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Maize Marketing Strategies: The Trade-Off Between Risk and Profit for a Mpumalanga Maize Farm

by

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ABSTRACT

Maize Marketing Strategies: The Trade-Off Between Risk and Profit for a Mpumalanga Maize Farm

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Degree: MSc Agric

Department: Agricultural Economics, Extension and Rural Development

Study Leaders: Dr J.M. Geyser and Mr. P.G. Strauss

South Africa has become, after deregulation, part of the global village. This brought about many business opportunities, but with it came many challenges with respect to grain marketing. It is well-known facts that the marketing of grain has become quite a challenge in S.A. South African producers do not receive support from government as far as input subsidies and significant import tariffs are concerned and have to make sure that they stay ahead of rising input costs in order to produce maize on a profitable basis.

It is therefore extremely important for any maize farmer in South Africa to make use of the best grain marketing strategies at his or her disposal. Choosing the best grain

marketing strategy will not only assist the producers to receive the best price for their produce, but will also serve as a very effective risk mitigation strategy. The general objective of the study is to examine different marketing strategies and to determine the optimal maize marketing strategy for a representative farm located in the Mpumalanga Highveld for a specific season under volatile marketing and environmental conditions.

A representative farm for the Mpumalanga Highveld is constructed, based on production data, budgeted financial statements, general financial management and the complete farm setup as obtained from a farmer study group located in the district of Middelburg, Mpumalanga Highveld, The most general maize marketing strategies available for the representative farm is identified and discussed as far as each of their advantages and disadvantages are concerned.

The complete farm setup for the representative farm is used to develop a budgeting and maize marketing model. This is done in conjunction with three different scenarios, which cover the most frequent circumstances in which producers can find themselves. With the help of this model, the optimal marketing strategies are determined which yields the optimal profit and minimize price risk for the representative farm.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

It is a well-known fact that the marketing of grain has become quite a challenge in South Africa. This is mainly due to the abolishment of the grain marketing boards in the late 1990's and the deregulation of the market as a whole. The South African market has become increasingly exposed to the world market (Vink, *et al*., 2000). South Africa is, after deregulation, completely part of the global village. This brought about many business opportunities, but with it came a lot of challenges with respect to grain marketing.

The development of exchange-traded derivative instruments in South Africa started in the late 1980's. The South African Futures Exchange (Safex) is traded on the Johannesburg Stock Exchange (JSE) where there use to exist two divisions:

- Safex Financial Derivatives and
- Safex Agricultural Derivatives.

However, Safex was bought out by the JSE in 2001 and is now known as the Agricultutal Products Division of the JSE, but in this study it will be referred to as Safex.

As far as the production of maize is concerned, South Africa use to produce more white than yellow maize; approximately a relationship of 60:40. However, compared to one of the world's biggest maize producing countries, the U.S.A., South Africa is a fairly small maize-producing country. On average, South Africa produces between eight and ten million tons per year while the U.S.A produces between 240 and 290 million tons. From this it is evident that South Africa doesn't have a significant impact on the world market in terms of price, but can be regarded as an important role player in the Southern African region, being one of the few net exporting countries of agricultural products in Africa.

The U.S.A. on the other hand, influences the world maize prices quite significantly. As a result the South African producers are exposed to shocks in the international market. These shocks include world maize surpluses and deficits, varying exchange rates and bad weather conditions e.g. droughts, hail storms, floods etc.

According to an OECD (high-income countries) report in 1987, ministers already stressed the need for a progressive reduction in agricultural support and a move towards those forms of support that are less production and trade distorting in order to let the agricultural sector respond more to market signals. However, producers in the U.S.A. and

European countries are still subsidized by their governments to help absorb these shocks. The Producer Support Estimate (PSE) is estimated at 30% in 2004, the same level as in 2003 for the OECD countries. The United States Agriculture Department is required by law to subsidize over two dozen commodities. An average of $16 billion/year was paid out between 1996 and 2002. (Agricultural Policies in OECD Countries: Monitoring and Evaluating (2005)) Europe has the Common Agricultural Policy (CAP) which represents about 44% of the E.U.'s budget (Hardaker, et al., 2000).

The subsidies guarantee a minimum price to producers and in some cases lead to direct payments to farmers who plant specific crops. This causes surplus production of some crops, including maize, which leads to exports to developing countries like South Africa. The increased volume of maize may lower the import parity price of maize (the exchange rate will also have an influence) which may put downward pressure on South African maize prices.

South African producers do not receive support from government as far as input subsidies and significant import tariffs are concerned and have to make sure that they stay ahead of rising input costs in order to produce maize on a profitable basis. It is therefore extremely important for any maize farmer in South Africa to make use of the best grain marketing strategies at his or her disposal. Choosing the best grain marketing strategy will not only assist the producers to receive the best price for their produce, but will also serve as a very affective risk mitigation strategy.

1.2 PROBLEM STATEMENT

1.2.1 General Problem Statement

South African grain producers are exposed in a volatile grain market and face great uncertainty and risk as far as their grain prices on the one hand and input costs on the other hand, are concerned. Due to the fact that the producers do not receive any subsidies for inputs, farmers, especially those in low yield areas, find it difficult to produce maize on a profitable level.

Furthermore the price of maize is mainly formed on Safex. South Africa produces an average of 9.2 million tons off maize annually and, on average, 200 000 tons of maize is traded on Safex daily. Thus 2.17 % of South Africa's total maize production is traded daily (Safex, 2007). As far as the U.S. market is concerned, 805 million contracts are traded annually, thus only 0.97 % of the total U.S. production is traded daily on the Chicago Board of trade (CBOT, 2007). This is probably one of the reasons why the South African maize price is so volatile.

The maize price is influenced by a large number of fundamental factors like supply and demand, the Rand to U.S. dollar exchange rate (since world grain is traded in U.S. dollars), and weather conditions.

Consequently the price, as can be seen from Figure 1.1, is very volatile and fluctuates between import and export parity prices. Import parity is when maize is sold locally for the same price as what buyers can import maize for from another country while export parity is the opposite. The South African maize price is also influenced by the level of trade. Industry experts are of the opinion that, in the South African market, exports to neighbouring countries also have an impact on the domestic price (Meyer, et al., 2006).

From the above, it is evident that the South African maize price is influenced by such a huge number of factors, most of which are not controllable by the maize producer. Hence producers often make mistakes as far as their maize marketing strategies are concerned. This stresses the importance for producers to utilize the best possible maize marketing strategies at their disposal.

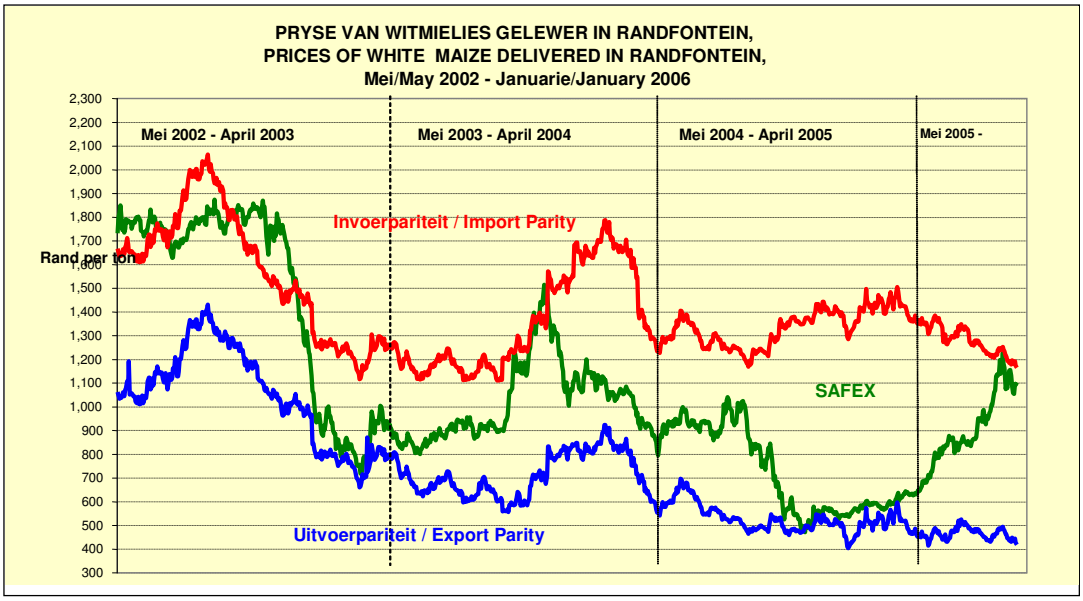


Figure 1.1: Import and Export Parity Prices of White Maize Delivered in Randfontein
Source: Grain S.A., 2006

1.2.2 Specific Problem Statement

With a wide variety of marketing strategies available to the South African maize farmer, it is extremely challenging to choose the correct strategies to market their maize. The wrong marketing strategies are often chosen for a specific season, often due to incorrect information e.g. farmer's intensions to plant, the amount of maize in the market (domestically and internationally), the exchange rate etc. for the next season. Another major influencing factor is the farmer's own financial position which will also determine the farmer's marketing strategy as far as storage period and time of selling are concerned. All these factors will contribute to the producer making a profit or a loss. Many farmers, for instance, can't afford their own silos due to the huge initial capital investment and choose to store their maize in farmer co-operatives' silos which costs money in the form

of storage and handling cost. Others are financially forced to sell their produce as soon as they harvest it. This decreases their post-marketing strategy options and makes it even more important to make use of the best strategies available to them.

1.3 OBJECTIVES OF THE STUDY

1.3.1 General Objectives of the Study

Although there is no single winning recipe for maize farmers that will guarantee them the best prices for every marketing season, there is an 'optimal marketing strategy' for each season that will also serve as the best risk mitigation strategy. The general objective of the study is to examine different marketing strategies and to determine the optimal marketing strategy for a representative farm located in the Mpumalanga Highveld for a specific season under volatile marketing and environmental conditions.

1.3.2 Specific Objectives of the Study

- To "construct" and validate a representative farm in the Mpumalanga Highveld by utilizing production data and financial statements from the Middelburg Akkerbouforum (an agricultural study group);
- To identify the various maize marketing strategies available to the representative farm;

- To determine all the advantages and disadvantages of each available marketing strategy or alternative;
- To use the complete representative farm setup to develop and validate a budgeting and maize marketing model;
- To determine the optimal marketing strategies which will yield the highest profit and minimize price risk for the representative farm by using the budgeting and maize marketing model.

1.4 STATEMENT OF HYPOTHESES

The development and validation of a budgeting and maize marketing model that will assist a typical Highveld maize farmer to choose a marketing strategy in varying market and environmental conditions that will maximize profit and minimize risk.

1.5 METHODS AND PROCEDURES

A representative farm for the Mpumalanga Highveld will be constructed based on production data, budgeted financial statements, general financial management and the complete farm setup as obtained from a farmer study group located in the district of Middelburg, Mpumalanga Highveld, South Africa. The most general maize marketing strategies available for the representative farm will be identified and discussed as far as each of their advantages and disadvantages are concerned. The complete farm setup for

the representative farm will be used to develop a budgeting and maize marketing model. This will be done in conjunction with three different scenarios, which will cover the most frequent circumstances in which a producer can find him or herself. With the help of this model, the optimal marketing strategies will be determined which will yield the optimal profit and minimize price risk for the representative farm.

1.6 CONCLUSION AND OUTLINE OF THE STUDY

Since the abolishment of the grain marketing boards in the late 1990's, the marketing of grain has become quite a challenge in South Africa. South Africa is a fairly small maize-producing country compared to one of the world's biggest maize producing countries, the U.S.A., but is an important role player in the Southern African region, being one of the few net exporting countries of agricultural products in Africa.

South African producers do not receive support from government as far as input subsidies and significant import tariffs are concerned and have to make sure that they stay ahead of rising input costs and very volatile maize prices in order to produce maize on a profitable basis. It is therefore extremely important for any maize farmer in South Africa to make use of the best grain marketing strategies at his or her disposal.

The outline of the study is as follows: chapter one gives a brief introduction to the maize marketing environment in South Africa. From there flows the problem statement and objectives of the study. Chapter 2 takes a look at maize production figures, both

internationally and domestically in order to arrive at the correct production figures for the representative farm. In Chapter 3, various marketing alternatives, available to the Highveld farmer, and their advantages and disadvantages are discussed. The representative farm will make use of these same marketing options. Chapter 4 looks at profit optimization and some of the risks, and risk mitigation strategies involved in agriculture. Different financial statement elements, which will be used by the representative farm, are discussed as well as the analyses of the farming results.

Chapter 5 displays the complete farm setup and financial statements for the representative farm, Delta farming and a financial and diagnostic analyses is done. The different marketing alternatives for Delta farming is analysed and compared. Different types of models, their building blocks, model evaluation and previous models in the literature are discussed in Chapter 6. In Chapter 7, the Budgeting and Marketing Model is discussed including: how the model works, the three scenarios for Delta Farming, the comparison of the model's output and the conclusion. Chapter 8, the final chapter, summarises the study and presents the final conclusion.

CHAPTER 2

MAIZE PRODUCTION IN SOUTH AFRICA AND SPECIFICALLY IN THE MPUMALANGA HIGHVELD

2.1 INTRODUCTION

For the aim of this study it is necessary to identify and describe a typical Mpumalanga Highveld maize farmer. This will be done by designing a representative farm based on data as obtained from a farmer study group situated in the district of Middelburg, Mpumalanga Highveld. The representative farm will be designed by using data such as production data, financial statements and the complete farm setup for maize and cattle producing farm in the Middelburg district.

However, before this study can be conducted, it is necessary to sketch a general background on maize production internationally, in South Africa and specifically in the Mpumalanga province.

2.2 INTERNATIONAL MAIZE PRODUCTION

As it has been mentioned earlier, the South African maize market is part, and is influenced by, the international maize market. Hence it is important to not only look at

the domestic market in isolation, but the international maize market also needs to be studied.

2.2.1 World Maize Supply and Demand

From Figure 2.1, it is evident that world maize supply and demand remained almost in equilibrium from the 1999/2000 season up to the 2003/2004 season. During the 2004/2005 season, however, world maize production exceeded world maize consumption resulting in a world-wide decrease in maize prices in the following season due to huge carry-over surplus.

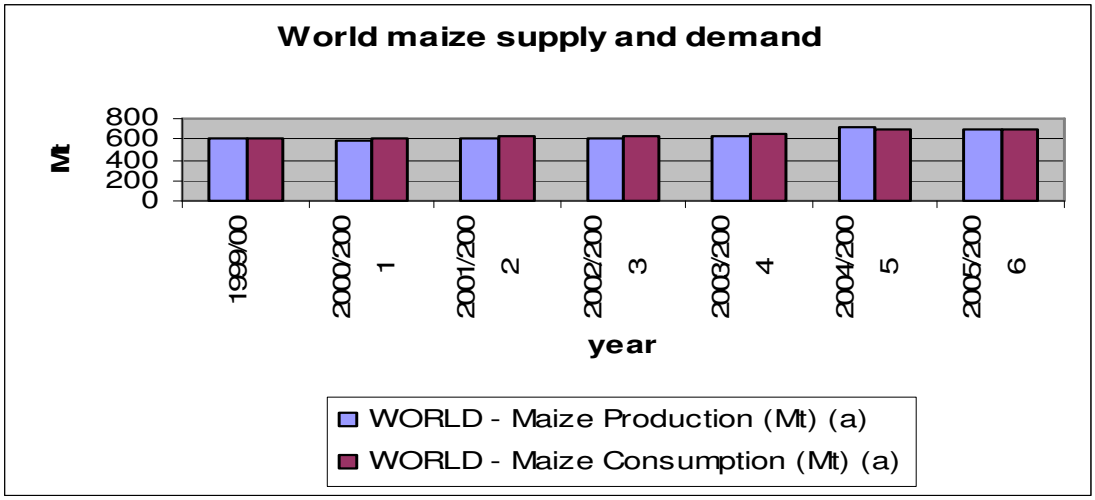


Figure 2.1: World Maize Supply and Demand
Source: SAGIS, 2007

2.2.2 World Export Price: U.S.A.

Figure 2.2 below confirms what was mentioned earlier and one can clearly see the decrease in world maize prices 2004/2005 season due to world maize production

exceeding world maize consumption. The trend continues into the 2005/2006 season due to the carry-over surplus.

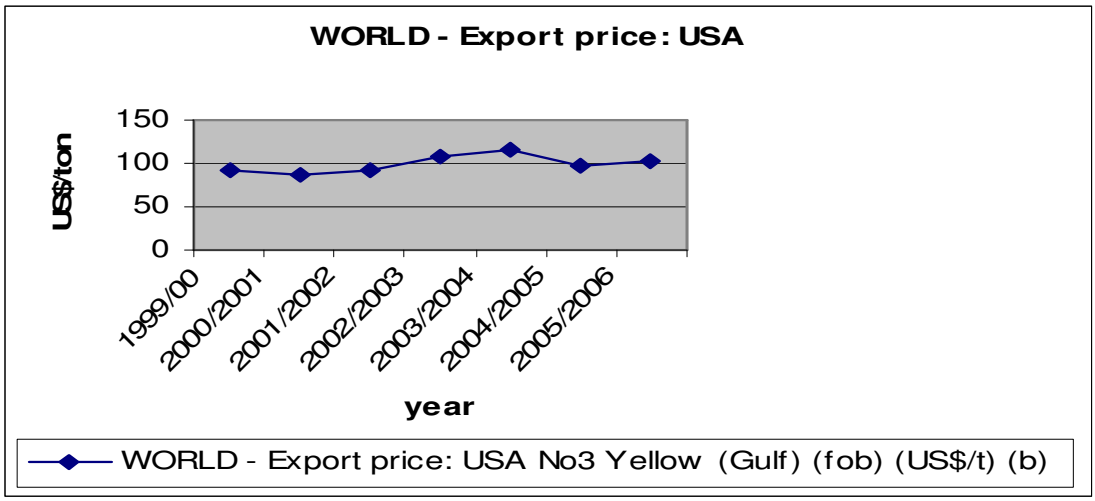


Figure 2.2: Nominal World Export Price: USA
Source: SAGIS, 2007

2.3 MAIZE PRODUCTION IN SOUTH AFRICA

As can be seen from the Figure 2.3 below, South Africa consists of nine provinces of which seven produce maize**.** Maize, especially white maize, is one of South Africa's most important agricultural products, since it is used as staple food by millions of people in Southern Africa. Yellow maize is the most important ingredient in feed rations for a number of sectors e.g. dairy, beef, poultry, egg production etc. Maize contributes approximately 36 % to the gross value of field crops, and the average annual gross value of maize for the five years up to 2006/2007 amounts to R8 368 million. The major areas of commercial production are situated in the Free State, North West and Mpumalanga

provinces (National Department of Agriculture, 2006). The following map and table indicates the distribution of maize plantings (2004/05) per province in South Africa:

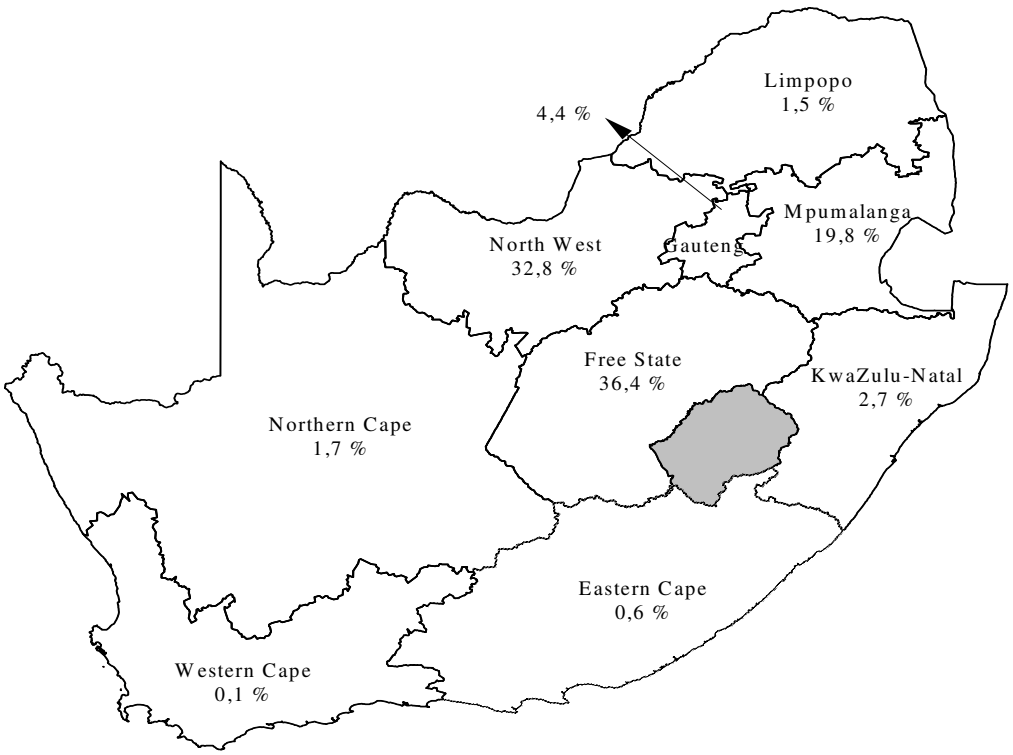


Figure 2.3: Percentage contribution to S.A. maize production
Source: National Department of Agriculture, 2006

Maize is planted between mid-October and mid-December. Factors such as rainfall pattern and other weather conditions of a particular season determine the planting period as well as the length of the growing season.

The present (2007) ratio of areas planted in South Africa is 64 % white and 36 % yellow maize. The estimated area of white maize under irrigation is approximately 5 % and dry-land contributes 95 %, while the estimated area of yellow maize under irrigation is approximately 14 % and dry-land contributes 86 % (National Dept. of Agriculture., 2007)

2.3.1 Maize Imports and Exports for South Africa

The maize industry is an important earner of foreign exchange for South Africa through the export of maize and maize products. Figure 2.4 below shows the imports of maize to and exports from South Africa for the past five seasons:

Figure 2.4 Maize imports and exports for South Africa
Source: National Department of Agriculture, 2007

The BLNS countries, Zimbabwe, Angola, Mozambique and other foreign countries such as Japan are mostly the important export destinations for South Africa. Normally, the exports of domestic maize last only until the end of October when the harvesting of the U.S. crop and U.S. exports start. There are a couple of logistical problems associated with the exporting of maize, especially rail capacity available for exports to African countries are quite limited. South Africa's ports can only handle approximately 100 000 to 150 000 tons of maize per month therefore, trade is limited (National Department of Agriculture, 2007).

