technical support in their production processes.
- Assist small-scale farmers in solving impending disputes amongst one another, with local community as well as with service providers (i.e. local government, Eskom, contractors etc).
- Assist small-scale farmers to ensure timely and effective service delivery from contractors. Farmers participating in the scheme will make use of contractors for the cultivation of the land. The timely and effective cultivation and harvesting of the crop is of utmost importance when two crops per annum are produced on the same land.

On the 5,300 hectares allocated towards the TIS, the project will assist 170 beneficiaries directly which will have an indirect impact on approximately 533 people. However, an investment of approximately R230,827 per beneficiary will be required from government to ensure that the project is successful. It is estimated that on a typical farm unit in the TIS

(10ha) a farmer will realise an average monthly income of R 1,846. The environmental impact of the business plan is also expected to be high as a result of land that needs to be cultivated.

4.3.4.4 Veldt management

The NWP is one of the provinces in South Africa with the highest land and veldt degradation indexes. This negatively impacts on the production capabilities and subsequently the economic performance of the province. Therefore, the veldt management plan is concerned with the improvement of land and veldt degradation through the eradication of bush encroachment, clearing of road reserves and establishment of fire belts. The contracting concept upon which the plan is based is also likely to contribute towards the upliftment of the rural poor, as it will create employment opportunities for, amongst others, the unskilled people that reside in local communities.

The cost of veldt management (bush eradication, clearing and maintenance of road reserves and fire belts) will vary according to the type of application or procedure followed, the number of hectares attended to, the type of vegetation, the land capabilities and degree of degradation, etc. Thus, based on the level and size of the different variables, the cost of veldt management can range between R200 and R4,000 per hectare. It is therefore suggested that the overall veldt management programme be divided into smaller projects for each local municipality. Based on the degree of veldt degradation in the NWP and the size of the operation, an estimated 100 beneficiaries will benefit directly, with 370 people benefitting indirectly from the project. Each beneficiary is estimated to realise an average monthly income of approximately R2,500 and the investment required by government per beneficiary will equate to R1,000.

It is recommended that beneficiaries form project teams from where local governments can contract them to improve the degradation index in the local municipality. Local municipalities are recommended to make use of these project teams. The proposed business plan addresses two major issues in the NWP namely the improvement of the natural resource base and the upliftment of the rural poor. The project is also expected to have a positive impact on the environment.

4.3.5 Joint venture business concept

Properly chosen and implemented, joint ventures can be a great way for a small business to get in on opportunities (and profits) that otherwise would be missed out on (Ward, 2010). A joint venture is defined as a strategic alliance where two or more people or companies agree to contribute goods, services and/or capital to a common commercial enterprise. According to Ward (2010), joint ventures can enable small-scale businesses (e.g. small-scale farming business) to extend their marketing research, access required information and resources, and build credibility with a particular target market as well as access new markets that would be otherwise inaccessible.

Two agricultural opportunities are combined in the joint venture business concept, in an attempt to transform small-scale producers to commercial farmers. Figure 4.1 shows the schematic representation of the business concept. This business concept will be based on the principles developed and implemented by the Temo Agri Services (TAS) division of the Magalies Graan Koöperasie (MGK, 2010). To develop a business model similar to that of the MGK, a farmer's development division needs to be formed within the relative cooperative and be coupled with a farmer's share trust, through which small-scale farmers are represented. To link the farmer's development division and the farmer's trust, shares of the cooperative must be obtained by the farmer's trust. This will result in a joint venture between the cooperative and the farmer's trust. Moreover, small-scale farmers that qualify to be part of the proposed concept would automatically obtain equal shares in the farmer's share trust (MGK, 2010).

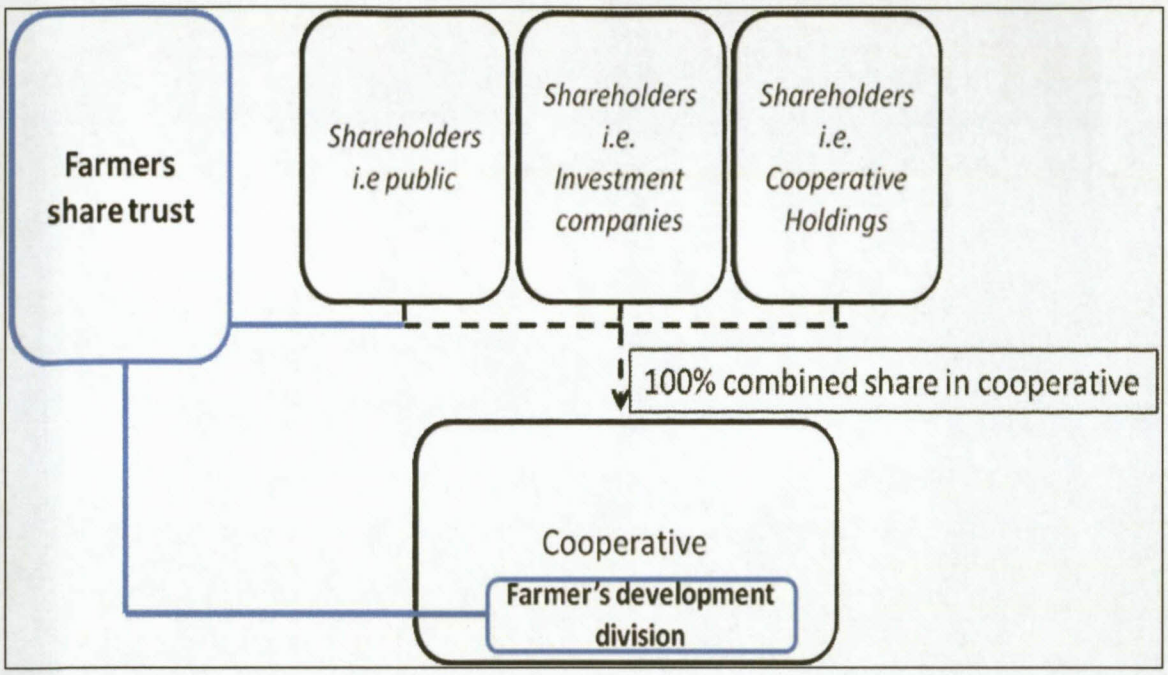

Figure 4.1: Schematic representation of the joint venture business concept.

Source: Van Schalkwyk (2009).

4.3.5.1 Grain production

Grain and oilseed production consist of massive potential to improve food security and to alleviate poverty in the province. This is especially true when considering the natural resource base and infrastructure supporting grain and oilseed production in the province. Moreover, large parts of the former homelands that are suitable for grain and oilseed production lay fallow. Transforming this land into productive units will not only contribute towards prosperity in the province, but it will have a significant impact on the rest of the country as well. Moreover, NWP is known for its grain production capabilities and is therefore an obvious choice to incorporate small-scale producers. This business plan links the grain production capabilities of the province with the joint venture business concept as developed by the Agri Temo Services division of MGK.

Based on the proposed business model, capital requirements of the project will include the acquisition of shares by the farmers trust in the agri-business in order to ensure a joint venture by the farmer's trust and the farmer's development division. The investment amount needed to acquire these shares will depend on the number and price and cannot be determined before the actual implementation takes place.

However, taking the MGK as an example, should the farmer's share trust obtain 20% of the shares in the cooperative at an average price of R3 per share, the capital required will amount to a total of R15 million. On the other hand, suggestions from the pilot project recommend that the current Agri Temo Division be expanded to accommodate an additional 30 000 hectares with an investment of R1.3 million. The investment of R1.3 million could create a situation where an additional 190 households, or 703 people, could benefit from the Agri Temo Initiative.

The investment per beneficiary is highly dependent on the type of crop used in the project and can vary between R6,800 and R78,000. The pilot project suggests that maize be used as it is the crop with the best established market in the province. The investment per beneficiary to engage in grain production will amount to an estimated R75,000. The number of shares acquired by each beneficiary will not vary as each crop type is undertaken in a separate project. There will, however, be a variance in the profits depending on the capital investment of the beneficiary. The environmental impact of the project is expected to be high with lands that need to be cultivated. However, the potential level of community involvement in the project is regarded as a positive outcome of the project.

4.3.5.2 Small-scale beef production

In general, approximately 70% of the 122.3 million hectares of South African land is suitable for raising livestock, particularly cattle, sheep, pigs and goats (SAMIC, 2005). As a result, the red meat industry is one of the foremost contributors towards the agricultural economy. This is similar for the NWP, with the natural resource base of the province which strongly supports livestock production in most regions.

Moreover, beef has been identified as the commodity with which small-scale farmers have the most experience and knowledge, making it an attractive choice for the incorporation of small-scale farmers into the mainstream economy.

However, the challenge facing small-scale and subsistence beef producers in the NWP is to transform the informal production units that prevail on communal land into a vibrant commercial livestock production system. One means of addressing this challenge has been the initiation and implementation of the Western Frontier Beef Beneficiation project in the

NWP. This is a government initiative to develop an inclusive and equitable red meat organisational framework, to ensure improved market linkages, to develop the relevant animal production and business skills among developing red meat farmers, and to ensure that the appropriate infrastructure is in place to subsequently create a vibrant commercial livestock production system. The proposed business plan seeks to build on the beef beneficiation project to ensure the economic upliftment of small-scale and subsistence cattle farmers in the NWP by vertically integrating the supply chain. Hence, the proposed business plan strives to unlock the value-adding opportunities that might be present.

The proposed business plan focuses on the establishment of an integrated red meat supply chain through the development/establishment of a feedlot, feed mill, abattoir and meat processing plant. Beef production units will be established for the small-scale farmers and will subsequently serve as the supply base for the above-mentioned infrastructure developments.

The establishment of the entire red meat supply chain enables the business plan to create numerous employment opportunities for the surrounding community, ultimately assisting in the upliftment of the rural poor. The supply base of this red meat supply chain is a 1,000 head feedlot. In order to establish a 1,000 head feedlot as well as the accompanied feed mill, abattoir and meat processing plant will require an investment of approximately R10,800,320 from government. This will amount to an investment of approximately R105,885 per beneficiary. The entire project is estimated to benefit approximately 102 beneficiaries, having an indirect impact on 377 people residing in the NWP.

