Financial benchmarking analysis: Northern Cape farmers

By

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Declaration

"I declare that the Study hereby submitted for the Magister in Agriculture Economics at the Department of Agriculture Economics, University of the Free State, is my own independent work and that I have not previously submitted this work, either as a whole or in part, for a qualification at another university or at another faculty at this university. I also hereby cede copyright of this work to the University of the Free State."

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J.I.F. Henning

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Janus Henning
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Financial benchmarking analysis: Northern Cape farmers

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Abstract

The primary objective of the study was to develop a financial measurement-based benchmarking system for GWK on the financial status of their producers. Financial benchmarking systems provide the producers with opportunities to evaluate their past and current financial performance, not only to their own financial status but also to other producers that are included in the benchmarking data. To have a better understanding of the performance of the farm's financial status and to have a possible explanation of why certain changes had occurred, the first secondary objective was to compare trends of the whole agriculture sector of South Africa with those that occurred to the GWK producers in the study. It was found that the GWK producers had followed more or less the same trends than those experienced by the South African agricultural sector.

After the trends were compared between GWK producers and the South African agricultural sector, the limited financial statements obtained from GWK, were analyzed by calculating the financial measurements for each farm over the five years. This was done in order to determine the border values that can be used to divide each measurement into three performance groups. These groups will be used to determine the position for each measurement of a farm relevant to the other farms in the benchmarking system. When the producer has seen the indication that a certain measurement is in the midpoint of bottom performance groups, he knows there are other options available to improve that position, as is already being done by other producers. This leads to another secondary objective that was identified and analyzed.

When a producer wants to improve one or even more than one financial measurement, certain changes have to be made that will influence the income statement and balance sheet. As these statements are interactive and a change in one area of the statement will have an influence on the overall results, it is necessary to have an idea or indication of what these influences can be. To provide some background on what the possible outcomes can be the correlation between the measurements and their determinants were determined. These correlations will provide important information on what the possible results of a certain change by a producer on a farm can be. As the financial market is ever-changing, the changes cannot always be hundred percent predictable, but one can at least provide an idea of what can be expected.

The last secondary objective is to rank the farms according to their operating efficiency for each enterprise, using DEA. As results indicated, this method of benchmarking can be used in coordination with the border measurement benchmarking system. The difference that exists is that the DEA benchmarking system only divides the farms into two groups as being efficient and inefficient. These two groups can be compared to the results obtained from the border measurement benchmarking system; the farms identified as being the efficient ones are mostly the farms that had most of their financial measurements in the top performance and the top half of the midpoint performance groups. The opposite is also true for the farms identified as being inefficient.

Conclusions and recommendations from the study include that a benchmarking system can provide very important information to producers on the performance of their farms, not only to past performance, but also with regard to their rivals. When certain adjustments have to be made to improve the performance of the farm, it is important to remember the possible correlation that exists between the financial measurements and what the possible outcomes can be. The correlation between the measurements is also a point that is available for future research. Lastly, it is recommended that when a farm's financial position is benchmarked to other competitors, more than one benchmarking system is to be used. This will provide more accurate information to the actual performance of the farm, as a wider spectrum is covered by using for example the border measurement and DEA benchmarking systems.

Finansiële "benchmarking" analise: Noord Kaap boere

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Samevatting

Die primêre doel van die studie was om 'n finansiële "benchmarking" stelsel vir die GWK handels area te ontwikkel. Finansiële "benchmarking" bied aan produsente die geleentheid om hul historiese asook huidige finansiële prestasies te evalueer, nie net teenoor hul eie prestasies nie, maar ook teenoor die prestasies van ander produsente in die distrik. Om die finansiële status van die GWK distrik produsente beter te verstaan en redes vir hoekom sekere veranderings plaas gevind het, is die eerste sekondêre doelwit om die tendese van die Suid Afrikaanse lanbou te vergelyk met die tendese van die GWK distrik produsente. Die gevolgtrekking is dat die produsente van die GWK distrik min of meer dieselfde tendense gevolg het as wat deur die Suid Afrikaanse landbou sektor ervaar was.

Nadat die tendense vergelyk was, is die finansiële state, verkry vanaf GWK Beperk, ge analiseer deur die finansiële maatstawwe te bereken vir elke plaas oor vyf agtereenvolgende jare. Die analise is gedoen om die grens waardes te bereken wat elke maatstaf in drie prestasie groepe verdeel. Hierdie groepe word gebruik om die posisie van 'n plaas relatief tot ander plase in die "benchmarking" sisteem te bepaaal. Wanneer die produsent 'n indikasie kry dat 'n sekere maatstaf in die middelste of onderste prestasie groep verdeel is weet die produsent dat daar wel opsies beskikbaar is om die maatstaf posisie te verbeter, wat alreeds deur ander produsente bereik is.

Wanneer 'n produsent een of selfs meer as een finansiële maatstaf wil verbeter moet sekere veranderings plaasvind wat die inkomste- en balans- staat affekteer. Die finansiële state is interaktief en 'n verandering en een area sal 'n effek op die ander finansiële staat veroorsaak. Daarom is dit nodig om 'n idée te ontwikkel van wat die

moonltike veranderinge en gevolge kan wees. Om moontlike idees te skep is die korrelasies tussen die maatstawwe en hul determinante bereken. Korrelasies wat nodige inligting kan verskaf oor die moontlike gevolge van ‘n verandering wat deur ‘n produsent gemaak word. Omdat daar voortdurende veranderng plaasvind in die finansiële mark, kan die verandering nie altyd honderd persent voorspel word nie. Hierdie is slegs moontlikhede wat verwag kan word.

Die laaste doelwit is om die plase in ‘n rangorde, volgens hul bedryfsdoeltreffendheid, vir elke bedryfstak te bepaal. Die rangorde word bepaal volgens die “Data Envelopment Analysis” (DEA) metode. Resultate het getoon dat die DEA as ‘n “benchmarking” sisteem in samewerking met die grensmaatstaf metode gebruik kan word. Die verskil tussen die metodes is dat DEA die produsente in twee groepe verdeel as doeltreffend en ondoeltreffend. Hierdie twee groepe kan vergelyk word met die grens maatstaf metode. Plase wat as doeltreffend geïdentifiseer is, is die plase in die boonste prestasie groep, of in die boonste helfte van die middel prestasie groep. Die teenoortgestelde is dan van toepassing om die ondoeltreffende plase in die onderste prestasie groep.

Gevolgtrekkings en voorstelle na afloop van die studie sluit in dat ‘n “finansiële “benchmarking” belangrike inligting aan produsente kan deurgee oor hul prestasie. Die inligting is nie net van toepassing oor hul historiese prestasies nie, maar ook oor huidige en teenoor mededingers se prestasies. Wanneer sekere veranderings gemaak word om die prestasies te verbeter is dit belangrik om te onthou dat daar korrelasies bestaan tussen die finansiële maatstawwe en wat as gevolg daarvan die gevolge kan wees. Korrelasies tussen die maatstawwe is ook ‘n onderwerp vir verdure studies.

Ten slotte word voorgestel dat wanneer ‘n plaas se finansiële posisie “gebenchmark” word tenor ander mededingers, moet daar van meer as een sisteem gebruik gemaak word. Dit verseker dan dat akkurate inligting teenoor die prestasie van die plaas deurgegee word as gevolg van die wyer veld van inligting en resultate wat verwerk word. ‘n voorbeeld van twee sisteme is dan die grens maatstaf en DEA wat gesamentlik gebruik was in die studie.

List of abbreviations

AAFC – Agriculture and Agri Food, Canada

CDRC - Capital debt repayment capacity

DAFF – Department of Agriculture, Forestry and Fisheries

DEA – Data Envelopment Analysis

FFSC – Farm Financial Standards Council

FINAN – Year-end analysis

FINFLO – Cash flow planning

FINLRB – Financial long-term planning

GWK – Griekwaland – Wes Korporatief

NFI – Net farm income

ROA –Rate of return on assets

ROE – Rate of return on equity

RSA – Republic of South Africa

U.S.A – United States of America

WisDRBT - Wisconsin Dairy Farm Ratio Benchmarking tool

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Chapter 1
Introduction

1.1. Background

To manage a business is much like being an aircraft pilot, the operator has to make regular adjustments to stay on the intended course. Farming is similar to any kind of business that has to be managed to have an optimal performance. With farming the producer[1] has to use his financial statements to guide him through the management process.

According to Barry, Ellinger, Hopkin, and Baker (1995) financial management can be described as the acquirement and use of financial resources and protection of equity from various sources of risk. Future plans depend heavily on certainty of decision-making and the linkage between time and risk that influence the certainty under which decisions are made. The producer makes daily decisions that have an influence on the profitability of the farming business. These daily decisions have an impact on the financial performance of the farm and therefore essential to take daily decisions into account in the financial management of a farm.

Agriculture producers, and probably any other group, are under pressure to perform economically by creating livelihoods and profits for themselves and also affordable food, fibre and fuel for other people and at the same time, while doing this, minimizing the damage to the environment (Jack, 2009). Volatility in commodity prices and income has become a major part of agriculture and made it even more important for the producer to closely monitor the financial position of a farm (Boehlje, Dobbins, Miller, Miller and Barnard, 1999). Most producers concentrate on the production rather than on planning, financial record-keeping and marketing (Pena, Klinefelter and Warmann, 1999). By just concentrating a bit more on planning, financial recordkeeping and marketing, several

[1] Producer refers to the person that is managing the farm or making the financial decision.

advantages can be obtained, amongst which the identification of future problems and opportunities. With the use of continued analysis the producer is equipped to identify errors made in the past, which will prevent the same errors being made in the future. Information that is used is extremely important; with accurate information many benefits can be utilized.

A great challenge is to collect and sort significant information for the purpose of making decisions (Crane, 2004). The core of managing risk is to make good decisions. Correct decision-making depends on accurate information and analysis. Thus, one needs to be alert, because accurate financial record-keeping is very important since the decisions that are made, are no better than the information on which they are based (Crane, 2004). A record-keeping system should at least facilitate the preparation of financial systems and monitoring of the performance. Producers need financial statements to keep the business on track by comparing the actual performance to the planned performances and importantly taking action when things go astray (Pena *et al.,* 1999).

The most useful coordinated financial statements which are used for summarizing a farm's financial position include the following three financial statements: Balance sheet, income statement and the cash-flow statement (Crane, 2004 and Pena *et al.*, 1999). An effective system and producer must be able to use these statements to determine the financial position and performance at any time. Analyzing the financial progress, these statements must be evaluated over several years (Pena *et al.*, 1999) and not for a single year. By doing the analyses over several years, certain trends can be identified and this will help with important decision-making for the future regarding the farm (Crane, 2004). Identification of trends and the effect of certain decisions that were made, help the producer with the planning of operations for the following years. The producer must be able to identify where the business's financial position is, has been and where it is going (Pena *et al.,* 1999). If producers are unable to read and interpret their financial statements they are unable to determine how their business is performing, or where it is heading.

Interpreting of up to date financial statements is crucial for farm management. The financial statements can be analysed with the use of certain financial measurements[2] and benchmarking techniques (Blocker, Ibendahl and Anderson, 2003). These measurements can be used to analyse performance over time or to compare (benchmark) the operation against other operations and measurements. The measurements assist in identifying areas that needs to be examined and may need some adjusting. Therefore, it can also be used to benchmark a producer, or a group of producers, in an industry against norms that can be used to identify areas of weaknesses in a group or individual. The measurements can be compared to acceptable norms or be used as a benchmarking tool.

1.2. Problem statement

Financial benchmarking is becoming increasingly important in agriculture, as it provides a system that can be used to analyze the financial performance of the farm with the performance of others in the same area or industry. In South Africa there are only a few benchmarking systems or programs that analyse the farms according to financial measurements to establish certain norms that can be compared. In other countries around the world there are some established programs in use to do these analyses and provide some information to the producers.

A question asked by producers is just how financially healthy their farm is? This is a question asked by most producers when analyzing their financial statements and work with lenders to get that exact fine-tune of their operations (Craven, Nordquist and Klair, 2011). An answer to this question can be to benchmark the operation, where the amounts of your farm are compared to those amounts of similar farms. According to Craven *et al.* (2011), and Vogt (2010), the idea of benchmarking is gaining momentum in agriculture (Vogt, 2010).

When considering financial benchmarking systems it is important to distinguish between the different types of financial benchmarking. A number of financial benchmarking systems exist that use the financial statements of farms to calculate measurements that

[2] Measurements include calculations of financial ratios and currency values

are used for benchmarking and then there are also systems that use financial information to benchmark the production systems used on the farm. In its proper based form, benchmarking is based on the things that are done on the farm, how the things are done and what the consequent outcomes are in the form of productivity and financial positions (Ronan and Cleary, 2000).

Benchmarking is an important tool that assists an individual to improve the performance of the farm operations. The process helps the producer to identify the strengths and weaknesses which in turn, help to make better business decisions and to take advantage of future opportunities (Clarke and Rodier, 2006). Clarke *et al.,* (2006) explains that they have developed an innovative and unique interactive tool that gives producers the opportunity to compare their financial performance with the performance of others; which are farm operations that are similar in size, type and region. To compare (benchmark) the farm's financial performance against the performance of other farms is a powerful farm management tool. These comparisons can lead to improved decision-making, identification of trends and pitfalls. To provide the Canadian producers with a tool which they can use to benchmark their performance, Agriculture and Agri Food, Canada's (AAFC) had provided them with the interactive tool: Benchmarking for Success. This tool is available from a web based and CD platforms to producers (Clarke *et al.,* 2006). The tool has been developed by AAFC with assistance from Instrux Media in Canada, available in English and French to all producers, at no cost. All that is required from the producer is his financial information necessary to complete a simplified income statement and balance sheet.

The tool has several characteristics that provide feedback to the producer. It has the ability to input five years of financial information, access to five years of financial benchmark information, industry benchmark for 14 regions, 10 commodity groups and 8 revenue categories, graphics to display trends, combined with benchmarking and trend analysis. This website has, however, been discontinued.

Agri benchmark is a global network of farm economists that are generating sustainable, comparable, quantified information about farming systems worldwide. The system's

goal is to develop powerful tools for a worldwide analysis of agricultural branches, compare typical farms through production systems, production costs, competitiveness and future development. South Africa became a member of the Agri benchmark beef and sheep network in 2007 (Deblitz *et al*. 2009).

FINPACK is another software package which provides information for planning the activities of farms and evaluating their efficiency (Ferrara, Nordquist and Ciani, 1996). This software was developed by the Centre of Farm Financial Management at the University of Minnesota, U.S.A in 1972 and has already been developed into more than eight versions, being the leader in the farming industry (Kurtz, 2009). The software satisfies the needs of producers with a profitability, liquidity and solvency analysis with the use of main components like the balance sheet, data banks, financial long-range planning, cash-flow planning and year-end analysis.

The aim of the FINPACK software is to optimize farm financial management, but while optimizing farm management it also includes family management. Family management is included in the model by including non-farm assets and liabilities in the balance sheet. Deferred liabilities are also included in FINPACK, that allows the user to estimate the net proceeds from sales from the farm after taxes and selling costs (Ferrara *et al.,* 1996). The characteristics of FINPACK do not only make it usable for producers but also for lenders and institutions of education that can use it for technical assistance to the producers (Ferrara *et al*., 1996). The FINPACK software uses certain measures that are appropriate in the analysis of the financial position of farms.

The Farm Financial Standards Council (FFSC) in the U.S.A recommends certain measures that producers should use as standard financial measures of their farm's performance (Nordquist, Kurtz, Holcomb and Paulson, 2007). These financial measures are referred to as the "Sweet 16" (Blocker *et al.,* 2003 and Crane, 2004). The calculations of these measurements are also done according to recommendations from the FFSC. The sweet 16 measure are divided into five categories namely: Liquidity, Solvency, Profitability, Repayment Capacity and Financial Efficiency. Each of these categories has several calculation measurements that help to determine the

effectiveness of each category. These measurements are used to determine the effectiveness of the farm as a whole and can be used to do benchmark analysis between different farms.

All of these calculations are used in the mentioned software and models. These calculations have thus an important role to play in the agriculture sector and management of farms. The problem existing in South Africa is that there is no program or model publicly available that a producer can use to test his results and position against other similar farms in his or any other region. The different agribusinesses do analysis for the producer, but there is no way of benchmarking the performance against the performance of the other farms in that region. In South Africa there is no standardized program that producers can use to measure their farms' performance to other similar farms in the same district, province or even the whole country. Whereas in Canada, a producer can simply use the internet, provide his financial information, and in a couple of seconds see what the farm's performance is in relation to other farms in the district or country, identify weaknesses and asses areas that need improvements.

All of the mentioned programs are currently in use or in one case has been discontinued. These programs provide some important information to the producers which they can use to improve the financial performance of their farms. To improve the financial performance, the producers must know which areas of their farms they can improve on, in relation to the other producers in the area or industry. The aim of this study is to provide a system that will analyse the performance of producers in an area or industry, establish certain norms that can be compared (financial measurements) by producers that would provide them with information of the performance of the farm relative to others. This performance relative to other farms, provide some information on which areas the farm is not performing as efficient as the other farms, or to the contrary. This can all be done by looking at the measurements that are being used as norms, as each measurement considers certain aspects of the farm that are necessary for producing goods.