2.3.2 Average Yield for South Africa

From Figure 2.5 below, it is evident that maize yield has increased for the last ten years. The reason being improved higher yielding cultivars and good rainfall the past couple of seasons with the exception of the 2002/2003 and 2006/2007 seasons due to drought (National Department of Agriculture, 2007). The following graph illustrates this more clearly.

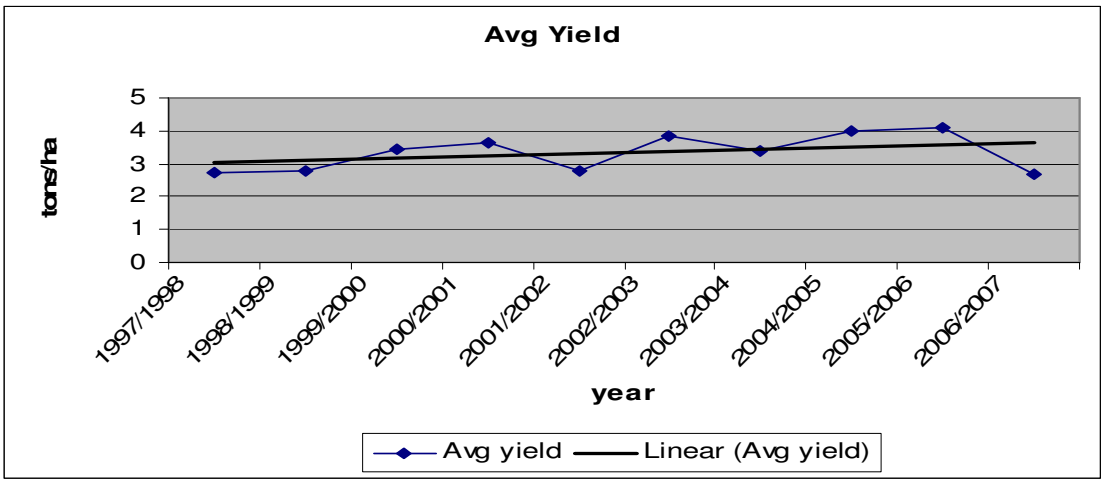


Figure 2.5: Average maize yield for South Africa
Source: SAGIS, 2007

2.3.3 Five-year Moving Average for Maize Yield in South Africa

It is evident from Figure 2.6 below, illustrating the five-year moving average for maize yield in South Africa, that the average yield of maize has increased quite significantly. This is due to better production technology e.g. better land preparation methods, the withdrawal of marginal lands, precision farming and better adapted cultivars (National

Department of Agriculture, 2007). This is one of the reasons why S.A. is a surplus producer of maize.

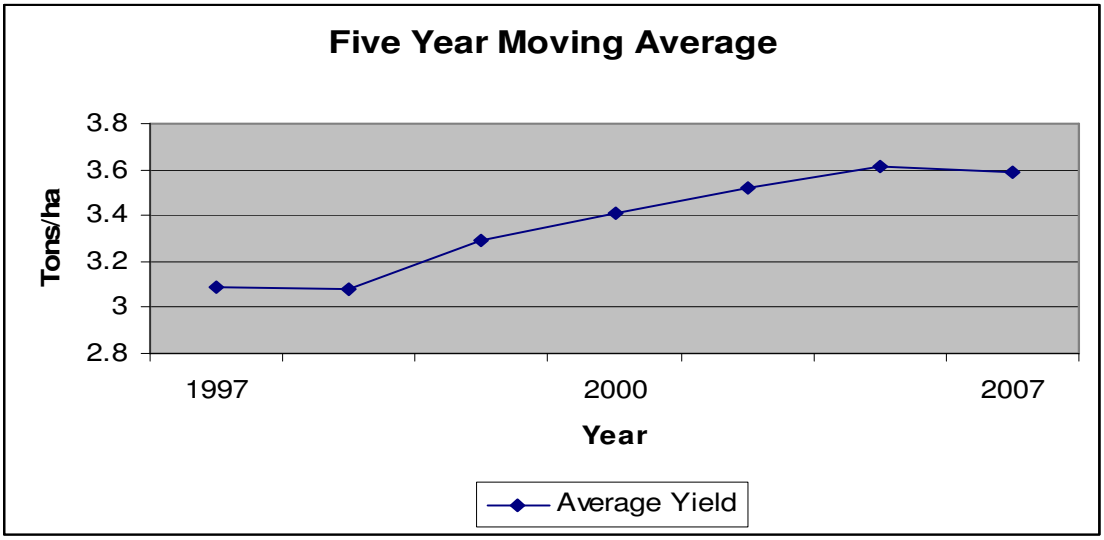


Figure 2.6: Five-year moving average for maize yield
Source: SAGIS, 2007

2.3.4 Average Price per Ton

Figure 2.7 indicates that the average price per ton (for both white and yellow maize) remained in the region of R1000-00 for the last ten years. Note that the average Safex price was determined by using the historical daily Safex closing prices from 1999 to 2007 The major increase in the price for the 2001/2002 season was due to the deterioration of the rand against the U.S. Dollar and a lower national crop yield due to draught.

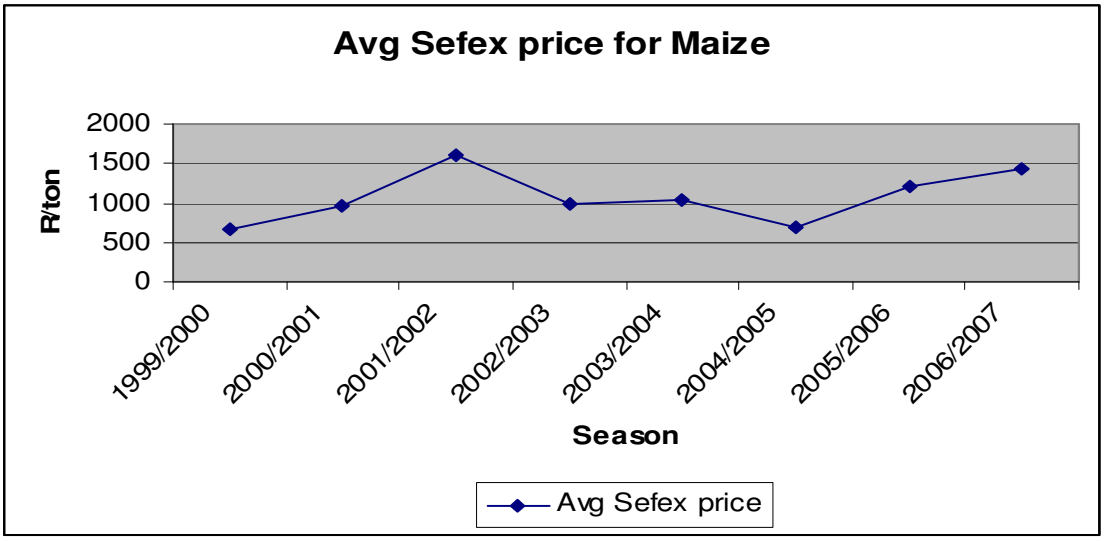


Figure 2.7: Nominal Average farmer's price per ton
Source: Safex, 2007

2.3.5 Exchange Rate

Figure 2.8 shows the exchange rate between the Rand and the U.S. Dollar. It is important to note the similarity between Figures 2.7 and 2.8. It is a very clear indicator of how big the influence of external factors, such as the exchange rate (over which the producer has no control) is on the price of maize in South Africa. This is one of the major contributing factors to the high volatility of the maize price, which makes it very difficult for farmers and millers as far as budgeting, buying and selling is concerned.

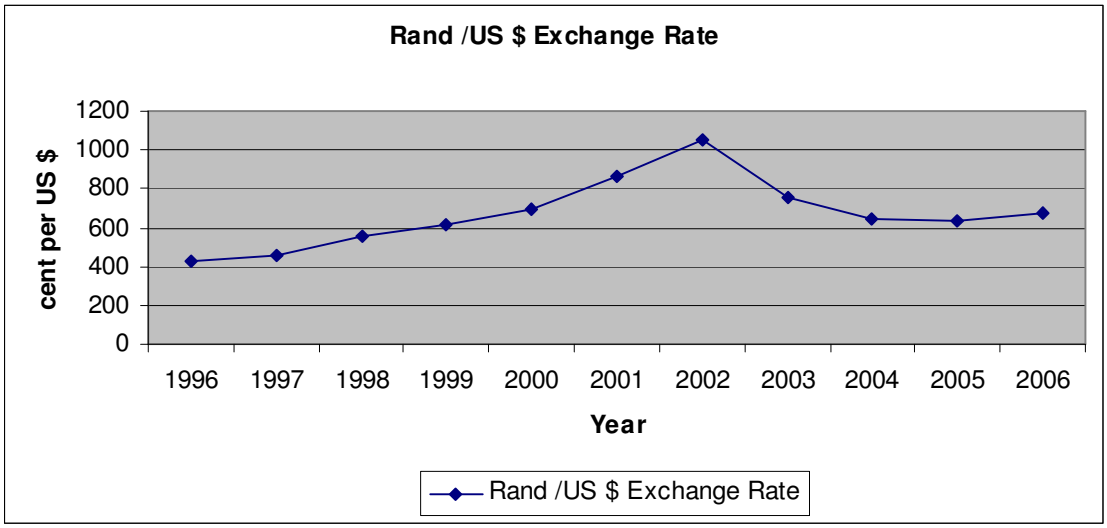


Figure 2.8: Nominal Rand / US Dollar Exchange Rate
Source: South African Reserve Bank, 2007

2.4 PRODUCTION DATA FOR THE MPUMALANGA HIGHVELD

The name, Mpumalanga, means "*the place where the sun rises*" in Zulu. Mpumalanga lies in eastern South Africa, north of KwaZulu Natal, bordering Swaziland and Mozambique. It constitutes 6.5% of South Africa's land area. In the north it borders Limpopo and to the west the Free State and Gauteng. Its capital is Nelspruit (Mpumalanga Information, 2006).

The bubbles on each Figure 2.9 and 2.10 below indicate the amount of white and yellow maize produced in each province. Mpumalanga produces the third most maize in South Africa, after North West and the Free State. Mpumalanga produces both yellow and white Maize. Traditionally it produced about 70% yellow and only 30% white maize, but

for the last five years the ratio has changed to about 55:45 (Hawkins, 2006). Thus most maize farmers on the Mpumalanga highveld produce the same amount of yellow and white maize. As far as average yield is concerned, the twenty year average for yellow maize is 3.12 tons/ha and 3.15 tons/ha for white maize (South African Grain Information Service (SAGIS), 2006).

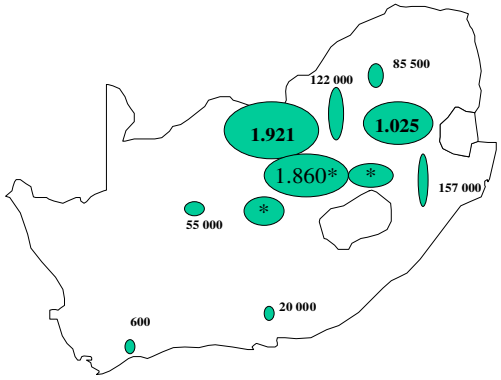


Figure 2.9 **White Maize Production Areas in South Africa**
Source: Hawkins, 2006

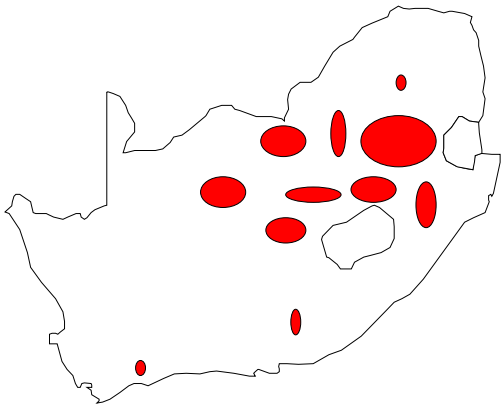


Figure 2.10 **Yellow Maize Production Areas in South Africa**
Source: Hawkins, 2006

2.4.1 Maize Yield

As can be seen from Figure 2.11 below, the white and yellow maize yield in Mpumalanga has been practically the same each year, except for one or two years, for the last twenty years. Thus, as far as yield is concerned, it doesn't matter whether Mpumalanga Highveld farmers produce more white or more yellow maize. Farmers will make a decision between planting more white or more yellow maize based on the price difference between yellow maize (YM) and white maize (WM) which will be determined by demand.

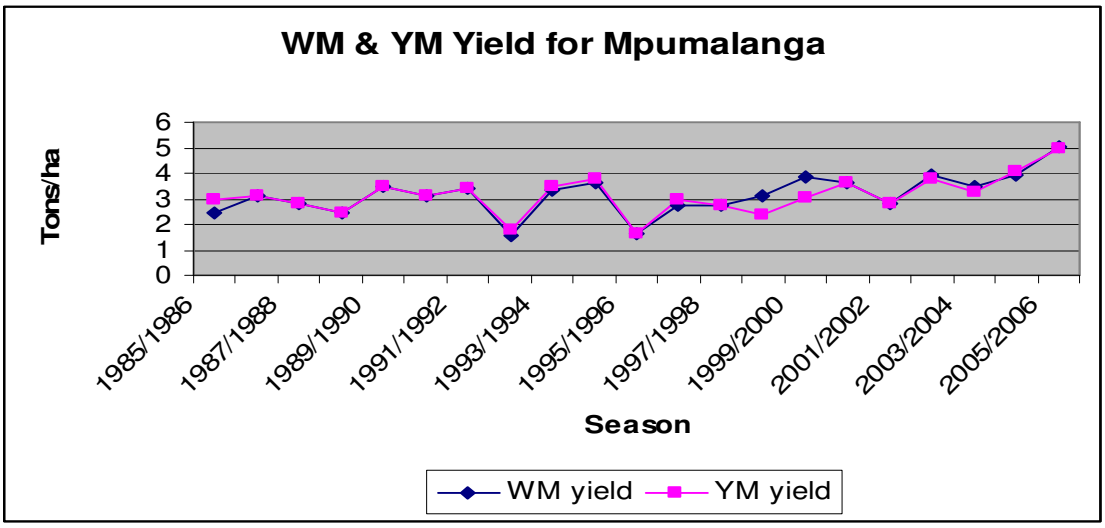


Figure 2.11: Maize yield for Mpumalanga
Source: SAGIS, 2007

2.4.2 Input Cost per Hectare for the Mpumalanga Highveld

From Figure 2.12 it is evident that the direct input cost per ha increased by about twenty percent per year from 1996 to 1998 and then direct input costs remained almost unchanged for three years as inflation and the exchange rate were relatively stable. Direct input costs peaked in the 2002/2003 season mainly due to the deterioration of the Rand during the previous season. Direct input costs came down from 2003 onwards as the Rand appreciated again. This is a very important aspect to note, since direct input costs are such a large portion (about 66 %) of the overall farming expenses.

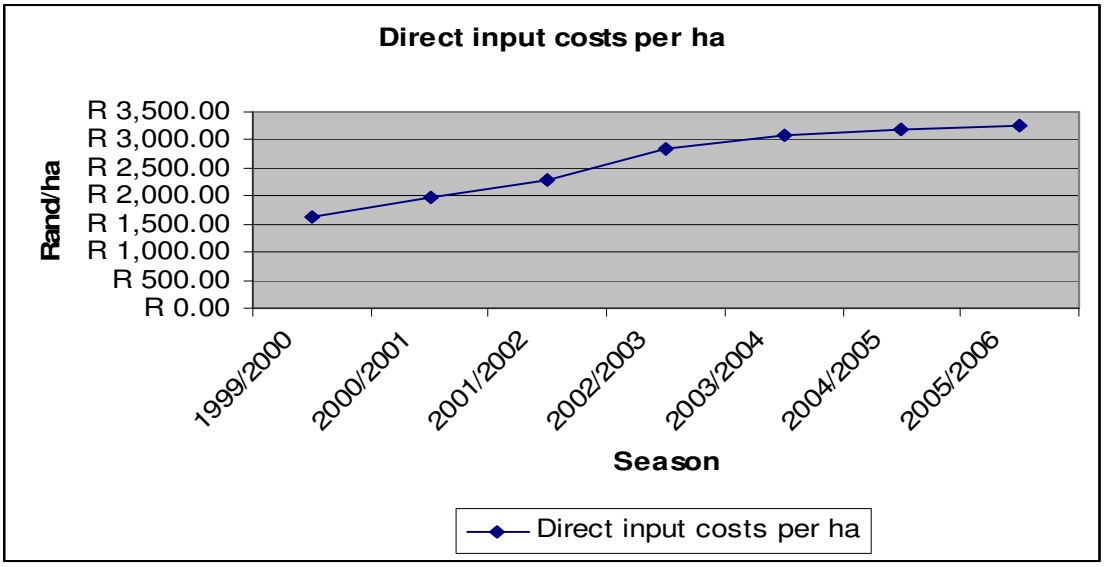


Figure 2.12: Nominal Direct Input cost/ha for Mpumalanga
Source: Grainsa, 2006

2.5 CONCLUSION

Maize contributes approximately 36 % to the gross value of field crops, and the average annual gross value of maize for the five years up to 2004/05 amounts to R8 675 million. This stresses the importance of white maize production in South Africa.

Mpumalanga produces the third most maize in South Africa making it an important contributor to the country's total maize production.

Rising input costs on the one hand and stagnated maize prices on the other hand, causes a cost squeeze effect for South African maize producers. This stresses the importance for producers to utilise the best possible marketing strategy at their disposal to ensure optimum profit and minimum risk.

CHAPTER 3

MARKETING STRATEGIES AVAILABLE TO THE HIGHVELD MAIZE FARMER

3.1 INTRODUCTION

If one wants to determine the best marketing strategy for a commodity, it is very important to know and understand what marketing is all about. According to Kohls (1972), marketing is the performance of all business activities involved in the flow of goods and services (maize in this case) from the point of initial agricultural production until they are in the hands of the ultimate consumer. It is important to note that groups with different interests will view marketing differently.

Consumers want their products at the lowest possible cost, while farmers want the highest possible return. This may lead to conflict between producers and consumers, or in this case, the maize miller. Both maize producers and millers are exposed to a volatile market affected by many factors outside their control. There exist various tools and marketing strategies for both farmers and millers to hedge themselves against these price fluctuations.

3.2 HISTORY OF SOUTH AFRICAN GRAIN MARKETING

During the 1920's, producers complained that prices for their products were too low and unstable. The situation even got worse during the Great Depression in the 1930's. The Export Subsidy Act of 1931 was imposed as a result (De Swardt, 1983). Later in 1937 the Marketing Act (which was revised in 1968) established a system whereby farmer-dominated control boards decided who should produce, handle, trade, and at what price.

The single channel, fixed price marketing arrangement for maize was introduced only in 1944/45. With it came the establishment of the Grain Marketing Board. During the early 1980's agricultural policy started to change mainly due to the liberalisation of the South African financial system from the 1970's onwards (Bayley, 2000). This led to:

- the real depreciation of the Rand during the 1980's;
- the scaling down of interest rate subsidies on loans from the Land Bank;
- and increased pressure on the government's budget.

This led to the withdrawing of government subsidies, to cover marketing costs, to the control board system. Furthermore, the Maize Board was making maize export losses which government was not prepared to cover anymore.

In 1996, the new Marketing Act for Agricultural Products was implemented and Control Boards were abolished in 1997. The South African market was increasingly exposed to the world market. Today South Africa is completely part of the global village. This brought about a lot of business opportunities, but with it came a lot of challenges with respect to grain marketing.

The development of exchange-traded derivative instruments in South Africa started in the late 1980's. An agricultural futures market was established in 1995 where volumes of white maize futures and options traded have increased rapidly (Bayley, B. 2000).

Today the South African Futures Exchange (Safex) is traded on the JSE where two divisions exist:

- Safex Financial Derivatives and
- Safex Agricultural Derivatives.

However, as mentioned earlier, Safex was bought out by the JSE in 2001 and is now known as the Agricultutal Products Division of the JSE, but in this study it will be referred to as Safex.

Only about 1.548 million hectares of white and yellow maize were planted during the 2005/2006 season, as apposed to almost double that the previous season. This was mainly due to a huge decrease in maize prices.

Thus there was a huge decrease in hectares of maize planted and it helped to bring the supply and demand of maize into equilibrium again. Producers planted only 55% of the usual amount of hectares of maize for the 2005/2006 season. This swing is the largest in the history of the South African maize market (Gouws, 2006).

3.3 MARKETING STRATEGIES AVAILABLE TO THE HIGHVELD MAIZE FARMER

Different maize marketing strategies need to be studied in terms of how each of them works and what advantages or disadvantages each of them has. They are the following:

- Harvest and store maize in co-operation silos to sell at a later stage when the price increases.
- Pre-harvest forward contracts.
- Harvest and store in own silos.
- Harvest and store in silo bags.
- Hedge yourself on Safex (futures and options).
- Sell maize on spot market and buy futures.
- Use your maize as animal feed and sell animals.
- The “one third” strategy.
- Bio-ethanol plants

3.3.1 Harvest and Store Maize in Silos Co-operation to Sell at a Later Stage When the Price Increases

This is probably the most common or conventional way for maize marketing. Especially the older generation farmers prefer this approach. The main reason for them choosing this strategy is probably because it is the most convenient and well-known way to them. This is the way maize marketing was done in the olden days when the Maize Marketing Board was still operating. As previously mentioned, marketing boards were abolished in South Africa, hence, for the last eight or ten years, this has not necessarily been the best marketing strategy. When following this strategy, there are a couple of things that should be kept in mind. The first, and probably the most important, are the costs of storage and secondly the maize handling fees.

Advantages:

- It is a well-known way of marketing maize and almost all farmers have experience as far as this method is concerned.
- The producer can share in price increases later in the season when supply decreases and demand increases.