Other economic benefits will include skills development and income generation for the rural poor. The business plan proposes that land already earmarked for redistribution be used for the small-scale beef production.

4.4 Conclusion

During the review of the study area as well as the SWOT workshops that were held throughout the province, the Agricultural Master Plan (AMP) for the NWP linked specific business concepts to various agricultural opportunities to create development plans. The SWOT workshops provided a platform for experts to advise on the feasibility of the

agricultural opportunities identified during the review of the study area. The same sessions also provided industry experts with an opportunity to share their ideas with regard to agricultural opportunities that exist in the various regions of the province. In addition, the meetings also formed part of the process to determine the most suitable business methods in order to exploit the identified agricultural opportunities in the province. Note that the business methods are only a guideline and that the alternative concepts might prove to be more efficient once implementation starts. The business concepts will not have an influence on the ranking of the plans and subsequently the recommendations made with regard to the budget allocation.

Against this backdrop, it might be concluded that the identified agricultural opportunities coupled with the proposed business concepts make for attractive ways of improving the level of agricultural development in the province. However, the implementation of these plans will require substantial capital investment to improve human resources, infrastructure development, natural resources and the institutional environment. The simultaneous implementation of all these identified plans will therefore not be possible. Given this situation, the various plans need to be ranked in order to determine which are most likely to yield the highest returns in terms of welfare improvement in the province.

Chapter 5

Development of criteria for Multiple Criteria Analysis (MCA)

5.1 Introduction

As mentioned in the previous chapter, ranking of the business plans in terms of their development potential will assist decision makers if confronted with contradictory choices. In order to assist decision makers in the North West Province (NWP) with conflicting choices like the allocation of funds to the various development initiatives (i.e. business plans for the identified agricultural opportunities), a Multiple Criteria Analysis (MCA) methodology is applied. Part of an MCA is the development of a criterion that will be used to rank the options available, which in the case of this study refers to the different business plans of the identified agricultural opportunities. The development of the criteria is probably the most important part of the MCA and will play an essential role in determining the outcome of the analysis.

A similar study conducted by Van Schalkwyk *et al.* (2000) in the Eastern Cape developed a criterion for a similar MCA model. This criterion was developed with similar objectives and constraints and is thus used as a basis for the development of the criteria for this study. This study adopted and transformed the criterion to make it suitable for the ranking of projects in the NWP as some of the economic, environmental and social characteristics differ between the provinces.

Following the set of criteria, the model requires that different weights be assigned to each of the set criteria to rank the alternatives accordingly. This is followed by a conflict analysis, which reflects on the actual ranking of the plans. The following section will detail on the process of criteria selection, the assignment of weights for the different criteria, conflict analysis and a description of the model.

5.2 Criteria development

The basic aim of the MCA is to rank the actions that can be taken to solve a problem to which several alternatives but conflicting choices exist. The ranking is based on set goals or criteria (Balyamujura, 1995). Fischer, Granat and Makowski (2010) states that when evaluating the performance of alternative choices, often the specification of a single objective function does not adequately reflect the preferences of decision makers. Fischer *et al.* (2010) suggest that when decision makers deal with practical resource complexities, their preferences are normally of a multi-objective nature, therefore, all factors impacting on agricultural development in the NWP need to be considered when developing a multi-objective MCA model.

Considering the aim of decision makers in the NWP to improve sustainable agricultural development i.e. improve the welfare of the community and at the same time conserve the province for future use, an MCA model was developed that depicted a trade-off between economic, environmental and social factors. Within the background of budget constraints, it is of utmost importance for government that agricultural development should be conducted in a sustainable manner if they are to deliver on the national imperatives and the promises made.

Van Schalkwyk *et al.* (2000) is of opinion that, in order to determine the optimal trade-off between the economic, environmental and social objectives, the following criteria need be considered:

- Economic benefits to the NWP which can be analysed through factors such as job creation, income generation, and contribution to geographical product.
- Long term sustainability which can be analysed through factors such as economic sustainability, environmental sustainability and social sustainability.
- Future prospects which can be analysed through factors such as economic growth potential, potential for future replication and adaptability to change.
- Degree of local resource utilisation which can be analysed through factors such as use of existing state assets, use of local resources, use of external resources and degree of institutional self-reliance.

The above-mentioned criteria, which are to be optimised in order to attain an increase in welfare, are illustrated in Figure 5.1. The criteria will be used to evaluate the different alternatives and to determine the best development plan under the set objectives i.e. improved welfare and conservation of the province for future use.

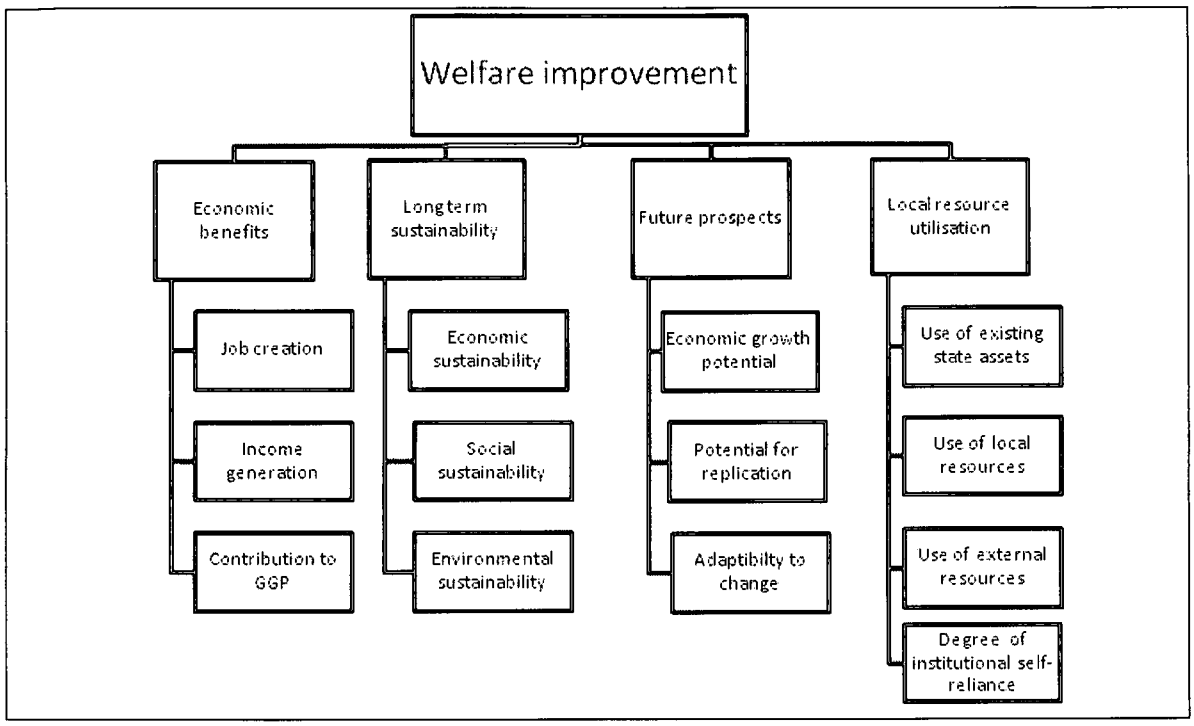

Figure 5.1: Criteria for MCA.

5.2.1 Description of criteria

As shown in Figure 5.1, welfare improvement is divided into four categories namely economic benefits, long term sustainability, future prospects and local resource utilisation. Although the different factors that could influence each of these categories were mentioned in the previous section, it is essential that each criteria and sub-criteria be discussed in detail (see Table 5.1, 5.2, 5.3 and 5.4). This will provide a background with regard to the importance or allocation of weights. Shown in Figure 5.1, economic benefits are divided into three categories namely job creation, income generation and contribution to GGP (Gross Geographical Product). Below is a detailed description of each (see Table 5.1).

Table 5.1: Economic benefits criteria.

CATEGORY	DEFINITION
Job creation	Refers to the number of direct beneficiaries that will benefit from the specific opportunity i.e. employment opportunities. It also includes the number of indirect employment opportunities that will be created by the implementation of the identified project/plan.
Income generation	Income generated by the beneficiary over a one year period i.e. salaries or benefits for an individual.
Contribution to GGP	This includes both the implementation cost of the specific project as well as the financial contribution i.e. income that is generated through the project.

The long term sustainability of a project is crucial especially when considering that it is one of the most important factors hindering the success of current development projects. A more specific description of each of the criteria which is accounted for under long term sustainability (see Table 5.2) follows in the next paragraphs.

Table 5.2: Long term sustainability criteria.

CATEGORY	DESCRIPTION
Economic sustainability	Economic sustainability refers to the farms/project viability or profitability. Profitability in this case reflects on the gross agricultural product, financial margin, farm size, intensive/extensive nature of production and the use of agricultural machinery.
Environmental sustainability	Environmental sustainability reflects on the ability of the project to keep natural capital intact. This can be measured in terms of the extent to which the project makes use of fertilizers, pesticides and water. Farm management practices i.e. residue management, application of organic manure, manure management, crop rotation, double cropping, farm machinery operation and type of farming system is also taken into account when determining the contribution towards environmental sustainability.
Social sustainability	Social sustainability refers to the cohesion of society and its ability to work towards a common goal. It can be measured through factors including the age of the farmers, level of education needed and the number of employment opportunities it creates within the agricultural sector.

In order for the business plans to be properly evaluated, the future prospects of each plan must be taken into account. For this exercise the following three categories were thought to be sufficient to determine the future prospects of each business plan (see Table 5.3).

Table 5.3: Future prospects criteria.

CATEGORY	DESCRIPTION
Economic growth potential	Reflects on the potential of the project to facilitate or contribute towards economic growth.
Potential for replication	Ability of the project to be replicated in other regions of the province.
Adaptability to change	Adaptability (flexibility) of the project to a change in the market, political and economical environment.

The extent to which each business plan utilises local resources is important in the sense that the development is targeted at improving the rate of development success which will ultimately impact positively on the province's economy. Subsequently table 5.4 shows the specific description of each identified criteria under local resource utilisation.

Table 5.4: Local resource utilisation criteria.