The objective for producers in a certain district of South Africa, would thus be to develop a model for analysing, benchmarking and determining the efficiency of the financial

position of a farm, using financial measurements to other similar farms in order to identify problem areas and improving the farm's financial situation.

1.3. Objectives

The aim of the study is to develop a financial measurement-based benchmarking system for GWK on the financial status of their producers. The *primary objective* is to develop a financial measurement benchmarking system in order to evaluate the current and past performance of the producers. The system will provide similar tools like the internet-based models already available in other countries.

In order to achieve the primary objective the following *secondary objectives* must be reached:

- To compare the trends of specific commodities produced by GWK producers that were followed by the South African agriculture sector with those of the GWK producers.
- To analyze 5 years of financial statements and establish cut-off norms with which the farms can be benchmarked and divided into different performance groups.
- Analyze the correlation between the measurements that will help to identify areas that can be improved with the knowledge on how the other measurements will change.
- To rank the farms, according to their operating efficiency, in their respected enterprise groups using data envelopment analysis. This will help to identify the differences between farms according to their efficiency.

After the primary and secondary objectives have been determined, recommendations will be made on how the measurements can be improved. Information on key aspects that can be looked at to improve the performance of the farm will be mentioned, taking in consideration the correlation between the measurements and overall position of a farm's measurements.

1.4. Chapter outline

The literature review done in **Chapter 2,** will focus on the financial measurements, namely, some of the existing benchmarking models that are used internationally, provide some information on Data Envelopment Analysis and conclude the chapter with information on how to improve the performance of a farm. In **Chapter 3** the methodology and data used will be described. **Chapter 4** is a discussion of the South African agriculture sector that will identify trends in the sector that will have an influence on the producers in the specific GWK trading area. After the comparisons of the South African agriculture sector and producers in the GWK trading area are made, the benchmarking and developed cut-off norms for the measurements will be calculated and discussed in **Chapter 5**. The conclusions and recommendations follow in **Chapter 6.**

Chapter 2
Literate Review

This chapter evaluates literature published on the usage of benchmarking and financial measurements and other farm management options that include the usage of financial measurements and benchmarking, not only in agriculture but also in other industries. Secondly there will be an explanation of different models that are currently available to farmers in order to help them evaluate their financial position and benchmark their current position to other similar operations according to several factors that influence the farm financial position. Another benchmarking option, Data Envelopment Analysis will also be discussed to provide background and explain how this method can be used in the agriculture sector. Lastly, some options will be explained on how the performance of a farm can be improved.

2.1. Literature on benchmarking and financial analysis

2.1.1. Introduction

To be a successful producer, the producer needs to have a clear understanding of the forces that have an impact on the agriculture industry and the direction of the micro and macro environment of the farm. To be successful, there has to be an effective method for executing and monitoring the strategic and operational plans for the farm (Miller, Boehlje and Dobbins, 1998). These plans are essential to provide a clear sense of what the farm is about and the precise objectives of the farm. Strategic decisions are associated with factors such as: product mix of the farm, marketing linkages and the financial structure of the business (Miller *et al.*, 1998). This is why the producer has the responsibility to evaluate and monitor the financial performance of the farm on a constant basis (Boehlje *et al.*, 1999). In order to accomplish the task of evaluating and monitoring the financial performance of the farm, the producer has to decide how the performance will be evaluated. According to Boehlje *et al.,* (1999), there are couple of

steps to follow in order to evaluate the financial performance: firstly, to collect data that accurately reflects the performance of the farm, secondly, one must develop a set of standard financial measurements (the measurements used by the FFSC) and then lastly, use this information for the evaluation of the farm's performance (Boehlje *et al.*, 1999). Most of the data needed by the producer are available in the financial records of the farm (Boehlje *et al.*, 1999). These records provide a structured format that allows the producer to summarize the financial information, in order to be more manageable for decision-making (Swenson, 2003). Most farm businesses have access to these records as it is standard requirements for obtaining credit and for tax purposes (Boehlje *et al*., 1999).

Producers can be helped with accurate financial records and production data to analyze their information and make the necessary adjustments to operate more efficiently and thus increasing the farm profitability (Arenzo, 2004). The primary objective of the financial analysis is to make better business decisions and identifying possible strengths and weaknesses. Producers should use the information from financial records of several years as a whole and not separately, as the information from the past can help with identifying certain trends and patterns (Crane, 2004).

The financial performance of a business is summarized with the use of the balance sheet and income statement (Feng and Wang, 2000); to further summarize the performance, the financial ratios can be used from the data of the balance sheet and income statements (Swenson, 2003). Financial measurements represent an important tool that can be used by decision-makers (Martikainen, Perttunen, Yli-Olli and Gunasekaran, 1995). What is a financial ratio? A financial ratio is the result of a comparison using two or more elements of financial data, the ratio can either be presented as a percentage (XX %) or as a comparison to one (XX: 1) (FFSC, 2008). These financial ratios (when the ratios are used collectively and over time for a farm), can identify the overall trend of a farm or business (Ferris and Malcolm, 1999). When using the financial ratios the financial managers (decision-makers) as well as any interested external parties such as investors and credit providers, are able to evaluate the success of the business and the ability to meet the financial obligations (Martikainen

et al. 1995). The FFSC has developed financial guidelines for agriculture producers. These guidelines consist of a set of recommended standardized farm financial factors, measures and reporting formats that producers can use to have a better understanding of their farm as a business. Recommended measures for farm financial analysis are divided into five categories: Liquidity, Solvency, Profitability, Repayment Capacity and Financial Efficiency; these categories are also referred to as the "Sweet 16" (Crane, 2004). With the use of these financial measurements a producer can identify the specific area of operation that needs to be adjusted. The calculation of the measurements can, however, be useless unless there is a meaningful basis of comparison to evaluate the values of each measurement (Swenson, 2003).

There are several methods of comparing the values of these financial measurements. The first method is the past performance method. This method monitors the progress of the business by constructing financial measures on a periodic basis and comparing the present performance to past performance (Swenson, 2003). There are certain acceptable norms that can be used as guidelines for producers or the measurements can be benchmarked against the farm's past operations (historical benchmarking) (Blocker *et al.*, 2003 and Boehlje *et al.*, 1999). The second method that can be used is to use industry benchmarks. Industry benchmarking is described by Swenson (2003) as the average of a financial measure from several similar businesses that provides a good point of reference. Each farm has its own unique aspects; this means that the most appropriate comparison would be farms that have similar enterprises and resources (Swenson, 2003).

The idea of benchmarking in agriculture is gaining more momentum (Vogt, 2010). The gaining of momentum in benchmarking is, according to Vogt, (2010), due to the increase in information available on the internet and other sources. This increase in sources of information provides the necessary information to compare one business to others (Vogt, 2010). Craven *et al.* (2011) also provides several factors on why the demand for benchmarking is growing in agriculture. Some of these factors mentioned, include that benchmarking provides producers with an opportunity to evaluate how their performance compared to other producers, it also provides them with the opportunity to

identify where they can improve their own businesses and lastly benchmarking provides the producers with high quality documents that they can submit to credit providers (Craven *et al.*, 2011).

Improving the financial performance evaluation in agriculture is not a short-term proposition, but a longer term objective (FFSC, 2008). The financial guidelines for agricultural producers are just a start and to get unity behind the guidelines will be to the advantage of everyone in the agricultural industry (FFSC, 2008). Unacceptable financial measurements and performances can be caused by problems that originate from temporary setbacks beyond the producer's control. There are options available to the producer, one of which is to do nothing and wait for the problem to correct itself (Boehlje *et al.,* 1999). On the other hand, the problem can be severe and more persistent; in this situation the producer has no alternative option but to make adjustments to improve the financial performance. Short-term solutions to these problems can be to improve the cash flow and in the longer run to be sure that the resources are effectively used to generate revenues and thus producing profits that are competitive within the farming industry (Boehlje *et al.*, 1999). The linkage between the financial measurements and performance are very important and therefore one must always know how to measure the measurements, what the measurements mean and how to improve the measurements when they are unacceptable.

Financial measurements provide useful financial information to investors and analysts, which can be used to evaluate the operation of a firm and analyse the position of the firm within a sector over time (Gallizo *et al.,* 2003). The same can be done with a farm, as a farm is also a business which main objective is to maximize profits. According to Swenson (2003), one measurement is not sufficient to make a conclusion on the overall performance of a farm business. Ferris and Malcolm (1999) mentioned that there are some very useful financial measurements which, when they are used collectively and over time for an individual farm, can tell a lot about the financial performance of the farm business.

These measurements can be used to evaluate which areas need improvements. When these measurements are not found to be satisfactory, the producer can make the

necessary adjustments that will lead to improved performances (Boehlje *et al.*, 1999). The usage of measurements also has several disadvantages, as the measurements are only as reliable as the information used to calculate these measurements. If there are any mistakes in the information that were used in the calculation of the measurements, the measurements are useless. Another very important aspect to keep in mind with the use of measurements is to be certain that the correct formulas are used to do the calculations (Blocker *et al.*, 2003).

2.2. Financial Measurements

Financial measurements are divided into five categories that each consist out of several individual measurements. These five categories will be discussed in the following section including each of the individual measurements.

2.2.1. Liquidity

Liquidity is a measure of the capability of the farm to repay its debts and other expenses that are due within a year (Blocker *et al.*, 2003). Liquidity plays an important role in the ability of a business to withstand financial stress (FFSC, 2008). The liquidity consists of important components of the financial structure that include the level of investment in current assets and what the extent of financing is through the use of current liabilities. According to Gitman, Beaumont Smith, Hall, Lowies, Marx, Strydom and van der Merwe, (2010), the current assets of manufacturing firms in South Africa account for about 46% of the total assets and current liabilities represent 70% of total financing. This explains why the management of current assets and liabilities is very important. To gain a better understanding of liquidity, the current assets and liabilities will be discussed

To help analyzing the current ratio, another ratio can be used. This is the relation between current assets against total assets and current liabilities against total assets. A higher ratio is not always an indication of the best performance position, as a change in the current assets has an effect on the profitability – risk trade-off (Gitman *et al.,* 2010). Current assets are also referred to as working capital and it represents the portion of investments in the farm that circulates from one form (asset) to another (cash) in the

ordinary day to day conduct of business (Gitman *et al.,* 2010). Current liabilities form a percentage of the farm's short-term financing, as it includes all debts of the farm to be paid within the following year. The difference between the current assets and current liabilities is known as net working capital; net working capital can be either positive or negative.

When referring to the liquidity of a business or farm, it refers to the ability to generate enough cash on order to meet cash demands as they occur from time to time, and to provide for events that may occur, both anticipated and unanticipated (Barry *et al.,* 1995). The liquidity is closely tied to the risk position of a firm or farm, the occurrence of risk in day to day business is one factor that causes the need for liquidity (Barry *et al.,* 1995). Profitability is the relation between revenues and costs that are being generated with the use of the assets of the farm; assets include both current and long-term assets. For a farm to increase its profits, there are two options available: (1) is to increase revenues and (2) decrease costs. Risk, in the short-term context, is the probability that the farm will not be able to pay bills as they become due (Gitman *et al.,* 2010). This is the reason why net working capital can be crucial to a farm, as it is used to meet all the short-term obligations of the farm and it is generally assumed that the higher the net working capital, the lower the risk will be (Gitman *et al.,* 2010).

These ratios can be used to help determine whether there are enough cash to cover upcoming obligations. Liquidity can be measured with the use of the current ratio and working capital (FFSC, 2008).

The **current ratio** indicates how much of the current liabilities will be covered if all the current assets are liquidated. This ratio indicates the extent to which the current assets will exceed the current liabilities that are due in the following 12 months (Swenson, 2003). The higher the current ratio, the higher is the liquidity of the farm and vice versa. The higher ratio indicates that the business has a "cushion" to meets its short-term obligations without the need to disrupt the normal flow of the farming business (Swenson, 2003). A problem can exist when the ratio are too high, the problem is that it indicates that most of the assets are investments that are not easily to be converted into quick cash.

There are also several limitations when using the current ratio as provided by the FFSC (2008). These limitations include:

- The current portion of postponed taxes must be included as current liabilities, when it is not included, the current ratio may be too high.
- The ratio is a static notion from financial resources. It is an indication for a specific point in time and indicates that at that specific time the obligations can be met.
- The ratio ignores the committed line of credit as financial resources available that will ensure the timely payments of obligations.
- Even though current assets are described as being available to be liquidated within 12 months, the current ratio does not recognize that in many circumstances the current farm assets cannot be liquidated instantly. In favour of the current ratio is that not all of the current liabilities are due instantly, but both the current farm assets and the current farm liabilities are based on a one-year time period.
- The valuation of current assets influences the current ratio.
- The quality or condition of the current assets is not precisely known, thus, there is no clear indication that they will be sold for the amount that is shown on the balance sheet.
- The level of the current ratio will vary depending on the type of business enterprise and will also be influenced by the time of the production cycle.
- Lastly, businesses that have limited currents assets and liabilities may indicate a strong current ratio, but the liquidity of that specific business is limited.

Working capital is, according to the FFSC (2008), a theoretical measure of the amount of funds that are available on the farm to purchase inputs and inventory items after all the current assets have been sold and the payments of all the current liabilities were made. In other words, it is a method to show how much of the current assets would be left if all of them would be sold and used to pay all the current liabilities. As the case with the current ratio, one would like to have a high number, but not too high as again it indicates an inefficient usage of assets to generate revenue (Blocker *et al.,* 2003).

Working capital is best used as a benchmark for the same farm, using historical data as the measurement can be influenced by the size of the farm. The working capital is not a ratio but a currency value and therefore it is important to asses this measure according to the size of the farm (FFSC, 2008), when it is used for decision-making.

The limitations for the working capital value include some of the limitations that were already mentioned for the current ratio (FFSC, 2008), which include:

- Similar to the current ratio, the deferred part of taxes should be included as current liabilities; otherwise the working capital value can be overstated.
- Because the working capital is calculated as a currency amount (South African Rand), it is difficult to compare the value with the value from other farms. According to the FFSC it is nearly impossible to set one standard for this value for all farms.
- This is also a static measure for a specific point in time. Similar to the current ratio it is just an indication of how the obligations will be met at a specific point in time.
- Working capital ignores committed lines of credit as financial resources available to purchase inputs and inventories that are necessary on the farm.
- Once again the measure does not recognize that many of the current farm assets cannot be liquidated immediately, but many of the current liabilities are also not due immediately.
- The value of measure that determine the value of the asset is affected by the value placed on the current asset; there is also no assurance that the quality and conditions are reflected by the value of measure that is shown on the balance sheet.
- The level of measure for working capital will vary according to the type of business enterprise and the time in the production cycle.

Apart from these two measurements, the Centre of Farm Financial Management at the University of Minnesota uses another measurement to measure the liquidity of a farm. This measurement is working capital against gross revenue (Craven *et al.*, 2011). According to Craven *et al.* (2011), this is a better measure of liquidity as it relates the

level of working capital to the size of the business. This new measurement, apart from the measurements provided by the "Sweet 16", provides another measurement that can be compared to other farms, without the problem of farms' sizes, as this was also mentioned by Craven *et al.*(2011), in the explanation why the Centre of Farm Financial Management rather prefers using this measurement than that of only working capital.

2.2.2. Solvency

Solvency is a measure of how well a farm can pay off all of its debt with the use of the farm assets. This is a measure to determine whether the assets of the farm, if liquidated, would be enough to pay all of the debt associated with the farm (Blocker *et al*. 2003). Solvency is a good way to show how much of the farm as a business is owned by the owner and how much is owned by the bank or debt supplier.

Solvency is measured with the use of three mathematically equivalent measurements; Debt against assets, equity against assets and debt against equity. Although these measurements are mathematically equivalent they do supply different interpretation options.

The **debt against asset ratio** can be difficult to interpret; emerging farmers will normally have higher ratios than older farms. The debt against assets ratio can also be called the leverage of the business (Boehlje *et al.,* 1999). A higher ratio can simply mean that more of the assets are leveraged and that credit providers have a large stake in the farming business (Blocker *et al.,* 2003). In other words, the ratio indicates the percentage of the farm owned by a credit provider or credit providers, it indicates the relation that exists between debt and equity capital. A desired ratio for a certain farm depends on the age of the farm and varies between different farming enterprise operations. Debt against asset ratio is a measure of the financial position of the farm (FFSC, 2008). The ratio compares the total farm debt obligations that are owed against the total value of farm assets (FFSC, 2008). This gives an expression of the portion of the total farm assets owed to the creditors, or in other words, it is the claim that the creditors have on the assets on the farm. Debt against asset ratio can also be used as

an indication of the risk exposure of the farm (FFSC, 2008). The higher the ratio, the greater the risk exposure of the farm will be.

One factor that can have a large influence on this ratio is leasing land instead of buying, this method avoid the use of debt to get access to more land. Smaller values are preferred to larger ones, as this indicates a better chance of maintaining the solvability of the farm should there come a period of unfavourable economic conditions (Kay *et al.* 2004).