Disadvantages:

- There is no form of price risk protection when producers use this method alone.
- Cost of storage and maize handling fees are always a huge factor.

- Opportunity cost (foregone interest).

3.3.2 Pre-Harvest Forward Contracts

Farmers make use of these contracts to control and hedge price risk. A forward contract can be seen as an agreement between two parties to buy or sell any kind of asset at a pre-agreed future point in time. Therefore the trade and delivery date are not the same. One party agrees to buy, the other to sell, for a forward price agreed in advance. The forward market is an informal market by which these contracts are entered into.

Advantages

- This strategy helps farmers to control and hedge price risk.

Disadvantages

- Depending on the nature of the contract, farmers don't share in the benefits of an increasing price.
- Default risk.

3.3.3 Harvest and Store in Own Silos

Producers erect their own silos in order not to pay storage cost when storing in a cooperation silo. This way a farmer can store his maize at no direct storing cost and sell when prices increase after the harvesting season. The initial capital of building a silo and installing a weighing bridge needs to be kept in mind.

Advantages

- Producers who have their own silos do not to pay direct storage cost.
- The producer can share in price increases later in the season when supply decreases and demand increases.
- They can sell their maize immediately when the price suits them without any time-consuming administration work and arrangements with silo-managers.

Disadvantages

- The initial capital of building a silo and installing a weighing bridge might be too high for smaller farming business.

3.3.4 Harvest and Store in Silo Bags

Silo bags are a new system which stores grains in a safe, economical and profitable way, but it remains risky as far as the quality of maize stored in this manner is concerned. Although it is much cheaper to store maize in silo bags than in the conventional concrete silos, there might be a quality risk due to the growth of fungus under certain climatic conditions (Moos, 2006).

Advantages

- This method of grain storing is ideal for farmers who don't want to pay storage cost and don't have the capital to erect their own silos.
- The producer can share in price increases later in the season when supply decreases and demand increases.

Disadvantages

- This is still a new concept in South Africa and many farmers are wary to make use of silo bags.
- Risks may include quality problems when maize is stored for a long period.
- Silo bag machinery and the bags itself needs to be bought or hired to fill and empty the bags.
- The bags' environment must be safe and secure, e.g. electric fencing, to avoid physical damage to the bags.

3.3.5 Hedge Yourself on Safex (Futures and Options)

This is one of the grain marketing strategies most farmers, especially the older generation, “fear”. A hedge is basically an insurance that is taken out specifically to reduce or cancel out price risk. The term comes from a gambling saying "hedging your bets."

In futures markets, hedging involves taking a futures position opposite to that of a cash market position. A farmer would, for instance sell maize futures against his crop. Another alternative is to make use of options. An option is a contract whereby one party, the buyer or holder, has the right but not the obligation to exercise the contract, while the seller or writer of the option has the obligation to honour the contract if the contract holder wants to exercise it. The option prices are calculated with the Black and Scholes formula:

$$f(s, t) = SN(d_1) - xe^{r(t-t^*)} N(d_2)$$

where:

$$d_1 = \frac{\ln \frac{s}{x} + (r + \frac{1}{2} v^2)(t - t^*)}{v\sqrt{t - t^*}}$$

$$d_2 = \frac{\ln \frac{s}{x} + (r - \frac{1}{2} v^2 (t - t^*)}{v\sqrt{t - t^*}}$$

Table 3.1: Symbol Description for the Black and Scholes Formula

Symbol	Description
S	Market Price
X	Strike Price
F	Option Price
R	Interest Rate
T	Current Date
t*	Expiry Date
t-t*	Remaining Time Span of Option
V	Market Volatility

Source: Scheepers, 2005

A study by Scheepers (2005) shows how maize price risk can be reduced with great success by hedging on Safex. This can be accomplished by the responsible usage of derivative products. His study shows that the agricultural derivatives market is efficient and effective. For a futures market to be efficient, the market should reflect the impact of current information on the future price (Washburn & Binkley, 1990).

His study also shows that there is an improvement in the market efficiency mainly due to the increase in knowledge of potential and current participants. This leads to an increase in active participants, which leads to higher volumes and a larger information base, which ultimately contributes to market efficiency and transparency. Furthermore the producer can, by making use of available futures markets instruments, have foresight in the expected price to be realized for his commodity at a future date. This knowledge can be of great value to the producer as far as budgeting and future planning is concerned (Scheepers, 2005).

Advantages

- This strategy helps farmers to control and hedge price risk.

Disadvantages

- It costs a certain amount of money to make use of futures and options.
- Most farmers are not competent to trade on Safex, hence they make use of brokers who ask a certain fee.
- Can be expensive.

3.3.6 Sell Maize on Spot Market and Buy Futures Contracts

Producers, who don't want to store their maize at all, follow this strategy. They sell their maize in the spot market as soon as they harvest it and buy futures in order to stay in the market. This way they don't pay any storage cost and can still share in the benefit of an increasing price after the harvesting period.

Advantages

- Producers don't pay storage cost.
- They repay finance debt quicker and save on interest.

Disadvantages

- When one buys futures, you always have the risk of the market turning against you e.g. a sharp decrease in price.

- Margin calls: the margin account needs to be "topped up" if the market turns against your position.

3.3.7 Use Your Maize as Animal Feed and Sell Animals

Farmers can use their maize as animal feed and sell the animals. However, a farmer will only choose this option if it is financially feasible to do so. Factors like the animal's feed transferring ratio, the price of maize and the price of meat will be taken into consideration.

Advantages

- Farmers who have this option can always exercise it in low maize price years and still earn enough money from their livestock.

Disadvantages

- The price of meat also fluctuates and there is no guarantee that meat prices will be sustainable during low maize price seasons.

3.3.8 Bio-ethanol plants

Eight bio-ethanol plants at a value of R700 million each might be erected in three provinces in South Africa during the next couple of years (Hawkins, 2006). Each plant could use 375 000 tons of maize and produce 158 million litres of ethanol (Van Zyl,

2005). The fact that animal feed is produced as a by-product from producing ethanol will be a great advantage which enhances the economic feasibility of ethanol plants in South Africa (Brink, 2006).

The establishment of an economically-viable bio-fuels industry in South Africa is becoming an attainable goal as a result of the high, and rising, price of oil, the requirement to diversify energy supply, the global drive to limit greenhouse gases and to curb global warming, technological advances that are lowering the cost of bio-fuels production and the enormous local job-creation potential of such an initiative (Robinson, 2006).

Advantages

- Bio-ethanol plants will remove many of the surplus maize from the South African market which should increase the average maize price.
- Greenhouse gases and global warming will be limited due to the decreased use of fossil fuels to make fuel such as petrol and diesel.
- The erection of bio-ethanol plants has great job-creation potential.
- The fact that animal feed is produced as a by-product from producing ethanol will be a great advantage.

Disadvantages

- The erection of a bio-ethanol plant will be a huge initial capital outlay.

- If maize prices for the human market rises above the ethanol market, farmers would rather sell there maize on the human market which might leave the ethanol plants without maize.
- If oil prices fall below a certain price, it might be cheaper to manufacture fuels, like petrol, from crude oil.
- If South Africa starts using bio-fuels, imports of cheaper bio-fuels from other countries might flood the South African market.

3.4 CONCLUSION

From as early as the 1920's producers complained that prices for their products were too low and unstable. The South African grain market went through a number of marketing act changes to address these problems. The development of exchange-traded derivative instruments in South Africa started in the late 1980's. An agricultural futures market was established in 1995. In 1996, the new Marketing Act for Agricultural Products was implemented. Today the South African Futures Exchange (Safex) is traded on the JSE which serves as a price forming instrument for grains like maize, soya beans, sunflower and wheat.

It is evident that there are many marketing strategies or alternatives available to the Highveld maize farmer. The question is which of these alternatives should a farmer choose to optimize profit and minimize risk?

Chapter 4

PROFIT AND RISK

4.1 INTRODUCTION

In order to develop a profit-optimization model one needs to know the exact definition of profit, how to calculate it and how to maximize it. Furthermore one needs to know what types of risk one would be facing optimizing profit and how to manage these risks in order to obtain one's objective.

4.2 WHAT IS PROFIT?

A firm, or in this case a farming business, is said to be making an economic profit when its revenue exceeds the total opportunity cost of its inputs. It is said to be making an accounting profit if its revenues exceed the total expenses/costs the firm pays for those inputs. This is sometimes referred to as producer's surplus. In short, profits equal revenue minus costs.

To illustrate, let's assume the farm produces n outputs $(y_{1,\ldots,}y_n)$ and uses m inputs $(x_{1,\ldots,}x_m)$. Let's furthermore assume that the prices of the output produced are $(p_{1,\ldots,}p_n)$

and the prices of the inputs used are $(w_1,\ldots,w_m)$. Thus the profit of the farming business, Π, can be expressed as:

$$\Pi = \sum p_i y_i - \sum w_i x_i.$$

It is obvious that the first term is revenue and the second term is cost. It is important to note that if a farmer owns land and uses it in his production, that land should be valued at its market value in order to compute the economic costs. Economic costs like these can also be referred to as opportunity costs. This calculation is needed due to the fact that the farmer could rent his land to someone else, but he chooses to utilize it himself. The rent he looses by doing this is part of the opportunity cost of his production. It makes more sense to calculate economic profit, using costs if a factor is purchased now, rather than using historical costs (when a factor was bought originally).

It is important to note that cost is divided into two groups namely:

a. **Fixed cost:** when it is difficult to adjust some inputs during a certain time period. An example on this would be a lease on a building or land. Such factors of production are in a fixed amount.

b. Variable cost: if an input factor can be used in different amounts e.g. seed, fertilizer, etc.

Any business (including a farming business) should have the following main aims:

a. Profit Maximization: To be able to maximize profit one first needs to determine the farming business' production function. Let us assume that the farming business uses only two input factors, x_1 and x_2. Let $f(x_{1,}\, x_2)$ be the production function for the farming business, w_1 and w_2 be the prices of the two inputs and p be the price of output. Thus the profit-maximization problem facing the farming business can be written as:

$$\max\ p\, f(x_{1,}\, x_2) - w_1 x_1 - w_2 x_2$$

Now the derivative of the business's production function, called the marginal product, is determined. Production economic theory state that the value of the marginal product of a factor should equal its price in order to maximize profit, as can be seen from the equation below.

$$pMP_1(x_1, x_2) = w_1.$$

If the value of marginal product (MP) is larger than its cost, the profits can be increased by increasing input 1. If, on the other hand, the value of MP is less than its cost, then profits can be increased by decreasing the level of input 1. Profits shouldn't increase or decrease when input 1 is increased or decreased when profit maximization is reached for the short run. Thus, input factor, x_2, is kept fixed in this case.

In the long run however, the farming business is free to choose the level of all its input factors. Thus the long run profit-maximization problem can be written as:

$$\max p\, f(x_1, x_2) - w_1 x_1 - w_2 x_2.$$

In this case, both input factors are free to vary. Obviously, in this case, the values of the marginal product of both input factors should equal their prices as can be seen from the equations below.

$$pMP_1(x_1,x_2) = w_1$$

$$pMP_2(x_1,x_2) = w_2.$$

b. Cost Minimization: If a farming business is maximizing profits when producing output, y, then it must be minimizing cost by producing y. If this is not the case then there must be some cheaper way of producing y. From this observation it seems best to break the profit-maximization problem into two parts:

- It is firstly necessary to determine the cost-minimizing level of specific quantities output y.
- Secondly one needs to determine the profit-maximizing level of output y.

Suppose we have two factors of production, x_1 and x_2, which costs w_1 and w_2 and we want to determine the cheapest way of producing y. The production function for the farming business would be $f(x_1, x_2)$ Thus the cost-minimizing problem can be written as:

$$\text{Min } w_1x_1 + w_2x_2$$

$$\text{Such that } f(x_1, x_2) = y$$

Since y, w_2 and w_1 will determine the desired level of output to minimize cost, the cost function is written as: $c(w_1, w_2, y)$. It measures the minimal costs of producing y units of output when input factor prices are (w_1, w_2) (Varian, 1999).

4.3 RISK AND UNCERTAINTY

Risk is generally defined as imperfect knowledge where the probabilities of the possible outcomes are known. Uncertainty exists when these probabilities are not known. In short, uncertainty is imperfect knowledge and risk is uncertain consequences (Hardaker, et al., 2000).

4.3.1 Some of the Risks in Agriculture

a. **Production Risk:** Most farming activities are exposed to the unpredictable nature and all its elements. Hence production risk can be defined as the uncertainty of the performance of crops or livestock.

b. **Price or Market Risk:** Farmers need to make a decision on what and how much to produce with farm input and output prices very seldom known for certain at the time. Furthermore, producers are exposed to competitive, unpredictable markets for both in- and outputs.

c. **Institutional Risk:** This may include unfavourable government policies or institutions farmers need to do business with that is not trustworthy.

d. **Human Risk:** The people, who operate the farm, including the owner, managers and workers, may be a source of risk. Death, illness or any other reason may prevent these people from doing their work, will result in loss of profit for the farming business (Hardaker, et al., 2000).

4.3.2 How to Manage Risk in Agriculture

Risk management is, according to Hardaker, "the systematic application of management policies, procedures and practices to the task of identifying, analyzing, assessing, treating and monitoring risk". The figure below shows the steps in risk.

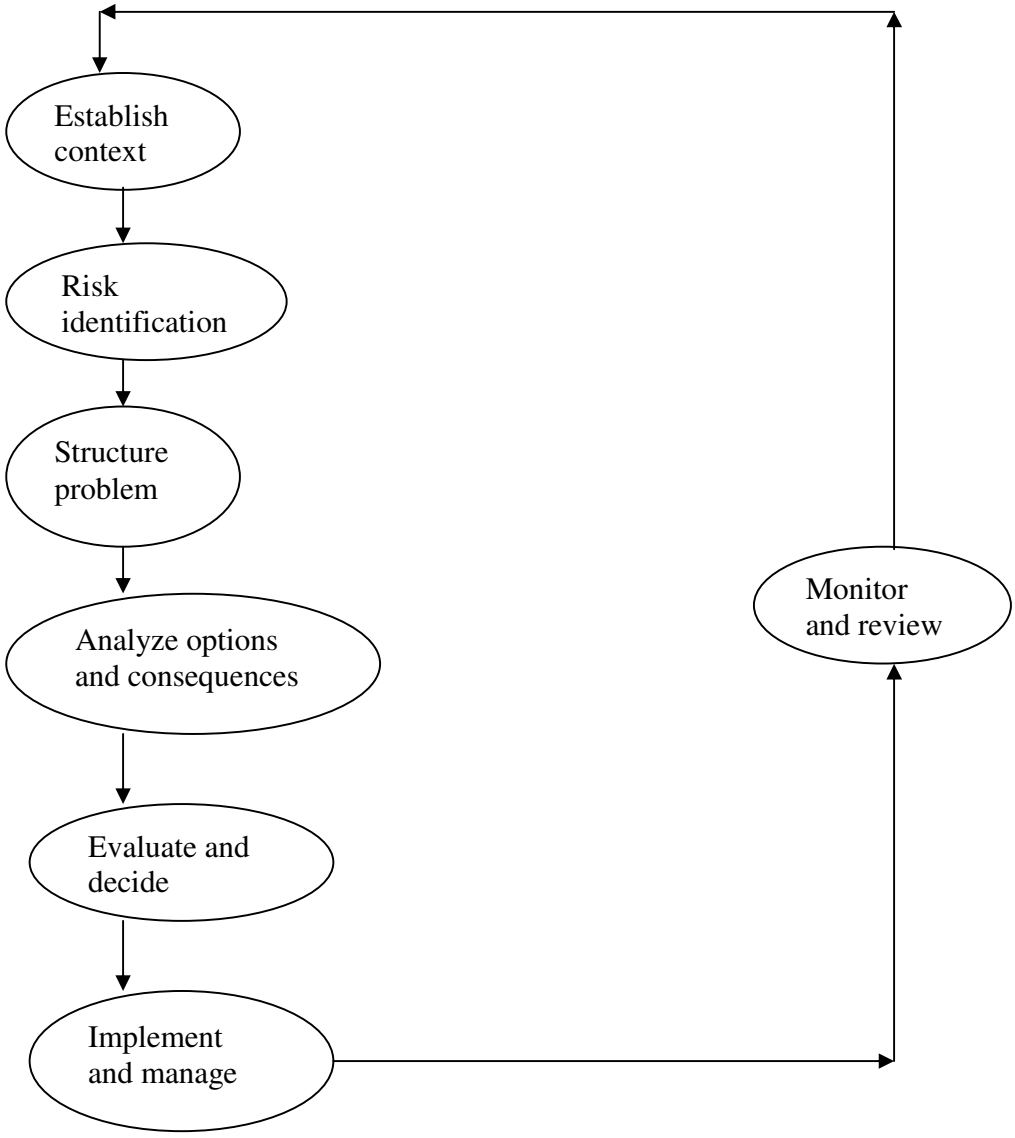


Figure 4.1: The steps in risk management: An outline
Source**:** Hardaker, et al., 2000

It is extremely important for any farming business to manage risk in order to avoid losses and maximize opportunities and profit. Risk management should be a continuous, adaptive process integrated into all relevant decision-making procedures of the farming business.

There are certain steps to be followed as far as risk management is concerned. These steps are:

a. Establish context: This is done to set the scene and to identify the parameters within which a particular risk or range of risks is to be considered. The context can be considered in terms of three different aspects namely:

- The strategic context which defines the relationship between the farming business and its environment and identifies the strengths, weaknesses, opportunities and threats by means of a SWOT analyses.

- The organizational context which is the process of setting and communicating goals and objectives as well as the division of responsibility within the farming business.

- The risk management context which implies some priority setting since all risks can't be dealt with at the same time.

b. Risk identification: This needs a systematic approach to ensure that important risk problems are not overlooked. The whole aim is to make a list of events that may have an important effect on the performance of the farming business. One needs to ask yourself what might happen, why and how it will happen and what effect it will have on the farming business.

c. Structure problem: It is necessary to identify the exact nature of the risk being considered. Questions like: Who faces the risk?, who suffers if things go wrong?, what are the basic and proximate causes of the risk?, how is the risk currently managed?, what other options are currently available to manage the risk? and who decides what to do?

d. Analyze options and consequences: Given current risk management practices, the farming business needs to determine the chance of occurrence of a certain risk. If the current risk management strategy is judged to be unsatisfactory, analyzers proceed to consider alternative strategies of risk management.

e. Evaluate and decide: The farming business then needs to evaluate the risky consequences of the available decision options to reach a decision on what is the best strategy to use. This will depend on the farming business' attitude towards risk.

f. Implement and manage: This means to do what was decided on and implement the chosen strategy. The implementation of the correct strategy also needs to be managed by the responsible person(s).

g. Monitor and review: The risk management plan needs to be maintained once it has been chosen and implemented correctly. When some risk management plans seem to be unsatisfactory, they need to be reviewed in order to deal with the problem appropriately (Hardaker, et al., 2000).

4.4 FINANCIAL STATEMENTS AND -MANAGEMENT

To be able to do financial analyses it is important to understand the conceptual basis of the financial reporting system and of the preparation of financial statements. The farming business's financial statements will probably be prepared by its accountant who will select the accounting methods and compile accounting data. Most businesses compile five principal financial statements which generate information for external users. These financial statements include the following:

- Balance sheet (statement of financial position)
- Income statement (statement of earnings)
- Statement of comprehensive income
- Statement of cash flows
- Statement of stockholders' equity

It is important to note that these financial statements are interrelated and are normally augmented by footnotes and supplementary data. Together these statements can provide relevant, reliable and timely information which is needed to make essential financial decisions.

4.5 DIFFERENT FINANCIAL STATEMENT ELEMENTS

All transactions and some other events have an effect on the farming business and need to be recorded in the appropriate financial statement(s). These include the following:

4.5.1 The Balance Sheet

The balance sheet is also known as the statement of financial position and it reports major classes and amounts of:

- Assets: Resources owned or controlled by the firm;
- Liabilities: External claims on those assets;
- Shareholders' equity: Owners' capital contributions and other internally generated sources of capital

and their interrelationships at specific points in time. The basis for recording all transactions in financial reporting is expressed as the balance sheet equation:

Assets (A) = Liabilities (L) + Stockholders' Equity (E)

4.5.2 The Income Statement

The income statement is also known as the statement of earnings. It reports on the performance of the farming business as a result of its operating activities. Most changes in assets, liabilities and equity between two consecutive balance sheet dates of the farming business are explained here. Thus the income and balance sheet are interrelated. Elements of the income statement are:

- Revenues: Inflows of an entity from delivering or producing goods (products) rendering services, or other activities that contribute to the entity's ongoing major or central operations.
- Expenses: From delivering or producing goods (products), rendering services or carrying out any other activities that constitute to the entity's ongoing major or central operations (White, et al., 1998).

4.5.3 Statement of Cash Flows

It reports on cash receipts and payments in the period of their occurrence seen as operating, investing, and financing activities. Thus it explains changes in consecutive

balance sheets and supplements the information provided by the income statement (White, et al., 1998).

* Note that section 4.6 to 4.8.3 was taken from (Van Zyl, J. et al., 2006)

4.6 FINANCIAL MANAGEMENT OF THE FARMING BUSINESS

In order for the farming business manager(s) to do accurate and effective financial management and decision-making they require detailed information on:

- Historical costs;
- Yields;
- Input utilization and production;
- Present financial and physical conditions as well as;
- Future costs, yields and production.

The farm manager(s) can obtain this needed information from two sources namely:

- External sources which is information collected from outside the farm business;
- Internal sources which is the farming business's own financial statements and records.

Both these sources are very important, but the main focus will be on the latter.

Keeping financial records or management information is very important because the progress and financial success and progress of the farm business can be determined over a period of time. A measurable and factual comparison with previous years can be established. Objectives can be set and future planning and decision-making can be done. Tax management, tax planning and the complying with tax requirements can be achieved. Credit can be obtained, the cash-flow position of the farm business can be obtained and financial control is possible.

An internal farm management information system, which consists of the respective financial statements and farming records, is needed. Furthermore it needs to be analyzed and interpreted. Figure 4.2 below gives a schematic representation of such an internal farm management information system.