CATEGORY	DESCRIPTION
Use of existing state assets	Refers to the extent to which a business plan will utilise existing assets in order to succeed. These assets include physical assets like infrastructure in the region of implementation.
Use of local resources	Extent to which the intervention utilises local resources (i.e. institutional, human and natural resources) in the NWP.
Use of external resources	Extent to which the intervention utilises external resources (resources located outside the NWP).
Degree of institutional support	The degree to which the business plan is dependent on institutional support for its financial survival. In this case, institutional support is measured in terms of the amount of capital required from local government to establish/implement the specific venture.

5.3 Multiple Criteria Analysis

A wide variety of MCA methods can be used to assist with conflicting decisions like the allocation of resources towards agricultural development in the NWP. A comprehensive review of all the possible MCA methods can be found in Figueira, Salvatore, & Ehrgott (2005). Hajkowicz (2007) is of opinion that the most common MCA methods are the analytic hierarchy process (AHP), weighted summation, "ELECTRE", PROMETHEE[2], "ORESTE" and Compromise Programming. Moreover, the studies by Gershon and Duckstein (1983), Özelkan and Duckstein (1996), Eder, Duckstein and Nachtnebel (1997), Raju, Duckstein and Arondel (2000) as cited by Hajkowicz (2007) reveals that changes in the method can change the outcome of the analysis, although the differences are usually minor.

In an attempt to bridge the gap between the different MCA methods, Van Huylenbroeck (1995) combines the principles of the "ELECTRE", PROMETHEE and "ORESTE". In the

[2] Preference Ranking Organization Method for Enrichment Evaluations

process he captures the essentials of each method to develop a new MCA method. Van Huylenbroeck (1995) refers to this new MCA method as the conflict analysis method (CAM). The CAM is based on a more general formulation, combining the basic notions of indifference, incomparability and strong preference from the "ELECTRE", the different types of preference functions from the "PROMETHEE" and the PIR-test from the "ORESTE" approach. As a result, Van Huylenbroeck (1995) bridges the gap between the different MCA approaches by combining the strengths and eliminating their weaknesses. Therefore, the CAM approach could be regarded as the most appropriate method to apply when solving conflict decisions.

5.3.1 Multiple Criteria Analysis model

In order to conduct the CAM, preference indicators have to be calculated for each pair of alternatives. Preference indicators are used to determine the degree of dominance of the one alternative over the other. Preference indicators have to be calculated for each pair of alternatives. Assuming alternatives *a* and *b*, let $e_j(a)$ and $e_j(b)$ be the preference scores for alternative *a* and *b* respectively. This can be defined as follows in its general form:

$$P(a,b) = \frac{1}{n}\sum_{j=1}^{n} g_j[e_j(a,b)]$$

With:

$$e_j(a,b) = e_j(a) - e_j(b) \quad if \quad e_j(a) > e_j(b)$$
$$= 0 \quad if \quad e_j(a) \leq e_j(b)$$

g_j = Weight factor for criteria j

n = Total number of criteria

The degree of dominance *P(a,b)* is a function both of the difference in the evaluation score and of the relative importance of those criteria for which *a* is judged to be better than *b*. The preference score for a criterion can be measured along a preference curve, transforming the difference in evaluation scores into a preference between 0 and 1. According to Van Huylenbroeck (1995), six different kinds of preference functions can be used depending on the available data. These are:

- 0-1 criterion:

  This is the true criterion function applied in the "ELECTRE" 2 approach or the usual criteria in PROMETHEE, which is characterised by an infinite discriminating power. In this case, a difference in the preference function between alternatives immediately implies a total preference.

- 0-1 criterion with indifference area:

  The same is true for this preference function, but here an indifference threshold, to allow a margin of error, is considered.

- Multilevel criterion:

  This criterion is an extension of what Roy (1985) is calling a pseudo criterion. The level of dominance depends on the interval in which the difference in evaluation scores is situated.

- Linear criterion:

  This is probably the most common type of preference function and the one applied in the weighted summation technique. The slope of the preference function depends on the value of the total preference threshold.

- Rank order criterion:

  This is a discontinuous type of preference function that only makes use of the ranking of the objects for each criterion.

- Gaussian criterion:

  In this preference function the preference score changes continuously with the difference in evaluation scores.

This study will only make use of the multilevel criterion and the 0-1 criterion. The reason for using the 0-1 and the multilevel criteria is because the 0-1 criterion is characterised by an infinite discriminating power while the multilevel criterion depends on the difference in evaluation scores and is sufficient to accomplish the desired goals.

However, essential in the calculation process of the preference function is the establishment of weights for the relevant criteria. Specified criteria have different levels of importance and subsequently cannot be directly compared to each other. This problem can be overcome with the establishment of weights for each criterion which make it possible to compare criteria with different levels of importance with each other. After the weights have been established

for each criterion (see section 5.3.2), each project/business plan will be weighed using the preference functions discussed above.

5.3.2 Establishment of weights

Once all the preference scores have been calculated, they have to be weighted according to their relative importance. The conflict analysis method (CAM) information on the hierarchy of the criteria can be introduced and obtained in three ways depending on the type of data available namely:

- The decision maker is able to give quantitative weights: these are rescaled between 1 and 100.
- The decision maker may not be able to give a priority order: in this case the decision maker is asked to compare the criteria two by two and the weights are derived from the eigenvector of the pair wise comparison matrix.
- The decision maker is only able to give a rank order: in this case the expected value of the weights is calculated.

If the decision maker is only able to give quantitative weights, as in this case, Van Huylenbroeck (1995) states that two approaches are possible. The first approach is applied in the "ORESTE" method where the rank order information of the priorities is combined with the information about the criterion scores in a distance function. However, this is a rather complicated and arbitrary method. Van Huylenbroeck (1995) further explains that the estimation of the expected average value of the g_j-factor is a more theoretical sound way. On the basis of a uniform distribution of weights, it can be proved that the expected average value of the weights fulfilling the conditions imposed by the ordinal rank is given by the following equation:

$$g_i = \sum_{i=k}^{n} \left(\frac{1}{i}\right)$$

With:

k = priority level or ranking of criterion j (with k = 1 for the most important and k = n for the least important criterion).

Modifications to this formula make it possible to handle rank orders with ties (by multiplying the weight factor of order *k* by the number of times this rank order occurs) or with a degree of difference (Van Huylenbroeck, 1995). Based on this, the weights of each sub-criterion are calculated according to their priority ranking (Table 5.2). The priority ranking was determined by the stakeholders in the field workshops. These weights will subsequently be used in the equation discussed in section 5.3.1 in order to determine the preference function which will indicate the preference of *a* over *b* and *b* over *a*.

Table 5.5: Weights awarded to each sub criteria.

SUB-CRITERIA	WEIGHT	PRIORITY RANKING
Job creation	0.1493	1
Income generation	0.1493	1
Contribution to GGP	0.0498	3
Economic sustainability	0.1493	1
Social sustainability	0.0746	2
Environmental sustainability	0.0746	2
Economic growth potential	0.0372	4
Potential for replication	0.0498	3
Adaptability to change	0.0746	2
Use of existing state assets	0.0299	5
Use of local resources	0.0746	2
Use of external resources	0.0372	4
Degree of institutional support	0.0498	3

5.3.3 Conflict analysis method (CAM)

The preference indicator P(a,b) measures the degree of dominance of *a* over *b* and likewise, P(b,a), measures the degree of dominance of *b* over *a*. The comparison of both preference indicators makes it possible to analyse the degree of conflict between the two alternatives. In order to determine the exact relationship between the two alternatives, indifference and incomparability thresholds are introduced to distinguish a so-called preference, indifference

and incomparability or conflict situation (PIR test). Figure 5.2 depicts a flow pattern necessary to perform the PIR test.

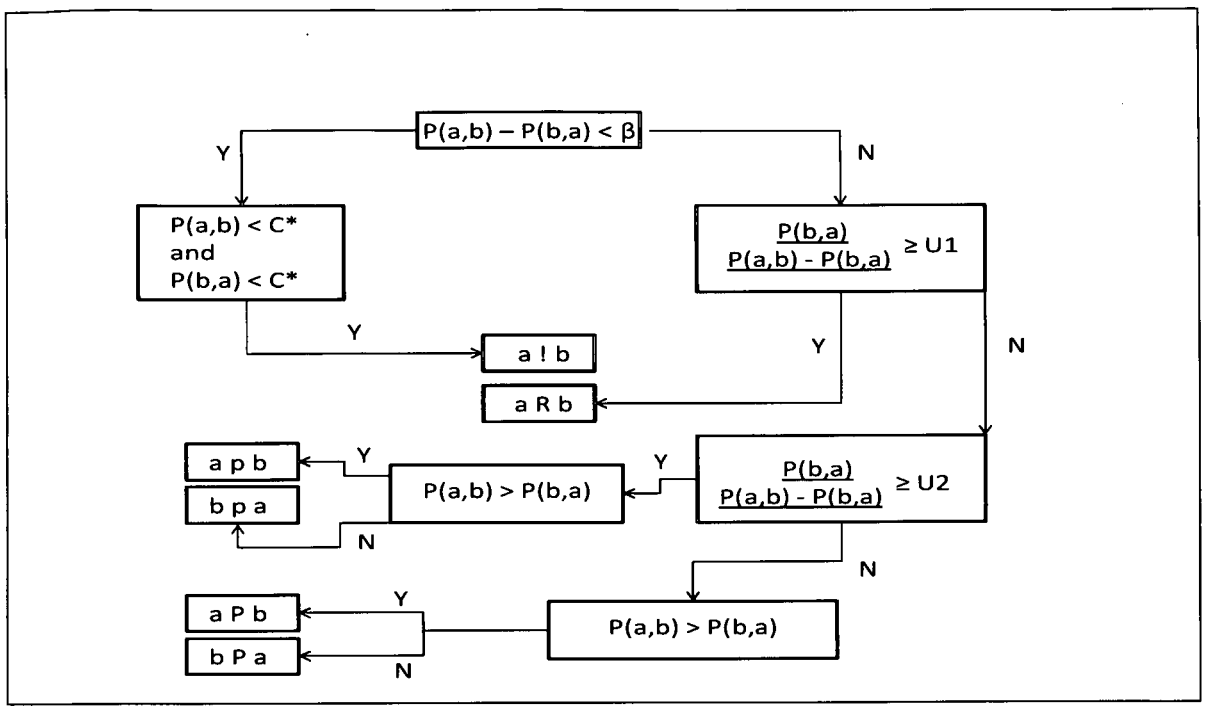

Figure 5.2: PIR sensitivity test.