According to FFSC (2008), the limitations that can be associated with the debt against asset ratio include:

- Delayed taxes should be included as liabilities, if this is not done the debt against asset ratio can be understated.
- The ratio is influenced by the value placed on the farm assets.
- The reasonable value for the ratio varies between the different enterprises. The range of acceptable value will vary because it depends on the variability in income, the proportion of land owned that is used for farming, the risk that is associated with normal production and the fluctuations in value of assets that change due to changes in the demand for agricultural assets.

The **equity against asset ratio** is also a measure of the financial position of the farm. It specifically measures the portion of farm assets that are financed by the owner's own equity, or it is the owner's claim on the assets on the farm. This is just the opposite of the debt against asset ratio that was described previously. The higher the equity against asset ratio is, the more capital is employed on the farm and less money is used from creditors.

The limitations associated with the equity against asset ratio include (FFSC, 2008) the same limitations than with the debt against asset ratio.

Debt against equity ratio can also be referred to as leverage. Leverage is the relationship between the businesses debt and equity capital used to finance the business. The more debt that is used to finance the business, the higher the business

is leveraged. Leverage can be in favour of or unfavourable for a business, depending on the manner in which the debt is used in the business (Boehlje *et al.,* 1999).

A farm that has too little debt can be limited to its size, efficiency, growth and earning capacity (Boehlje *et al.*, 1999). The farm can also have too much debt which has its own complications. Too much debt can result in inefficiency, accelerating financial losses and can ultimately lead to the failure of the farm (Boehlje *et al.*, 1999). Debt has an influence on solvency through the value of assets that are available to secure all the farm's liabilities.

The limitations associated with the debt against equity ratio (FFSC, 2008) are the same as the equity against asset and debt against asset ratios.

2.2.3. Profitability

Profitability measures the profit that a producer generates through different operations on the farm. It is a measure of the efficiency at which the assets and equity are used to generate revenues and how the revenues are converted into profit (Blocker *et al.*, 2003). There are three profitability measures that are generally accepted for their value to the management of a farm. There are three ratios used to determine profitability: Rate of Return on Assets, Rate of Return on Equity and Operating profit margin (Boehlje *et al.*, 1999) and one currency value: Net income.

The **return on assets ratio (ROA)** is a measure of the productivity of all the farm assets including debt capital, in other words, the return on assets is the assessment of the overall efficiency with which the farm assets are used to produce net income from operations (Boehlje *et al.*, 1999). Interest expenses are also included in this calculation, this is to include all farms with different financial structures, farmers that do make use of debt capital are thus not penalised. This ratio is one of the best overall measures of the operating performance on a farm (Boehlje *et al.*, 1999). Everything, right or wrong, that the producer did while operating the farm, is reflected in the ROA. Because this ratio reflects both right and wrong, this makes it difficult to determine the corrective action and more information will be needed (Boehlje *et al.*, 1999).

The FFSC (2008) identified the following limitations that can be associated with the rate of return on assets ratio includes:

- The withdrawals of the owner and unpaid labour and management must be calculated correctly. When these are not correctly calculated the ROA can be under- or overstated.
- When the ROA is compared to non-farm investments such as stocks and bonds, the ROA may seem to be low. The low level of ROA can be explained because neither realized or unrealized gains on farm real estate and other assets are included as income.
- The method of valuation on assets can influence the ratio.
- Net farm income from operations is calculated on a pre-tax basis.
- Assets and incomes that are not related to the farm must be excluded when this ratio is calculated, or when it is included care must be taken to recognize the impact on the ratio.
- The ratio can vary because of structural characteristics of the farm, especially the portion of land and assets owned by the farmer, which is used in farming operations.

Rate of Return on equity (ROE) provides information about the performance of debt in the capital structure. Debt is an important component of the capital structure as it provides the necessary resources to take advantage of future profit opportunities (Boehlje *et al.*, 1999). ROE is a useful measure of the performance of the owner's investment (equity). There are other alternatives available to the owner where the money can be invested; when investing money into the farm the returns should at least be higher than the returns of a less risky investment opportunity like a long-term certificate of deposit (Boehlje *et al.*, 1999).

The ratio should exceed the ROA for farms that borrow money. If the ROE is smaller than ROA it indicates that the borrowed capital is not earning enough to pay the cost associated with the borrowed money. The opposite can also be a possibility when ROE

is larger than ROA; this has shown that there is an investment possibility in the farm that has reasonable returns (Boehlje *et al.*, 1999).

When considering the rate of return on equity ratio, one must be careful of the following factors (FFSC, 2008):

- The withdrawals of the owner and unpaid labour and management must be calculated correctly, when these are not correctly calculated the ROA can be under- or overstated.
- When the ROE is compared to non-farm investments such as stocks and bonds, the ROE may seem low. The low level of ROE can be explained because neither realized or unrealized gains on farm real estate and other assets are included as income.
- The method of valuation on assets can influence the ratio.
- Net farm income from operations is calculated on a pre-tax basis.
- Assets and income that are not related to the farm must be excluded when this ratio is calculated, or when it is included care must be taken to recognize the impact on the ratio.
- The ratio can vary because of structural characteristics of the farm, especially the portion of land and assets owned by the farmer, which is used in farming operations.

Operating profit margin measures the returns to the capital per rand of gross revenue (Crane, 2004). The operating profit margin focuses on the per unit produced component of earning profit (Crane, 2004).

The limitations that can be associated with the operating profit margin include (FFSC, 2008):

- When net farm income from operations is not calculated by matching revenues and expenses incurred to create revenues, then the operating profit margin can be over- or understated.

- The withdrawals of the owner and unpaid labour and management must be calculated correctly, when these are not correctly calculated the ROA can be under- or overstated.
- Net farm income from operations is calculated on a pre-tax basis.

Net farm income originates directly from the income statement. The calculation is to subtract the expenses from farm revenues and add the gain or losses from the sale of farm capital assets in an absolute rand value (Crane, 2004). Net farm income represents the returns to the farmer that can be used for unpaid operators, family labour, management and owner's equity (Crane, 2004).

There are a few limitations that can have an effect on net farm income as mentioned by the FFSC, 2008:

- Like working capital, the net farm income is a rand amount (the amount can be positive or negative). Once again, it is difficult to compare this value to the value of other farms. According to the FFSC (2008), it is also impossible to establish one standard for all farms.
- Net farm income is calculated on a pre-tax basis.
- This is a close approximation of matching the revenues with the expenses that generate revenues on the farm. If the income statement is prepared using a cash basis accounting method, the beginning and ending accrual balance sheets are needed to make necessary adjustments for the changes that had occurred in inventories, accounts receivable, accounts payable, prepaid expenses and accrued expenses.
- The form of business organisation can cause some problems and difficulties with the interpretation of the net farm income. This is because different forms use different adjustments in their statements. Because of these differences, one must be careful to compare farms with one another.

2.2.4. Repayment capacity

Capital debt repayment capacity (CDRC) measures how well a producer can repay term debt using his farm and non farm income. The capital debt repayment capacity enable borrowers and lenders of money to determine if the farm has the capable ability to generate enough funds needed to repay the debt and for asset replacement (FFSC, 2008). The limitations according to the FFSC (2008), that are associated with the measurement include:

- Interest expense is the accrual adjusted interest expense that is calculated in the income statement.
- All income and expense data used in the calculation of the measurements is accrual adjusted data and not cash flow.
- The replacement allowance expenditure is the net amount of cash that is invested in activities, minus the new financing provided for the purchase of new assets.
- The measure is a currency value and is difficult to compare across farms and to set a standard for all farms or enterprises.

2.2.5. Financial Efficiency

The Asset turnover ratio is a measure of how efficiently the assets on the farm are used to generate revenues (FFSC, 2008). The producer has two methods to increase the farm profits. Firstly, the farm must increase the profit per unit produced or increase the volume of production. The second option can only be workable if the farm is profitable (FFSC, 2008).

The limitations that are associated with the asset turnover ratio include (FFSC, 2008):

- Like the previous situation where the assets of the farm were involved, the valuation of the assets can have a major influence on the ratio.
- Gross revenue cover a whole accounting period, while the average farm assets represents only two points of that specific accounting period.

- The ratio can also show some wide variations depending on the type of enterprise and the portion of land used for operations that is owned by the owner.
- All the assets that are not used for the farm must be excluded from the denominator, or care must be taken to recognize what the impact of non-farm assets will be.

The **operating expense ratio** reflects the relationship between all the operating expenses and gross revenue. Operating expense ratio is a measure on how efficiently the operating expenses are managed to generate gross farm revenue (Swenson, 2003). The lower this ratio is, the better the expenses are managed to generate revenue. The type of farm will have an influence on the operating expense ratio (Swenson, 2003).

The limitations of the operating expense ratio include (FFSC, 2008):

- This ratio can be very sensitive to the accuracy and reliability of the information that is used to calculate it.

Interest expense ratio is a reflection of the relationship between interest expenses and gross revenues.

The limitations that can be associated with the interest expense ratio include (FFSC, 2008):

- This ratio can be very sensitive to the accuracy and reliability of the information that is used to calculate it.

Net farm income from operations ratio reflects the relation between net farm income from operations and gross revenues.

The limitations that can be associated with the net farm income from operations ratio include (FFSC, 2008):

- This ratio can be very sensitive to the accuracy and reliability of the information that is used to calculate it.
- The net farm income from operations is calculated on a pre-tax basis.

These measurements provide a basis that can be used to asses and analyze the differences in performance of farms. The measurements can therefore be used as a tool to benchmark farms and compare performance with the objective to determine less efficient farms and provide them with information on where the more efficient farms are performing and how it can be done.

2.3. Benchmarking

2.3.1. Introduction

Benchmarking is a long-standing and a highly developed practice that has been used in the agricultural sector (Jack, 2009); even though the use of the term benchmark is a fairly recent occurrence, previously benchmarking was referred to as comparative analysis (Flemming, Farrell, Villano, and Flemming, 2006). When reading about the development of benchmark setting and benchmark for the best practice, there is very little reference to farming and food (Jack, 2009). Flemming *et al.,* (2006), mention that benchmarking has been developed as a farm management tool for detecting areas where producers could increase their profit by adopting the methods of their peers, who are able to achieve better results. Benchmarking is defined by Jack (2009) as the "usage to signify a particular systematic approach in which a business evaluates its own operations and procedures through a detailed comparison with those of another business, in order to establish the best practice and to improve performance." This definition is normally referred to as best practise benchmarking (Jack, 2009). Benchmarking can therefore be defined as looking for the businesses that are the best at doing something and then learning how they do it in order to emulate that performance (Boehlje *et al.*, 1999).

Benchmarking is a powerful management tool that can be used by agricultural producers to manage their risks and improve their profitability (Craven *et al.*, 2011). According to Ferris *et al.* (1999), benchmarking has a valuable role to play in the improving of productivity of farming and plays a major role in farm standards to help identify weaknesses. Benchmarking is intended to be used as a diagnostic tool; there may be some insight and advantages from looking closely at a competitor's farm for an explanation of why things are different. There are two types of benchmarking that can

be used to analyze and interpret the financial records. The farm's financial history records can be used for historical benchmarking. When historical benchmarking is used, the farmers must focus on the improvement of their own financial measurements and the discovery of possible problems (Blocker *et al.*, 2003). The other type of benchmarking is to compare the farm to other similar farms in the area and of the same year. The best farm analysis must include both the accounting guidelines and both of the benchmarking options, historical and similar farm benchmark (Blocker *et al.*, 2003).

When using benchmarking as a guideline for analysing the financial performance of the farm business it is important to know exactly which of the financial indicators, illustrated in Figure 2.1, has to be larger or smaller than the industry benchmarks (cut-off values). The indication of the financial strength will depend on which measurements are being considered.

	Top	Cut off	Mid	Cut off	Bottom
Liquidity					
Current ratio	>	2.00	< <	1.00	<
Working Capital	>		< <		<
Solvency					
Debt against asset	<	30%	< <	60%	<
Equity against asset	>	70%	> >	40%	>
Debt against equity	<	43%	< <	150%	<
Profitability					
ROA	>	5%	> >	1%	>
ROE	>	10%	> >	5%	>
Operating profit margin	>	35%	> >	20%	>
Net farm income	>		> >		>
Repayment Capacity					
CDRC	>		> >		>
Financial Efficiency					
Asset turnover ratio	>	40%	> >	20%	>
Operating expense ratio	<	60%	< <	80%	<
Interest expense ratio	<	10%	< <	20%	<
Net income ratio	>	20%	> >	10%	>

Figure 2.1: Industry benchmarks by Blocker *et al.*, (2003)
Source: Blocker *et al.,* (2003)

2.3.2. Benchmarking studies

There have been several models and papers done about benchmarking with the use of financial statements and ratios. Some of these models are available on the internet for farmers to use free of charge and others that can be purchased. Most of these models are based on countries other than South Africa, including the U.S. and Canada.

When developing a benchmarking system it is important to have accurate and complete information. Another important factor is the number of year's worth of information that must be used to develop the benchmarking system that will reflect the situation of the farmers. In the paper, benchmarking recommendations using a sample of Kansas farms, by Yeager and Langemeier (2007) appear; they have concluded that five years of data is necessary to benchmark farms that are similar in their production enterprises. The objective of the study was to set a standard of how many years of data should be used for benchmarking, with the assumption that at some point there is a stabilization of the financial measurements in question. To determine whether there was any stabilization in the measurements a t-test was performed by Yeager *et al.,* (2007) to compare the measurements from one set of years to the same set of years, plus an additional year. Yeager *et al.,* (2007) found that if the p-value was below 0.05, the average measurements were significantly different and one can reach the conclusion that the ratios were not becoming more stable. The results of their study were that there is no significant difference in year four to year five for the average measurement comparisons. Langemeier (2010) has also indicated that using only one year's worth of data to do benchmarking can be problematic.

Several studies have also been done in the United States that analyze the financial characteristics of farms in the country. One of these studies is the financial characteristics of North Dakota Farms that were done over several years to provide information to producers, credit providers, educators or anybody else that can make use of the information. These studies were done by the North Dakota State University and they have already provided several papers by Andrew L. Swenson. According to Swenson, (2003), the financial records including balance sheet and income statement, provide a structured format to summarize the financial information that makes it more

manageable for decision-making after the information is summarized into key measures of financial performance. The calculation of the financial measures can be useless unless there is a meaningful basis of comparison to evaluate the numbers. Swenson (2003) uses two methods of comparison, namely past performance and industry benchmarks. The past performance helps the business so that it can be monitored by constructing financial measures on a periodic basis and then comparing the past and present performance. Industry benchmarks provide the average or median financial measure from several similar businesses that can be used as a good point of reference. Each farm has its own unique aspects and the most appropriate way to compare the farms is to do it according to certain aspects, like resources or enterprises (Swenson, 2003 and Swenson, 2009).

In the studies done by Swenson (2003 and 2009) about the financial characteristics of North Dakota Farms, the farms were grouped according to several characteristics that include; the region, type of farm (enterprise) and size. Sixteen financial measurements were used to calculate the financial performance of the farms; the recommendations of the FFSC were followed in the calculations. The financial measures include: Liquidity (current ratio, working capital), Solvency (debt to asset, equity to asset, debt to equity), Profitability (rate of return on assets, rate of return on equity and operating profit margin and net income), Repayment Capacity (term debt coverage ratio and capital replacement and term debt repayment margin) and Financial Efficiency (asset turnover, operating expense ratio, depreciation expense ratio, interest expense ratio and net farm income ratio). These farms were then sorted in order from the strongest to the weakest by using each of the sixteen financial measures. The median, the midpoint value of the specific measure in use, was then calculated that sorted the values in categories higher and lower than the median. After the median was calculated, the ratios were divided into quartiles, the upper quartile is the value that had exceeded by one-fourth of the farms and the lower quartile is the value that was exceeded by three-fourths of the farms (Swenson, 2009).

2.4. Available models and analysis programs

2.4.1. Production system benchmarking models

One available benchmark system that is currently available in South Africa is done by Agri Benchmark through the National Agricultural Marketing Council, University of the Free State and the University of Pretoria. This benchmarking is done to benchmark a typical farm of a district within a country with another district in another country. The drawback of this benchmarking method is that the data collected is that of a typical farm in the specific area and does not include the financial data of one or more specific farms that can be analysed and benchmarked against each other to determine certain problems (negative) or positive areas for the farms in the district.

Agri Benchmark is a global network of agricultural economists that generates sustainable, comparable, quantified information about farming systems worldwide. Agri Benchmark is a non-political and non-profit activity (Zimmer *et al.* 2008). The results and values of the network are developed by mutual agreement and the methods and results are exposed to an ongoing quality assurance process that is open for public discussions. One of the goals of Agri Benchmark is to develop powerful tools for a worldwide analysis of agricultural branches. The enterprises that are used for the Agri Benchmark analysis is beef and cash crops.

In the Agri Benchmark context benchmarking means that they benchmark typical farms, production systems and enterprises at a specific point in time and over time. A typical farm is a hypothetical farm (Zimmer *et al.* 2008) defined as being an existing farm or a data set describing a farm, being in a specific region which represents a major share of output for the product considered, running a prevailing production system for the product that reflects the prevailing combination of enterprises, land, capital resources and labour (Deblitz *et al.* 2009).