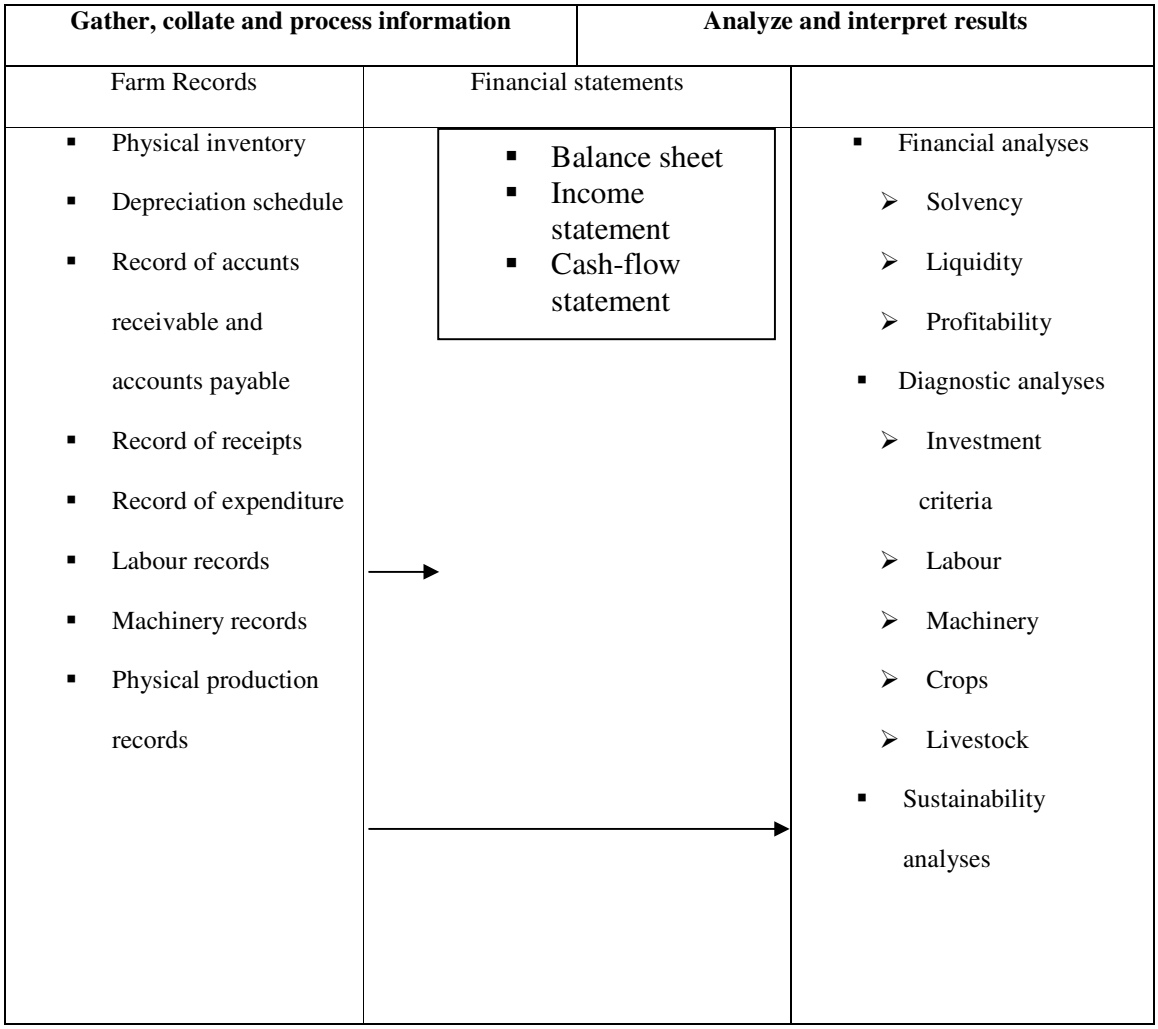


Figure 4.2 An internal farm management information system
Source: Van Zyl, J. et al., 2006.

4.7 ANALYSES OF THE FARMING RESULTS

A proper farm record-keeping system will enable the farm manager(s) to analyse the farm business both physically and financially. Detailed record-keeping would be a waste if the analyses and interpretation of the farming results are not done. All the gathered information can only make a significant contribution to the planning, implementation,

control and coordination of the management task if it is analyzed and interpreted correctly and meaningfully. There are basically three types of analyses which farm managers should do namely:

- **Financial analyses:** Where the financial position, strength and growth is determined and controlled.
- **Diagnostic analyses:** Where factors responsible for a satisfactory (or unsatisfactory) efficiency level are identified which allows the analyses of the various enterprises in the farm business.
- **Sustainability analyses:** Where the source and application of funds are specifically evaluated.

It is quite logical that the farm manager(s) should start with the financial analyses. The diagnostic analyses is done to determine the reasons for the current financial position and lastly the sustainability analyses is done indicate how assets are being financed.

4.7.1 Financial Analyses

A financial analysis is not only the analyses of income and expenditure, but it also shows the ability of the farm business to meet financial liabilities, carry risk, utilize and safely apply capital available. Financial knowledge and information is used to evaluate the past, present and future financial positions of the farm business. The financial position of the

farm business can be determined by making use of certain financial ratios. They need to be meaningful and comparable and should be interpreted in relation to other ratios. Certain norms or rules of thumb should be used as guidelines when interpreting these ratios. When these ratios are used to analyze the financial position of the farm business, it should be kept in mind that rules of thumb will differ from those used in other production sectors.

Rules of thumb for agriculture will also differ for young and established farmers, different regions, enterprises in the same region, emerging and commercial farmers, risks involved in different enterprises etc.

According to Van Zyl et al (2006), the farming business's financial position can be analyzed using the following ratios:

4.7.1.1 Solvency

It indicates to which extend the assets of a business exceeds its liabilities. Thus, solvency shows the ability of the farm business to meet its liabilities, if business activities were to be terminated. Solvency can be determined using various methods; however, only four of these will be discussed here.

a. Net capital ratio

This method indicates the ratio between total assets and total liabilities. It is an indication of whether outstanding liabilities would be met if all assets were sold. It is calculated as:

$$\text{Net capital ratio} = \frac{\text{Total assets}}{\text{Total liabilities}}$$

The higher the ratio is the better the solvency position. A ratio exceeding 2:1 is usually accepted as safe. The type of farming business, the risks evolved etc. are determining factors. If the net capital ratio is less than 1:1, the business is insolvent or bankrupt.

b. Leverage ratio

It reflects the ratio of total liabilities to own capital in a farm business. It indicates the farmer's ability to meet his liabilities with own capital. It is calculated as:

$$\text{Leverage ratio} = \frac{\text{Total liabilities}}{\text{Own Capital (net worth)}}$$

It is important to note that the suitability of the ratio would depend on the cost of capital and would differ from one farm business to another. A farm business with a healthy capital position's leverage ratio should generally be less than 1:1. Thus the farmer should not owe more than the amount of own capital that he contributed to the business.

c. Own capital ratio

It is the ratio between the farmer's own contribution and the total assets of the business. It is calculated as:

$$\text{Own capital ratio} = \frac{\text{Total own capital (net worth)}}{\text{Total assets}}$$

An own capital ratio of at least 0.50 is desirable for a financially sound farm business. Once again, the ratio would depend on the cost of capital and would differ from one farm business to another.

d. Growth of the farm business

The financial progress of the farm business is indicated by the percentage increase in net worth from one year to the next. Since the growth in the entrepreneur's own capital or interest in the business is reflected, only the net worth is relevant. Hence, growth of business is calculated as:

$$\text{Growth of business} = \left(\frac{\text{Net worth (yr2)} - \text{Net worth (yr1)}}{\text{Net worth (yr 1))}} \times 100\right.$$

The growth of the business should exceed the inflation rate in order to achieve a positive real growth. Otherwise the real purchasing power of net worth (own capital) would be decreasing.

4.7.1.2 Liquidity

It is an indication of the farming business's continued ability to meet all current payments and liabilities that are necessary to continue the activities of the business and to be able to take advantage of possible opportunities for expansion or profit-making. Liquidity can thus be seen as the ratio of inflow to outflow of funds in the short term. Liquidity ratios are, just like solvency ratios, calculated from the balance-sheet as well as a cash-flow statement. Liquidity can be assessed by comparing the actual monthly overdrawn bank balance on the cash-flow statement to the available credit facility. The degree of liquidity is indicated by the difference. A positive cash flow is experienced when the overdrawn bank balance is less at the end of the financial period than at the beginning. Liquidity problems, on a chronic basis, can lead to solvency problems and can eventually lead to insolvency. There are three static liquidity ratios used to measure liquidity.

a. Current ratio

It is the ratio of current assets to current or short term liabilities. It indicates to which extend current liabilities can be redeemed through cash and the sale of other current assets. It is calculated as:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

It is healthy to maintain a ratio of at least 2:1 depending on the ratio of the farm business and risks involved.

b. Acid test ratio

This ratio measures the immediate liquidity by excluding items that cannot be converted to cash immediately. It is calculated as:

$$\text{Acid test ratio} = \frac{\text{Current assets - stocks \& supplies}}{\text{Current liabilities}}$$

A ratio of 1:1 is a good ratio since a high ratio shows that a large amount of capital is not being utilized productively. This ratio will only be calculated for types of farm businesses which carry stock that cannot be soled quickly and be converted to cash.

c. Intermediate ratio

This ratio is used to calculate liquidity in the medium term. This ratio as calculated as:

$$\text{Intermediate ratio} = \frac{\text{Total current assets + medium term assets}}{\text{Total current liabilities + medium term liabilities}}$$

A ratio higher than 4:1 is desirable, but it depends on the type of farming activities etc.

4.7.1.3 Profitability

It is the percentage ratio between the profit earned in a given period and the capital used to realize that profit.

a. Farm profitability or Return on Assets (RoA)

It is expressed by calculating net farm income (NFI) as a percentage of average total capital employed in the farm business during the financial period. An important note is that total capital employed includes the assets of the farm business, the value of rented land, leased equipment and land used for share-cropping. Due to the fact that capital fluctuates constantly during a financial period, the average capital investment is used to calculate profitability. Hence there are two steps for this calculation:

Step 1:

$$\text{Average total capital employed} = \frac{\text{Opening value + closing value}}{2}$$

Step 2:

$$\text{Farm profitability} = \frac{\text{Net farm income}}{\text{Average total capital employed}} \times 100$$

It indicates the net farm income (NFI) per R100 total capital employed in the farm business. The manager(s) can now compare the profitability for the present year to that of the previous years so that any problems regarding the profitability can be identified and addressed in time.

b. Profitability on own capital or Return on Equity (RoE)

It is calculated by expressing farm profit as a percentage of average own capital or net worth employed during the financial period under review. The interest earned by the farmer on own capital, after borrowed capital has been serviced, is thus indicated by this ratio. It is also calculated using two steps:

Step 1:

$$\text{Average own capital} = \frac{\text{Opening value + closing value}}{2}$$

Step 2:

$$\text{Profitability of own capital} = \frac{\text{Farm profit}}{\text{Average own capital}} \times 100$$

The profitability of own capital should be compared to farm profitability for the same period, profitability of own capital in previous years and profitability of alternative investments to see whether it is satisfactory or not. If, for instance, profitability of own capital, is greater than the farm profitability it indicate that financing is employed profitably. Thus the return on borrowed capital exceeds the cost thereof.

4.7.1.4 Efficiency ratios

In order to determine to what extend the available resources are being utilized efficiently these ratios are calculated. There are basically two ratios used in this regard.

a. Capital turnover ratio

It indicates how efficiently capital is being employed in the farm business and is calculated as:

$$\text{Capital turnover ratio} = \frac{\text{Gross production value}}{\text{Average total capital employed}}$$

A high capital turnover ratio indicates a productive employment of capital. Depending on the intensity of the farming activities, agriculture is normally characterized by a relatively low capital turnover ratio.

b. Cost ratio

This ratio indicates the ratio between total expenditure (excluding private expenses) and gross production value. It is calculated as:

$$\text{Cost ratio} = \frac{\text{Total expenditure}}{\text{Gross value of production}}$$

The cost ratio is compared to that of previous years or similar farming business. It indicates the claim of expenditure for each unit of income.

c. Debt servicing ratio

It measures the ability of the farming business to meet its debts or liabilities and is calculated as:

$$\text{Debt servicing ratio} = \frac{\text{Debt redemption (instalment + interest)}}{\text{Gross value of production}}$$

The higher the debt servicing ratio, the greater the financial pressure on the farm business as far as production, growth etc. are concerned.

4.7.2 Diagnostic Analyses

According to Van Zyl et al (2006), after the analysis of the financial position of the farm business is done, the farm manager should have a good idea of its financial status and performance. However, a diagnostic analyses needs to be done to find out how and why this position was reached.

In order to evaluate the success of the farm business, results for a specific production year should be measured against standards or criteria. This way deviation can be identified and rectified. The size of the farm business, the type of enterprise and the purpose of analyses will determine the efficiency analyses applied. Types of comparative criteria or norms can be developed are the following:

- For a year-on-year comparison criteria based on the farmer's, own records can be used;
- For a group or area of cooperating farmers, average criteria will be used;
- Criteria based on the performance of the top achievers of a group of farmers;

- Generally accepted norms developed for and adjusted to the particular circumstances of the farm business and;
- Criteria obtained from research results as far as the physical and financial performance of the farm business is concerned.

A record-keeping system must therefore contribute towards the development of pertinent criteria for diagnostic purposes. This will also assist the farm manager in identifying rectifying inefficiencies in the production process. By using efficiency criteria, deficiencies in the farm business are diagnosed. Below, various efficiency criteria are discussed.

4.7.2.1 General Criteria

General criteria important to the farm business as a whole are net farm income per hectare, net farm income per R100-00 capital investment, gross margin for the farm as a whole, return on total capital investment, gross margin per hectare, fixed costs per hectare, interest earnings on own capital and the increase or decrease in the net worth of the farm business.

4.7.2.2 Investment Criteria

For the investment criteria the farm manager will take land, fixed improvements and livestock into account. It is also important to look at the land value per hectare including value of improvements per hectare and total farm value per hectare. As far as livestock is concerned, capital investment in livestock per live stock unit (LSU) and the value of livestock per hectare are taken into account. For machinery and equipment the farm manager will take capital investment in power machinery, capital investment in implements per hectare arable land, and capital investment in vehicles per hectare will be included.

4.7.2.3 Utilization of labour

As far as the utilization of labour is concerned, the following is taken into account: Labour costs per labourer (full-time) per month, gross production value per labourer, gross production value per R100 labour costs, net farm income per R100 labour costs and labour efficiency. Labour efficiency includes the total number of labour days worked by labourers as a percentage of the maximum number of available labour days. One can also look at labourers per day per unit harvested and hectares cultivated per labourer per day.

It is important to note that factors such as prices, climate, cultivation practices and mechanization are not taken into account when these criteria are calculated but, should be

included in their interpretation in order to identify the weaknesses and strengths of the farm business.

4.7.2.4 Crop Cultivation

It is extremely important for the farm manager to take the following into account as far as the production of maize is concerned:

- Gross margin per hectare;
- Effective utilisation of cultivated land which includes: hectares cultivated per tractor unit, ratio of hectare cash crops to hectare fodder, cultivation costs per hectare arable surface area and yield per hectare harvested per 100mm rainfall or per irrigation cycle.
- Measurement of practices including: kilogram seed used per hectare, yield per hectare, fertilisation costs per hectare, fertiliser applications per hectare and cultivation costs per hectare.

These criteria should be compared with the results of other farms, research results and the results of previous years. One of the most important objectives of crop criteria is to determine the relative profitability for various enterprises in the same farm business. If production practices and fixed cost requirements of different crop enterprises correspond, their gross margins per hectare are suitable for comparing profitability between them. This will assist the farm manager in identifying enterprises that should be expanded, contracted or corrected.

4.7.2.5 Livestock production

For livestock production, the following criteria apply:

- Gross margin per livestock unit (LSU) or small stock unit (SSU)
- Criteria measuring pasture management including: hectare pasture per grazing LSU or SSU and kilogram meat production per hectare
- Criteria measuring the management of pasture as well as herds or flocks which includes: calving percentage, fertility rate (in percentage), reconception rate (in percentage), weaning percentage, intercalving period, weaning mass, margin over feed costs, price per kilogram meat sold and the mortality rate.

For stock-farming, the same considerations applied for crop enterprises are used. To be able to make comparisons between crop and stock enterprises, gross margins have to be sufficient. If this is not the case, then fixed costs and non-directly allocable costs should first be divided and allocated to the various enterprises before comparisons can be made. Complete and detailed records are required to make meaningful allocations.

4.7.3 Financial Sustainability Analyses

The diagnostic analyses, solvency, liquidity and profitability give the farmer a good idea of the financial status and performance of the farm business. Financial sustainability analyses now compare the financing assets, with specific reference to the sources and the

employment of funds, to physical quantities of productive assets. The results of a specific financial plan are measured against standards of criteria hence the financial risk or sustainability of the farm business and specific farming practices can be evaluated. The criteria mentioned, which apply to the farm business as a whole, are the following:

- Debt per hectare, per livestock unit or per lactating cow
- The ratio of debt to net farm income (Van Zyl, et al., 2006).

4.8 Conclusion

The main objective of the farming business should be to optimize its profit and to minimize its risk. The farmer faces several risks and uncertainties and he needs to manage these risks in order to obtain his goals. The analyses of the farming results in the form of an internal farm management information system, including financial, diagnostic and sustainability analyses, can be seen as a tool to assist the farmer in obtaining the mentioned goals. This tool alone, however, might not be enough for the representative farm located in the Mpumalanga Highveld to obtain these goals. As stated in the previous chapter is evident that there are many marketing options available to the representative farm and it needs an additional tool to enable it to obtain these objectives. Hence a budgeting and marketing model needs to be developed to address this issue.

Chapter 5

FARM SETUP

5.1 INTRODUCTION

For this study, data is obtained from several farms (15 farmers) belonging to the Middelburg Akkerbou Forum (an agricultural study group) to construct, using weighted average values, an imaginary but very realistic, representative farm setup. The farming business will be called Delta farming. Since the majority of farmers belonging to the study group farms east of Middelburg, it is assumed that the representative farm, Delta farm, is situated 20km east of Middelburg. It is assumed that this farming business is propriety. It is a mixed farm on which dry land maize and cattle (for meat) are produced.

5.2 THE FARM SETUP

The farm setup is as follows:

Table 5.1: Different Farm Setup Components for Delta Farming

Season	**2005/2006**
Description	**Quantity**
Usage	**Hectares**
Dry land maize	1 500
Planted pastures	50
Pasture	1000
Cattle	**750** LSU's (live stock units)
Cows	400
Bulls	10
Weaners	340
Total farm size	**2 550**

The farming business employs fifteen full-time labourers. Their annual work schedule is as follows:

Table 5.2: The annual calendar for Delta Farming

Date *	**Activity**
1 August - 15 September	General Farm Maintenance
1 October – 10 November	Planting of maize (depending on rainfall)
10 November – 22 December	Weed and pest control
2 January – 20 April	General Farm Maintenance
25 April – 30 June	Harvesting of maize
15 July – Planting time	Land preparation

* Note that dates may vary a bit depending on rainfall, frost and other factors outside the farmer's control.

As far as the cattle are concerned, it is an ongoing process of injections, vaccination, de-horning, marking, feeding etc. throughout the year. Assuming that the farmer doesn't use mating seasons with his cattle, and only swap his bulls every three months, there will be weaners sold at least three times per year.

5.2.1 Rainfall for Delta Farming

Figure 5.1 below indicates the monthly rainfall for a region situated 20 km east of Middelburg, Mpumalanga and is the "location" of the representative farming business, Delta Farming. It is a typical summer rainfall area where the rain season starts during September, peaking between November and January and ends during April with very little or no rain during the winter months.

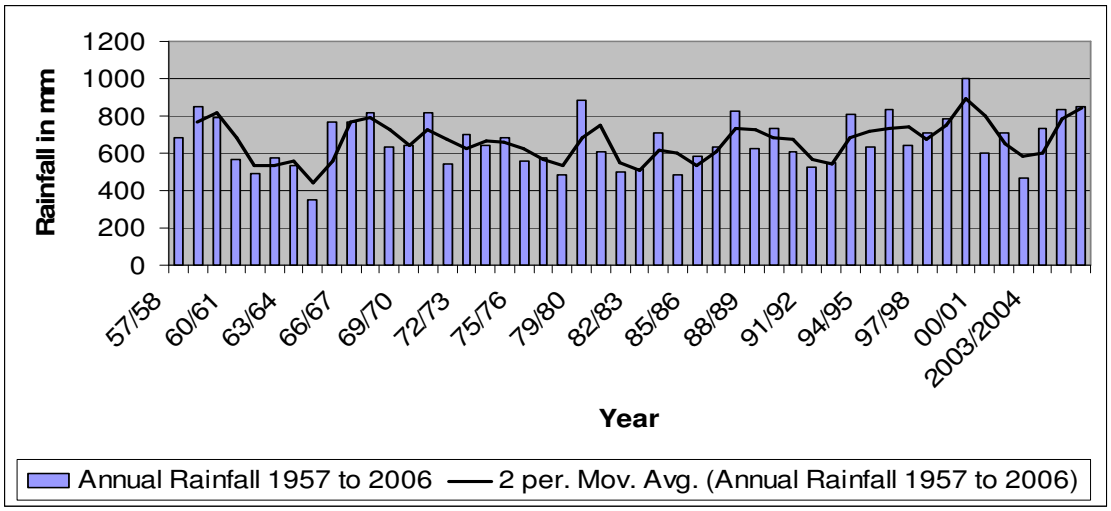


Figure 5.1: Total Annual Rainfall for Delta Farming (1957 to 2006)
Source: C&D Farming Middelburg, 2007

Figure 5.2 below shows the annual rainfall for Delta Farming which is situated 20 km east of Middelburg, Mpumalanga.. From this graph it is evident that total annual rainfall is very variable for this region. The average yearly rainfall for this 49-year period is 664mm. It is obvious that this amount is ample to insure a good maize yield, but the determining ftacor is the distribution of rainfall during the growth season.