(! = indifference, R = incomparability, p = weak preference and P = strong preference)

Source: Van Huylenbroeck (1995).

Pastijn and Leysen (1989) indicated that the threshold values (*β, C*, u1 and u2*) can be freely selected in the conflict analysis but can also be related to certain reference situations. The indifference threshold can be considered as an estimate of the margin of error in determining the criterion scores. Van Huylenbroeck (1995) developed the following framework in determining the threshold values.

Assuming that for each criterion j an indifference threshold βj is specified that:

$$a \succcurlyeq_j b \leftrightarrow e_j(a) - e_j(b) \succcurlyeq \beta_j \leftrightarrow \hat{e}_j(a,b) \succcurlyeq f(\beta_j)$$

If there has to be unanimity for all criteria, this means:

$$P(a,b) - P(b,a) = \frac{1}{n}\sum_{j=1}^{n} g_j \cdot f(\beta_j) - 0 \succcurlyeq \beta \leftrightarrow \beta < \frac{1}{n}\sum_{j=1}^{n} g_j \cdot f(\beta_j)$$

However for simple dominance it is enough that both objects are equal for all criteria except one (Lillich, 1990), or

$$a \approx {}_k b \; for \; k <> j \; and \; a > {}_j b \rightarrow a \; P \; b,$$

or

$$\hat{e}_k(a,b) = 0 \; and \; \hat{e}_j(a,b) > f(\beta_j) \rightarrow a \; P \; b,$$

or

$$P(a,b) - P(b,a) = \left(\frac{1}{n}\right) g_j . f(\beta_j) - 0 > \beta \rightarrow a \; P \; b$$

Since this is the minimum and j can be selected arbitrary, it is sufficient that

$$\beta = \left(\frac{1}{n}\right) \min\{g_j . f(\beta_j)\}$$

B has to be selected between these lower and upper limits, while C*, u1 and u2 can, according to Pastijn and Leysen (1989), be derived from a perfect conflict situation. In such a situation all criteria are of the same type and equally important and both actions, and objects are dominating the other one for the half of the criteria with a difference in preference score of m times β (the indifference threshold), or in notation form:

Criteria:	C1	C2	C3	...	C_{n-2}	C_{n-1}	C_n
ê(a,b)	mβ	mβ	mβ	...	0	0	0
ê(a,b)	0	0	0	...	mβ	mβ	mβ

This gives preference indicators as:

$$P(a,b) = \frac{1}{n} \sum_{n=1}^{\frac{1}{2}n} g_j(m.\beta) and \; P(a,b) = \frac{1}{n} \sum_{j=\frac{1}{2}n+1}^{n} g_j(m.\beta)$$

If g_j is equal for all criteria, then

$$P(a,b) = P(b,a) = \frac{1}{2} m.\beta$$

This means that indifference C* has to be less than above-mentioned value. The thresholds *u1* and *u2* are kinds of sensitivity parameters and can be derived from a so-called minimal preference perturbation index, indicating the number of couples that have to be switched in the perfect conflict situation before preference is concluded. Van Huylenbroeck assumes that for a weak preference the score of p_1 couples has to be switched in favour of object a, the preference indicators subsequently are

$$P(a,b) = \frac{1}{n}\sum_{j=1}^{\frac{1}{2}n+p_1} g_j(m.\beta) \text{ and } P(a,b) = \frac{1}{n}\, g_j(m.\beta) \sum_{j=\frac{1}{2}n+p_1+1}^{n} g_j(m.\beta)$$

and if g_j is equal for all criteria then,

$$P(a,b) = \frac{\left[\left(\frac{1}{2}n + p_1\right)m.\beta\right]}{n} \text{ and } P(b,a) = \frac{\left[\left(n - \frac{1}{2}n - p_1\right)m.\beta\right]}{n}$$

or

$$\frac{P(a,b)}{\{P(a.b) - P(b,a)\}} = \frac{n - 2p_1}{4p_1}$$

Therefore, for a weak preference situation *u1* has to be higher than this value and for strong preference the scores of p_2 (with $p_2 \geq p_1$) couples have to be switched. The following condition is obtained:

$$u1 \geq \frac{n - 2p_1}{4p_1} \geq u2 \geq \frac{n - 2p_2}{4p_2}$$

5.4 Conclusion

MCA was believed to be the most appropriate method to serve as a decision support system to assist decision makers in making conflicting decisions that can guide budget allocation for agricultural development initiatives. The basic aim of the MCA is to rank the actions that can be taken to solve a problem to which several alternatives albeit conflicting choices exist. The ranking is based on set goals or criteria that are weighted depending on their relative importance. A wide variety of MCA methods can be used to obtain the final ranking or scoring of the decision option. The most common MCA methods are the analytic hierarchy

process (AHP), weighted summation, "ELECTRE", PROMETHEE, "ORESTE" and Compromise Programming.

In an attempt to bridge the gap between the different MCA methods, Van Huylenbroeck (1995) combined the principles of the "ELECTRE", PROMETHEE and "ORESTE" and referred to this new MCA method as the conflict analysis method (CAM). The CAM was subsequently used to rank the development alternatives in this study according to the set goals or criteria.

Chapter 6
Application and Results

6.1 Introduction

In the previous chapters, the concern with regard to the low level of agricultural development success in the NWP was raised. Recommendations on how to improve the level of success were also made and it was argued that one of the ways to improve the success rate of agricultural development in the NWP is to identify viable agricultural business plans and rank them according to a set criteria. With that in mind, a multiple criteria analysis (MCA) model was developed. The results of the analysis will be discussed in this chapter.

As explained in Chapter 5, the first step of the MCA is the development of set criteria according to which the different business plans are ranked. Based on the set criteria, the business plans will now be ranked according to their economic contribution towards the North West Province (NWP), the long term sustainability, the future prospects and the degree of resource utilisation of each plan. The criteria are used to address the overall objective of agricultural development in the province, namely to improve the welfare of the rural poor and at the same time conserves the natural resources of the province for future use.

The following section will provide detail on the application of the MCA to rank the business plans as discussed in Chapter 4. Amongst others, the chapter will elaborate on the application of the MCA as well as results obtained from the method.

6.2 Application

The basic information used to compare the different business plans in terms of a set criterion was obtained from a study done in the Eastern Cape. The criterion was modified according to the inputs from a series of SWOT workshops that was held throughout the NWP.

Important information was acquired from these workshops which ultimately assisted in determining the value of each business plan in terms of the respective criteria (see Table 6.1). A detailed description of each of the criteria is provided in Chapter 5 which clarifies the specific factors that was included into each criterion. The specific information included into each criterion will justify the values awarded to each business plan. For instance, each business plan was awarded a value in terms of the potential employment opportunities created. This value was transformed into a percentage value in order to compare the business plans with each other. The business plans generating the highest value in terms of a criterion were awarded a percentage value of 100. The remaining received values accordingly. The rank order may differ depending on the priorities of the decision maker at a specific time.

However, before the business plans can be ranked, weights need to be assigned to the identified criteria (see Table 6.1). In order to be able to assign weights, stakeholders were consulted in an attempt to determine a priority list in terms of the identified criteria (see section 5.3.2). For example, job creation was identified as a high level priority criterion and was subsequently included as a priority level 1 criterion with a weight of 0.1493. On the other hand, the use of existing state assets were identified as a low priority level criterion and was included as a priority level 5 criterion with a weight of 0.0299.

Moreover, changes in the set criteria or the underlying factors of each criterion could impact on the outcomes of the analysis. Based on this, sensitivity analysis needs to be conducted. The sensitivity of changes in the criteria or underlying factors of each criterion is determined through:

- a change in the preference function used i.e. from the multilevel criteria to the 0-1 criteria; and
- a change in the rank order of the criteria i.e. income generation from category 1 to 2, contribution to GGP from category 3 to 1, economic sustainability from category 1 to 2, economic growth potential from category 4 to 1, potential for replication from category 3 to 4, adaptability to change from category 2 to 3, use of local resources from category 2 to 3.

Table 6.1 illustrates the value in percentage awarded to each business plan in terms of the identified criteria. Additionally, the weights and priority ranking of each criterion is also included. This information will be used in the application of the MCA.

The first scenario (base scenario) will use the multilevel type preference function while the second scenario (sensitivity test) will be conducted with the 0-1 type preference function. The results from the analysis are reported in the following sections. In the conflict analysis, that is conducted by the PIR sensitivity test, a value of 3.5 is applied for β, 7.5 for C* and values of 5 and 1 for u1 and u2 is applied respectively.

Table 6.1: Data for comparison of the different business plans.

	Weight	Priority ranking	GH	MCH	GM	B	BP	AF	ET	VM	TIS	VP	GP	PC
Job creation	0.1493	1	20.0	19.0	28.6	19.0	48.6	19.5	2.4	47.6	81.0	100.0	95.2	19.0
Income generation	0.1493	1	71.4	71.4	71.4	63.4	71.4	71.4	100.0	71.4	52.7	56.7	83.7	94.2
Contribution to GGP	0.0498	3	12.1	30.2	52.1	7.9	32.6	41.4	0.7	0.4	100.0	41.7	45.2	7.0
Economic sustainability	0.1493	1	60.0	80.0	100.0	80.0	100.0	60.0	60.0	80.0	60.0	80.0	40.0	40.0
Social sustainability	0.0746	2	42.9	57.1	71.4	100.0	85.7	71.4	85.7	71.4	85.7	85.7	100.0	85.7
Environmental sustainability	0.0746	2	75.0	75.0	100.0	60.0	60.0	20.0	100.0	75.0	27.3	21.4	20.0	20.0
Economic growth potential	0.0372	4	75.0	75.0	100.0	75.0	100.0	75.0	100.0	100.0	100.0	100.0	75.0	75.0
Potential for replication	0.0498	3	57.1	57.1	100.0	71.4	85.7	57.1	57.1	100.0	57.1	85.7	57.1	57.1
Adaptability to change	0.0746	2	66.7	66.7	100.0	50.0	100.0	100.0	50.0	100.0	66.7	100.0	100.0	100.0
Use of existing state assets	0.0299	5	20.0	20.0	10.0	10.0	10.0	20.0	10.0	30.0	100.0	40.0	20.0	20.0
Use of local resources	0.0746	2	85.7	85.7	100.0	85.7	100.0	100.0	71.4	100.0	85.7	100.0	100.0	100.0
Use of external resources	0.0372	4	75.0	75.0	75.0	62.5	87.5	62.5	100.0	62.5	75.0	87.5	62.5	62.5
Degree of institutional support	0.0498	3	2.5	1.0	0.6	3.8	0.9	0.7	48.5	100.0	0.3	0.7	0.7	4.4

With GH = Goat Hotel, MCH = Milk Cow Hotel, GM = Goat Meat, B = Broilers, BP = Beef Production, AF = Animal Feed, ET = Eco-tourism, VM = Veldt Management, TIS = Taung Irrigation Scheme, VP = Vegetable Production, GP = Grain Production, PC = Perennial Crops.