2.4.2. Internet based programs

There are currently no known available internet-based financial measurements benchmarking system that can be used by a producer in any district of South Africa. Some of the agribusinesses do financial measurement analysis for producers, but this analysis is done by experts employed by the agribusiness. There are several websites

on the internet worldwide, where any farmer can make use of and complete the necessary financial statements. From these statements the financial measurements, measurements that the organizing company of the website decides on, are measured and provide the producer with helpful information on his situation according to similar farmers in his province or country. In the words of Clarke and Rodier (2006), describing the model that was developed in Canada: "Agriculture and Agri – Food Canada has developed an innovative and unique interactive tool that allows producers to compare financial performance of their farm with other similar Canadian operations with respect to size, type and region." This tool guides producers through the completion of simplified income statements and balance sheets. From the information provided by the producer, a series of financial measurements are calculated for their farm operations and compared against the industry benchmark. The comparison is done with the use of five financial measurement categories; efficiency, liquidity, debt management, asset management and profitability (Clarke and Rodier, 2006).

Characteristics of the tool include the ability to input up to five years of financial information, or get access of up to five years of financial industry benchmark information. The producers can use the tool to get access to industry benchmarks for 14 regions of Canada with 10 commodity groups and 8 income categories (Clark *et al*., 2006). The industry benchmarks used in the tool are derived from Statistics Canada's whole farm database. The farms are sorted in categories based on the type of products they sell. Farms are then identified as a certain type of farm when 50% or more of the farm's agriculture sales comes from one commodity or commodity group. The commodities are grouped according to ten farm types. Groups of commodities in Canada for the comparisons are: Grain and Oilseed, Fruit and Tree Nut, Potato, Vegetable and Melon, Greenhouse and Nursery, Cattle, Dairy, Poultry and Eggs, Sheep and Goats and Hogs. The farms are not only categorised according to their industry but also according to their gross revenue and geographic coverage.

The gross revenue coverage is determined by the amount of gross revenue generated by the farm in one accounting year. The gross revenue that is available for use with the tool is: $ 10000 - $ 49 999, $ 50 000 - $ 99 999, $ 100 000 - $ 249 999, $ 250 000 -

$ 499 999 and $ 500 000 +. The revenue classes are also divided in the three aggregated classes of $ 10 000 - $ 99 999, $ 100 000 + and $ 10 000. The industry benchmarks data are also available for farms that are highly specialized; a farm is highly specialized when 90% or more of its revenue is obtained from one commodity or commodity group (Clarke *et al.,* 2006).

The tool guides a user through a process to complete simplified income statements and a balance sheet. From the simplified financial records, a series of financial measurements are calculated for the specific farm operation. These measurements are then used to compare with industry benchmarks that are calculated for three ranges. The three ranges range from the top 25% of farms, mid-point farms and lastly, the bottom 25%. The comparison is done in the categories mentioned already; efficiency, liquidity, debt management, asset management and profitability. All of these categories form part of the identified "Sweet 16" that are illustrated in Figure 2.1. The information for the financial records can be entered for multiple years to conduct the trend analysis which can be used to assess operation performance over time (Clarke and Rodier, 2006).

2.4.3. Software computer programs

FINPACK is a software package which provides information for planning the activities of farms and evaluating their efficiency (Ferrara *et al.* 1996). This software was developed by the Centre of Farm Financial Management at the University of Minnesota, U.S.A in 1972 and has already been developed into more than eight versions, being the leader in the farming industry (Kurtz, 2009). The software satisfies the needs of producers with a profitability, liquidity and solvency analysis with the use of main components like the balance sheet, data banks, financial long range planning, cash-flow planning and year-end analysis. The software was created in 1972 and quickly spread through the U.S. due to the mid 1980's financial crisis (Ferrara *et al.* 1996). In 1996 the FINPACK software was used in 37 states of the U.S. and was also available in Irish and Polish versions. According to Ferrara *et al.*, (1996) the FINPACK software package provides information for planning farm activities and evaluating the efficiency of the farm by utilization of ad hoc accounting data. The main components of the software are the

balance sheet, data banks, financial long-term planning (FINLRB), cash-flow planning (FINFLO) and year-end analysis (FINAN). With the use of these main components the software satisfies the needs of farm planning and efficiency with profitability, liquidity and solvency analyses. The aim of the FINPACK software is not only to optimize the managing of the farm, but also include family management as the balance sheet include non-farm assets and liabilities (Ferrara *et al.* 1996).

Another spreadsheet–based benchmarking model is the Wisconsin Dairy Farm Ratio Benchmarking tool (Cabrera, 2010). The Wisconsin Dairy Ratio Benchmarking Tool (WisDRBT) is an analysis tool that creates trends by comparing financial measurements to a farm's past performance and a comparative analysis with the industry (Cabrera and Vanderlin, 2009). The tool represents 15 of the "Sweet 16" measurements from the FFSC. This tool adds meaning to a farm's financial performance by comparing the performance graphically to the state wide Agriculture Financial Advisor (AgFa©) database (Cabrera and Vanderlin, 2009). The annual data consists of 500 dairy farms for the years 2000 – 2008. WisDRBT can do the analysis for each of the years and can filter the financial measurement analysis according to herd size, income per cow or milk per cow. The filter analysis displays the cumulative probability distributions for the 15 financial measures. An individual can enter his own financial value and compare the value to the standards of the industry and Wisconsin benchmarks. The tool also provides a DuPont analysis based on Rate of Return on Assets, Operating Profit Margin and Asset Turnover ratio (Cabrera and Vanderlin, 2009).

2.5. Data Envelopment Analysis

Each of the financial measurements provides information about the certain category that the measurements represent. This makes it difficult to rank the farms using the measurements, as weight has to be given to each category and to decide on the exact weight for a category can be problematical. In order to rank the farms according to their operating efficiency, the Date Envelopment Analysis method will be used.

Data Envelopment Analysis (DEA) is a non-parametric mathematical programming model which is used to evaluate the relative efficiency of a group of entities or decision-making units (DMU) in the use of multiple inputs to produce multiple outputs (Al-

Shammari and Salimi, 1998). DEA is an approach that relies on mathematical programming instead of econometrics techniques (Sarafidis, 2002). A DMU refers to the collection of firms, departments, divisions or administrative units that have the same goals and objectives with common inputs and outputs (Al-Shammari and Salimi, 1998). DEA is based on the work by Farrell from 1957 on the measurement of productive efficiency. It was actually the work by Charnes, Cooper and Rhodes (1978), that developed the DEA technique (Al-Shammari and Salimi, 1998).

According to Sarafidis, (2002), DEA can be best explained by explaining what index numbers are. To estimate the efficiency non-parametrically across several firms can be done by a simple index of relative performance such as the following as used by Sarafidis (2002).

$$efficiency\ score = (\beta_1 y_1 + \beta_2 y_2 + \cdots .. + \beta_k y_k)/cost \qquad (1)$$

Y indicates different outputs and β are the weights that are attached to these outputs (Sarafidis, 2002). One of the problems that are associated with simple indices like these are that they implicitly assume a linear relationship between costs (inputs) and outputs, in other word they assume constant returns to scale (Sarafidis, 2002). Another restriction is that the weights attached to inputs/outputs take the same value for all firms. This can often be a disadvantages as the weights can legitimately differ between the firms, because of different circumstances or variations in the importance attached to different inputs/outputs, the result as stated by Sarafidis (2002) is that simple index numbers tend to be rather uninformative.

The objective of DEA is to use linear programming techniques to find a set of weights for each farm that maximizes the efficiency score for those farms, subjected to a constraint that no farm can have an efficiency score of greater than 100% at the specific weights (Sarafidis, 2002). The purest version of DEA would use the efficiency index of equation 1 and allow these weights of this index to vary for each firm in a way that the individual firm's performance compares in the most favourable way with the other remaining firms. One characteristic of the model is that it would reject a solution for a particular firm if the set of weights that maximizes the relative performance scores is

greater than 100 percent for any other firm (Sarafidis, 2002). This is the way that DEA builds up a so-called envelope of observations that are most efficient at each set of weights. In this way a firm can be shown to be inefficient if it is less efficient than another firm at the set of weights that maximizes its efficiency. For an inefficient firm there would be one or more firms that are more efficient with the target firm's set of weights, these firms are known as the peer group for the inefficient firm (Sarafidis, 2002).

The original DEA model that was put into operation by Charnes, Cooper, and Rhodes, (1978) was only applicable to technologies that are characterized by constant returns to scale (Emrouznejad and Amin, 2009). Banker, Charnes and Cooper (1984) then had a breakthrough when they extended the original model by Charnes *et al.,* (1978) to accommodate technologies that has variable returns to scale (Emfouznejad and Amin, 2009). When DEA analysis is done, it is usually done with absolute numerical data, which reflects amongst others, the size of the unit (Emfouznejad and Amin, 2009). There are however, some cases where authors used ratio variables instead of absolute numbers as inputs and/or outputs. According to Hollingsworth and Smith, (2003) the use of the original standard model of Charnes *et al.,* (1978) when data is used in the forms of ratios are technically incorrect and should be rejected. A general non-parametric model for financial ratio analysis was first initiated by Femandez-Castro and Smith in 1994 (Ablanedo-Rosas, Gao, Zheng, Alidaee, and Wang, 2010). Most of the previous DEA studies that measured the efficiency of logistics and supply chain entities focus on the operational performance; however, the financial performance might directly influence the survival of a business (Ablanedo-Rosas *et al.*, 2010). Financial and operational ratios in performance evaluation were combined by Feng and Wang (2000), for the major airlines in Taiwan. This was also done by Scheraga (2004), to investigate the operational efficiency of 38 global airlines. The financial ratio-based DEA model developed by Femandez-Castro and Salimi (1998) caught the attention of many researchers and was adopted by Al-Shammari and Salimi (1998), to evaluate the performance of banks in Jordan. The financial ratio-based DEA model was also adapted by Ablanedo-Rosas *et al.,* (2010), to study the relative efficiency of Chinese ports.

2.6. Improving financial performance

2.6.1. Introduction

Unacceptable farm financial performance, measured by the financial measurements, can be caused by many problems. These problems include factors that are beyond the producer's control (Boehlje *et al.*, 1999). When the farm is experiencing difficult times it is normally caused by several external factors and very rarely a single management problem or decision that caused the financial problem (Jolly and Vontalge, 1995). To improve the measurements different aspects of the farm has to be improved. There are several options for a producer to improve his financial performance and the improved performance will be reflected in the financial measurements. Strategies to improve the financial performance especially in times with low prices and income, is very important (Boehlje *et al.,* 1999).

2.6.2. Period identification of the problem

The producers have to identify whether it is a short-term or long-term problem. To improve the short run financial performance, one of the most important aspects is the cash-flow of the farm (Boehlje *et al.*, 1999). To improve the cash-flow, the farmer can sell some of his current assets, but has to be careful not to sell too much as it will affect his cash-flow in the future. There are several possibilities the farmer can negotiate in term of his loans. Options include: to reduce the size of intermediate or long-term debt payments or to renegotiate the repayment term of the loan. The farmer can even consider the option to lengthen the period of the term and to add a balloon payment to the last payment (Boehlje *et al.*, 1999). Short-term debt can also be extended to intermediate or long-term loans. A possibility for the farmer is to generate non-farm income or to seek ways to increase the revenues from non-farming activities and/or to reduce the non-farm expenditure including family spending (Boehlje *et al.*, 1999). One important aspect to remember regarding farming and cash-flows is that farms work according to seasonal trends (Boehlje *et al.*, 1999) and thus money flows also happen in seasonal trends.

Whenever the problem is identified to be a longer run problem, the same aspects as in the short run can be important, but there are other aspects than will require attention.

One of the important aspects that are essential is the effective usage of resources (Boehlje *et al*, 1999.). The resources must be used effectively to generate revenues and produce profit at such a level as to compete with other farmers in the industry and also to meet the need of the farmer (Boehlje *et al*, 1999).

2.6.3. Probable causes of poor financial performance

The difficulty with improving poor financial performance is that it can be caused by several interacting or chain reaction factors. In most cases the resolution for these problems are a unique situation for any given farm (Jolly and Vontalge, 1995). Even if the problems are unique to a certain farm, the options taken by that producer can provide important information and options to others that might experience almost the same or different problems. Following below are several options that can be examined and corrected to improve the financial performance of a farm.

2.6.3.1. Scale

When referring to scale it indicate the size of the farm. When a farm is too large the managerial control can be too thinly spread and this can result in inefficient production on the farm (Jolly and Vontalge, 1995). On the other hand, when a farm is too small the fixed investment costs are spread over too few units of output and this can also lead to inefficiency (Boehlje *et al.*, 1999). An important factor to consider regarding the size of the farm, is economy of scale. This will lead to minimizing per unit costs on the farm.

2.6.3.2. Employment

This employment refers to both on-farm employment and off-farm employment. When there is an excess of labour on the farm, the amount of withdrawals for wages or family living expenses can affect the profitability and even the liquidity of the farm (Jolly and Vontalge, 1995). Employment can also be affected by scale as discussed previously. The profitability of the farm can also be affected when the size of the farm is either too small or too large, relative to the labour supply. Whenever the labour supply is too large for the farm, the supply can be reduced through the use of off-farm employment or by eliminating the hired and/or the family employees of the farm (Jolly and Vontalge, 1995). The expansion of the labour force can be utilized when the supply of labour is inefficient. This can be done by purchasing or even leasing additional assets, shifting of

more labour-intensive enterprises or to attempt to improve the productivity with the use of more intensive management (Jolly and Vontalge, 1995).

2.6.3.3. Efficiency

Efficiency in this instance refers to the relationship between input and output on a farm. According to Boehlje *et al.*, (1999) the efficiency is determined by the farms manager's managerial and technical skills. In the case of large operations, efficiency will reflect not only the performance of the manager but also those of the hired managers and workers (Boehlje *et al.*, 1999). Efficiency can be measured in physical, economic and (Jolly and Vontalge, 1995) financial terms (Boehlje *et al.*, 1999). Physical terms of efficiency include factors like crop yields, pigs per litter and rate of gain, while the economic measurements include variable costs per hectare and the returns per rand of feed fed. Financial measures include measuring the intensity that the farm assets are used to generate gross revenues and how effective the cost control strategies are (Boehlje *et al.*, 1999). Even though there are a number of efficiency measurements, there are no perfect measurements (Jolly and Vontalge, 1995).

Financial efficiency of a farm is influenced by productions skills, purchasing, pricing, financing and marketing decision. For a farm to be successful it must produce sufficient net income to succeed over longer terms (Boehlje *et al.*, 1999). A farm that has a low efficiency will generally show a lower than average profitability (Jolly and Vontalge, 1995). In the long run, this lower than average profitability can realise into losses in equity that was earned and thus reduce the solvency of the farm; however, the farm may have enough equity reserves to withstand low efficiency for several years. To improve the efficiency of a farm requires, in most cases, improving the basic farm management and technical skills that are acquired on the farm (Jolly and Vontalge, 1995).

2.6.3.4. Debt structure

The debt structure refers to the amount of debt that is still outstanding, but not just the value of the debt, but the term and cost associated with the debt as well (Jolly and Vontalge, 1995). The debt structure or leverage of the farm is the relation between debt and equity capital used to finance the business. Leverage is a factor that can either

work in favour of the farm or against, all depending on whether the debt is used to generate profits that are higher than the costs of the debt. The responsibility of the producer is therefore, to construct the farm's capital structure is such a way that the leverage will work in favour of the farm and not against it (Boehlje *et al.*, 1999).

A farm that has too little debt in his capital structures can be limiting its size, efficiency, growth and earning capacity. The opposite is also true for a farm that has too much debt and can lead to inefficiency, accelerating financial losses and finally this can lead to the failure of the farm (Boehlje *et al.*, 1999). Normally the problems with debt structures arise when the debt load of the farm is too high, too costly or the repayment term is too short (Jolly and Vontalge, 1995). In the end the debt structure of farm influences the profitability through interest cost, the liquidity by the debt servicing and solvency by the value of assets that are available to secure liabilities. If a farm, has any debt, it can also be too much when this specific farm does not generate net income. Even over the short-term temporary setbacks can arise and lead to higher financial stress. This can be caused by a debt load that is too high for the current income; debt can be too costly because of rising interest rates, poorly structured repayment terms and by a drop in the value of collateral used (Boehlje *et al.*, 1999).

There are some options that a producer can consider to improve the problem areas that arise in the debt structures of a farm. The primary area of importance that must be considered, is that operating debt must be self-liquidating. Operating loans should be used to finance profitable production activities on a farm (Boehlje *et al.*, 1999). Other options that a producer or manager can consider is to lengthen the period of the loan terms that would improve the cash-flow of the farm. Liabilities can be reduced, or the assets that require debt servicing can be sold for a surplus that is higher than their cash generating abilities (Jolly and Vontalge, 1995).

Once a farm has been evaluated in terms of these four factors the producer or manager can implement corrective actions that are specially targeted at the problem areas to improve the performance and prevent future problems. Figure 2.2 is a representation of a financial troubleshooting diagnostic tree that can help with identifying and correcting problems in the financial performance of a farm. This diagnostic tree is an

oversimplified process that demonstrates the chain reactions between the four factors and actions that can be used to correct the problems (Jolly and Vontalge, 1995). This diagnostic tree displays that farms can have different options to improve their financial performances because of the differences in problems that are experienced.