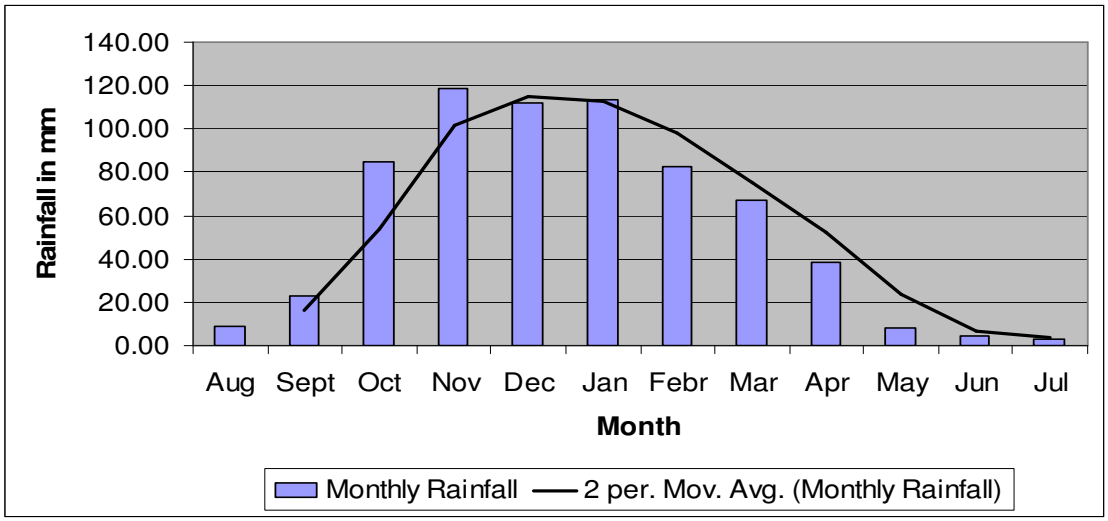


Figure 5.2: Average Monthly Rainfall for Delta Farming (1957-2006)
Source: C&D Farming Middelburg, 2007

5.2.2 Production Data for Delta Farming

Weighted average production cost for maize from 1999 to 2006 for the Middelburg Akkerbouforum is used for the purpose of this study. These costs are divided into direct input costs (e.g. seed, lime, fertilizer etc.) and other costs like mortgage and rent of land (fixed cost) which all add up to the total input cost. Figure 5.3 below compares direct with fixed costs per hectare. It shows that direct input costs has increased quite significantly from R1 624-46 / ha in 1999/2000 to R3 265-52 / ha in 2005/2006. This is an average increase of 12.67 % per year. The increase is mainly due to imported inputs and the ever-increasing transport cost, which is linked to the oil price. Fixed costs on the other hand remained fairly stable over the eight year period due to relative stable interest rates.

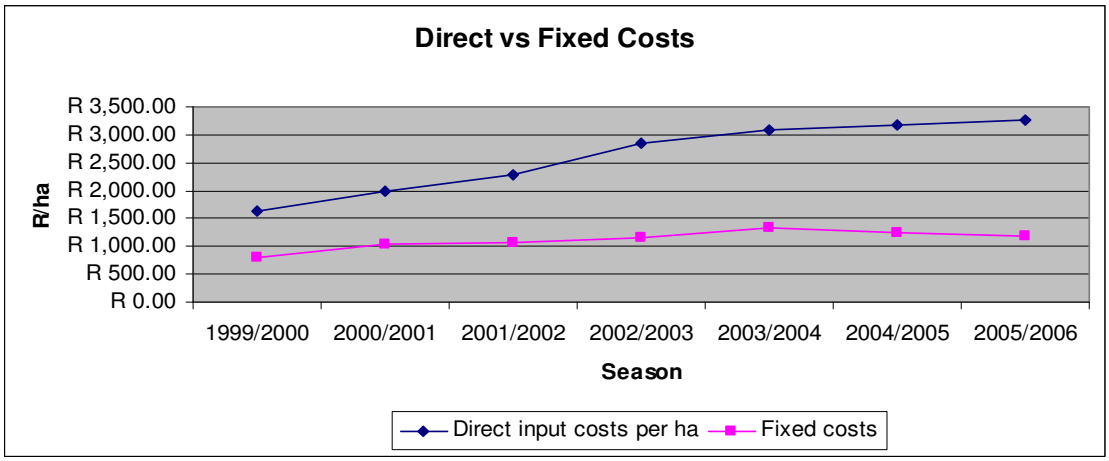


Figure 5.3: Nominal Direct vs Fixed Input Costs
Source: Middelburg Akkerbouforum, 2007

Figure 5.4 indicates that income per hectare has remained above direct input costs per hectare for the seven year period, indicating a reasonable profit. It is important to note however, that other costs like interest, replacement cost of machinery, mortgage and rent of land still have to be added which makes the profit margin a lot smaller.

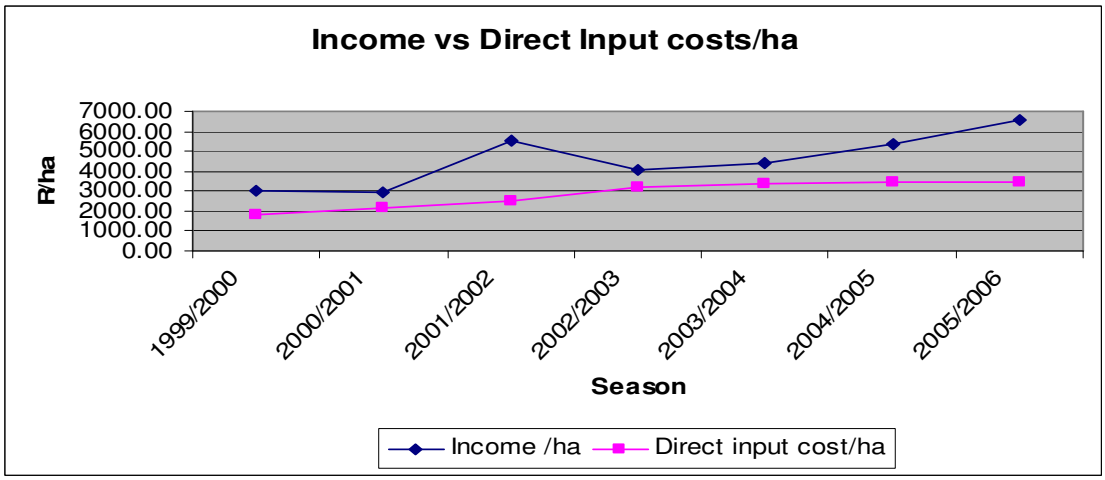


Figure 5.4: Nominal Income/ha vs Direct Input Costs/ha for the Middelburg Akkerbou Members
Source: Middelburg Akkerbouforum, 2007

It is evident from Figure 5.5 that the average yearly weaner price increased significantly over the last nine years. The price will probably continue to increase as South Africa's middle class income group increases, increasing the consumption of meat. This is very important from the farmer's point of view, since weaners can be produced to spread risk. It is for this reason that the feeding of own maize to weaners is also considered as a maize marketing strategy. Furthermore, feedlots use yellow maize as feed, thus increased weaner production will also increase the demand for yellow maize, pushing its price up.

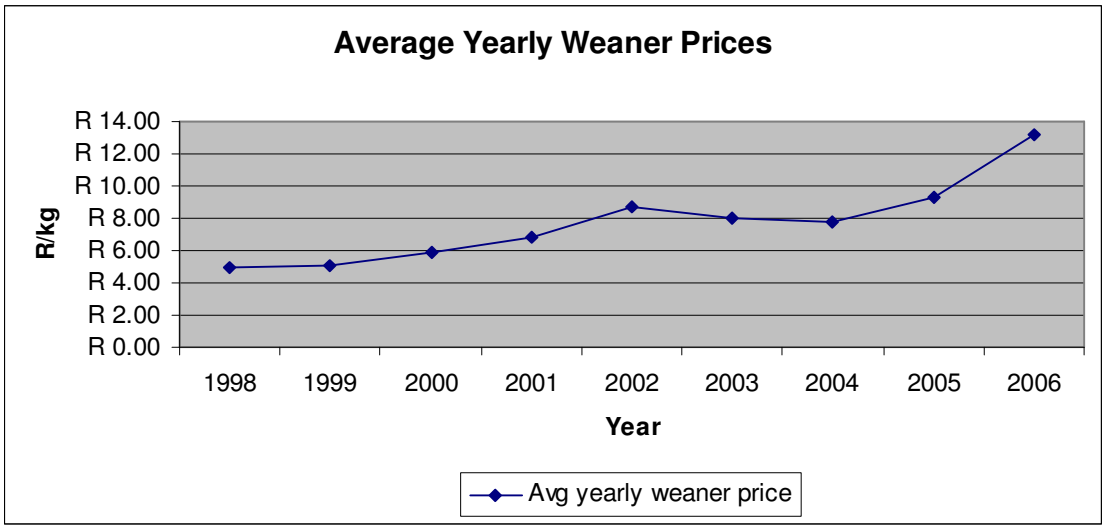


Figure 5.5: Average Nominal Yearly Weaner Prices
Source: Red Meat Producers Organization, 2007

5.2.3.1 Average Nominal Annual Maize Price

The Figure 5.6 below shows the average yearly white and yellow maize prices for South Africa. It is evident that the maize price is very volatile and differs significantly from one year to the next. It is therefore very difficult for producers to do financial budgeting and to make the correct marketing decisions for each season. There isn't a big difference

between white and yellow maize prices accept for the 2001/2002 season due to increased exports of maize to neighbouring countries. The price spike during this season was mainly due to the deterioration of the Rand against all the U.S. dollar (figure 2.8) and drought resulting in a total production of only 7935800 tons, while the total maize demand is about 8.2 million tons annually (SAGIS, 2007).

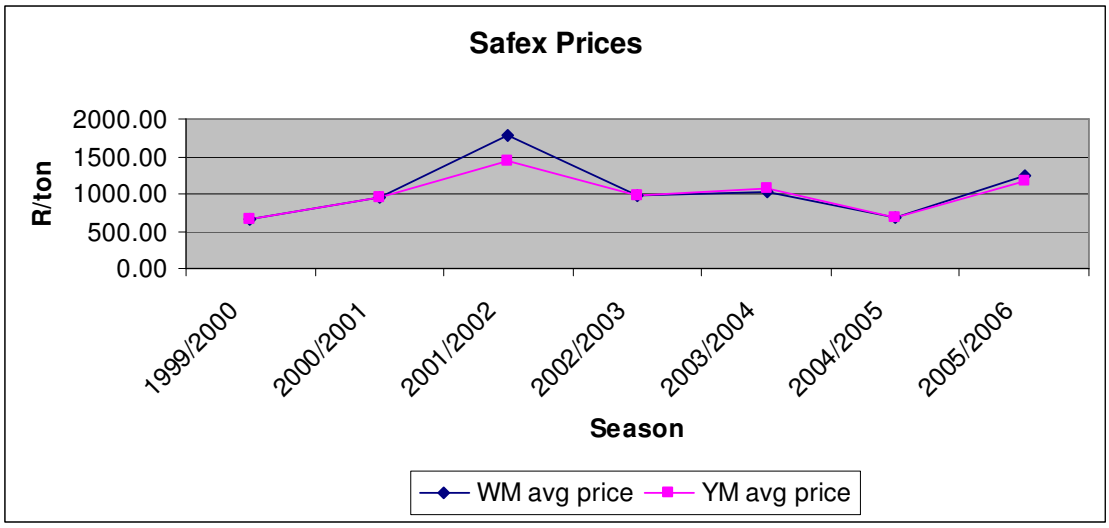


Figure 5.6: Nominal Safex Maize Prices
Source: SAGIS, 2007

It has been mentioned earlier that the farmer's price per ton of maize is determined by Safex minus the transport differential of about R 100-00. The transport differential depends on the distance in kilometres of the Safex silo, in which the farmer's maize is stored, from Randfontein. From figure 5.7 it is evident that these farmers' average yearly maize price is not necessarily R 100-00 under the average yearly Safex price. Factors contributing to this phenomena is good marketing strategies applied by these producers (e.g. selling maize at peak prices and holding on to there maize during low-price periods) and in times of a maize shortages, buyers are willing to pay a premium for maize e.g. a reduced transport differential, prices equal to the Safex price or even prices above Safex.

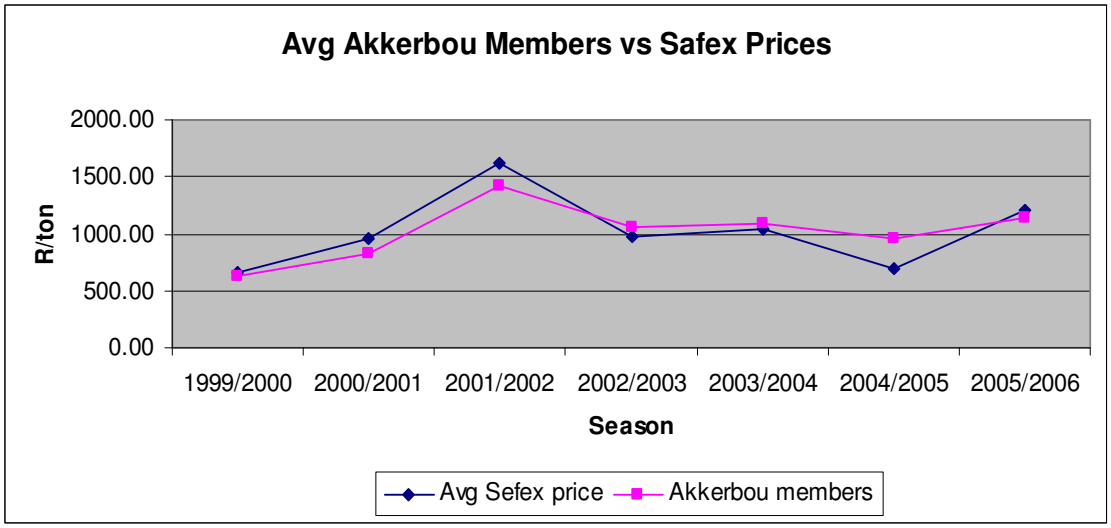


Figure 5.7: Average Akkerbou Member Prices vs Average Safex Prices
Source: Middelbug Akkerbouforum (2007), SAGIS (2007)

5. 2.4 Average Monthly Yellow (YM) and White (WM) Maize Prices

The Figure 5.8 below shows the average monthly white and yellow maize prices from the 1999/2000 to the 2005/2006 season. The price is high during January and starts to decrease as the season progresses towards harvest time. It is at its lowest during the harvesting season (May to July) and then it gradually starts to increase again to peak during December. From this data it is evident that a farmer would receive the best prices for his maize if his financial position allowed him to store his maize after harvesting and sell during the months of November, December, January and February.

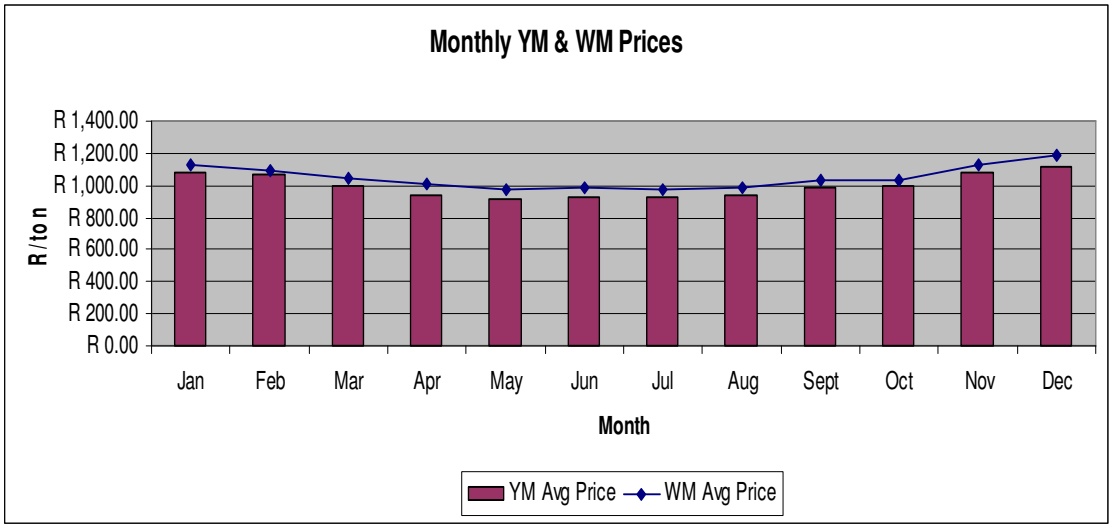


Figure 5.8: Average Monthly YM and WM Nominal Maize Prices
Source: SAGIS, 2007

5.2.5 Financial Break-Even VS Average Farmer Price

The financial break-even price was calculated by using the Middelburg Akkerbou Member's weighted average total input costs and there average yield from the 1999/2000 to the 2005/2006 season. The farmer price is the average yearly Safex price minus R 100-00 transport differential. Figure 5.9 shows that the average farmer price is above the financial break-even price from 1999/2000 to 2000/2003, peaking during the 2001/2002 season when the price was very high due to reasons mentioned earlier. For the 2003/2004 season, financial break-even is relatively equal to the average farmer price. During the 2004/2005 season, financial break-even is well below the average farmer price due to the fact that supply exceeded demand. The balance returned during the 2005/2006 season when farmers planted only 55 % of the normal hectares planted in South Africa to bring maize supply down (Gouws, 2006).

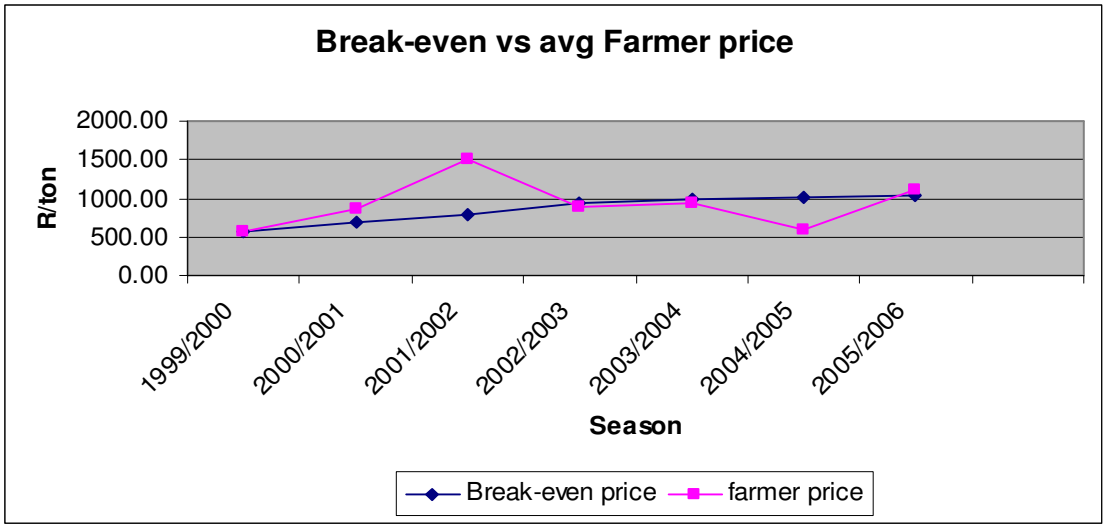


Figure 5.9: Financial Break-Even VS Average Farmer Price for the Middelburg Akkerbou Members
Source: Middelbug Akkerbouforum, 2007; SAGIS, 2007

5.3 FINANCIAL STATEMENTS FOR DELTA FARMING

5.3.1 The Balance Sheet

Delta farming's complete balance sheet is in Appendix A (table A.1). The following notes and assumptions are applicable on the balance sheet:

- The financial year-end is 31 July.

- For land and fixed improvements, an average value of R 5 800 per hectare is used. The amount used for this calculation was obtained from several attorneys in Middelburg and Bethal as average farmer-to farmer selling prices of land (dry-land maize and pasture) in the Middelburg district.

- The decline in the value of the medium term assets is due to depreciation.

- Delta farming owns 2050 hectares of land and bought an additional 500 hectares of land for R 4 000-00 per hectare in 2003.

- Delta Farming took a ten year (long term) loan from the bank with interest equal to prime rate.

- The **movable assets** are recorded at book value using the straight line depreciation method over five years.

- The moving assets are paid off over five years using a medium term loan from the bank with interest equal to prime rate.

- The **current assets** are also recorded at book value.

- The value for bank is determined in the monthly cash flow.

- The value for crop on field is determined using the average yield for the season and the expected average price for the season. It is important to note that the maize will be sold throughout the year.

- The livestock on hand is the book value, in rand, of all cattle currently on the farm.

- The **liabilities** are the book values of the medium and long term loans.

- The **equity** is the difference between the total assets and total liabilities to which the profit for each year is added.

5.3.2 The Income Statement

Delta Farming's complete income statement is in Appendix A (table A.2). The following notes and assumptions are applicable on the income statement:

- The **income** consists of the products sold namely, maize and livestock for the current year.

- The **net farm income** is the difference between the total income and the total expenses, excluding compulsory capital compensation.

- **Farming profit** is the difference between net farm income and compulsory capital compensation.

- **Net worth** is calculated by subtracting owner's compensation and income tax from farming profit.

- * Note that **growth in net worth** could not be calculated for 2004 due to the absence of financial statements for 2003

5.3.3 The Cash Flow Statement

Delta Farming's cash flow statement is in Delta farming (Excel) Cash Flow. The following notes and assumptions are applicable on the cash flow statement:

- **Monthly cash flow statements** for both 2005 and 2006 were drafted.
- The **surplus or deficit** for each month is the difference between the total income and the total expenses for that month.
- The **opening balance** is the previous year's closing balance as captured by the bank balance in the balance sheet.
- If the **new balance** is positive, the farmer receives zero percent monthly interest, since there is no interest on a positive cheque account since April 2005 (SARB, 2006). If not, the farmer pays twelve percent (the interest rate on an overdraft during the last quarter of 2006 (SARB, 2006) monthly interest.
- The cash flow risk ratio is also calculated as a percentage by dividing total cash needs by total cash receipts.

5.4 FINANCIAL ANALYSES

A financial analysis is done to determine the financial position, strength and growth of the farm business.