6.3 Results from the MCA

As mentioned, the multilevel preference function was initially used to conduct the MCA and is discussed in the following section. Results from the sensitivity analysis i.e. 0-1 criterion function and multilevel preference function with different ranking orders are discussed in section 6.3.2 and 6.3.3 respectively.

6.3.1 Conflict analysis: multilevel preference function (base scenario)

Table 6.2 illustrates the multilevel preference indicators as used in the conflict analysis. These values already incorporates the relative weights of the criteria and are a fair reflection of the preference of each business plan. These values are used in the PIR sensitivity test to determine the exact relationship between two alternatives.

Table 6.2 depicts the values gained from analysing the values in Table 6.1 with the conflict analysis method (CAM). The goal of the CAM is to determine the relationship between two alternatives and the values in Table 6.2 is the first step in achieving this goal. The following step is to determine the exact relationship between two alternatives. This step entails using the PIR-sensitivity test.

Table 6.2: Multilevel preference intensity indicators.

	GH	MCH	GM	B	BP	AF	ET	VM	TIS	VP	GP	PC
GH	**0.00**	0.17	0.30	3.60	1.15	3.64	4.47	0.81	4.97	4.84	5.88	6.12
MCH	3.81	**0.00**	0.25	4.18	1.09	5.82	7.34	1.50	7.21	4.78	8.12	8.99
GM	15.27	11.58	**0.00**	14.16	3.59	13.35	15.72	6.07	15.30	9.45	14.46	17.02
B	6.17	3.12	1.76	**0.00**	0.93	6.90	6.67	1.93	6.90	3.92	7.56	8.29
BP	16.02	12.32	3.49	13.22	**0.00**	13.58	16.72	5.17	12.83	6.21	11.72	16.08
AF	5.50	4.04	0.24	6.18	0.57	**0.00**	8.27	1.57	4.89	1.69	2.30	3.67
ET	10.37	9.61	6.65	10.00	7.76	12.31	**0.00**	6.62	12.16	11.67	12.38	11.04
VM	16.16	13.21	6.46	14.71	5.66	15.07	16.07	**0.00**	15.38	9.12	14.14	17.28
TIS	15.38	13.98	10.74	14.74	8.37	13.45	16.67	10.43	**0.00**	3.95	7.73	16.30
VP	20.44	16.74	10.08	16.95	6.95	15.44	21.37	9.36	9.14	**0.00**	8.21	18.29
GP	17.33	15.93	10.94	16.43	8.30	11.89	17.93	10.24	8.76	4.06	**0.00**	11.03
PC	7.88	7.11	3.81	7.48	2.97	3.57	6.89	3.69	7.65	4.45	1.34	**0.00**

With GH = Goat Hotel, MCH = Milk Cow Hotel, GM = Goat Meat, B = Broilers, BP = Beef Production, AF = Animal Feed, ET = Eco-tourism, VM = Veldt Management, TIS = Taung Irrigation Scheme, VP = Vegetable Production, GP = Grain Production, PC = Perennial Crops.

Table 6.3 reflects on the results from the PIR-sensitivity test and therefore shows the exact relationship between two alternatives. In other words, Table 6.3 illustrates the preference of each business plan in relation to the other business plans with: '!' that reflect on indifference between the plans, R on incomparability, > on a weak preference and >>> which reflect a strong preference. For example, from the results, GH is reportedly indifferent compared to B. Furthermore, VP and GM are reported to be incomparable with MCH, with MCH that are likely to yield higher returns than GH. A strong preference for BP is reported when compared to AF etc.

Table 6.3: Results of the conflict analysis for the multilevel criterion function.

First Action P(a,b)	Second action P(b,a)											
	GH	MCH	GM	B	BP	AF	ET	VM	TIS	VP	GP	PC
GH	!	<	<	!	<	!	<	<	<	<	<	<
MCH	>	!	<	!	<	!	<	<	<	<	<	>
GM	>	>	!	>	!	>>>	>>>	!	>	R	>	>>>
B	!	!	<	!	<	!	<	<	<	<	<	R
BP	>	>	!	>	!	>>>	>>>	!	>	!	>	>>>
AF	!	!	<<<	!	<<<	!	<	<	<	<	<	!
ET	>	>	<<<	>	<<<	>	!	<	<	<	<	>
VM	>	>	!	>	!	>	>	!	>	R	>	>>>
TIS	>	>	<	>	<	>	>	<	!	<	R	>>>
VP	>	>	R	>	!	>	>	R	>	!	>>>	>>>
GP	>	>	<	>	<	>	>	<	R	<<<	!	>
PC	>	<	<<<	R	<<<	!	<	<<<	<<<	<<<	<	!

With GH = Goat Hotel, MCH = Milk Cow Hotel, GM = Goat Meat, B = Broilers, BP = Beef Production, AF = Animal Feed, ET = Eco-tourism, VM = Veldt Management, TIS = Taung Irrigation Scheme, VP = Vegetable Production, GP = Grain Production, PC = Perennial Crops.

6.3.2 Conflict analysis: 0-1 criterion function (sensitivity test)

Similar to the previous section, Table 6.4 illustrates the 0-1 preference indicators as used in the conflict analysis. These values already incorporates the relative weights of the criteria and are a fair reflection of the preference of each business plan. Values obtained in Table 6.4 are the first step in determining the relationship between two alternatives. The following step will be to use these values in the PIR sensitivity test and to determine the exact relationship between two business plans. The exact relationship between two business plans is depicted in Table 6.5. In other words, Table 6.5 illustrates the preference of each business plan in relation to the other business plans. A description of the abbreviations in Table 6.5 can be found in section 6.3.1. Following is the results obtained.

Table 6.4: 0-1 preference intensity indicators.

First Action P(a,b)	Second Action P(b/a)											
	GH	MCH	GM	B	BP	AF	ET	VM	TIS	VP	GP	PC
GH	0.00	19.91	7.97	56.47	15.43	31.09	42.81	18.65	19.90	19.90	23.62	48.50
MCH	29.85	0.00	7.97	41.54	15.43	23.62	50.27	18.65	27.36	19.90	23.62	33.57
GM	80.85	80.85	0.00	84.57	26.11	67.15	51.00	33.57	41.04	41.03	52.22	67.15
B	23.62	16.16	12.44	0.00	12.44	31.08	53.48	22.39	38.54	27.36	23.62	41.03
BP	77.11	77.11	31.09	77.11	0.00	64.66	51.00	48.50	44.76	27.36	42.27	67.15
AF	32.35	47.28	7.97	50.27	17.92	0.00	42.81	14.93	22.40	12.44	12.44	37.32
ET	46.01	46.01	23.62	38.55	23.62	46.01	0.00	41.03	23.62	23.62	46.01	46.01
VM	66.43	58.97	22.90	66.43	19.15	56.47	44.04	0.00	41.04	23.62	41.54	56.47
TIS	55.24	55.24	40.31	56.48	32.85	66.42	42.81	44.03	0.00	25.38	51.49	66.42
VP	80.10	72.64	34.08	65.18	32.85	77.60	53.99	44.03	52.23	0.00	60.19	70.14
GP	54.74	54.74	37.82	50.27	47.77	44.78	50.27	44.78	44.79	29.85	0.00	37.32
PC	29.86	29.86	22.89	25.39	15.43	19.90	42.81	29.85	22.40	12.44	12.44	0.00

With GH = Goat Hotel, MCH = Milk Cow Hotel, GM = Goat Meat, B = Broilers, BP = Beef Production, AF = Animal Feed, ET = Eco-tourism, VM = Veldt Management, TIS = Taung Irrigation Scheme, VP = Vegetable Production, GP = Grain Production, PC = Perennial Crops.

Table 6.5: Results of the conflict analysis for the 0-1 criterion function.

First Action P(a,b)	Second Action P(b/a)											
	GH	**MCH**	**GM**	**B**	**BP**	**AF**	**ET**	**VM**	**TIS**	**VP**	**GP**	**PC**
GH	!	<	<	>	<	R	R	<	R	<	<	R
MCH	>	!	<	>>>	<	<	>	<	>	<	<	<
GM	>	>	!	>>>	<	>>>	>	>	>>>	>	R	>
B	<	<<<	<<<	!	<	<	>	<	>	<	<	R
BP	>	>	>	>	!	>>>	>	>>>	>>>	>	<	>>>
AF	R	>	<<<	>	<<<	!	R	<	<	<	<	>
ET	R	<	<	<	<	R	!	<	R	<	R	R
VM	>	>	<	>	<<<	>	>	!	>	R	R	>
TIS	R	<	<<<	<	<<<	>	R	<	!	<	<	>
VP	>	>	<	>	<	>	>	R	>	!	>	>>>
GP	>	>	R	>	>	>	R	R	>	<	!	>
PC	R	>	<	R	<<<	<	R	<	<	<<<	<	!

With GH = Goat Hotel, MCH = Milk Cow Hotel, GM = Goat Meat, B = Broilers, BP = Beef Production, AF = Animal Feed, ET = Eco-tourism, VM = Veldt Management, TIS = Taung Irrigation Scheme, VP = Vegetable Production, GP = Grain Production, PC = Perennial Crops.