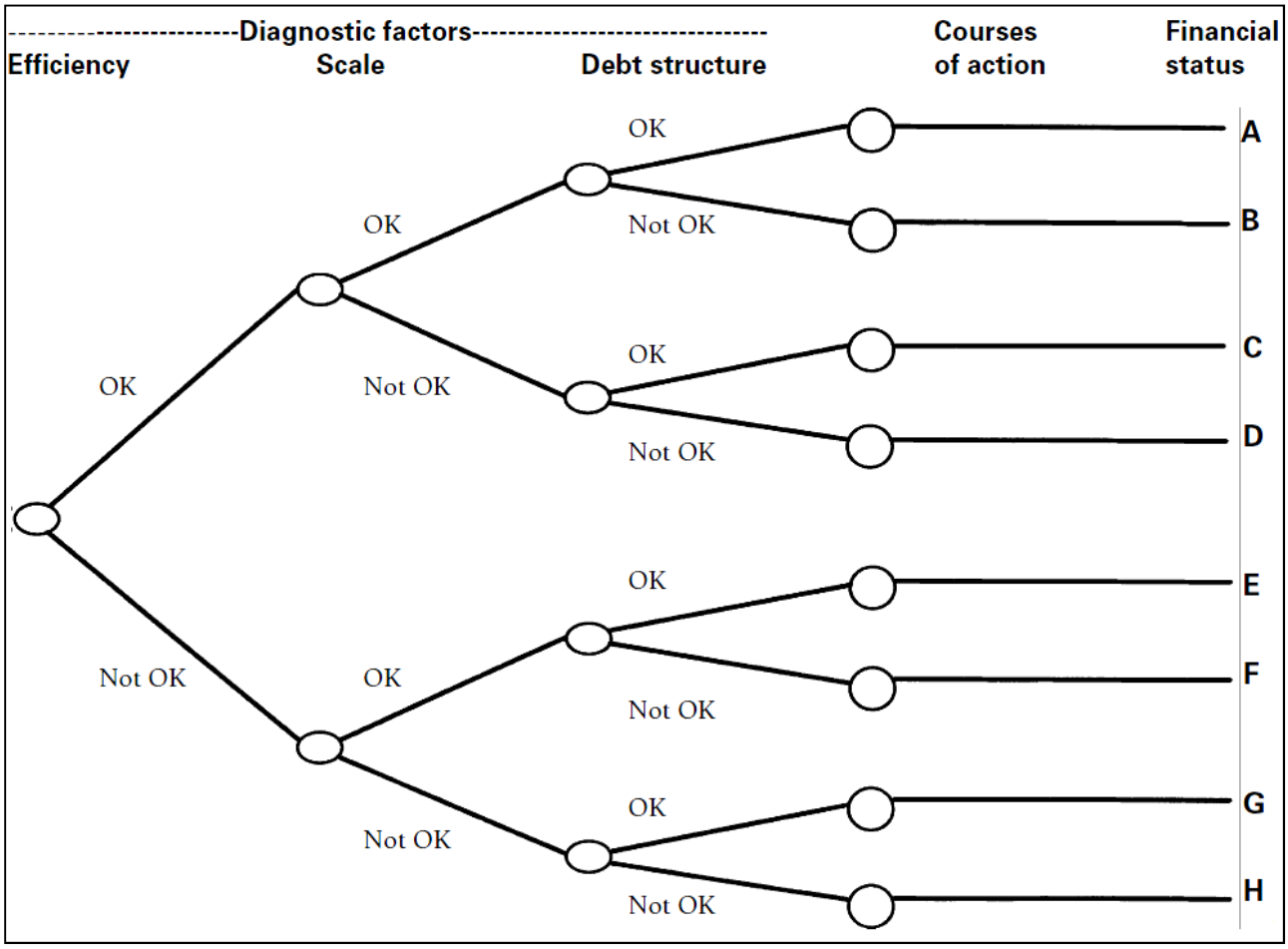

Figure 2.2: A financial troubleshooting diagnostic tree
Source: (Jolly and Vontalge, 1995)

The manager identifies problem areas by choosing whether that specific area is OK or Not OK. By doing this there are several financial status results that are identified on the right hand side by the letters A to H. When the diagnostic tree is used to rectify problem areas on the farm certain management options or adjustment exists. These options or adjustments are provided by Jolly and Vontalge (1995) and are illustrated in Figure 2.3. The options in Figure 2.3 are linked to the financial status results identified on the right hand side by the letter A to H.

----------Diagnostic Factors----------			Courses of Action	
Efficiency	Scale	Debt Structure		
	Financial Status A			
OK	OK	OK	1.	Review financial performance annually.
			2.	Keep current on new technology.
			3.	Examine potential for expansion.
			4.	Consider off-farm investments.
	Financial Status B			
OK	OK	Not OK	1.	Restructure debt: Lengthen term or reduce interest rate to improve cash flow.
			2.	Sell assets to reduce debt.
			3.	Reduce debt through “shelving” or write off.
			4.	Consider Chapter 12 bankruptcy.
	Financial Status C			
OK	Not OK	OK	1.	Address scale problem or else cash flow problems will develop.
			2.	Expand by adding an enterprise or expanding existing enterprises. Use records to make expansion decision.
			3.	Investigate custom crop farming or custom livestock feeding.
			4.	Use resources fully: machinery, labour.
			5.	Examine whether management ability and emotional stability are sufficient to handle the additional stress of expansion.
			6.	Increase off-farm employment, but assess its effect on efficiency.
			7.	Consider retiring, if appropriate.
	Financial Status D			
OK	Not OK	Not OK	1.	Identify several low cost ways to expand, such as renting additional land or facilities custom feeding livestock, crop share renting vs. Cash renting or custom crop farming.
			2.	Increase of-farm income, but assess its effect on efficiency.
			3.	Scale back the farm business to allow a significant increase in off-farm income.
			4.	Declare Chapter 7 bankruptcy, and start again.
	Financial Status E			
Not OK	OK	OK	1.	Improve enterprise record keeping and analysis.
			2.	Re-orient priorities: Spend more time on management.
			3.	Deal with facts. Management is a personal thing and affects self-worth.
			4.	Work to improve and sustain management.
			5.	Use advisory services.
			6.	Improve marketing skill and performance.
			7.	Examine family living expenditures and operating costs.
			8.	Evaluate whether the operation is too large to manage efficiently.
			9.	Discuss whether to quit farming while equity is still good.
			10.	Establish a point where additional credit should not be extended.
			11.	Decide if an off-farm job would be better than self-employment.
	Financial Status F			
Not OK	OK	Not ok	1.	Determine if debt problems are due to poor efficiency or outside circumstances. Will debt problems develop again of solved now?
			2.	Evaluate long-term. Is there a future in farming?
	Financial Status G			
Not OK	Not OK	OK	1.	Determine of farming is a “hobby” rather than a business.
			2.	Consider leaving before equity is gone.
			3.	Determine if resources can be employed better elsewhere.
			4.	Obtain off-farm employment.
	Financial Status H			
Not OK	Not OK	Not OK	1.	Decide if resolving this difficult situation is worth the hassle.
			2.	Consider the effects on marriage, family, health and so on.
			3.	Consider selling out or declaring bankruptcy.

Figure 2.3: Financial troubleshooting diagnostic factors and action courses

Source: (Jolly and Vontalge, 1995)

This list in Figure 2.3 provides merely a few of the options available; they just provide simple ways by which the problems can be resolved. Boehlje *et al.*, (1999) also adopted some of the courses of action that are shown in Figure 2.3 and listed several courses that can be adopted to improve the financial performance of a farm. These courses of action by Boehlje *et al.*, 1999 are shown in Figure 2.4.

Scale

1. Expand by adding an enterprise or expanding existing enterprises. Use demonstrated results (records) to make expansion decisions.
2. Use fixed resources (machinery and labour) fully.
3. Identify low-cost ways to expand, such as renting additional land or facilities, custom feeding livestock, crop-share renting, or custom farming.
4. Examine whether your management ability and emotional stability are sufficient to handle the additional stress of expansion.
5. Increase off-farm employment, but assess its effect on efficiency.
6. Scale back your farm business to allow a significant increase in off-farm income.
7. Consider retiring, if appropriate.
8. Consider merging with another farming unit.

Employment

1. Eliminate hired family employees.
2. Obtain an off-farm job.
3. Move to part-time farming status.
4. Add labour-intensive enterprises with low-capital requirements.
5. Expand operations to increase labour use.
6. Increase intensity of operations (throughput) to increase labour productivity.
7. Reduce family withdrawals to a level that is consistent with efficiency or level of farm employment.

Efficiency

1. Reduce family living expenditures and operating costs.
2. Focus on productivity and throughput.
3. Improve enterprise record keeping and analysis.
4. Reorient priorities; spend more time on management.
5. Use advisory services. Don't do things that others can do cheaper and better.
6. Improve marketing skill and performance.
7. Evaluate whether the operation is too large to manage efficiently.

Leverage

1. Establish minimum standards for the financial performance of new investments.
2. Evaluate the costs and returns associated with every investment considered.
3. Don't use cash flow or operating loan proceeds to finance capital purchases.
4. Use retained earnings to finance the equity component of capital purchases.
5. Maintain adequate financial reserves.
6. Structure debt in order to maintain balance between assets' useful lives and repayment periods. Don't abdicate your role in negotiating repayment terms.
7. Never give more collateral than is absolutely necessary.
8. Avoid high-cost borrowing, such as overdrafts and credit card debt.
9. Estimate how much you can afford to owe based on expected future income.
10. Identify and sell unproductive/unprofitable assets; reduce and restructure debts.
11. Don't own what you can control through leases; sell and lease-back.
12. Evaluate the rate of return expected from capital investments, and compare to the interest rate of borrowed debt.

Figure 2.4: Courses of action to improve farm financial performance

Source: (Boehlje *et al.*, 1999)

These are not the only options available to a producer to improve his financial performance. This is just to provide a starting point of options to be considered that are available to the producers.

Chapter 3
Methodology

3.1. Introduction

When developing a financial measurement benchmarking system, financial statements are needed to calculate the measurements. The financial measurements can be calculated from a balance sheet and income statement of a farm. In order to calculate the measurements, the financial statements have to be obtained from several farms.

3.2. Data used and study area

The data used in the study was obtained from GWK Limited agribusiness head office in Douglas. GWK Limited has a study group of producers in the GWK trading areas that include: Barkley West, Douglas, Hopetown, Marydale, Modderrivier, Niekerkshoop and Prieska. These areas are divided into the Douglas, Hopetown, Jacobsdal, Prieska and Prieska Livestock study groups. The position of these towns in South Africa is shown in Figure 3.1. One of the services provided by GWK, is an annual production results analysis that is formulated from a group of producers that forms part of their study group. Most of the Crop producers in the district are irrigation producers. The data used include the financial statements from the study groups used to draft the production results annually; the income statement and balance sheet from amongst all the available data of the study group were obtained. According to the FFSC (2008), these statements contain enough information to analyse the financial position of a farm according to 16 financial measurements (Hoag, 2009). The FFSC proposed standardized processes on how to calculate each one of the 16 measurements known as the “Sweet 16” (Hoag, 2009). The financial statement available from these study groups for the years 2004 to 2009 are a total of between 76 and 85 farms. Only 38 farms were identified as complete for the years 2005 to 2009 (5 years). These farms were analysed according to the financial formulas for the “Sweet 16” ratios as identified by Blocker *et al.* (2003) and recommended by the FFSC like it is shown in Table 3.2.

The financial statements obtained from GWK do not include depreciation because they use the statements to compare the different farms in their districts according to averages. The reason for omitting depreciation is that different methods exist to calculate depreciation and each producer can choose his own method to determine his depreciation of assets. For this reason GWK has decided to omit the depreciation because it can influence their data (Zwiegers and Kluge, 2010). In this specific study depreciation are also omitted and only 14 of the "sweet 16" ratios are calculated and used to evaluate and benchmark the GWK district producers. The other measurement that were not used, are the term debt ratio.

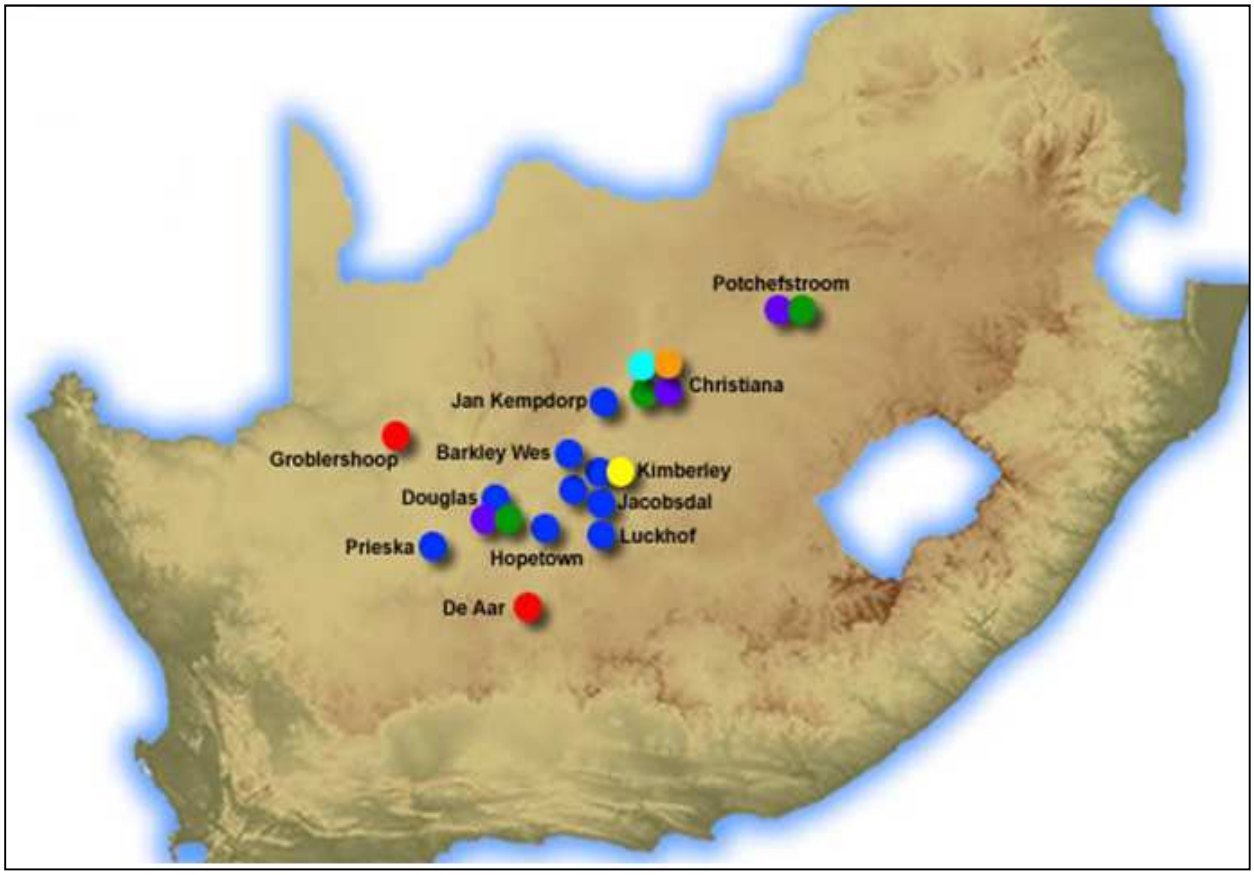

Figure 3.1: GWK trading area, Northern Cape, South Africa
Source: (GWK, 2011)

3.2.1. Methodological framework

There are some important factors that have to be investigated to gain a better understanding of the measurements obtained and the changes that occurred annually. The agriculture sector, just as many other sectors, is dependent on the economy as a

whole. As the economy change, there will be some changes in the agriculture sector. To have a better understanding of these trends, reports from the Department of Agriculture, Forestry and Fisheries are used. The data used is published in the reports called Trends in the Agricultural sector, Economic Review of South African Agriculture and Abstract of Agriculture Statistics. The main purpose for the use of these reports are to identify the economic trends resulting from external economic factors in agriculture over the years from 2005 to 2009; this will help to understand the variations in the financial performance of the producers in the study district. Variation in the financial performance can be influenced by the management and management decision of a farm, but can also be influenced by the external economic situation in which the farm has to be managed. This is the main reason why it is important to analyse the macro economic trends in the agriculture sector as a whole, as there exist some variations in the sector that is passed on to the performance of individual farms. These macroeconomic changes that occur also influence the financial performance of producers in the GWK trading area. When there are changes in the agriculture sector, the producers from the GWK trading area are also influenced and this can have an effect on their financial performance. This is why it is necessary to compare the economic trends in the agriculture sector as a whole to the changes that were experienced by the GWK producers. With a better understanding of what happened in the agriculture sector during the five year period, the financial statements for the GWK producers can be analyzed.