5.4.1 Solvency

Solvency shows the ability of the farm business to meet its liabilities if business activities were to be terminated. The following ratios are used to determine the business's solvency:

a. Capital Ratio

2005

Net Capital Ratio = Total Assets	R21,806,658.18	**6.19**
Total Liabilities	R3,525,400.00	

2006

Net Capital Ratio = Total Assets	R27,891,689.66	**10.39**
Total Liabilities	R2,683,600.00	

It indicates the ratio between total assets and total liabilities. A ratio exceeding 2:1 is usually accepted as safe, thus in this case, the business is very safe in terms of the total assets to total liability ratio. The main reason is due to the assumption that Delta Farming already owns 80 % of its total assets. It is evident that Delta Farming's net capital ratio improved from 2005 to 2006 due to a decrease in its total liabilities and an increase in its total assets' value.

b. Leverage ratio

2005

Leverage Ratio = Total Liabilities	R3,525,400.00	**0.19**
Own Capital (Net Worth)	R18,281,258.18	

2006

Leverage Ratio = Total Liabilities	R2,683,600.00	**0.11**
Own Capital (Net Worth)	R25,208,089.66	

It indicates the farmer's ability to meet his liabilities with own capital. A farm business with a healthy capital position's leverage ratio should generally be less than 1:1 Thus Delta Farming's leverage ratio is low and his ability to meet his liabilities with his own capital is very good.

c. Own capital ratio

2005

Own Capital Ratio = Total own Capital (Net Worth)	R18,281,258.18	**0.84**
Total Assets	R21,806,658.18	

2006

Own Capital Ratio = Total own Capital (Net Worth)	R25,208,089.66	**0.90**
Total Assets	R27,891,689.66	

It is the ratio between the farmer's own contribution and the total assets of the business. An own capital ratio of at least 0.50 is desirable for a financially sound farm business. Thus this farmer's own capital ratio is very good and improved slightly from 2005 to 2006.

d. Growth of the farm business

2005

Growth of business = (Net worth (yr2) – Net worth (yr1) x 100	-0.04	**-4.00%**
Net worth (yr 1)		

2006

Growth of business = (Net worth (yr2) – Net worth (yr1) x 100	0.38	**37.89%**
Net worth (yr 1)		

The financial progress of the farm business is indicated by the percentage increase in net worth from one year to the next. The growth of the business should exceed the inflation rate in order to achieve a positive real growth. In this case the growth of the farm business is very high for 2006, and well above inflation. This is mainly due to a 75 % increase in the maize price and a 1.41 % percent increase in yield from the 2005 to the 2006 season.

5.4.2 Liquidity

It is an indication of the farm business's continued ability to meet all current payments and liabilities that are necessary to continue the activities of the business and to be able to take advantage of possible opportunities for expansion or profit-making.

In this case, however, there is no current liabilities, thus the liquidity ratios cannot be calculated as such. However, the fact that the business's current liability is zero; while its current assets' value is relatively high it can be assumed that its liquidity is high.

5.4.3 Profitability

It is the percentage ratio between the profit earned in a given period and the capital used to realize that profit.

a. Farm profitability (RoA)

It is expressed by calculating net farm income (NFI) as a percentage of average total capital employed in the farm business during the financial period. Thus there are two steps in this calculation.

Step 1:

2005

Avg total capital employed = Opening value + closing value	R45,241,382.51	**R22,620,691.25**
2.00	2	

2006

Avg total capital employed = Opening value + closing value	R49,698,347.83	**R24,849,173.92**
2.00	2	

Step 2:

2005

Farm profitability = Net farm income x 100	R1,975,243.61	**8.73%**
Average total capital employed	R22,620,691.25	

2006

Farm profitability = Net farm income x 100	R4,081,698.78	**16.43%**
Average total capital employed	R24,849,173.92	

A net farm income (NFI) of R 16-43 is realised per R100-00 total capital employed in the farm business for 2006, which is good for a farming business The manager can now compare the profitability for the present year to that of the previous years (R 8-73 per R100-00 for 2005) so that any problems regarding the profitability can be identified and addressed in time. In this case, farm profitability increased.

b. Profitability on own capital (RoE)

This indicates interest earned by the farmer on own capital, after borrowed capital has been serviced. It is also calculated using two steps.

Step 1:

2005

Average own capital = Opening value + closing value	R37,348,782.51	**R18,674,391.25**
2.00	2	

2006

Average own capital = Opening value + closing value	R43,489,347.83	**R21,744,673.92**
2.00	2	

Step2:

2005

Profitability of own capital = Farm profit x 100	R745,649.61	**3.99%**
Average own capital	R18,674,391.25	

2006

Profitability of own capital = Farm profit x 100	R 3,239,898.78	**14.90%**
Average own capital	R21,744,673.92	

The profitability of own capital is now compared to farm profitability for the same period, profitability of own capital in previous years and profitability of alternative investments to see whether it is satisfactory or not. Although farm profitability increased from 2005 to 2006, profitability of own capital is a bit less than farm profitability and indicates that financing is not utilised effectively. Thus the return on foreign capital does not exceed the cost thereof.

5.4.4 Efficiency ratios

These ratios are calculated to determine to what extend the available resources are being utilized efficiently.

a. Capital turnover ratio

It indicates how efficiently capital is being employed in the farm business and is calculated as:

2005

Capital turnover ratio = Gross production value	R6,289,494.69	**0.28 : 1**
Average total capital employed	R22,620,691.25	

2006

Capital turnover ratio = Gross production value	R10,374,319.07	**0.42 : 1**
Average total capital employed	R24,849,173.92	

Delta Farming has a capital turnover ratio of 0.42 : 1 for 2006 and 0.28 : 1 for 2005, thus there is an improvement but it remains relatively low. Depending on the intensity of the farming activities, agriculture is normally characterized by a relatively low capital turnover ratio.

b. Cost ratio

This ratio indicates the ratio between total expenditure (excluding private expenses) and gross production value. It is calculated as:

2005

Cost ratio = Total expenditure	R6,037,358.90	**0.84 : 1**
Gross value of production	R7,146,658.13	

2006

Cost ratio = Total expenditure	R6,749,923.60	**0.62 : 1**
Gross value of production	R10,862,580.37	

The cost ratio is compared to that of previous years or similar farming business. It indicates the claim of expenditure for each unit of income. Thus, a cost ratio of 0.62 : 1 (for 2006) indicates that R 0.62 rand is spent for each R 1-00 of income. Delta Farming's cost ratio decreased from 2005 to 2006.

c. Debt servicing ratio

It measures the ability of the farming business to meet its debts or liabilities and is calculated as:

2005

Debt servicing ratio = Debt redemption (installment + interest)	R3,913,194.00	**0.55 : 1**
Gross value of production	R7,146,658.13	

2006

Debt servicing ratio = Debt redemption (installment + interest)	R3,063,394.00	**0.28 : 1**
Gross value of production	R10,862,580.37	

The higher the debt servicing ratio, the greater the financial pressure on the farm business as far as production, growth etc. are concerned. Thus, a debt servicing ratio improved from 2005 to 2006 and a ratio of 0.28 : 1 for 2006 is relatively low. This also corresponds with the low leverage ratio and indicates that Delta

Farming can increase its dept exposure as long as RoA remains bigger than the cost of dept (after tax).

5.5 DIAGNOSTIC ANALYSES

After the analysis of the financial position of the farm business is done, the farm manager should have a good idea of its financial status and performance. However, a diagnostic analyses needs to done to find out how and why this position was reached. For the purpose of this study, a year-on-year comparison criteria based on Delta farming's own records is used. By using efficiency criteria, deficiencies in the farm business are diagnosed. Below, various efficiency criteria are discussed.

5.5.1 General Criteria

The following general criteria are used as part of the diagnostic analyses:

Table 5.3: Diagnostic Analyses: General Criteria

Description	2006	2005
Net farm income per hectare	R2,721.13	R1,316.83
Net farm income per R100 capital investment	0.16	0.09
Gross margin for maize	R5,278,155.99	R3,639,696.12
Gross margin for weaners	R863,728.68	R557,427.75
Return on total capital investment	0.42	0.28
Gross margin per hectare maize	R3,518.77	R2,426.46
Gross margin per hectare fodder	R863.73	R557.43
Fixed costs per hectare	R1,154.62	R1,086.32
Interest earnings on own capital	14.90%	3.99%
The increase or decrease in the net worth of the farm business	37.89%	4.00%

It is evident from Table 5.3 that all the significant financial ratios indicate that there is a great improvement in Delta Farming's financial position from the 2004/2005 to the 2005/2006 season. The main reasons are a 75 % increase in the maize price, a 1.41 % increase in yield from the 2005 to the 2006 season.

5.5.2 Investment Criteria

For the investment criteria the farm manager will take land, fixed improvements and livestock into account.

Table 5.4: Diagnostic Analyses: Investment Criteria

Description	Rand Value per hectare	Rand Value per Hectare
	2006	2005
Land and Improvements	R4,976.47	R4,898.04
Total Farm Value (including all assets)	R10,937.92	R8,551.63
Livestock	R1,134.95	R906.43
Machinery & Equipment (arable land)	R1,027.93	R1,284.91
Vehicles	R38.15	R47.69

As Table 5.4 indicates, land and improvements total farm value and livestock's Rand value per hectare increased from 2005 to 2006 indicating an improvement in Delta Farming's financial position**.** Machinery and equipment and vehicle's rand value per hectare decreased due to the fact that these items are recorded at there book value, thus deprecation lessened their values.

5.5.3 Utilization of Labour

As far as the utilization of labour is concerned, the following is taken into account:

Table 5.5: Diagnostic Analyses: Utilization of Labour

Description	2006	2005
Labour costs per labourer (full-time) per month	R1,964.67	R1,945.15
Gross production value per labourer per month	R60,347.67	R39,703.66
Gross production value per R100 labour costs	R3,071.65	R2,041.16
Net farm income per R100 labour costs	R1,328.83	R967.71

Table 5.5 shows that Delta Farming's labour costs increased slightly, but all the other indicators show that the business's labour utilization is very efficient. However, one should keep in mind that this is mainly due to an increase of 75 % in the maize price and a 1.41 % increase in yield from the 2004/2005 to the 2005/2006 season.

5.5.4 Crop Cultivation

It is extremely important for the farm manager to take the following into account as far as the production of maize is concerned:

Table 5.6: Diagnostic Analyses: Crop Cultivation

Description	2006	2005
Hectares cultivated per tractor unit (ten tractors)	150	150
Gross margin per hectare	R3,964.34	R2,678.04
Ratio of hectare cash crops to hectare fodder	1.43	1.43
* Cultivation costs per hectare arable surface area	R2,678.26	R2,595.42
Yield per hectare harvested, per 100mm rainfall or per irrigation cycle	0.95 ton / 100 mm rain	0.57 ton / 100 mm rain
Kilogram seed used per hectare	13.89 kg/ha	13.89 kg/ha
Yield per hectare	5.74 ton/ha	5.66 ton/ha
Fertilisation costs per ha	R954.89	R903.70
Fertiliser applications per ha	460 kg/ha	460 kg/ha
Cultivation costs per ha	3277.38	3185.85

From table 5.6 the following diagnostic analyses on crop cultivation can be done:

- **Hectares cultivated per tractor unit** remained unchanged on 150 hectares from 2005 to 2006 because no tractors were bought or sold during this period and the hectares of arable land remained unchanged.

- **Gross margin per hectare** increased significantly due to an increase of 75% in the maize price and a 1.41 % increase in yield from the 2004/2005 to the 2005/2006 season.

- **Ratio of hectare cash crops to hectare fodder** also remained unchanged on 1.43.

- **Cultivation costs per hectare arable surface area** increased due to an increase in diesel repair and maintenance, seed, lime, fertilizer herbicide

and pesticide costs from 2005 to 2006. * Note that "cultivation cost" for Delta Farming was only calculated for the maize production, since the pastures are long-established.

- **Yield per hectare harvested, per 100mm rainfall or per irrigation cycle** increased due to the fact that Delta Farming had 998 mm of rain in the 2004/2005 season and harvested 5.66 tons per hectare. In the 2005/2006 season, however, Delta Farming had 602mm of rain and harvested 5.74 tons per ha. This stresses the importance of the spreading of rainfall during a season and proves that more rain isn't necessarily better as far as maize yield is concerned.

- **Kilogram seed used per hectare** remained unchanged on 13.89 kg which gives a total of 36 000 plants per hectare.

- **Yield per hectare** increased slightly from 5.66 to 5.74 ton per hectare (an increase of 1.43 %) probably due to the better rainfall distribution during the 2005/2006 season.

- **Fertilisation costs per hectare** increased due to an increase in the price of fertilizer.

- **Fertiliser applications per hectare** remained unchanged on 460 kg per hectare which includes 240 kg of fertilizer (4:3:4) during planting and 220 kg of nitrogen (8:0:1) applied as top fertilizer.

- **Cultivation costs per hectare** also increased due to an increase in the prices of seed, fertilizer, diesel, repair and maintenance, labour and diverse costs.

5.5.5 Livestock production

For livestock production, the following criteria apply:

Table 5.7: Diagnostic Analyses: Livestock Production

Description	2006	2005
Hectare pasture per grazing LSU	0.72 ha	0.71 ha
Kilogram meat production per hectare	72.29 kg	71.24 kg
Calving percentage	86.25 %	85 %
Fertility rate (in %)	86.25 %	85 %
Reconception rate (in %)	98.00 %	97 %
Weaning percentage	85.25 %	83.5 %
Intercalving period (days)	585	585
Weaning mass (kg)	220 kg	220 kg
Mortality rate (in %)	1 %	1.5 %
Margin over cost for weaners	R2364.43	R1512.43

Table 5.7 shows that there is a very marginal change between the 2004/2005 and 2005/2006 season in most indicators. The only real significant change is the change in margin over cost for weaners due to the huge increase of 42 % in average yearly weaner price from the 2004/2005 to the 2005/2006 season.

5.5.6 Financial Sustainability Analyses

Financial sustainability analyses compare the financing assets, with specific reference to the sources and the employment of funds, to physical quantities of productive assets. The results of a specific financial plan are measured against standards of criteria hence the financial risk or sustainability of the farm business and specific farming practices can be evaluated. The criteria mentioned, which apply to the farm business as a whole, is the following:

Table 5.8: Diagnostic Analyses: Financial Sustainability Analyses

Description	2006	2005
Debt per hectare	R1,052.39	R1,382.51
Dept per livestock unit	R3,554.44	R4,700.53
The ratio of debt to net farm income	0.66	1.78

From Table 5.8 it is evident that Delta Farming is much better of in 2006 than in 2005 as far as financial sustainability is concerned. This is mainly due to an increase of 75 % in the maize price and a 1.41 % increase in yield and increase of 42 % in average yearly wiener prices from the 2004/2005 to the 2005/2006 season**.**

5.6 MARKETING ALTERNATIVES AVAILABLE FOR DELTA FARMING

The most general marketing alternatives available to maize farmers are used for the purpose of this study. Historical data is used to determine, for each season from 1999 to 2006, which marketing strategy would have yielded the best result as far as average income, cost and ultimately profit per ton are concerned.

5.6.1 Harvest and Store Maize in Afgri (Co-operation) Silos to Sell at a Later Stage When the Price Increases

To evaluate this marketing strategy, the following assumptions are made:

- The farmer stores his entire harvest in an Afgri silo.
- The farmer sells his maize three times per year namely July (just after harvesting), December (price is usually high as indicated by historical prices) and February (price is usually high due to summer drought).
- The costs involved are handling cost per ton and storage cost per ton per day obtained from Afgri.
- The income is calculated using tons harvested and average monthly farmer prices for yellow and white maize during the three selling months.
- The "percentage better off using this alternative", is calculated using the average yearly July farmer price for maize as a percentage of the profit made using this particular marketing strategy. This will apply for all the marketing strategies.

The following results were obtained:

Table 5.9: The results obtained from harvesting and storing maize in Afgri silos

YM & WM Season	Cost/ton	Income/ton before cost	Income/ton after cost	Income Jul Safex - 100	% Better off using this option
1999/2000	R53.11	R577.68	R524.57	R439.93	16.14
2000/2001	R58.67	R966.60	R907.94	R781.79	13.89
2001/2002	R65.75	R1495.41	R1429.66	R1452.88	-1.62
2002/2003	R73.33	R928.50	R855.17	R757.00	11.48
2003/2004	R80.41	R943.97	R863.57	R782.89	9.34
2004/2005	R85.46	R635.69	R550.23	R515.43	6.33
2005/2006	R89.51	R1170.33	R1080.82	R1242.96	-15.00

Sources: Safex, 2007; Afgri, 2007

5.6.2 Pre-Harvest Forward Contracts

To evaluate this marketing strategy, the following assumptions are made:

- The forward contracts are entered into during February (price is usually high due to summer drought) at a forward cash price for July and December. Thus the farmer sells half his harvest in July and the other half in December.
- The prices are determined using the futures price minus R100-00 transport differential, but this is negotiated between the buyer and the farmer.
- There are no other costs involved in forward contracts

The following results were obtained:

Table 5.10: The Results Obtained from using Pre-Harvest Forward Contracts

YM & WM Season	Cost/ton	Income/ton before cost	Income/ton after cost	Income Jul Safex - 100	% Better off using this option
1999/2000	0	R567.3	R567.25	R439.93	22.45
2000/2001	0	R832.3	R832.25	R781.79	6.06
2001/2002	0	R1373.8	R 373.75	R1452.88	-5.76
2002/2003	0	R1066.8	R1066.75	R757.00	29.04
2003/2004	0	R1276.3	R1276.25	R782.89	38.66
2004/2005	0	R564.3	R564.25	R515.43	8.65
2005/2006	0	R894.3	R894.25	R1242.96	-39.00

Source: Safex, 2007

5.6.3 Harvest and Store in Own Silos

To evaluate this marketing strategy, the following assumptions are made:

- The farmer sells his maize during February (carrying over maize from the previous season) and December. The maize can be stored up to 24 months
- Cost is calculated on a 100% five year loan with fixed interest rates.
- Adding 1000 ton storage capacity each year for six years and assuming that the total harvest is stored in the farmer's silos for the sake of the study.

The following results were obtained:

Table 5.11: The Results Obtained from Harvesting and Storing Maize in Own Silos

YM & WM Season	Cost/ton	Income/ton before cost	Income/ton after cost	Income Jul Safex - 100	% Better off using this option
1999/2000	R93.20	R646.56	R553.41	R439.93	20.51
2000/2001	R94.90	R1059.01	R964.16	R781.79	18.92
2001/2002	R99.30	R1516.67	R1417.36	R1452.88	-2.51
2002/2003	R102.50	R1014.25	R911.75	R757.00	16.97
2003/2004	R103.20	R1024.51	R921.26	R782.89	15.02
2004/2005	R88.90	R695.83	R606.96	R515.43	15.08
2005/2006	R0.00	R1134.01	R1134.01	R1242.96	-9.61

Sources: ABC Hansen Africa Silos, 2007; Safex, 2007; SARB, 2007

5.6.4 Harvest and Store in Silo Bags

To evaluate this marketing strategy, the following assumptions are made:

- Maize is sold during December and February assuming that the total harvest is stored in silo bags.
- Maize can be stored up to 24 months
- Storage costs are calculated for one year, but since the CAP is R40, storage cost is only paid for about 108 days.
- Since silo bags are a relatively new marketing option in South Africa, only two seasons can be included for this study, but since it is such a straightforward marketing alternative two data points are enough to be used for the purpose of this study.

The following results were obtained:

Table 5.12: The results Obtained from Harvesting and Storing Maize in Silo Bags

YM & WM	Cost/ton	Income/ton before cost	Income/ton after cost	Income Jul Safex - 100	% Better off using this option
2004/2005	R65.00	R695.83	R630.83	R439.93	30.26
2005/2006	R65.00	R1134.01	R1069.01	R781.79	26.87

Sources: Safex, 2007; Louis Dreyfuss Silo Bags, 2007

5.6.5.a Hedge Yourself on Safex (Futures)

To evaluate this marketing strategy, the following assumptions are made:

- The farmer short (sell) July futures during February, because the maize price is usually high during this month due to summer drought.
- Each contract represents 100 tons.

- The farmer needs to pay R10 000-00 per contract into a margin account which needs to be topped up when the market turns against his position.
- The number of tons hedged, is determined by the cash flow risk ratio.
- The farmer closes his position in July buy going long (buys back the future contracts.
- The farmer sells his maize immediately on the spot market when harvested, hence no storage costs.

The following results were obtained:

Table 5.13: The Results Obtained from Using Futures as Hedging Tool on Safex

YM & WM Season	Cost/ton	Income/ton before cost	Income/ton after cost	Income Jul Safex - 100	% Better off using this option
1999/2000	R1.50	R503.86	R502.36	R439.93	12.43
2000/2001	R1.50	R726.97	R725.47	R781.79	-7.76
2001/2002	R1.50	R1,129.67	R1,128.17	R1,452.88	-28.78
2002/2003	R2.00	R861.47	R859.47	R757.00	11.92
2003/2004	R2.00	R1,064.97	R1,062.97	R782.89	26.35
2004/2005	R2.00	R498.30	R496.30	R515.43	-3.86
2005/2006	R2.00	R760.30	R758.30	R1,242.96	-63.91

Source: Safex, 2007

5.6.5.b Hedge Yourself on Safex (Options)

To evaluate this marketing strategy, the following assumptions are made:

- The farmer buys (long) put options for July during February.
- The put option prices are calculated using the Black Scholes Option Pricing formula.

- The number of tons hedged, is determined by the cash flow risk ratio.
- The farmer sells his put options during July.
- Profit is made on the July put option when the safex price drops below the July strike price.
- The farmer sells his maize immediately when harvested, hence no storage costs.