6.3.3 Conflict analysis: multilevel preference function with a different priority ranking order of the criteria (sensitivity test)

In order to illustrate the sensitivity with regard to a change in the ranking order of the criteria, different priority levels of criteria were identified (see Table 6.6). This was done by consulting additional stakeholders and is merely an attempt to illustrate the sensitivity of a change in the priority levels of the criteria and to get another perspective on the ranking preferences. Additionally, the inclusion of this scenario in determining the final ranking order gives a better representation of the preferences of all the stakeholders in the province. A similar preference function was used as in the base scenario (i.e. multilevel preference function), thus, the change in results is due to the change in the ranking order of the criteria. The new weights awarded to each criterion are as a result of a change in their priority ranking order (see Table 6.6).

Table 6.6: New weights awarded to each sub criteria.

	Weight	Changed priority ranking order	Previous priority ranking order
Job creation	0.1493	1	1
Income generation	0.0746	2	1
Contribution to GGP	0.1493	1	3
Economic sustainability	0.0746	2	1
Social sustainability	0.0746	2	2
Environmental sustainability	0.0746	2	2
Economic growth potential	0.1493	1	4
Potential for replication	0.0372	4	3
Adaptability to change	0.0498	3	2
Use of existing state assets	0.0299	5	5
Use of local resources	0.0498	3	2
Use of external resources	0.0372	4	4
Degree of institutional support	0.0498	3	3

The changed priority ranking orders are illustrated in Table 6.6 and show a change in the following criteria: income generation (from 2 to 1), contribution to GGP (from 1 to 3), economic sustainability (from 2 to 1), economic growth potential (from 1 to 4), potential for replication (from 4 to 3), adaptability to change (from 3 to 2) and the use of local resources (from 3 to 2). Table 6.7 shows the preference indicators of the multilevel criteria function with different criteria. To determine the exact relationship between two alternatives, the preference indicators are incorporated into the PIR-sensitivity test (see Table 6.8). A description of the abbreviations with examples on how to interpret the results in Table 6.8 can be found in section 6.3.1.

Table 6.7: Multilevel preference intensity indicators with a different priority ranking order of the criteria.

First Action (a,b)	Second Action (b,a)											
	GH	**MCH**	**GM**	**B**	**BP**	**AF**	**ET**	**VM**	**TIS**	**VP**	**GP**	**PC**
GH	0.00	0.17	0.30	3.14	1.15	3.64	4.75	1.70	3.90	3.99	4.73	5.36
MCH	4.04	0.00	0.25	5.11	1.09	4.67	7.86	3.78	4.99	3.93	5.82	8.47
GM	16.87	12.94	0.00	16.59	4.95	13.61	15.44	8.88	10.60	8.11	13.28	18.76
B	4.89	2.98	1.76	0.00	0.93	5.61	5.66	2.50	5.00	3.54	5.12	5.92
BP	16.25	12.32	3.49	14.29	0.00	13.16	15.08	6.49	8.27	4.22	10.15	16.47
AF	6.83	3.99	0.24	7.06	1.25	0.00	9.88	4.71	2.91	0.85	1.15	5.15
ET	10.88	10.12	5.01	10.05	6.12	12.83	0.00	5.01	9.45	9.18	12.45	11.71
VM	15.85	14.05	6.46	14.90	5.52	15.66	13.01	0.00	11.83	8.13	13.58	16.72
TIS	24.26	21.48	14.41	23.62	13.53	20.09	23.68	18.06	0.00	8.41	12.93	24.42
VP	22.52	18.59	10.08	20.33	7.64	16.19	21.58	12.52	6.58	0.00	7.79	20.52
GP	18.25	15.47	10.23	16.89	8.57	11.47	19.83	12.96	6.08	2.77	0.00	13.95
PC	5.66	4.90	2.50	4.48	1.67	2.26	5.88	2.89	4.36	2.29	0.74	0.00

With GH = Goat Hotel, MCH = Milk Cow Hotel, GM = Goat Meat, B = Broilers, BP = Beef Production, AF = Animal Feed, ET = Eco-tourism, VM = Veldt Management, TIS = Taung Irrigation Scheme, VP = Vegetable Production, GP = Grain Production, PC = Perennial Crops.

Table 6.8: Results of the conflict analysis for the multilevel criterion function with a different priority ranking order of the criteria.

First Action (a,b)	Second Action (b,a)											
	GH	MCH	GM	B	BP	AF	ET	VM	TIS	VP	GP	PC
GH	!	<	<	!	<	<	<	<	<	<	<	<
MCH	>	!	<	!	<	!	<	<	<	<	<	R
GM	>	>	!	>>>	!	>>>	>>>	>	<	R	R	>>>
B	!	!	<<<	!	<	!	<	<	<	<	<	!
BP	>	>	!	>	!	>>>	>>>	!	<	<	R	>>>
AF	>	!	<<<	!	<<<	!	<	<	<	<	<	!
ET	>	>	<<<	>	<<<	>	!	<	<	<	<	>
VM	>	>	<	>	!	>	>	!	<	<	R	>>>
TIS	>	>	>	>	>	>	>	>	!	>	>	>>>
VP	>	>	R	>	>	>	>	>	<	!	>	>>>
GP	>	>	R	>	R	>	>	R	<	<	!	>>>
PC	>	R	<<<	!	<<<	!	<	<<<	<<<	<<<	<<<	!

With GH = Goat Hotel, MCH = Milk Cow Hotel, GM = Goat Meat, B = Broilers, BP = Beef Production, AF = Animal Feed, ET = Eco-tourism, VM = Veldt Management, TIS = Taung Irrigation Scheme, VP = Vegetable Production, GP = Grain Production, PC = Perennial Crops.

6.4 Summary of Results

Figure 6.1 reflects the ranking order that was obtained using the multilevel criterion function (base scenario). See Table 6.3 for a schematic representation of the scenario. According to Figure 6.1, vegetable production, veldt management, beef production and goat meat are ranked as the best alternatives, with grain production and the Taung Irrigation Scheme ranked as second best. Although the remaining six alternatives are on the same level, eco-tourism, broilers and the milk cow hotel concept is preferred over perennial crops, animal feed and the goat hotel plan. Thus, based on the ranking, capital investments into vegetable, beef and goat meat production as well as improved veldt management is likely to yield the highest returns in terms of the set criteria. However, the preference function combined with the criteria is not sufficient enough to give a clear representation of which business plans are more preferred when compared to the others. This is evident from the fact that no clear distinction can be made between the four best alternatives. Consequently the 0-1 criterion function was also applied.

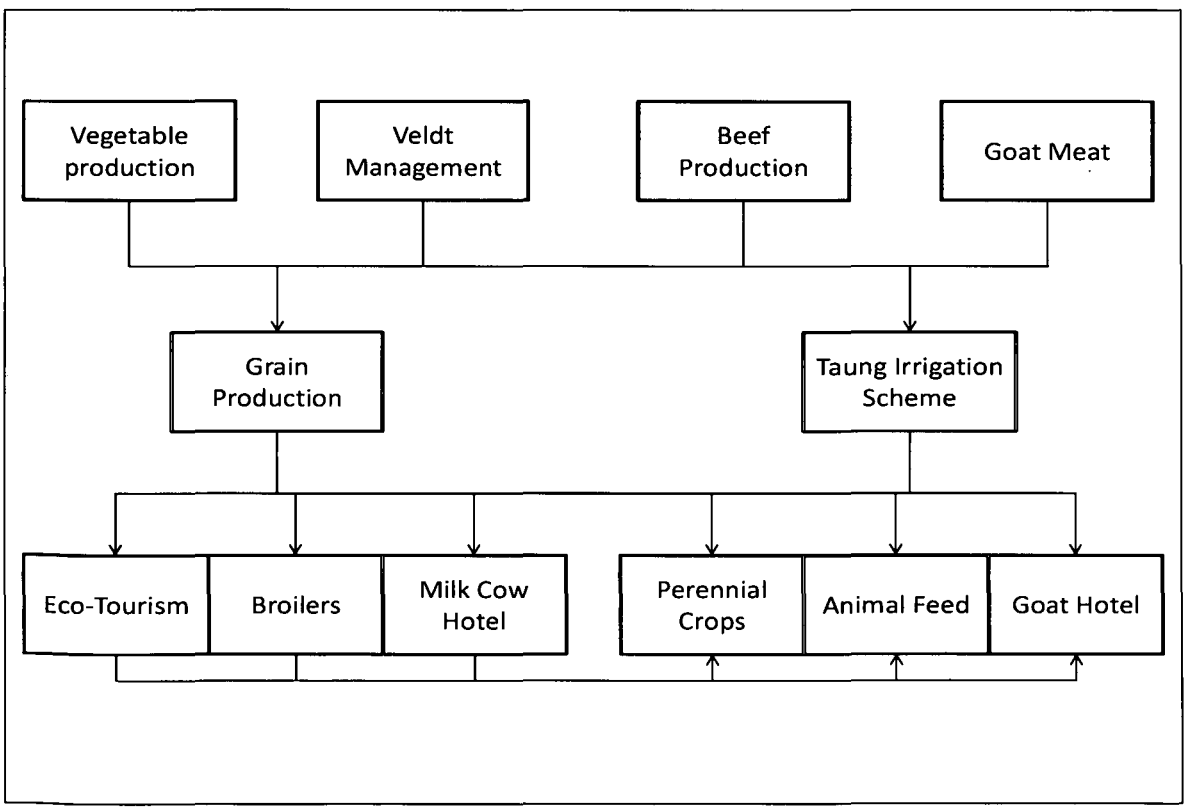

Figure 6.1: Scenario 1 (multilevel preference function).

Figure 6.2 is a schematic representation of the ranking order that was obtained by using the 0-1 preference function (see Table 6.5 for a schematic representation of the scenario). The scenario used the same criteria as was used for the multilevel preference function analysis. Thus, the sensitivity of changes in the preference functions was tested by changing the multilevel preference function to the 0-1 preference function. The change in preference functions resulted in better results, with beef production that is reportedly the best opportunity to pursue under the set criteria. This is followed by goat meat, vegetable production and veldt management ranked 2nd, 3rd and 4th respectively. Eco-tourism is believed to be the worst alternative in this scenario.