3.3. Benchmarking model

To analyze the financial statements for each of the farms, Microsoft Excel will be used. The measurements are calculated for each year over the five year period. These measurements are then divided into the three performance groups, bottom third, mid-point third and top third; groups are determined using the Excel function that identifies the third (⅓) largest and smallest value in a range of values. The range of values will be all the measurements that were calculated for the all the farms. The value that is identified as the third (⅓) largest and smallest is used as the border measurement for each of the ratios calculated. Benchmarking is done according to four farm types, firstly, all the farms (38) were included and secondly, all the livestock farms (9), thirdly,

the Crop-producing farms (17) and lastly, the combined enterprise farms (12). The total number of financial statements that has been analysed over the 5 years, is 190. Each farm has a number that is used in the study to identify the farm, a list of the numbers and the enterprise for the specific farm follows in Table 3.1.

Table 3.1: Farm identification numbers

Farm number	Enterprise	Farm number	Enterprise	Farm number	Enterprise
2	Mixed	4	Crop	30	Livestock
3	Mixed	5	Crop	32	Livestock
6	Mixed	8	Crop	34	Livestock
7	Mixed	9	Crop	40	Livestock
15	Mixed	13	Crop	43	Livestock
18	Mixed	14	Crop	45	Livestock
22	Mixed	16	Crop	49	Livestock
25	Mixed	17	Crop	50	Livestock
31	Mixed	20	Crop	54	Livestock
33	Mixed	21	Crop		
35	Mixed	23	Crop		
61	Mixed	24	Crop		
		27	Crop		
		29	Crop		
		38	Crop		
		44	Crop		
		69	Crop		

All of these farms shown in Table 3.1 are situated in the area indicated in Figure 3.1. The indicated area in the figure is the GWK trading area as used in this study, with the mentioned towns all situated within this area.

To analyse the financial statements for the producers in the GWK trading area, the previously mentioned “sweet 16” ratios are used as guidelines. The calculations for each of the measurements are shown in Table 3.2. The calculations are based on the proposed methods by the FARM FINANCIAL STANDARDS COUNCIL from the United States of America.

After the measurements are determined, the correlation has been tested between the farms, namely, only the Crop enterprise farms, mixed enterprise farms and the livestock

enterprise farms. The correlations are calculated in Excel's data analysis tool of correlation. The testing of correlation should give an indication of the interdependence of the measurements on each other and help the producer to make better business decisions knowing what the influence of one measurement is on the other measurements.

Table 3.2: "Sweet 16" Farm Financial Measures

Liquidity	
Current ratio	Total current farm assets ÷ Total current farm liabilities
Working Capital	Total current farm assets − Total current farm liabilities
Solvency	
Debt to Asset	Total farm liabilities ÷ Total farm assets
Equity to Asset	Total farm equity ÷ Total farm assets
Debt to Equity	Total farm liabilities ÷ Total farm equity
Profitability	
Rate of return on assets	(Net farm income from operations + Farm interest expense - Owner withdrawals for unpaid labour and management) ÷ total farm assets
Rate of return on equity	(Net farm income from operations - Owner withdrawals for unpaid labour and Management) ÷ total farm equity
Operating profit margin	(Net farm income from operations + Farm interest expense - Owner withdrawals for unpaid labour and management) ÷ Gross revenues
Net Farm income	Net farm income, accrual-adjusted (NFI) is calculated by matching revenues with expenses incurred to create those revenues, plus the gain or loss on the sale of business assets, but before taxes.
Repayment Capacity	
Capital debt repayment capacity	Net farm income from operations +/- Total miscellaneous revenues/expenses+ total nonfarm income- total income tax expenses total owners withdrawals+ interest on term debt
Financial Efficiency	
Asset turnover ratio	Gross revenues ÷ total farm assets
Operating expense ratio	(Total operating expenses - Depreciation/amortization expense) ÷ Gross revenues
Interest expense ratio	Total farm interest expense ÷ Gross revenues
Net income ratio	Net farm income from operations ÷ Gross revenues

Source: (FFSC, 2008)

After all the analyses have been done, the measurements can be used to determine the operating efficiency of one farm in relation to the other farms in his enterprise group. To

determine the operating efficiency of a farm a method called Data Envelopment Analysis will be used.

3.4. Data Envelopment Analysis

To rank the farms according to their operating efficiency, a DEA model has been constructed. The DEA adapted model provides a judgement on the efficiency of the farms, taking into account multiple financial measurements at once and combining them into a single measurement of efficiency. The approach by Fernandez-Castro and Smith (1994) was adopted by Al-Shammari and Salimi, (1998) in modelling the operating efficiency of banks: a non-parametric methodology. The same equations were used by Ablanedo-Rosas *et al.*, (2010) where they studied the relative efficiency of Chinese ports. In their research they examined the relative efficiency of 11 major Chinese ports by using an innovative adapted version of DEA (Ablanedo-Rosas *et al.*, 2010). This adapted version is an output orientated version of DEA that is based on financial measurements in which no inputs are used (Ablanedo-Rosas *et al.*, 2010). The financial measurement-based DEA model is as follows:

$$Maximize\ z_0$$

Subject to: $\sum_{n=1}^{N=1} \lambda n\, r_{in} \geq z_0 r_{i0}$ i=1,…, m

$$\sum_{n=1}^{N} \lambda_n = 1$$

$$Z_0 \geq 0;\ \lambda_n \geq 0\ (n = 1, \ldots\ldots, N)$$

Where Z_0 indicates the efficiency score of the measurement for DMU_0, λn represents the weight that is placed on each of the DMU's to determine the efficiency frontier for DMU_0 while r_i represents the observed measurement for DMU_0. N refers to the total number of DMU which is apprised on *m* financial measurements (Al-Shammari and Salimi, 1998).

For every farm the mathematical model is solved and in this manner the relative efficiency is determined for each DMU in question (Ablanedo-Rosas *et al.*, 2010). The output-orientated and financial measurement-based DEA model with variable returns to scale is defined by the equation described for measuring the efficiency of the DMU.

The efficiency score (α) for the DMU_0 is given by $1/Z_0$ and is positive and less or equal to 1 (Ablanedo-Rosas *et al.*, 2010). This efficiency score or α allows the ranking of the current DMU (DMU_0), where a port with an efficiency score of 1 is considerd as efficient and any score less than 1 (α<1) as inefficient (Ablanedo-Rosas *et al.*, 2010).

3.5. Summary of Methodology

The data obtained for the study consists of two parts. The first part is the macro economic data, that were obtained from reports that are produced by the National Department of Agriculture in South Africa. Data from these reports will be summarized by looking at key aspects that will have an influence on the financial performance of South African producers. The second part of the data is about the South African producers, more specificaly GWK trading area producers. GWK Limited has study group data that includes the financial statements of 38 producers over 5 years. Within the GWK trading area there are several enterprise farms in existence, which are divided into three groups namely, combined, Crop and livestock enterprises. The data from these farms was analyzed by using 14 of the "Sweet 16" financial measurements.

Each of the financial measurements were divided into three groups, top third, middle third and bottom third. These groups are the three performance groups that illustrate the performance of the financial measurement, with the best position being in the top third. The cut-off values are determined and are used as norms for benchmarking different farms against each other to determine the performance of a specific farm in relation to others. Another benchkmarking method will be used as well namely, to test the norms that were determined by the cut-off values and provide an extra method that can be used. This method is known as DEA, that identifies a farm as being efficient or inefficient.

A schematic summary of the Methodology is illustrated in Figure 3.2.

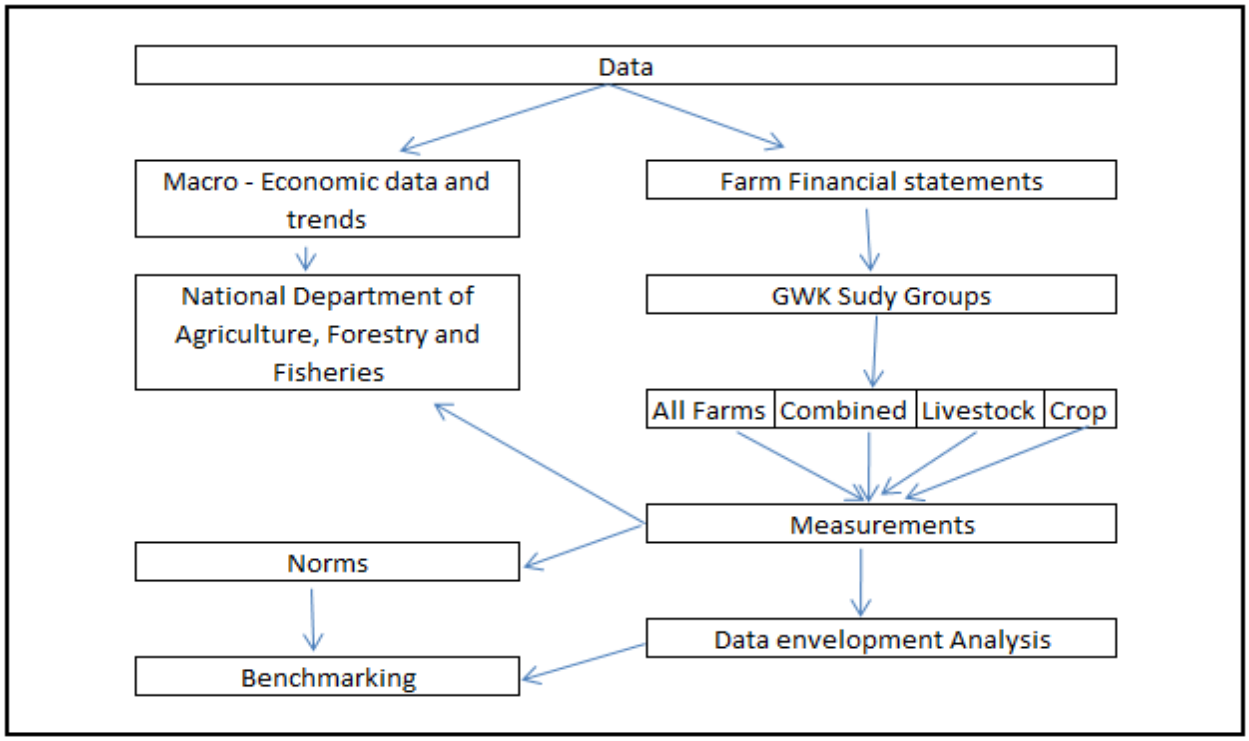

Figure 3.2: Schematic summary of methodology

Chapter 4
Overview of the South African Agriculture

4.1. Introduction

Before developing the cut-off values for the farms of the GWK district, one must evaluate the South African economy and the macro environment that has an effect on the agriculture sector. The producers are influenced by the economy and macro environment by factors amongst others, the inflation rate (Consumer Price Index) and Producer Price Index (PPI), interest rate. This is an important part of the study as these trends have an influence and give a better understanding of why certain ratios have been improving or declining within a certain period. The producers are influenced by the same factors that influence other producers, so the trends give a better understanding of what has happened and can even supply information on what can be expected in the future. Factors like the climate, prices of products and the volume of production influence the value of production, cash flow and net income of the farms. The interest rate cycle influences the level of farming debt, total assets and capital.

In this chapter these factors will be discussed and the trends displayed in graphs. The first part will be about the South African agriculture, the second part about the GWK producers' enterprises and then finally, the two sections will be compared to see whether there were any similarities in the movements and trends over the years. This will facilitate the process to ascertain when macroeconomic changes occur in the South African agriculture and if these changes have immediate or delayed effects on the financial position of the GWK trading area producers. The products mainly produced by the producers in the district include: wheat, maize, sheep and cattle. The focus in this chapter will be on the above-mentioned products, as they have an effect on the farm as a business. All prices used in order to evaluate the changes are in real terms.

4.2. South African Agriculture

The season in review is not a specific production year, as it is from June to July. The season is an annual review, from July to June, which indicates what has happened with the production and prices during that specific year. Table 4.1 is a summary of what happened during the 5 years of the study, with an indication of the percentage change from year to year. Following the table will be a short summary for each year, highlighting the important changes that occurred.

Table 4.1: Summary of the overview of the South African agriculture economy (R millions)

	Gross value of production	Net Farm income	Expenditure on intermediate goods and services	Capital assets and investments	Farming debt
2004/05	R 70 207	R 12 188	R 40 410	R 140 317	R 35 592
% change	**+6%**	**+16%**	**+6%**	**+8%**	**+3%**
2005/06	R 74 245	R 14 088	R 42 637	R 150 996	R 36 686
% change	**+26%**	**+107%**	**+12%**	**+9%**	**+8%**
2006/07	R 93 390	R 29 164	R 47 796	R 164 141	R 39 481
% change	**+28%**	**+26%**	**+20%**	**+13%**	**+14%**
2007/08	R 119 840	R 36 673	R 57 486	R 184 874	R 44 940
% change	**+6%**	**+15%**	**+18%**	**+12%**	**+4%**
2008/09	R 127 568	R 42 329	R 67 647	R 206 582	R 46 792

Sources: (DAFF, 2006), (DAFF, 2007), (DAFF, 2008), (DAFF, 2009) and (DAFF, 2010)

4.2.1. The 2004/05 season

The 2004/05 season in review, ending June 2005, is the first season to be included in this study. This season is the basis of comparison for the seasons that follow until 2008/09. The volume of South African production for 2004/05 was higher than the previous season due to higher maize and soya bean production (DAFF, 2006). Producer prices of agriculture products had decreased on average from the 2003/04 season with 8.4% to the 2004/05 season. Total gross value of production for the 2004/05 season has decreased from the previous season and can be attributed to a decrease in the value of field crops that were produced as result of lower field crop

prices (DAFF, 2006). There was a decrease in the average prices received by producers for summer grain crops, oilseeds and sugar cane (DAFF, 2006). Gross income from animal products had however, shown a small increase compared to the previous season. The decrease in gross value of production is reflected in the decreasing farming income (DAFF, 2006).

The expenditure on fuel and fertilisers had the largest increase during this period (DAFF, 2006). Farm feeds were the main intermediate expenditure, and generally there was an increase in the prices of goods and services purchased for the production process during the 2004/05 season (DAFF, 2006). The net farm income for the 2004/05 season had decreased from the previous year (DAFF, 2006).

Capital assets and investments in agriculture for the 2004/05 season increased (DAFF, 2006). The largest contributor to the increase in capital assets and investments was a change in livestock inventory. While capital assets and investments increased, the direct effect was that the total farming debt had also increased. One positive fact was that while total debt had increased, the debt as a percentage of assets had a sideward's trend for the past three seasons, after a decrease in percentage from the 2000/01 season to the 2002/03 season (DAFF, 2006).

In summary for the 2004/05 season, the decrease in gross value of production and net income will have a negative effect on the asset turnover ratio, net income ratio, ROA, ROE, operating profit margin, capital debt repayment capacity and net income. These same factors would also be influenced by the increase in production costs such as fuel, fertilizers and farm feeds. The operating expense ratio would therefore be higher because of the lower income levels and higher costs. The increase in capital assets and investments would cause a decrease in the debt against assets and debt against equity ratios and an increase in the equity against assets ratio. Total levels of debt as a percentage of assets had stayed relatively constant.

4.2.2. The 2005/06 season

During the 2005/06 season the agriculture production was lower than the previous season (DAFF, 2007). Field crops production had decreased as a result of the

decrease in maize, sorghum and dry bean production. Overall prices for agriculture products increased in 2005/06 from the previous season.

Gross value of production for the 2005/06 season increased by 5.75%; the increase in the gross value of production for the 2005/06 season can mainly be attributed to the animal products that were produced (DAFF, 2007). Farm income for the season also increased and was also attributed mainly to the increase in production of red and white meat and the increase in prices received for animal and horticulture products. Gross income from field crops decreased from the previous season due to a smaller maize crop.

The expenditures with the largest increases were fuel and farm services (DAFF, 2008). Farm feeds were the largest expenditure for the season, followed by farm services, maintenance and repairs, fuel and fertilizers. Generally there was an increase in the prices of goods and services that were purchased for the production process.

The gross investments in fixed improvements increased while machinery, implement and vehicle investments decreased by 2.4%, while the livestock inventory was virtually unchanged with no significant changes in the total number of animals compared to the previous year (DAFF, 2007). With capital assets in investments, the total farming debt has also shown an increase from the previous year (DAFF, 2007).

At the end of the 2005/06 year, the increase in gross value of production and net income will cause an increase in the following measurements: ROA, ROE, operating profit margin, net income, asset turnover ratio and net income ratio. Some of these ratios will also be negatively influenced by the increase in costs, depending on which change, income or costs, was the largest. The operating expense ratio will also be influenced by the change in income and costs but would increase with higher costs and decrease with higher income levels. The total debt and assets had both increased over the period, thus influencing the debt against assets and debt against equity ratios. With the increase in debt levels the equity against assets ratio can decline as more assets are obtained by using debt.

4.2.3. The 2006/07 season

From the 2005/06 season there was an increase in the volume of production (DAFF, 2008); even though there was an increase in the volume of production, the production of field crops decreased slightly as a result of the decline in oilseeds and hay products. The increase in volume of production is reflected in the increase in the gross value of production (DAFF, 2009). The increase can mainly be explained by the increase in the value of field crops (DAFF, 2009). The largest contributor, on percentage basis, to gross value of production was animal products, followed by field crops and then horticulture products (DAFF, 2008).

The gross income and expenditure on intermediate goods and services increased (DAFF, 2009). The two main expenditure items for the season were fertilisers and farm services (DAFF, 2009).