The following results were obtained:

Table 5.14: The Results Obtained from Using Options as Hedging Tool on Safex

YM & WM Season	Cost/ton	Income/ton before cost	Income/ton after cost	Income Jul Safex - 100	% Better off using this option
1999/2000	R30.18	R494.28	R464.10	R439.93	5.21
2000/2001	R13.61	R803.89	R790.28	R781.79	1.07
2001/2002	R2.09	R1451.91	R1449.81	R1452.88	-0.21
2002/2003	R56.81	R882.78	R825.97	R757.00	8.35
2003/2004	R41.39	R967.71	R926.32	R782.89	15.48
2004/2005	R434.55	R962.81	R528.26	R515.43	2.43
2005/2006	R141.13	R1103.87	R962.74	R1242.96	-29.11

Source: Safex, 2007

5.6.6 Sell Maize on Spot Market and Buy Futures Contracts

To evaluate this marketing strategy, the following assumptions are made:

- The farmer sells all his maize during harvesting (July) and buys December futures because the maize price is usually high during this month according to historical prices.
- Each contract represents 100 tons.

- The farmer needs to pay R10 000-00 per contract into a margin account which needs to be topped up when the market turns against his position.
- The farmer sells his futures in December and closes his position

The following results were obtained:

Table 5.15: The Results Obtained from Selling Maize on the Spot Market and Buy Futures

YM & WM	Cost/ton	Income/ton Before cost	Income/ton After cost	Income Jul Safex - 100	% Better off using this option
Season					
1999/2000	R101.50	R448.73	R347.23	R439.93	-26.70
2000/2001	R101.50	R1171.73	R1070.23	R781.79	26.95
2001/2002	R101.50	R1290.50	R1189.00	R1452.88	-22.19
2002/2003	R102.00	R849.34	R747.34	R757.00	-1.29
2003/2004	R102.00	R609.07	R507.07	R782.89	-54.40
2004/2005	R102.00	R721.84	R619.84	R515.43	16.85
2005/2006	R102.00	R1330.76	R1228.76	R1242.96	-1.16

Source: Safex, 2007

5.6.7 Use Your Maize as Weaner Feed and Sell Weaners

To evaluate this marketing strategy, the following assumptions are made:

- The farmer uses his yellow maize as feed for his weaners and sells the weaners.
- The feeding ration consists of 55 % yellow maize, 20 % Voermol SB100, 10 % soya oil cake and 15 % arogrostis.
- The soya oil cake price (per ton) was calculated as 85 % of the average yearly soya price per ton.

- The average weaner (6 to 7 months old) mass is 220 kg before they are fed.
- The weaners spend 100 days in the feedlot where they gain 1.6 kg per day.
- The average weaner life mass after 100 days is 400 kg and their average carcass mass is 228 kg (57 % of life body mass).

The following results were obtained:

Table 5.16: The Results Obtained from Using Maize as Weaner Feed and Selling Weaners

Season	Price realised per ton maize	Income July Safex – R 100	% Better off using this option
1999/2000	R601.87	R439.93	26.91
2000/2001	R369.65	R781.79	-111.49
2001/2002	R301.83	R1,452.88	-381.36
2002/2003	R473.76	R757.00	-59.78
2003/2004	R596.09	R782.89	-31.34
2004/2005	R722.12	R515.43	28.62
2005/2006	R433.78	R1,242.96	-186.54

Sources: Safex 2007; Afgri, 2007; Red Meat Producers Organization, 2007; Beefcor, 2007

5.7 Comparing the Different Marketing Alternative Results

The alternatives are:

1. *Harvest and Store Maize in Afgri (Co-operation) Silos to Sell at a Later Stage When the Price Increases.*

2. *Pre-Harvest Forward Contracts.*

3. *Harvest and Store in Own Silos.*

4. *Harvest and Store in Silo Bags.*

5.a *Hedge Yourself on Safex (Futures).*

5.b *Hedge Yourself on Safex (Options).*

6. *Sell Maize on Spot Market and Buy Futures Contracts.*

7. *Use Your Maize as Weaner Feed and Sell Weaners.*

Table 5.17: Comparing the Different Marketing Options

Comparing Options	1	2	3	4	5.a
YM & WM					
Season					
1999/2000	16.14	22.45	20.51	**	12.43
2000/2001	13.89	6.06	18.92	**	-7.76
2001/2002	-1.62	-5.76	-2.51	**	-28.78
2002/2003	11.48	29.04	16.97	**	11.92
2003/2004	9.34	38.66	15.02	**	26.35
2004/2005	6.33	8.65	15.08	30.26	-3.86
2005/2006	-15.00	-39.00	-9.61	26.87	-63.91

Table 5.17: Comparing the Different Marketing Options (cont.)

Comparing Options	5.b	6	7
YM & WM			
Season			
1999/2000	5.21	1.63	26.91
2000/2001	1.07	33.19	-111.49
2001/2002	-0.21	-12.71	-381.36
2002/2003	8.35	10.66	-59.78
2003/2004	15.48	-28.96	-31.34
2004/2005	2.43	28.40	28.62
2005/2006	-29.11	6.46	-186.54

Table 5.17 shows the percentage above (positive) or beneath (negative) the "benchmark price" (which is the average yearly July farmer price).

5.8 Analysing the Different Marketing Options

Table 5.18: Analysing the Different Marketing Options

Analyzing Options	1	2	3	4	5.a
Option Success Rate (%)	71.43	71.43	71.43	100.00	42.86
Average % Above Benchmark Price	11.44	20.97	17.30	28.56	16.90
Average % Below Benchmark Price	-8.31	-22.38	-6.06	0	-26.08

Table 5.18: Analysing the Different Marketing Options (cont.)

Analyzing Options	5.b	6	7	Average
Option Success Rate (%)	71.43	71.43	28.57	**66.07**
Average % Above Benchmark Price	6.51	16.07	27.76	**18.19**
Average % Below Benchmark Price	-14.66	-20.84	-154.10	**-31.55**

From Table 5.18 it is evident that marketing options 1, 2, 3, 4, 5.b and 6 have very good success rates of above 70 %. Option 7 has the lowest success rate, only 28.57 % but in order to make a decision on which marketing option is the best, one should look at the picture as a whole. Thus, not only the success rate should be considered, but also the average percentage above or below the benchmark price.

- **Option one's (Harvest and Store Maize in Afgri (Co-operation) Silos to Sell at a Later Stage When the Price Increases)** success rate is well above average on 71.43 %, indicating that, by choosing this option, the farmer will receive prices above the benchmark price 71.43 % of the time. The average percentage above the benchmark price is below average on 11.44 %. The average percentage below benchmark price is

below average on -8.31 % making this an effective, low risk marketing option, with moderate returns.

- **Option two's (Pre-Harvest Forward Contracts)** success rate is 71.43 %, indicating that, by choosing this option, the farmer will receive prices above the benchmark price 71.43 % of the time. The average percentage above the benchmark price is above average on 20.97 %. The average percentage below benchmark is lower than average on -22.38 % making this marketing option effective, a bit more risky with higher returns.

- **Option three's (Harvest and Store in Own Silos)** success rate is 71.43 %, indicating that, by choosing this option, the farmer will receive prices above the benchmark price 71.43 % of the time. The average percentage above the benchmark price is a bit below average on 17.30 %. But, the average percentage below benchmark is well below average on only -6.06 % % making this marketing option very effective, with low risk and good returns.

- **Option four's (Harvest and Store in Silo Bags)** success rate is excellent on 100 %, indicating that, by choosing this option, the farmer will receive prices above the benchmark price 100 % of the time. The average percentage above the benchmark price is above average on 28.56 %. The average percentage below benchmark is 0 % making this

marketing option very effective, with low risk and very good return. Farmers should keep in mind that silo bags are still a relative new concept in the South African market, and there are certain risks involved, as mentioned earlier, when using silo bags.

* Note that two data points are enough to be used for the purpose of this study since it is such a straightforward marketing alternative.

- **Option 5.a's (Hedge Yourself on Safex (Futures)** success rate is below average on 42.86 % indicating that, by choosing this option, the farmer will receive prices above the benchmark price 42.86 % of the time. The average percentage above the benchmark price is also below average on 16.90 %. The average percentage below benchmark price is below average on -26.08 %, making this marketing option very ineffective, with very high risk and moderate return.

- **Option 5.b's (Hedge Yourself on Safex (Options))** success rate is 71.43 %, indicating that, by choosing this option, the farmer will receive prices above the benchmark price 71.43 % of the time. The average percentage above the benchmark price is well below average on 6.51 %. The average percentage below benchmark price is bellow average on -14.66 %, making this marketing option very effective, with low risk and moderate return.

- **Option six's (Sell Maize on Spot Market and Buy Futures)** success rate is below average on 71.43 %, indicating that, by choosing this option, the farmer will receive prices above the benchmark price 71.43 % of the time. The average percentage above the benchmark price is below average on 16.07 %. The average percentage below benchmark price is below average on -20.84 % making this marketing option effective, with moderate risk and return.

- **Option seven's (Use Your Maize as Weaner Feed and Sell Weaners)** success rate is below average on 28.57 %, indicating that, by choosing this option, the farmer will receive prices above the benchmark price 28.57 % of the time. The average percentage above the benchmark price is above average on 27.76%. The average percentage below benchmark price is also very high on -154.10 % making this marketing option very ineffective, with very high risk and good return.

5.9 SUMMARY AND CONCLUSION

From Delta Farming's production data, it is evident that the farmer faces varying total rainfall from one season to the next. Input costs are on the rise, the maize price is very volatile. Thus the maize farmer needs a tool to help him choosing the best marketing strategy for each season.

Delta Farming's financial analyses show that this business' solvency is good. This is due to Delta Farming's low own capital ratio. The growth of the farming business is extremely high mainly due to a 75 % increase in the maize price and a 1.41 % percent increase in yield from the 2005 to the 2006 season.

In the case of Delta Farming there is no current liabilities, thus the liquidity ratios cannot be calculated as such. However, the fact that the current liability of the business is zero; while its current asset value is relatively high it can be assumed that its liquidity is high. Thus Delta Farming's continued ability to meet all current payments and liabilities that are necessary to continue the activities of the business and to be able to take advantage of possible opportunities for expansion or profit-making, is good.

Delta Farming farm profitability is above 15 %, which is good for a farming business since the benchmark is about 12 %..

However, profitability of own capital is slightly less than farm profitability indicating that financing is not utilised effectively. Thus the return on foreign capital does not exceed the cost thereof. Delta Farming has a capital turnover ratio of 0.40..Depending on the intensity of the farming activities, agriculture is normally characterized by a relatively low capital turnover ratio thus this ratio is quite normal. Its cost ratio of 0.62 indicates is not too high for a farming business and its debt servicing ratio of 0.28 is relatively low.
The diagnostic analyses shows the main reasons for achieving a better financial position in the 2005/2006 season (compared to the 2004/2005 season), are a 75 % increase in the

maize price, a 1.41 % increase in yield, a 42 % increase in average yearly weaner price and a decrease in Delta Farming's liabilities.

From the comparison between the different marketing options, taking each option's advantages and disadvantages into consideration, it is evident that a conservative (risk averse) farmer could choose one of the following options:

- Harvest and Store Maize in Afgri (Co-operation) Silos to Sell at a Later Stage When the Price Increases.
- Harvest and Store in Own Silos.
- Pre-Harvest Forward Contracts
- Hedge Yourself on Safex (using Options).

Farmers who are willing to take risks (or are in a strong financial position) for the possibility of a higher price for there maize could choose one of the following options:

- Harvest and Store in Silo Bags.
- Hedge Yourself on Safex (using Futures).
- Sell Maize on Spot Market and Buy Futures Contracts.
- Use Your Maize as Weaner Feed and Sell Weaners.

Chapter 6

MODEL DEVELOPMENT

6.1 INTRODUCTION

In order to develop a budgeting and marketing model one needs to know how model development is done and how the model will be used in order to obtain the objective. There are basically two categories for all the different types of models, namely deterministic and stochastic models based on the type of agricultural system being modelled and two basic approaches to farm simulation namely a normative and a positive approach depending on the purpose of modelling and simulation. The normative approach, implies optimising a system or attempting to quantify "what ought to happen" to the system and the positive approach implies describing a system or attempting to quantify "what is likely" to happen to a system. (Richardson, 2004). To be able to build a meaningful model, previous models in the literature are identified.

6.2 WHAT IS A MODEL?

According to Smith, a model can simply be seen as a representation. A graph that represents a company's sales over time or a map representing countryside can be seen as a model. Thus models characterize either what currently exists in fact, or what might

exist in future (Smith, 1988). Simulation models, more specifically, incorporate risk and answer the positive question of what is the likely outcome (Richardson, 2004). Within a farming business, the main purpose of the model is to provide the farm manager with a guide for evaluating a set of input variables. Models are thus developed to improve our understanding, prediction and control of real-world events. Models can further be described as being descriptive, predictive or normative (Smith, 1988). This distinction delineates the purpose or use of the model in management decision-making.

6.3 DIFFERENT TYPES OF MODELS

As mentioned above, models can be divided into different types to delineate the purpose or use of the model in management decision-making. The types are:

- **Descriptive models:** Models which merely describe a real-world process are seen as descriptive models. They provide a characterization of the nature and working of the modelled process. A simple accounting model for example:

  Profit = Revenue – Costs

  describes a large number of events, such as, sales, purchase of materials, expenditures for labour, overhead costs etc. These models make statements that certain phenomena are produced by other factors. These models are often used to depict large systems due to the large number of variables and interaction (Smith, 1988).

- **Predictive models:** These models are usually more complex than descriptive ones. They don't only describe objectives and events, but they are also designed to predict future events. A sales forecasting model, which predicts the result of the purchase decisions by a firm's customers, is an example of such a model. A time-series regression model, which predicts the impact of advertising reach and frequency on advertising effectiveness, can also be seen as a predictive model (Smith, 1988).

- **Normative (or control) models:** These models not only describe and predict, but provide direction about the proper course of action. Hence, these models are the most difficult to construct. Normative models tell us what should be done, asses the implications of decisions and provide solutions to problems. If we elaborate on the sales forecasting model and include the prices we can charge for our products enabling us to make a decision on what the price should be in the future, then we've got a normative model (Smith, 1988).
- **Ionic (or image) models:** These models are like reality in the sense that they look like reality. Examples of ionic models are photographs, maps, architectural miniatures, and rough layouts of advertisements (Smith, 1988).

- **Symbolic models:** Contrasting ionic models, these models do not look like reality, but emulate reality in other ways. Symbolic models include either verbal, schematic or mathematical forms which describes a specific process (Smith, S.M., 1988).

- **Positive models**: These models, consist of statistical relationships as estimated from historical data as well as accounting identities that are used to simulate a system in order to find positive answers (what the likely outcome of the system is) (Strauss, 2005).

According to Strauss (2005), empirical and mechanistic models are distinguished based on the purpose of modelling and simulating of the system. An empirical model's purpose is to describe a system while the purpose of a mechanistic model is to describe, but also add reason or understanding to the description. The following type of models can also be distinguished:

- **Production oriented models**: Are used to simulate farm production activities in more detail.

- **Budgeting models:** Are basically the accounting system of the farm and its purpose is to describe the financial processes and relationships of the farm within a relatively simple framework of physical production of commodities.
- **Simulation of farms based on the principles of industrial dynamics**: These models describe the basic management processes and relate these

to the basic production processes by means of flow speeds, levels and delays.

- **Enterprise simulation models:** These models incorporate the planning and decision-making processes involved in a specific enterprise of a complex farming system (Strauss, 2005).

6.4 OBJECTIVES FOR MODEL DEVELOPMENT

Models are intended to represent reality or a part of reality. Hence a fundamental issue is the convergence between the model and the reality it is designed to represent. It is expected that the model would confidently represent reality on all significant issues. The criteria of validity and utility should be used by model builders to measure the quality of the models. The accuracy of the model in describing and predicting reality is its validity.

A model which does not represent current or historic reality accurately is probably worse than no model at all. A model should not include so many variables that its basic structure is buried and that it increases decision making time and cost. The accuracy required in the results will determine the completeness and validity required. Model users should not expect a model to make their decisions for them, but the output from a model should only assist the user in making a decision.

Keeping this in mind, models can be excused from not representing reality perfectly, and should be simple enough for the managers to understand and deal with. This, of course, depends on the decision maker's purpose for the model. The value of a model is measured by its efficiency in helping the manager(s) arrive at a decision. Models should only be used if they can help us arrive at results faster, with less expense or with more validity (Smith, 1988).

6.5 BUILDING BLOCKS FOR MODELS

According to Smith (1988), the building blocks for models are:

- **Concepts and constructs:** A concept can be seen as an abstraction formed by generalization about particulars. "Mass", "strength" and "consumer attitude" are all concepts. Conscious inventions of researches to be used for the special research purpose are constructs. When we refer to something (e.g. consumer attitude) as a construct it does not only exist as a concept, but it can be observed and measured and is related to other constructs.

- **Variables:** Constructs studied by model builders are loosely called "variables". Variables are thus constructs that can be measured and quantified. If "consumer attitudes" is treated as a variable it suggests

some form of measurement which has produced data that represents consumer attitudes.

- **Cause and Effect:** Cause and effect is involved due to the relationship between variables. We can, for example, conclude that advertising caused sales to increase. To establish a cause-effect relationship, three conditions must be met:
  - Concomitant variation is necessary. If Y has an effect on X, movement of the two variables must be associated with each other.
  - Proper time order of effects. If we believe that Y has a causal effect on X, then Y should precede X.
  - Absence of competing explanations. To be sure that Y is causing X, One must be sure that other variables are not responsible for the change in X.

- **Operational definitions:** It assigns meaning to a variable by specifying how it is to be measured. Thus, it can be seen as a set of instructions about how we are going to treat a variable.

- **Propositions:** It is a statement of the relationships between variables. An explicit statement of the relationship between variables, including both the variables influencing the relationship and the form of the relationship, is required. Linking propositions together, in a way that

gives us a meaningful explanation for a system or process, produces a model.

6.6 EVALUATING MODELS

As mentioned earlier, the modelling process is helpful to managers because it sensitizes them to variables which are important in explaining a process. It forces managers and researchers to scrutinize and select appropriate variables, and to consider the relationships between them. The model-building process can be evaluated by a using a checklist which consists of some questions e.g.:

- Are concepts and propositions specified in the model?
- Are the concepts relevant at solving the problem at hand?
- Are the principle components of the concept clearly defined?
- Are all concepts relevant in explaining the problem?
- Are the concepts clearly defined and labelled?
- Is the concept specific enough to be operational, reliably and with validity?
- Are assumptions made in the model clear?
- Are the limitations of the model stated?
- Does the model predict?
- Does the model explain?
- Can the model be readily quantified?

- Are the outcomes of the model supported by common sense? (Smith, 1988).

6.7 PREVIOUS MODELS

According to Geyser (2000), a revolution was caused by the Agricultural Marketing Act No 47 of 1996. This act deregulated the grain marketing environment in South Africa and a vast number of adjustments were needed. Producers now faced a great risk as far as grain prices and investment were concerned. It became very important for producers to change their view on marketing. Marketing planning and marketing management should form an integral part of overall farm management.

Geyser posed the question whether a decision support system could be developed to manage investment risk faced by grain producers who have to market their crop. She made use of integer linear programming to develop the first Marketing Decision Support System (MDSS) for South Africa. Its aim was to develop the optimal combination of marketing instruments to optimize crop net return. Net cash flows of producers were determined by using various marketing instruments. Then the net return per ton for each marketing instrument was determined. The optimal combination of marketing strategies was determined by using integer linear programming. The marketing strategies used in this study were: forward contracts, futures, options and the spot market.

A farm-level modelling approach was followed by Strauss (2005). He developed a model to analyze the likely impact of change in policies and markets on the South African agricultural sector- or more specific, the financial viability of the farm. According to Strauss, the lack of analyses leads to a lack of understanding of the agricultural sector's environment, therefore increasing the difficulty of making decisions with regards to policy and business strategy.

He followed a positivistic approach, since questions like "what is the likely impact" and not questions like "what ought to be" was asked. Due to this approach, the model has the disadvantage that validation and verification are difficult and time consuming resulting from a lack of accurate and detailed data. This approach also entails that assumptions are made that very little adjustments in terms of the farm structure take place during the simulation process. Furthermore, the model assumes no risk. The modeller also needs theoretical as well as practical knowledge of the system modelled and simulated

Louw (1979) developed a simulation model, of the decision-making process in farm firms, to determine the effects of different growth strategies on firm growth under dynamic circumstances which include risk and uncertainty. Possibilities for expansion or rent were examined and results from the previous year were examined, since the current year's operational plan was partly determined by the success of the previous year's plan. Deterministic and stochastic models were used to test five different land procurement policies. In the stochastic model a random number generator was used to fluctuate yields and prices, repeating each case twenty times.

Results indicated that net worth is largely determined by the rate at which the operator gains control over land. The deterministic model showed that, under moderate inflation, the most liberal strategy (purchase and rent at every opportunity) with the conservative credit limitation gave the best results. The stochastic model suggested, however, that a deterministic analyses over-estimates results markedly and that price and yield variability tended to decrease the end net worth substantially

Although the simulation model yielded elucidatory information for policy purposes, aspects such as income tax, interest rates and medium term credit prevision require further attention.

Richardson, et al. (1981) developed a farm level income and policy simulation model (FLIPSIM). It is a Fortran computer programme designed to simulate the effects of alternative commodity programmes and income tax regulations on the survival, growth, and success of typical farms. It is a recursive; stochastic, firm-level simulation model which simulates a typical farm over a multiple-year planning horizon. Different sizes and types of crop and livestock farms can be simulated with the model. The output variables, such as economic success and remaining solvent are summarised in terms of probabilities

The model can also simulate livestock and dairy farms, mixed farms (grain and livestock), grain farms, different farm programmes, risk management strategies, technologies and income tax provisions.

6.8 SUMMARY AND CONCLUSION

There are basically two types of models, namely deterministic and stochastic models and two basic approaches to farm simulation namely a normative and a positive approach depending on the purpose of modelling and simulation. The model developed for this study is a positive model that simulates a system in order to find positive answers. It is also a budgeting model and describes the financial processes and relationships of the farm within a relatively simple framework of physical production of commodities.
The value of a model is measured by its efficiency in helping the manager(s) arrive at a decision. Models should only be used if they can help us arrive at results faster, with less expense or with more validity (Smith, 1988).

According to Geyser (2000), the deregulation of the grain marketing environment in South Africa caused a vast number of adjustments as far as grain marketing is concerned. Producers face a great risk as far as grain prices and investment are concerned. It is very important for producers to change their view on marketing. Marketing planning and marketing management should form an integral part of overall farm management. She developed a marketing decision support system (MDSS) for South Africa. Its aim was to develop the optimal combination of marketing instruments to optimize crop net return.