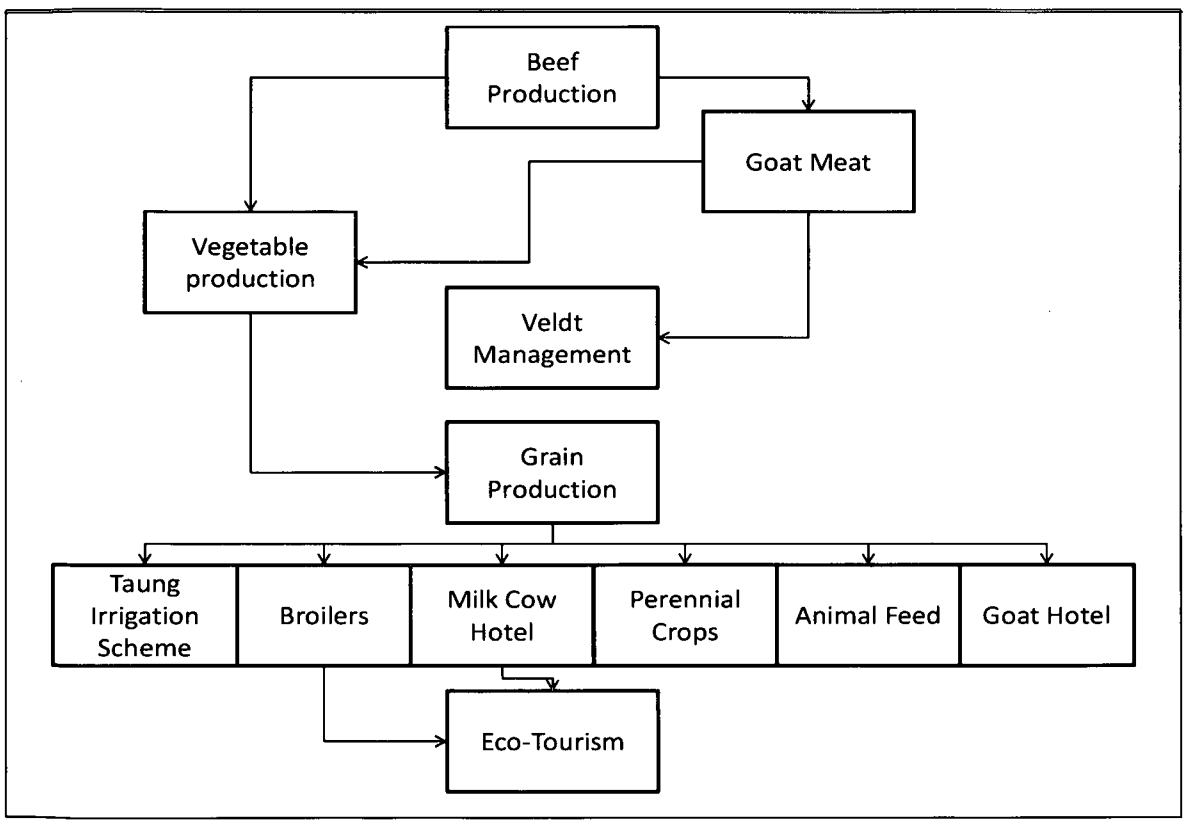

Figure 6.2: Scenario 2 (0-1 preference function).

Figure 6.3 illustrates the results obtained using the multilevel preference function with different priority rankings for the set criteria (see Table 6.6 for the change in priority rankings). New priority levels were identified for each criterion and weights were calculated accordingly.

When comparing Figure 6.3 with the previous scenarios (depicted in Figure 6.1 and Figure 6.2), it is clear that a change in the priority ranking of the criteria have a significant impact on the results. For example, in the previous scenarios the Taung Irrigation Scheme concept was not one of the preferred plans, however, with the changed priority ranks, results revealed that the plan is the most likely to achieve the set objective. The ranking order could be attributed to the fact that the Taung Irrigation Scheme has high values in criteria such as the contribution to GGP and economic growth potential. Moreover, despite changes in the results, business plans like beef, goat meat and vegetable production remain highly likely to yield the highest returns in terms of the objective. Alternatives like the eco-tourism, milk cow hotel, broilers, perennial crops, animal feed and the goat hotel remained lower in terms of achieving the objective.

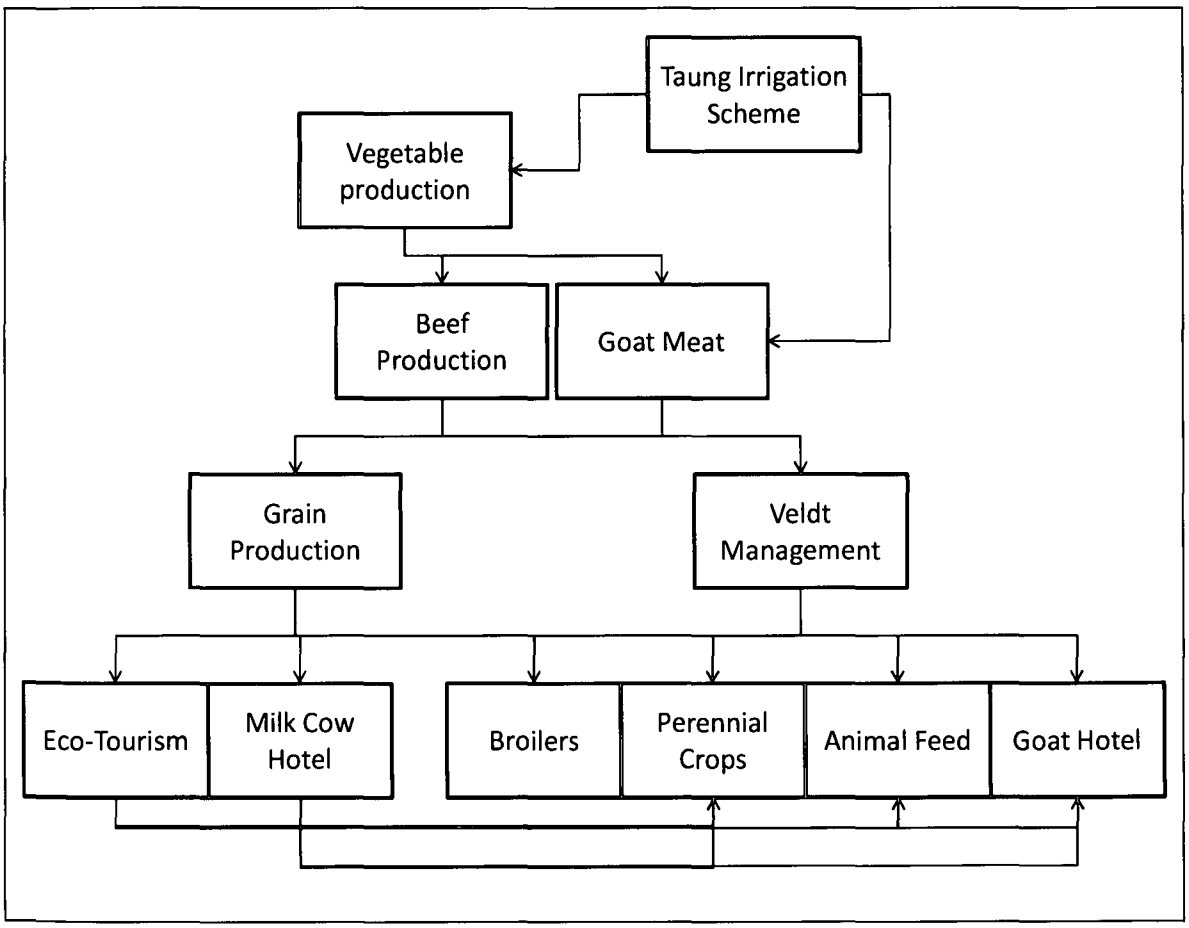

Figure 6.3: Scenario 3 (multilevel preference function with different ranking of criteria).

Thus, one might argue that when faced with a budget constraint, investing money or allocating funds towards beef, goat meat and vegetable development initiatives will most

likely achieve the set objective (i.e. welfare improvement while conserving the province for future use). Note that these results are based on the outcomes that will results from the business concepts and the size of the enterprise/venture as discussed in Chapter 4.

6.5 Conclusion

It is evident from the results that the criteria and the ranking priorities have a significant influence on the outcome of the MCA. However, when considering all scenarios, one might conclude that, beef production (see Chapter 4 for assumptions regarding the business concept and viable size of the enterprise) is the plan that is most likely to improve the success of agricultural development and by doing so, improve the welfare of the province. On the contrary, although the opportunities exist to engage perennial crop, goat milk and animal feed production in the province, they are evaluated as the plans which are the least likely to achieve the set objective.

Therefore, based on the set criteria and the ranking orders, it is recommended that funds firstly be allocated towards the implementation of beef production initiatives (provided that they are based on a joint venture business concept and linked to the Western Frontier Beef Beneficiation program). Following beef production is vegetable production which makes use of the contract grower concept, goat meat (Public Private Partnership), grain (joint venture), veldt management and the Taung Irrigation Scheme which employs contract farming. As mentioned, other business concepts might also be used to exploit these opportunities, however, once the business concept change the depicted ranking order will no longer hold. The reason for this is because once the business model is changed, the way in which the plan satisfies the criteria i.e. number of jobs that will be created by the venture, capital required, income generated etc. will change, resulting in a different ranking order. Thus, the ranking order depicted in this chapter is only valid for the given business concepts and the size of operation as discussed in Chapter 4.

Chapter 7
Summary and Conclusion

7.1 Introduction

The North West Department of Agriculture, Conservation, Environment and Rural Development (NWDACERD) is charged to assist and implement initiatives that will adhere to or help to achieve, amongst others, the national imperatives outlined in Chapter 1. Following the lead of National Government, and coupled with the rural nature of the province, agriculture was targeted as one of the main sectors to address the imperatives.

However, large portions of taxpayers' money have been invested in projects that have failed and, like every other institution, the provincial government is also confined to a fixed budget, meaning that in order to ensure successful agricultural growth and development, opportunities must be pursued in an effective manner. The effectiveness of development is largely dependent on the government's ability to channel resources into the most effective projects and still allocate resources to less crucial but nevertheless important projects. Such decisions can become extremely complicated, especially when in search of an optimal allocation of resources. Consequently, a Multiple Criteria Analysis (MCA) approach was implemented to serve as a decision support system to assist government with conflicting choices, like the allocation of funds towards development initiatives that will yield the highest returns.