Capital assets and investment in agriculture during the 2006/07 season was higher (DAFF, 2009). The increase in the capital assets and investment was helped by the decrease in livestock inventory compared to the previous year. This decrease is an improvement due to the fact that the change in livestock inventory had improved from high negative values in 2005/06 to smaller negative values. Total farming debt of the producers had increased to (DAFF, 2009).

The increase in gross value of production and gross income will increase the profitability and efficiency; increase in prices will also have a positive effect on the liquidity. The increase in the expenditure on goods and services will increase the operating expenses of the farming business, but as long as the increase in gross production value is larger than the increase in costs, the profitability and efficiency of the farms will keep on increasing. An increase in total assets of the farms will increase the solvency of the businesses but just as long as the increase in debt is smaller than the increase in assets.

4.2.4. The 2007/08 season

The volume of agriculture production for 2007/08 was 8% higher than the previous season (DAFF, 2009). Field crop production represented the biggest increase in production compared to the previous year, an increase of 29.3%, as a result in higher

production of summer grains and oilseeds (DAFF, 2009). Due to an increase in poultry products, production of animal products had showed a slight increase of 2.3%. With the increase in the volume of production for the 2007/08 season, the producer prices also increased on average by 24.1% (DAFF, 2009). The prices of field crops, weighted average price, increased by 41.2%, winter grains prices with 100.6%, oilseeds 79.9% and summer grain prices increased by 24.9%. Lastly, the prices of animal products had increased by 14.8% (DAFF, 2009).

With the overall increases in volume of production and increase in producer prices the gross value of production increased (DAFF, 2010). According to the Department of Agriculture, Forestry and Fisheries (DAFF) (2009), this increase can mainly be attributed to the increase in the value of field crops and the overall increase in prices received by the producers for the products they produced, as also explained previously. The inputs costs used to produce the products, had increased by just more than 20% from the previous season (DAFF, 2010), as a results of the increase in the expenditure on fertilizers and fuels (DAFF, 2009). The payment on salaries represented 14% of total farming costs and the interest paid by the producers to banks and other financiers accounted for 5.7% of the total farming costs (DAFF, 2009).

Gross investments for the season had increased by almost 8%, with an increase in the investments in machinery, implements and vehicles of 29% (DAFF, 2009). With the increase in total assets and investments the total farming debt for the 2007/08 season had increased (DAFF, 2010).

The 2007/08 year mostly had the same changes as the previous year with increases in gross value of production, gross income, expenditure on goods and services. Increases in the value of production should be marginally larger than increases of costs to be sure that the performance measure will increase. Debt and assets also increased over the period but the increase in assets remain larger than debt.

4.2.5. The 2008/09 season

For the last year, there has only been an estimated increase in production of 0.7%, with a decrease in the volume of field crops production of 2.4%, as a result of a decrease in

the production of summer grains (DAFF, 2010). In contrast to the decrease in summer grains, there have been increases in both winter grain and oilseeds production. In the case of oilseeds the highest levels of production ever was reported in the 2008/09 season (DAFF, 2010). Animal production had also showed a slight increase, this is a smaller increase than the increases from the previous season. With the decline in the volume of production there has been a slight increase in the average prices for the 2008/09 season (DAFF, 2010). The weighted average of field crops had increased slightly by 3%, while the prices of winter grain, oilseeds and summer grains all decreased. Prices of horticulture products and animal products had both increased with 7.7% and 8.5% respectively (DAFF, 2010).

Total production during the 2008/09 season increased with just over 6% (DAFF, 2011). This increase was mainly because of the slight increases in the value of horticulture and animal products (DAFF, 2011). The total expenditure on goods and services for the season, used as inputs in the production process, has increased with about 17% (DAFF, 2011). Expenditure on farm feeds, fuel and fertilizers were the products that had the biggest increases in prices (DAFF, 2010). The expenditure on salaries and wages was 12.7% of the total costs, a decrease from the previous year's 14% (DAFF, 2009) and the interest to banks and other financiers with a slight decrease to 5.5% (DAFF, 2010) compared to the previous 5.7% (DAFF, 2009).

The capital assets and investments in agriculture had increased from the previous season (DAFF, 2011). As during the previous year, the land and fixed improvements was the largest percentage of assets followed by livestock and machinery and implements (DAFF, 2010). Gross investments had also increased for the last season, with only a decline in the livestock inventory compared to the previous year. Debt as a percentage of total assets had fallen after a rather steady level over the previous seasons (DAFF, 2011).

A decrease in the level of production had no negative influence on the gross value of production as the prices of products increased. The costs of inputs and other expenditure also increased but the increase in production value was larger than the

increase in costs. Total debt as a percentage of total assets has decreased in the 2008/09 year, after relative steady levels over the previous few seasons.

4.2.6. Summary of trends in RSA agriculture on performance measurements

In Table 4.2, the possible changes that can occur in the financial measurements because of the changes in the South African Agricultural sector. This is just an indication of what should happen when considering only the relevant measurement and other factors remain unchanged.

Table 4.2: Possible changes in financial measurements due to changes in Agricultural economy

Measurements / Season	2004/05	2005/06	2006/07	2007/08	2008/09
Liquidity	Increase	Increase	Increase	Increase	Increase
Solvency[3]	Small increase	Decrease	Increase	Increase	Increase
Debt repayment ability	Higher	Increase	Increase	Increase	Increase
Profitability	Decrease	Increase	Increase	Increase	Increase
Financial Efficiency	Decrease	Increase	Increase	Increase	Increase

4.3. Producer prices and volume of Agriculture products

4.3.1. Introduction

Before evaluating what happened to the value of production for the GWK producers and the overall agricultural sector of the country, producer prices that influence the value of production will be discussed shortly. The two factors that have an influence on the value of production are the volumes that are produced and the prices received. This will provide some background on why there could have been a change in the value of the total volume of products produced.

It is important to remember that the price received per ton will have an effect on the volume of production in the next production year. The future price of a commodity helps to determine the area that will be planted and ultimately the quantity that is produced.

[3] Measured as debt against assets

The quantity that is produced multiplied with the price determines the value of production, and therefore one must consider the trends and volumes that prices follow. The prices for the different commodities are displayed in Figure 4.1.

It is no surprise, therefore, that agricultural producers tend to increase production when very high prices are expected; the same can be expected with production at very low prices (Rhodes, Dauve, and Parcell, 2007). In the words of Rhodes *et al.,* (2007), the response to the expected profits is the economic force behind the saying: "high prices are the cure for high prices and low prices are the cure for low prices." The time for adjustments to the prices in agriculture cannot be done over a short time such as the time necessary in factories or other businesses; the adjustment in agriculture is limited by time lags. Producers cannot increase the output of their production by next week by just increasing the number of workers or any other option, most of the production is done annually or in different cycles (Rhodes *et al., 2007*).

Boom and bust events in the economy tend to characterise the agricultural markets of a country (Gouel, 2010). Ezekiel (1938) had proposed the first formalisations for agriculture product prices with the use of the famous cobweb theorem (Gouel, 2010). This theorem describes the feature of agriculture markets where the production decision is made before the realisation of the product. This position leads to a short-term inelastic supply in the market and if this is accompanied by a low elastic demand, the implications are that a market disturbance will have an effect on the price (Gouel, 2010). Any adjustment in the market is very inflexible and the prices need to change noticeably to have any real change on demand. The cobweb model is a model that explains why the prices may fluctuate due to cyclical supply and demand in a market, where the amounts that will be produced are chosen before prices are observed. The cobweb model can be applied to the agriculture market as there is a time lag between the time when a product is planted and the time it is harvested.

There are a few agricultural prices that follow a regular pattern repeated over time – the price cycle (Rhodes *et al.*, 2007). These cycles of prices depend on a time lag, when prices are high, it will lead to higher output, the output will again lead to lower prices that will in turn, lead to lower output and this will once again cause an increase in prices and

the cycle starts all over again (Rhodes *et al.*, 2007). The cobweb model shows how it can be possible to have cyclical prices (Rhodes *et al.*, 2007). These cycling prices must be kept in the back of one's mind when considering the prices of agricultural products which will now be discussed.

4.3.2. Maize

Maize is the most important grain crop produced in South Africa. One advantage of maize is that it is being used as both a major feed grain and a staple food for the majority of the South Africa population (DAFF, 2007). The greater part of the maize that is produced in the country consists of white maize that is being used for human consumption (60%). The other 40% is made up of yellow maize used for the animal feeding industry (DAFF, 2007). The maize industry is characterised by volatile prices that are determined on the Johannesburg Futures Exchange, namely SAFEX.

The contribution of the maize industry to the gross value of agricultural production declined from the 2001/02 production season, mainly as a result of low world commodity prices. The prices of maize have been increasing for the first couple of seasons from 2004/5 to 2006/7. From 2006/7 the prices increased at a decreasing rate to the 2007/8 season and then the price has shown a considerable decrease to the 2008/9 season. The nominal and real prices for maize are shown in Figure 4.1 as well as the volume of maize production over the five year period.

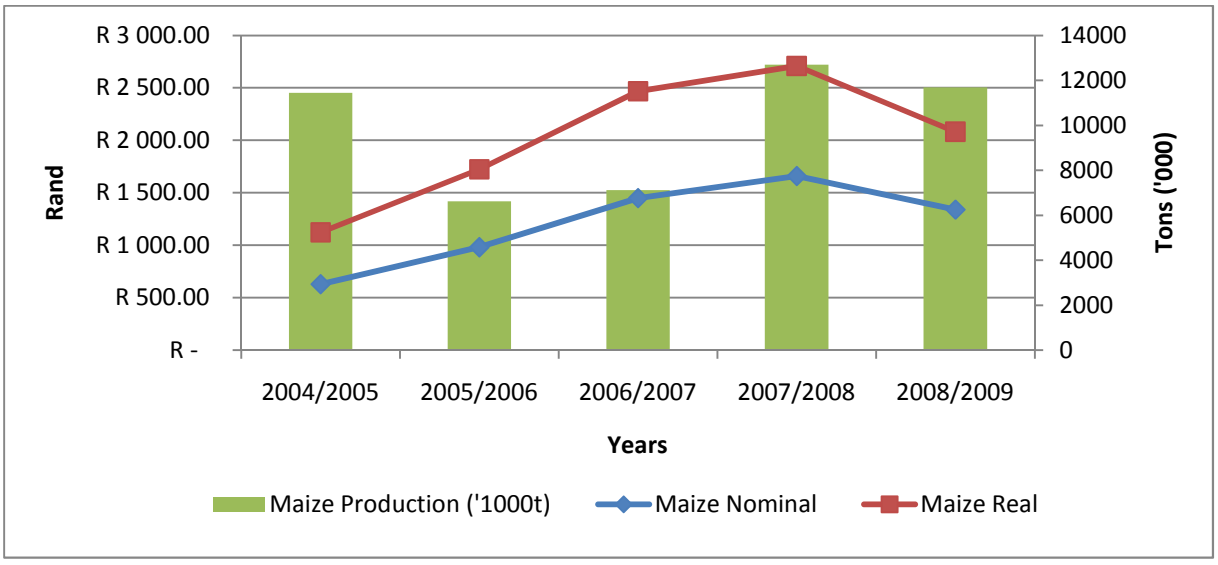

Figure 4.1: Nominal, real average Maize prices and production from 2004/5 to 2008/9
Source: (DAFF, 2009)

In contrast with the 2006/7 season the 2007/8 season had good consistent rainfall during the planting season, especially over the main producing areas (DAFF, 2009). This rainfall led to soil moisture increasing considerably and in turn the total area planted had increased by 9.7% to 2 799 000 ha (DAFF, 2009), from the previous year's 2 551 000 ha. Not only did the area planted increased in the 2007/8 season, there was also an increase in the average yield from the previous season. With the increases in area planted and yields, the total production in 2007/8 increased to 12 700 000 ton. This is the highest production over the five year period and an increase of 78% from 2006/7 (DAFF, 2010).

When one consider the prices and volume of maize, it is important to look at what had happened with the prices of sunflower and volume of production of sunflower. Many of the producers regard sunflower as an alternative to maize (JSE, 2010).

A summary of the annual maize prices for the seasons 2004/05 to 2008/09 is given in Table 4.2, at the end of this chapter.

4.3.3. Wheat

In terms of volume of production, wheat is the second most important field crop that is produced in South Africa. According to the DAFF (2010), the average annual gross revenue from wheat for the past 5 years, up to 2008/9, was R 3 360 million. Wheat is a commodity that is grown in the winter, planted from mid April to mid June in winter rainfall areas and between mid May and mid July in summer rainfall areas. Most of the wheat produced in South Africa is bread wheat and is generally classed as "hard" or "soft". The hard or soft is an indication of the protein content, hard wheat tends to have higher protein content than softer wheat.

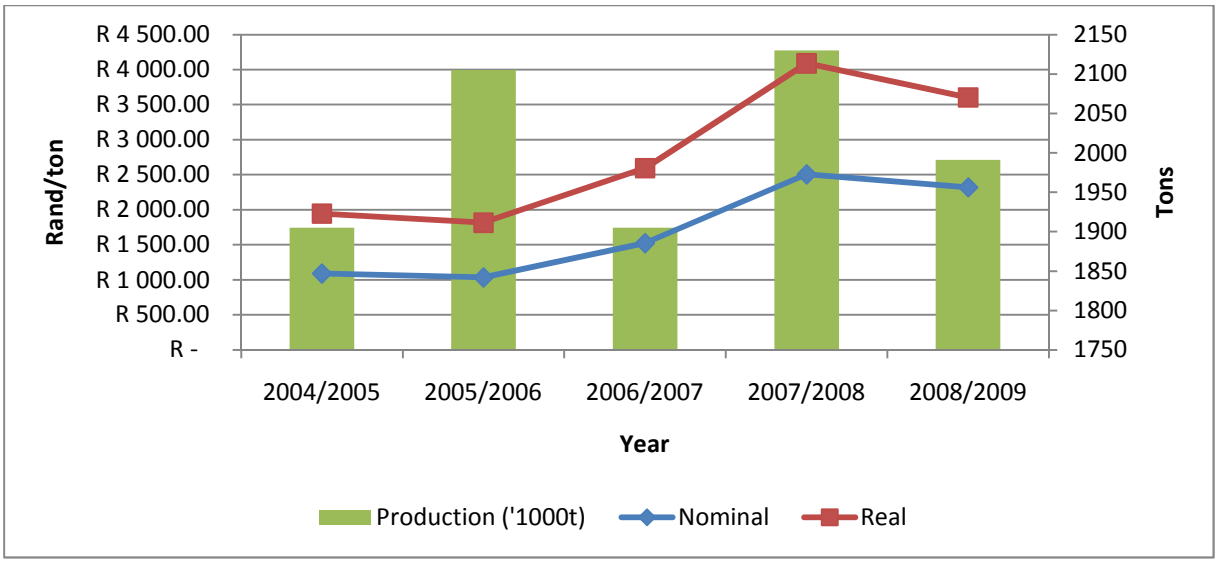

Figure 4.2: Nominal, real average Wheat prices and production from 2004/5 to 2008/9
Source: (DAFF, 2010) and (DAFF, 2011)

In Figure 4.2 the average wheat price for each of the respected years is shown in real and nominal terms. The figure shows that there was a relative increase of the price over the first four years and in the last year a downward tendency. Whenever the production was high in one year there was a downward tendency in the price the following year. This happened in the last year where the prices were down. Other factors that also influenced the drop in price were the sharp decrease in world wheat prices (DAFF, 2010). Weather conditions in some of the important wheat-producing countries caused an increase in the prices from the 2005/06 to 2006/07 season. A drop in the international wheat supply caused international prices to increase and this was also experienced in the South African Wheat market (DAFF, 2008).

A summary of the annual wheat prices for the seasons 2004/05 to 2008/09 is given in Table 4.2, at the end of this chapter.

4.3.4. Livestock

4.3.4.1. Livestock numbers

The largest part, almost 80%, of South African land is suited for extensive livestock farming, but livestock are also found in other parts where it is used in combination with other enterprises. The areas that are used for livestock farming include the Karoo areas of the Western and Northern Cape and the mixed veld types found in the Eastern Cape

and Southern Free State (DAFF, 2010). Other parts of the country where commercial sheep farming is found, include areas such as the Kgalagadi, winter rainfall areas, grasslands of Mpumalanga and the eastern Free State. Rainfall plays an important role in the availability of fodder and grazing that is needed for livestock farming and therefore a good correlation between rainfall and the size of herd exist (DAFF, 2010).

Cattle are found right throughout the country, with the largest number of cattle in the Eastern Cape, Kwazulu-Natal, Free State and North West provinces. The sizes of the herds vary depending on the type of farming. Type of farming includes dairy cattle and beef cattle. Herd sizes vary between the types of farming, with dairy farming varying between 50 and 300 head of cattle and beef farms range from small (20 head of cattle) to large farms or feedlots (more than 1 000 head of cattle). The total numbers of cattle are illustrated in Figure 4.3. As seen in the figure, the total number of cattle had stayed more or less the same over the past number of years.