Strauss (2005) stresses the importance of analyses to understand the agricultural sector's environment, leading to better decision making with regards to policy and business strategy.

Louw, (1979) developed a simulation model, of the decision-making process in farm firms, to determine the effects of different growth strategies on firm growth under dynamic circumstances which include risk and uncertainty.

Richardson, et al. (1981) developed a farm level income and policy simulation model to simulate the effects of alternative commodity programmes and income tax regulations on the survival, growth, and success of typical farms.

From all these previous studies done, it is evident that farmers face great difficulty and risk regarding variables outside their control. It stresses the importance of developing tools (in the form of simulation models) to assist producers in their decision making. For the representative farm located in the Mpumalanga Highveld there are so many different maize marketing options available, increasing risk and uncertainty, that it makes sense to develop a budgeting and marketing model to assist in marketing decision making.

Chapter 7

BUDGETING AND MARKETING MODEL

7.1 INTRODUCTION

This model was developed to assist a representative farm located in the Mpumalanga Highveld in making the correct marketing decision hence obtaining its goal of optimizing profit and minimizing risk. It uses the farm setup, financial statements (including the balance sheet, income statement and cash flow statement) and financial analyses ratios (comparing the last season with the next season) to show the farming business' financial position. It gives the farmer eight marketing options to choose from. The model user can run countless scenarios to see the exact effect each one will have on the business's financial position and it shows each marketing option's possible advantage or disadvantage.

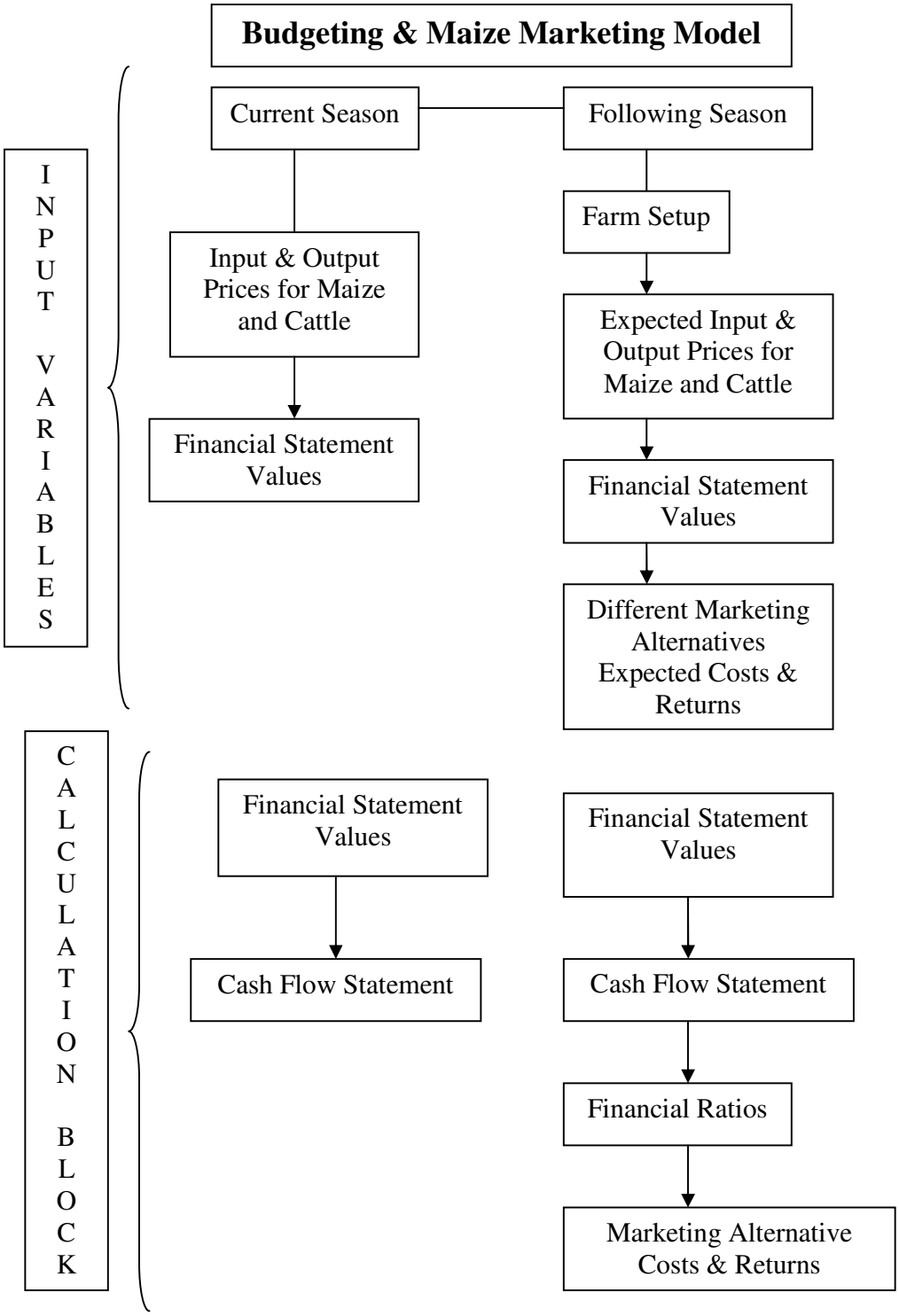
7.2 HOW THE MODEL WAS DEVELOPED

As suggested by Richardson (2004), the top down approach was used where the output variables were determined first and then it was worked backwards to determine the equations and parts of the model needed to properly calculate the output variables. The

model consists of various input and output variables. The model user simply fills in the needed input variables and the model determines the output variables.

7.3 MODEL LAY OUT

Below is a schematic representation of how the model works. The model consists of various input variables for both the current season (historical data) and the following season (budgeted and estimated data). It uses various calculations to determine certain values which eventually lead to the output block. The output block displays what the user would obtain when making certain decisions. It is evident that this is a positivistic model and consists of statistical relationships as estimated from historical data, as well as accounting identities that are used to simulate a system in order to find positive answers.


Budgeting & Maize Marketing Model
INPUT VARIABLES
Current Season
Following Season
Input & Output Prices for Maize and Cattle
Financial Statement Values
Farm Setup
Expected Input & Output Prices for Maize and Cattle
Financial Statement Values
Different Marketing Alternatives Expected Costs & Returns
CALCULATION BLOCK
Financial Statement Values
Cash Flow Statement
Financial Statement Values
Cash Flow Statement
Financial Ratios
Marketing Alternative Costs & Returns

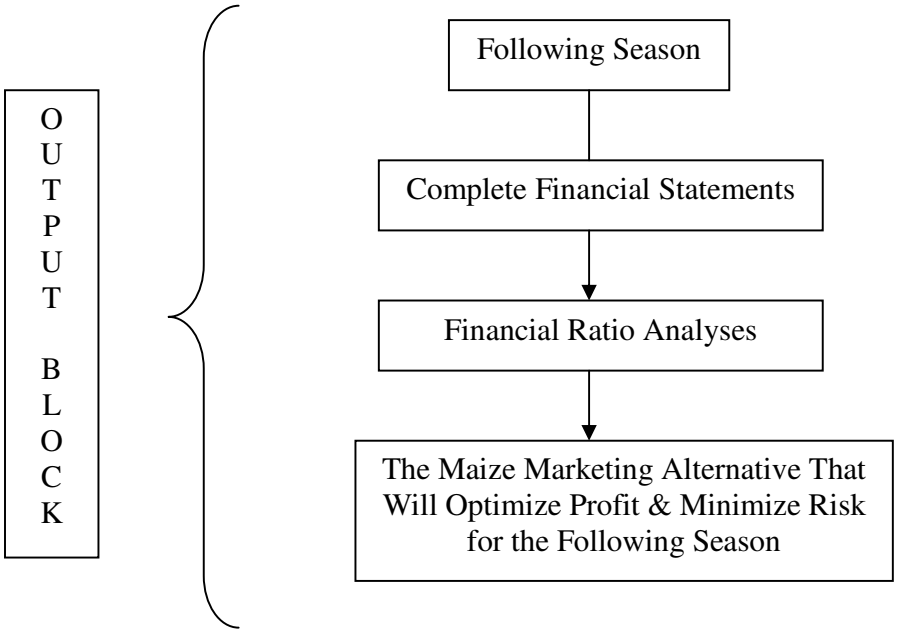


Figure 7.1 Budgeting and Maize Marketing Model Lay-Out

7.4 HOW THE MODEL WORKS

In the input block (Figure 7.1) the model user inserts various input variables namely:

- Hectares of dry-land maize produced.
- Expected yield per hectare.
- Number of cattle.
- Direct input costs per hectare for producing maize.
- Interest on input costs (if the farmer has to finance his inputs).
- Storage or hedging costs (if applicable).
- Owner's annual compensation.
- Average Product prices.

- Financial statement values, including the balance sheet, income and cash flow statements.

Note that these input variables are for both the current season (actual historical data) and the following season (budgeted and estimated values).The following input variables are only for the following season:

- Average Safex prices per ton of maize.
- Futures and Options prices.
- Brokerage fees.
- Handling and storage costs for maize.
- Number of weaners, average mass and price per kg. life mass.
- Number of days in feedlot, average daily mass increase and average carcass price per kg.
- Different feed ration prices.

In the calculation block (figure 7.1), the model calculates the following:

- Total input costs for maize.
- Income, cost and profit or loss per hectare.
- Average Safex and farmer prices per ton of maize.
- Option prices.
- Income and cost per weaner.
- Total value of livestock (cattle).

- Labour Cost per month and per hectare.
- Total income, farming profit and net worth.
- The balance sheet and cash flow statements for both the current and following season.
- Average monthly future and farmer prices per ton of maize.
- Cash flow risk ratio.
- Total tons of maize that needs to be hedged.
- Net income per weaner when in feedlot.
- Price realised per ton of maize when maize is fed to weaners.

In the output block (figure 7.1), the model displays the following:

- Complete financial statements (including the balance sheet, income and cash flow statements).
- Complete financial ratio analyses including: solvency, liquidity, profitability and efficiency.
- The different marketing alternatives' income after cost.
- The "percentage better off" for each marketing option.
- The comparison of all the marketing options.

7.5 THE THREE SCENARIOS FOR DELTA FARMING

For the purpose of this study, three scenarios are run which represent the most general maize marketing environments in which a maize farmer (specifically Delta Farming) can find himself. This will assist the farmer in selecting the optimal marketing strategy for the next season.

7.5.1 Scenario One (Over Supply of Maize)

This is a situation where there is either a bumper crop in the current season or a surplus from the previous season. Obviously this is the producers' less favourite scenario because it is the time when prices are at its lowest. However, if a farmer's yield for that year is percentage-wise higher than the price decrease and they she use the correct marketing strategies, it will offset the affect of the decreased price.

7.5.2 Scenario Two (Perfect Conditions)

Economically speaking, 'perfect conditions' normally implies that supply equals demand (Blackmore, et al., 2002) In the South African maize market, however, perfect conditions are most probably seen as supply exceeding demand by not more than 1.5 million tons since 900 0000 tons are needed for reserves and the country exports about 500 000 tons to its neighbours (Hawkins, et al., 2006). This ensures good enough prices for consumers

to make a living, for millers to mill profitably and for South Africa as a country to be food secured.

7.5.3 Scenario Three (Under Supply of Maize)

This is a scenario which very seldom occurs in South Africa. This scenario can either occur when there is a huge increase in consumption, some natural disaster (hail or drought) occurs or the area of maize planted decreases dramatically for some reason. Table 7.1 below indicates the expected maize prices for each of the three scenarios.

Table 7.1 Expected Maize Prices for Each Scenario

Scenarios	Avg Safex price	Average farmer price	Expected Avg Yield (t/ha)
Scenario 1 (Demand < Supply)	R1245.00	R1145.00	5.4
Scenario 2 (Demand = Supply)	R1500.00	R1400.00	4.5
Scenario 3 (Demand > Supply)	R1800.00	R1700.00	3.8

The three scenarios are ran using the data of the last season (2006/2007) and estimated figures for the coming (2007/2008) season. Note that the "average Safex price" used was obtained from market analysers at the time the scenarios were ran. The "expected average yield" was determined from historical data obtained from the Middelburg Akkerbou Forum.

7.6 ASSUMPTIONS FOR RUNNING THE THREE SCENARIOS

To enable the model user to compare the results obtained from the model, it is necessary to make some assumptions:

- The farm setup remains unchanged for all three scenarios.
- The budgeted direct input costs are increased by 12 % (the average increase for direct input costs for the Middelburg Akkerbouforum) from the previous season.
- Delta farming harvested an average of 4 tons per hectare and received an average price of R1 600-00 per ton.
- The beginning bank balance is R100 000-00 in the previous season.
- If the new bank balance is positive, the farmer receives 0 % interest, since there is no interest on a positive cheque account since April 2005 (SARB, 2006). If it's negative the farmer pays 12 % interest (the interest rate on an overdraft during the last quarter of 2006 (SARB, 2006)).
- All the other balance sheet figures were calculated from, as a continuation from Delta Farming's financial statements.
- All the figures used for determining the selling options results are realistic estimates and may vary from user to user.

The following financial analyses ratios were calculated by the model for each of the scenarios:

Table 7.2: Comparison of the financial analyses results for the three scenarios

Description	Scenario 1	Scenario 2	Scenario 3
Net Capital Ratio	14.41	14.60	14.87
Leverage Ratio	2.60	2.24	1.88
Own Capital Ratio	0.03	0.03	0.04
Growth of business	-39.83 %	-30.07 %	-16.73 %
Intermediate ratio	24.22	24.72	25.40
Average total capital employed	R21,980,102.84	R22,138,052.84	R22,354,052.84
Farm profitability	10.55%	11.27%	12.23%
Average own capital	R20,135,614.84	R20,293,564.84	R20,509,564.84
Profitability of own capital	8.84%	9.64%	10.71%
Capital turnover ratio	0.23	0.23	0.23
Cost ratio	0.76	0.75	0.73
Debt servicing ratio	0.16	0.16	0.16

From Table 7.2, it is evident that Delta Farming's financial position is best of with scenario 3 and worst of with scenario 1. Note that the negative business growth is due to the estimated 12 % increase in all direct input costs. Furthermore the previous season (2006/2007) was a very good year for Delta Farming with an average yield of 4 tons per hectare and an average price of R1 600-00 and lower input costs. Due to the fact that Delta Farming has no current liabilities, the current ratio cannot be calculated.

* Note that for each of the selling alternatives, the assumptions made in the model are the same as in sections 5.6.1 to 5.6.7.

Comparing the model output for the three scenarios, the following results were obtained as far as the different marketing alternatives are concerned:

Table 7.3: Comparing the "percentage better off using this option" for each of the three scenarios

Marketing Alternative	Scenario 1	Scenario 2	Scenario 3
1	3.35	4.65	5.65
2	10.13	9.98	9.87
3	6.76	8.25	9.40
4	10.14	10.94	11.57
5.a	14.04	-36.58	-70.25
5.b	0.83	-3.15	-16.85
6	-1.45	2.37	5.33
7	-80.45	-194.73	-627.57

Note that the "percentage better off using this option", is calculated using the average yearly July farmer price for maize as a percentage of the profit made using each particular marketing strategy. The average yearly July farmer price for maize is the price that a farmer would receive if he or she didn't make use of any of the mentioned marketing options.

As Table 7.3 indicates, for scenarios one, two and three, Delta Farming would be best off using *marketing alternative 4,* **Harvest and Store in Silo Bag**. However, it should be kept in mind that storing in silo bags can be risky as far as the quality of the maize is concerned.

Analyzing the other marketing options it is evident that:

Marketing Alternative 1, **Harvest and Store Maize in Co-operation Silos to Sell at a Later Stage When the Price Increases**, is very consistent for all three scenarios. Storage and handling costs should be kept in mind here.

Marketing Alternative 2, **Pre-Harvest Forward Contracts**, is very consistent as well and yields a better return than option one. However, one should be careful when entering a contract especially when it comes to the small print.

Marketing Alternative 3, **Harvest and Store in Own Silos**, is very consistent for all three scenarios and yields a good return. Note that erecting one's own silos might require quite big initial capital outlays, but once the farmer pays off the last debt on his own silos, there will be no direct storage cost to subtract from the maize price, which will make this option very profitable.

Marketing Alternative 5.a, **Hedge Yourself on Safex** (Futures), is not consistent at all and is a good example of what could happen if the futures market turns against the farmer's position on Safex.

*Marketing Alternative 5.*b, **Hedge Yourself on Safex (Options)**, is also not consistent, but is less risky than option 5.a.

Marketing Alternative 6, **Sell Maize on Spot Market and Buy Futures Contracts**, can be considered as a marketing option when in scenario 2 or 3, but it might be risky if the market moves in the opposite direction than anticipated.

Marketing Alternative 7: **Use Your Maize as Weaner Feed and Sell Weaners**, shows a negative percentage for all three scenarios, thus in this case, Delta Farming would not be better off feeding its maize to its own cattle. However, one should note that feed rations can differ quite significantly from the one used in this study which may lead to a different result.

7.7 SUMMARY

The Budgeting and Marketing Model is discussed in this chapter as far as how the model works, the three scenarios for Delta Farming, and the comparison of the model's output is concerned.

From the model output it is evident that Delta Farming would be best off using marketing alternative 4 (Harvest and Store in Silo Bag). However, it should be kept in mind that storing in silo bags can be risky as far as the quality of the maize is concerned. Marketing alternatives 1 (Harvest and Store Maize in Co-operation Silos to Sell at a Later Stage When the Price Increases), 2 (Pre-Harvest Forward Contracts) and 3 (Harvest and Store in Own Silos) are very consistent for all three scenarios and marketing strategies 2 and 3 yields good returns and might be considered the two best marketing alternatives for Delta Farming.

Chapter 8

Summary and Conclusion

The abolishment of the grain marketing boards in the late 1990's brought about many business opportunities, but with it came a lot of challenges with respect to grain marketing. Grain producers are exposed to a very volatile grain market and face great uncertainty and risk as far as their grain prices on the one hand and input costs on the other hand, are concerned. With a wide variety of marketing strategies available to the South African maize farmer, it is extremely challenging to choose the correct strategies to market their maize.

For this reason the general objective of the study is as follows:
To examine different maize marketing strategies and to determine the optimal marketing strategy for a representative farm located in the Mpumalanga Highveld for a specific season under volatile marketing and environmental conditions.

This was done by constructing and validating a representative farm in the Mpumalanga Highveld by utilizing production data and financial statements from the Middelburg Akkerbouforum (an agricultural study group). Various maize marketing strategies, available to the representative farm, were identified and all the advantages and disadvantages of each available marketing strategy or alternative were determined. A complete representative farm setup was developed and validated. A budgeting and maize

marketing model was developed to determine the optimal marketing strategies which will yield the highest profit and minimize price risk for the representative farm.

One can conclude that a budgeting and maize marketing model, that will assist a typical Highveld maize farmer to choose a marketing strategy in varying market and environmental conditions that will maximize profit and minimize risk, can be developed and validated successfully.

Appendix A

Table A.1: The Balance Sheet for Delta Farming

DELTA FARMING BALANCE SHEET ON 31 JULY 2006			
	2006	**2005**	**2004**
ASSETS			
Fixed Assets	12690000	12490000	12290000
Medium Term Assets	1643008	2053760	2567200
Current Assets	13558681.66	7262898	8577524
Bank	3184362.591	973403.5	100000
Crop on fields or in storage	7480188.693	3978107	6382396
Livestock on hand	2894130.374	2311388	2095128
TOTAL ASSETS	**27891689.66**	**21806658**	**23434724**
EQUITY AND LIABILITIES			
Capital Account	25208089.66	18281258	19067524
Owner's equity	23649393.37	18154721	19743505
Profit for the year	1558696.29	126536.8	-675981
Liabilities	2683600	3525400	4367200
Medium term loans	1283600	1925400	2567200
Long term loans	1400000	1600000	1800000
Total Equity and Liabilities	**27891689.66**	**21806658**	**23434724**
Net Worth	**25208089.66**	**18281258**	**19067524**
Growth in Net Worth	6926831.482	-786266	*

Table A.2: The Income Statement for Delta Farming

DELTA FARMING INCOME STATEMENT FOR THE YEAR ENDED 31 July 2006			
	2006	**2005**	**2004**
INCOME	**10862580.37**	**8795848**	**7146658**
Products sold			
Maize	9858450	8099460	6571530
Livestock sold	1004130.374	696388	575128.1
EXPENCES	**6780881.598**	**6820604**	**6198767**
Seed (36000 Plants per ha)	707250	694721.4	619155
Fertilizer	1432335	1355557	1353090
Lime	120465	186754.5	227595
Herbicides & Pesticides	424215	464502.7	468720
Diesel & Oil	684300	667381	561000
Repair & Maintenance	648820.2183	524211.1	606405
Insurance	230730	242221.4	227970
Diverse	314310	293306.2	238560
Labor	353640	350126.9	343620
Advertisements	1500	1200	985
Banking costs	18015.42	20671.5	15776
Electricity	58800	54000	47400
Vaccines and Medicine	27420	19113	18576
Gas en Lamp oil	21977.86	23658	19564
Membership and Course fees	20400	18000	5600
Licks and feed	59112.9	53739	48954
Livestock bought	36000	35000	31000
Licenses	10977	15380	11456
Maintenance on land and buildings	35737.59	62216.5	27807
Telephone, post, stationary	27650	25800	23600
Maintenance on vehicles and implements	365763.81	474048.5	178900
Depreciation	410752	513440	641800
Storage Cost	770709.8	725555.4	481233.9
Net Farm Income	4081698.776	1975244	947891.2
Medium term loan capital payment	641800	641800	641800
Mortgage and rent of land	200000	200000	200000
Interest paid	379794	387794	480392
Compulsory Capital Redemption	841800	1229594	1322192

Farming Profit	**3239898.776**	**745649.6**	**-374301**
Owner's compensation	320445	305940	301680
Income TAX	1360757.486	313172.8	0
Net Farm Profit	**1558696.29**	**126536.8**	**-675981**

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