The focus of the study is to improve the success of agricultural development in the North West Province (NWP). This spirals down to the following: to firstly identify agricultural opportunities that are most likely to succeed in the province, secondly to propose or develop business concepts for the identified agricultural opportunities that will assist government and prospective beneficiaries to exploit the identified opportunities and thirdly, to assist government in allocating resources towards the identified opportunities that are likely to yield

the highest returns in terms of the set objective i.e. to improve the welfare of the rural poor and at the same time conserve the natural resource base of the province for future use.

To address the afore-mentioned, agricultural opportunities were identified whereafter business plans for each possible intervention were developed. The possible interventions were analysed and ranked according to their environmental, economic and social impacts, thus illustrating the potential of each plan to address the set objective. Ultimately, this framework will assist decision makers to improve the success of agricultural development in the NWP.

The following section provides a summary of the findings from this study, while the last section draws some conclusions with regard to budget allocations towards the identified agricultural projects as well as recommendations for future research.

7.2 Summary of the study

Levels of extreme poverty, unemployment and unequal distribution of income were identified as some of the major concerns of government. Moreover, the levels of unemployment and poverty are reported to be the worst in the rural regions. This has shifted the focus of government towards the upliftment of the rural poor, and as a result the so-called national imperatives have been introduced. The main objective of these imperatives is to improve the welfare of the rural poor.

As mentioned, the agricultural sector was targeted as the main sector to ensure economic growth and rural development. The sector, especially in the NWP, lends itself towards this responsibility with the province being mostly rural in nature coupled with the fact that most of the rural population rely on agriculture for their livelihoods. However, the marginal success rate of agricultural development initiatives highlights the need for interventions that will improve the success and subsequently the welfare of the rural poor.

From the literature review in Chapter 2, several factors have been identified as inhibiting factors for the success of agricultural development. Global and local studies and projects were consulted in an attempt to identify the most significant factors impacting on agricultural development. The main factors as identified from the literature review include lack of farmer

training, limited size of operation, limited access to market information, insufficient infrastructure, lack of appropriate support services, HIV/AIDS, lack of access to credit and lack of ownership. These factors have proven to be essential elements in determining the success of rural farmers and therefore need to be considered when allocating resources to development initiatives. With large amounts of money flowing to agricultural development, it is only sensible to rank the agricultural opportunities that are least affected by these factors. In other words, it needs to be determined which agricultural opportunities will increase the yield of an investment.

Studies like the those by Magingxa (2006) and the AgMRC (2010) suggest that the development of workable business plans for agricultural opportunities can improve the success of development initiatives. This suggestion was based on the idea that business plans will provide a guideline that incorporate policies, institutions and mobilise resources to a degree that will improve the chances of success. In other words, a well developed business plan is likely to provide potential beneficiaries with a blueprint on how to exploit a specific opportunity.

In Chapter 3, a review of the study area was used as the basis to determine potential agricultural opportunities that might be available in the NWP. This review included a discussion on the geographics of the province, the socio-economic and economic overview and the state and functioning of the infrastructure that support agricultural production in the province. In addition to this, field workshops that were facilitated according to the SWOT analysis were also conducted in order to get a better perspective of the potential agricultural opportunities in the different regions of the province. A review of already established agricultural development projects in the NWP were also provided in the chapter. This was done in order to determine whether some of the newly identified opportunities could be aligned with already established enterprises so as to improve the success of agricultural development in the province.

The results were reported in Chapter 4. The main identified agricultural opportunities include the production of beef, goat meat, milk (both cow and goat), broilers, grain and oilseeds, vegetables and various citrus and sub-tropical fruits. Furthermore, some of the agricultural opportunities identified extended beyond the primary production and included processing of raw materials into animal feed, the promotion of eco-tourism activities and the improvement

of veldt management in the province. Chapter 4 also dealt with the development of business plans or concepts in order to guide government and prospective beneficiaries in their quest to successfully pursue the identified opportunities. The main business concepts proposed included that of a milk hotel, public private partnerships, outsourcing schemes, joint ventures and equity share schemes

However, workable business plans can only contribute towards the success of agricultural development and subsequently the eradication of poverty in the rural regions of the province once they are implemented. But, government is often faced with budget constraints. For example, it was estimated that only 3.66% of the annual provincial budget was destined for agricultural development. This highlights the importance of ensuring that resources, and specifically funds, are allocated to the initiatives that are likely to make the biggest contribution towards the eradication of poverty.

The afore-mentioned, coupled with other factors like the marginal level of past agricultural development success in the province, highlighted the need for a decision support tool that could assist government in the province with conflicting decisions. From the literature review in Chapter 2, it was concluded that a Multiple Criteria Analysis (MCA) can be regarded as the best methodology for ranking different alternatives if numerous external factors have to be taken into account. Chapter 5 detailed on the development of the MCA model that was used to rank the business plans. The business plans were ranked according to set criteria, and the criteria were determined by a specific goal i.e. to improve the welfare of the rural poor and at the same time conserve the natural resource base of the province. The criteria used in the analysis comprised the following:

- Economic benefits to the NWP - can be analysed through factors such as job creation, income generation, and contribution to geographical product.
- Long term sustainability - can be analysed through factors such as economic sustainability, environmental sustainability and social sustainability.
- Future prospects – can be analysed through factors such as economic growth potential, potential for future replication and adaptability to change.
- Degree of local resource utilisation – can be analysed through factors such as use of existing state assets, use of local resources, use of external resources and degree of institutional self-reliance.

Moreover, the MCA requires that different priority rankings or weights which reflect the level of importance of each criterion be assigned. The assigned weights coupled with the respective criteria were incorporated into three different scenarios of the MCA. These scenarios were used to illustrate the sensitivity of the criteria and to determine which business plan is likely to yield the highest returns, given the set objective.

The first MCA made use of a multilevel preference function to rank the business plans according to the set criteria. Results obtained from the analysis revealed that no distinction can be made between of beef, goat meat, vegetable production or veldt management. Thus, making use of the multiple preference function, these four business plans were regarded as the ones that are likely to yield the highest returns given the set objective. Using the same preference function, eco-tourism, broilers, milk cow and goat milk hotels, perennial crops and animals feed were reported to be yielding the lowest returns.

However, literature revealed that changes in the set criteria or the underlying factors of each criterion could impact on the outcome of the analysis. The distinction made between the twelve business plans were not sufficient using the multilevel preference function, which highlighted the need for future analysis or sensitivity analysis.

The second and third scenarios are part of the sensitivity analysis. Adjustments were made to the first scenario with a change in the respective weights of the criteria as well as the approach followed by the MCA. These adjustments were merely an attempt to illustrate the sensitivity of a change in the priority levels of the criteria and to get another perspective on the ranking preferences. Additionally, the inclusion of these scenarios in determining the final ranking order gives a better perspective of the preferences of all the stakeholders in the province.

The sensitivity analysis was conducted by:

- changing the preference function from the multilevel preference function to the so-called 0-1 preference function, and
- by changing the priority ranking order of the criteria.

Results from the first sensitivity analysis i.e. using a 0-1 preference function revealed that beef production is most likely to yield the highest returns. This was followed by the Taung Irrigation Scheme concept, broiler, milk cow and goat milk, perennial crop and animal feed and production. No distinction could be made between the second best alternatives. The scenario confirmed eco-tourism as the plan which is the least likely to achieve the desired outcome.

Results from the second sensitivity analysis i.e. changes in the priority ranking order of the criteria were in contrast with results previously obtained. According to the results from this analysis, the Taung Irrigation Scheme concept was regarded as the plan which is likely to yield the highest returns. This was followed by the beef, vegetable and goat meat production.

Taking all the results from all three scenarios into account, the beef production business plan is considered as the best for improving rural development in the NWP. Although some of the sensitivity analyses suggested that other development alternatives are preferred, beef production is on average considered as the best alternative. The reason beef production is considered as the best alternative is due to the fact that it has large values in 1st or 2nd priority criteria which carry the largest weights. These criteria include income generation, economic sustainability, social sustainability, adaptability to change and use of local resources.

On the other hand, business plans that are considered the worst alternatives such as the goat hotel, perennial crops and animal feed have relatively low values for these criteria and this reduces the sensitivity of these business plans to a change in the criteria or weights. Therefore, it might be concluded that the allocation of funds towards beef production initiatives (under the assumptions of the specific business plan as portrayed in Chapter 4) is most likely to yield the highest returns in terms of the set objective i.e. to improve the welfare of the rural poor and at the same time conserve the natural resource base of the province for future use. Beef production is followed by vegetables, goat meat, veldt management, Taung irrigation scheme, grain, broilers, cow milk and eco-tourism. In general, no distinction could be made between the three worst alternatives namely perennial crops, animal feed and goat milk.

7.3 Conclusion

The business plans with the highest priority ranking (see Table 7.1) are identified as the most likely to realise the highest returns if successfully implemented. It is therefore recommended that funds be allocated to the different opportunities based on the ranking order. However, it should be noted that the ranking order is only providing a guideline for government, and results might change once external factors change. Moreover, the results are very sensitive to change in criteria and priority weights. This implies that a different ranking order will be obtained should the objective be changed.

It is proposed that the newly indentified agricultural opportunities be linked to that of established ones, like the so-called flagship programs as reviewed in chapter 3. This will enable new entrants or beneficiaries to make use of established marketing channels, infrastructure, support services etc. which will enhance their chances on success. The business plans or concepts proposed for each identified opportunity serve as a guideline for government and beneficiaries to exploit the indentified opportunities and should not be seen as fixed, with alternative methods that may also prove to be successful. This is especially true when considering the alignment of new projects with established ones in the province.

7.4 Recommendations for future research

Although the initiatives discussed in this study are likely to improve the success of development, the question remains whether land reform, in its current form, is the best way of rectifying the injustices of the past, and by doing so address poverty and unemployment. Given the marginal level of success, shouldn't focus be shifted from redistributing land to alternative models for development? When reviewing literature, one will find that several alternative models similar to the ones used in South Africa are employed with vast success over the world. It is therefore suggested that future research be focused on the development of a multiple criteria model for the evaluation of alternative development models in South Africa. Results obtained from such a study can provide vital solutions in the search for improved success of agricultural development

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