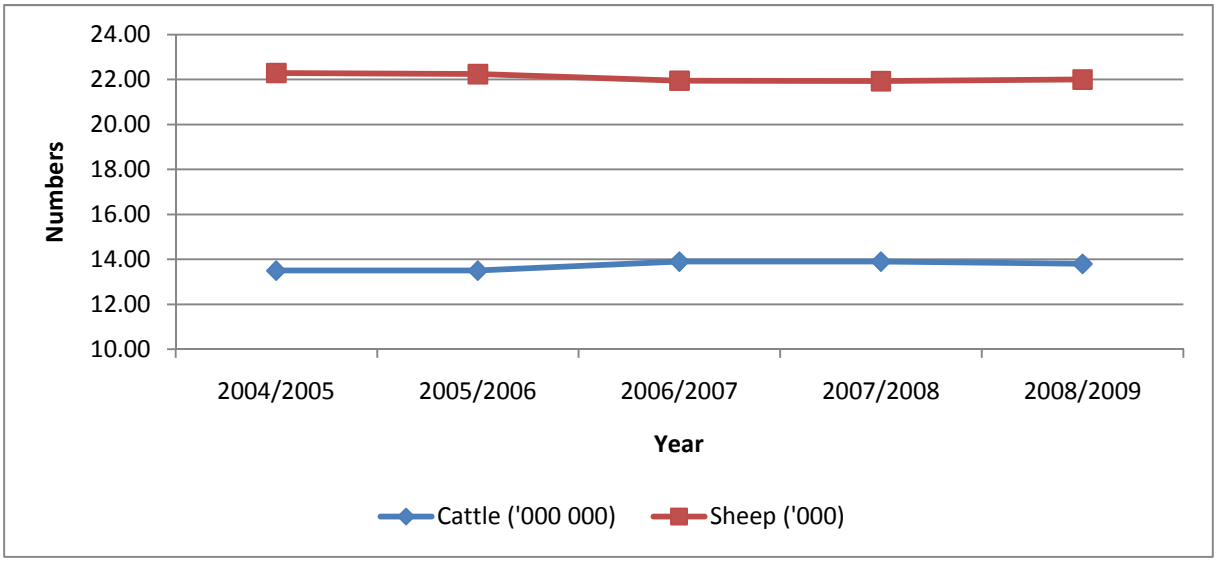

Figure 4.3: Cattle, Sheep and Goat numbers in South African Agriculture
Source: (DAFF, 2010)

When considering the livestock industry of South Africa, it is essential to consider it in two sections, namely white and red meat. These are the two main consumption patterns in South Africa with a relative price difference. The red meat industry is one of the most important and a growing industry in South Africa. In respect to the total gross value of production of South Africa, the red meat industry contributes on average about

14% (DAFF, 2009). The produce mostly produced by the producers in the GWK trading area is red meat, especially mutton and beef and this section will now be discussed.

4.3.4.2. Auctions

A very important factor to consider for auctions is the demand and supply in the determination of prices. Other important factors include the level of consumers' disposable income, the price of substitute products and import parity prices. The average producer price of beef for the 2004/05 year was R14.36/kg, an increase of 8.1% from the previous year (DAFF, 2007). The average prices for the next year, 2005/06, once again showed an increase. This time the prices increased to R16.47/kg, an increase of 14.7% (DAFF, 2007). The increasing pattern continued in 2006/07 with 15% to R19.46/kg (DAFF, 2009). The increase over the next year slowed down a bit to 7%, with an average of R20.88/kg (DAFF, 2009). For the last year under discussion, the prices continued with the increasing pattern, increasing with about 6% to an average price of R22.15/kg (DAFF, 2010). To summarize the movement of beef prices it is clear that there was an upward trend in the average prices for producers.

The mutton price was feeling the influence of an ever stronger international trade effect for the 2004/05 year with the average price for mutton and lamb increased by over 8% to R21.05/kg (DAFF, 2011). Prices of mutton and lamb once again increased by about 11%, to R23.37/kg in 2005/06 (DAFF, 2008). There was a decrease in the average mutton and lamb price during the last year 2006/07 and the average was R29.42/kg (DAFF, 2008), an increase of about 25%. During the next year ending 2007/08, the price of mutton and lamb decreased to R29,17/kg, a decrease of 1% (DAFF, 2010). During the last year of the study ending 2008/09, the increase of mutton and lamb prices continued to the highest point of R31.05/kg (DAFF, 2011), an increase of 6% from the previous year and also the highest over the five year period.

From Table 4.2 it is quite clear that there was an overall increase in the prices for the products that are mostly produced by producers in South Africa. This will also lead to an increase in the gross value of production, but it will not necessarily lead to an increase in net income or profit for the year.

Table 4.3: Summary of the main agricultural products prices and production for RSA

	Maize	Wheat	Livestock	
Season	R/ton	R/ton	Beef (R/kg)	Mutton and Lambs (R/kg)
2004/05	R 630.47	R 1 091.43	R 14.36	R 21.01
2005/06	R 981.97	R 1 033.99	R 16.47	R 23.37
2006/07	R 1 450.20	R 1 524.19	R 19.46	R 29.41
2007/08	R 1 660.33	R 2 505.58	R 20.88	R 29.17
2008/09	R 1 340.50	R 2 319.71	R 22.15	R 31.05

Sources: (DAFF, 2006), (DAFF, 2007), (DAFF, 2008), (DAFF, 2009) and (DAFF, 2010)

The reason for this is that, as the prices for products had increased the prices of the inputs used to produce these products had also increased over the time period and the net effect between these two factors must be considered to have an idea of what will happen to net income and profit for the year.

Table 4.4: Summary table of the South African agricultural sector

	Gross value of production (millions)	Product prices				Net Farm income (millions)	Expenditure on intermediate goods and services (millions)	Capital assets and investments (millions)	Farming debt (millions)
		Maize (R/ton)	Wheat (R/ton)	Beef (R/kg)	Mutton & Lamb (R/kg)				
2004/05	R 70 207	R 630.47	R 1 091.43	R 14.36	R 21.01	R 12 188	R 40 410	R 140 317	R 35 592
% change between years	6%	56%	-5%	15%	11%	16%	6%	8%	3%
2005/06	R 74 245	R 981.97	R 1 033.99	R 16.47	R 23.37	R 14 088	R 42 637	R 150 996	R 36 686
% change between years	26%	48%	47%	18%	26%	107%	12%	9%	8%
2006/07	R 93 390	R 1 450.20	R 1 524.19	R 19.46	R 29.41	R 29 164	R 47 796	R 164 141	R 39 481
% change between years	28%	14%	64%	7%	-1%	26%	20%	13%	14%
2007/08	R 119 840	R 1 660.33	R 2 505.58	R 20.88	R 29.17	R 36 673	R 57 486	R 184 874	R 44 940
% change between years	6%	-19%	-7%	6%	6%	15%	18%	12%	4%
2008/09	R 127 568	R 1 340.50	R 2 319.71	R 22.15	R 31.05	R 42 329	R 67 647	R 206 582	R 46 792

Sources: (DAFF, 2006), (DAFF, 2007), (DAFF, 2008), (DAFF, 2009) and (DAFF, 2010)

4.4. Comparison of GWK district and the South African agriculture

The following section compares the trends that were followed by the South African agriculture industry and GWK producers. This discussion will help to have a better understanding of why the ratios, that will be calculated and discussed in the following chapters, had changes and the possible causes for the changes. It will also give an indication of when ratios can be expected to change due to a change in the agricultural industry.

4.4.1. Gross value of production

The gross value of production for both the South African agriculture and GWK producers has shown an increase. The trends that were followed for both are similar, with the exception of the first season from 2004/05 to 2005/06 where there was a decrease in the value of production for the GWK producers instead of an increase as in the rest of South Africa. The other difference is for the last season from 2007/08 to 2008/09, where both decreased but a much larger decrease was experienced by the South African agriculture as a whole than that experienced by the GWK producers. This can be seen in Figure 4.9; GWK producers have indicated larger changes than those that occurred in the South African agriculture. The larger changes can be due to the fact that fewer producers are influenced by the changes in the GWK district than South Africa agriculture. The South African agriculture sector is indicated by the total value of production for the whole country, whereas the GWK producers are presented by an average of the levels of production for the 38 farms.

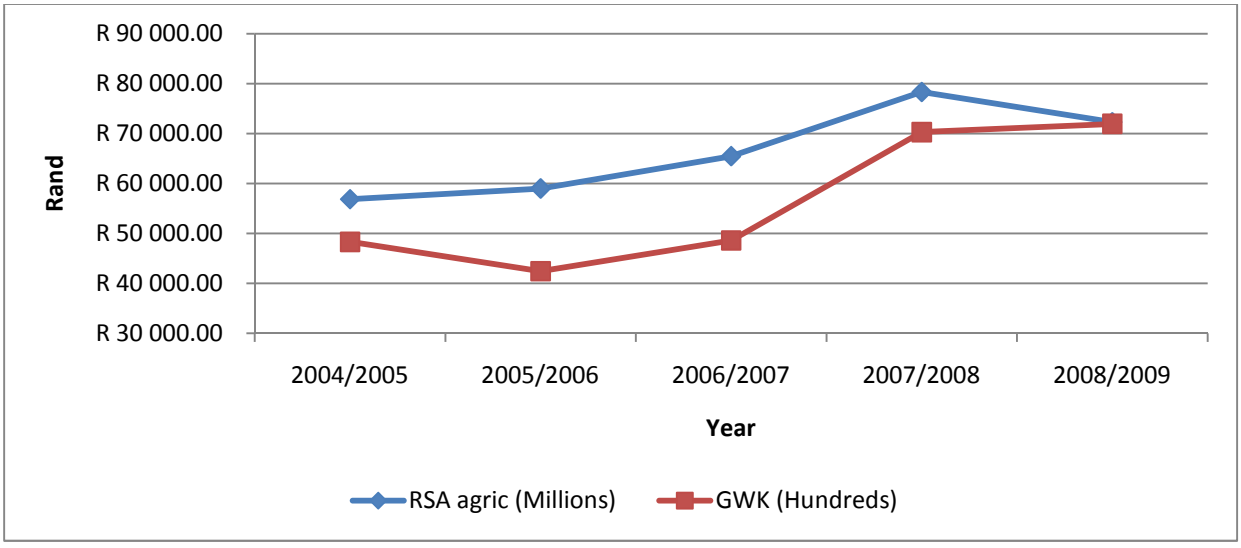

Figure 4.4: Gross value of production (RSA agric vs. GWK district)

When comparing the changes in the trends that were followed by the South African agriculture, it can be easily compared to the changes in prices of the products, especially the prices of maize and wheat. The prices for these products had an initial increase from the 2004/05 season but compared to the increase from the 2005/06 to 2006/07, this initial increase was very small. This increase pattern of the prices is also reflected in the gross value of production for South Africa, with the small initial increase and then the rather larger increase at the end of the 2006/07 season and reaching the highest point at the end of the 2007/08 season.

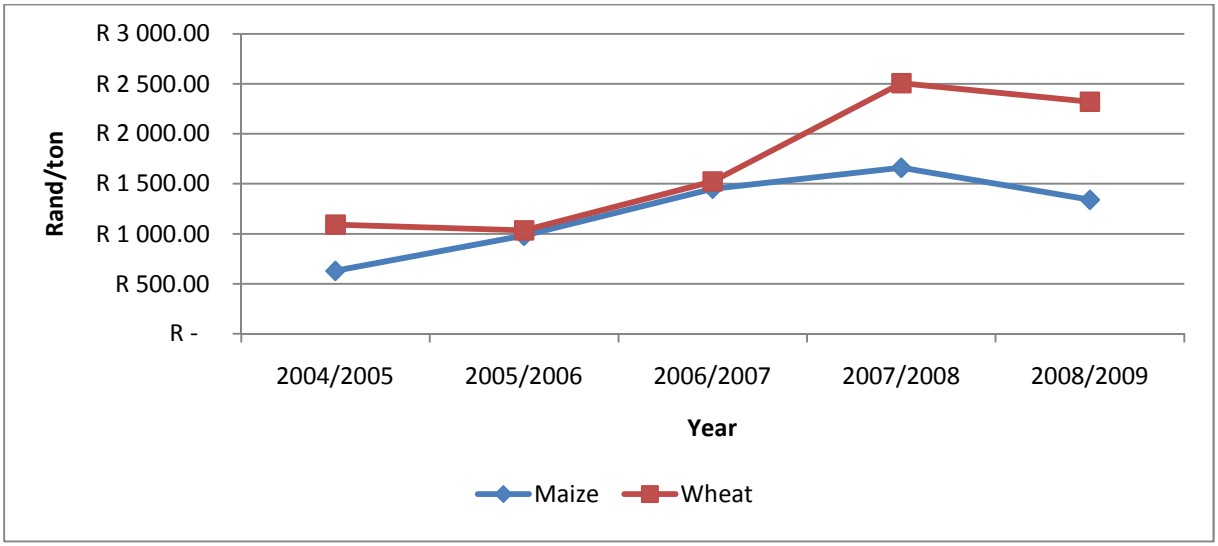

Figure 4.5: Producer prices of Maize, Wheat and Sunflower
Source: (DAFF, 2011)

4.4.2. Expenditure on goods and services

The expenditure on goods and services is a crucial part of farming, as this will influence the final products, quality and quantity that can be produced. The main expenditure that was identified by the Department of Agriculture for each year was compared with the expenditures of the GWK district producers to see whether the producers experienced the same external influence as mentioned by the Department.

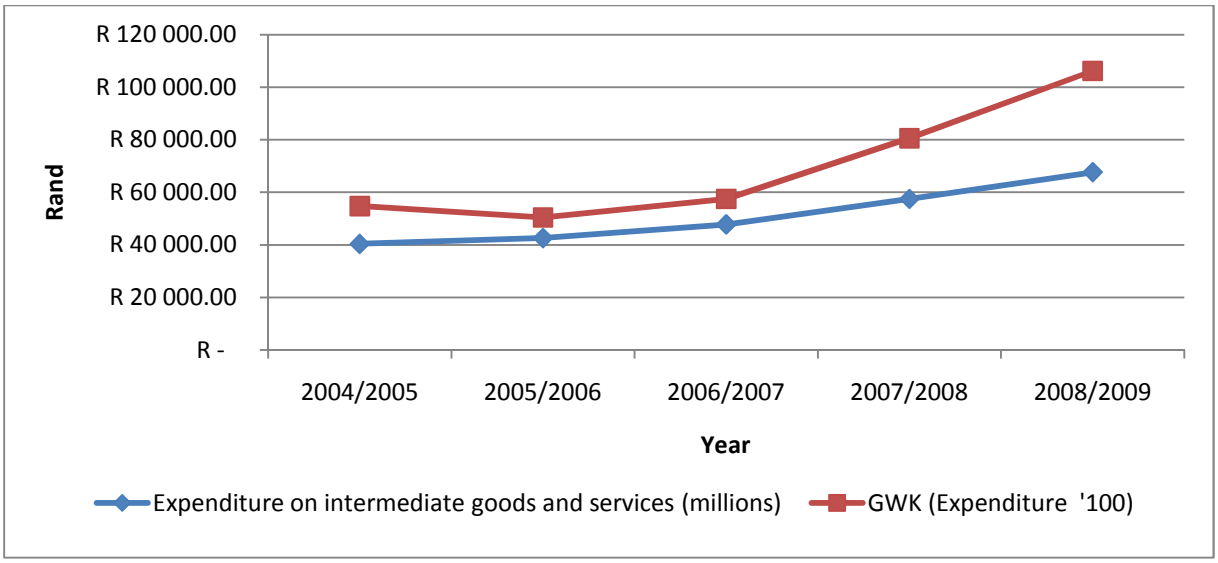

Figure 4.6: Expenditure on goods and services (RSA agric vs. GWK district)

The expenditure on intermediate goods and services for the whole agriculture sector of South Africa and the GWK district producers are shown in Figure 4.7. There was an increase over the past five years and this was also experienced by the producers in the GWK district. The effect can be seen from the 2006/07 season when there was a significant increase in the expenditure by the GWK producers; this increase is even greater than the increase experienced by the whole agricultural sector. One fact to remember is that most of the crop producers and mixed farms in the GWK district use irrigation. Electricity prices have an important role in the usage of irrigation on farms and it is a known fact that electricity prices in South Africa are increasing. From the 2004/05 season the average annual payment by the GWK producers for electricity increased by 94% to the 2008/09 season. This is an indication of how much electricity has increased over the period. Another main expenditure on farms is diesel; with the rather fluctuating Brent oil price, the diesel price shows some fluctuation in South Africa. As diesel is one of the important factors necessary for producers to produce, it is important to take the expenditure on diesel into account. As the case with electricity, the average annual expenditure on diesel also indicated a large increase from 2004/05 to 2008/09. The expenditure on diesel more than doubled, with an increase of 159% over the five years.

4.4.3. Capital assets and investments

Capital assets are an important part of farming, as this includes all the machinery and equipment used in the production process. The purchase price of equipment and other expensive assets are provided for with the use of external financing options. When considering changes in fixed assets on the farm, the debt levels can also show some changes. When considering the patterns that were followed by the GWK producers and RSA, it follows the same pattern. The GWK producers had a relative constant increasing pattern over the five years, while RSA showed the same movements. When considering interest rates and debt levels for the producers, it also increased over the period. Debt levels of the GWK producers had a spike in the 2007/08 year and this can also be seen in the capital assets and investments of the producers with a change from 2006/07.

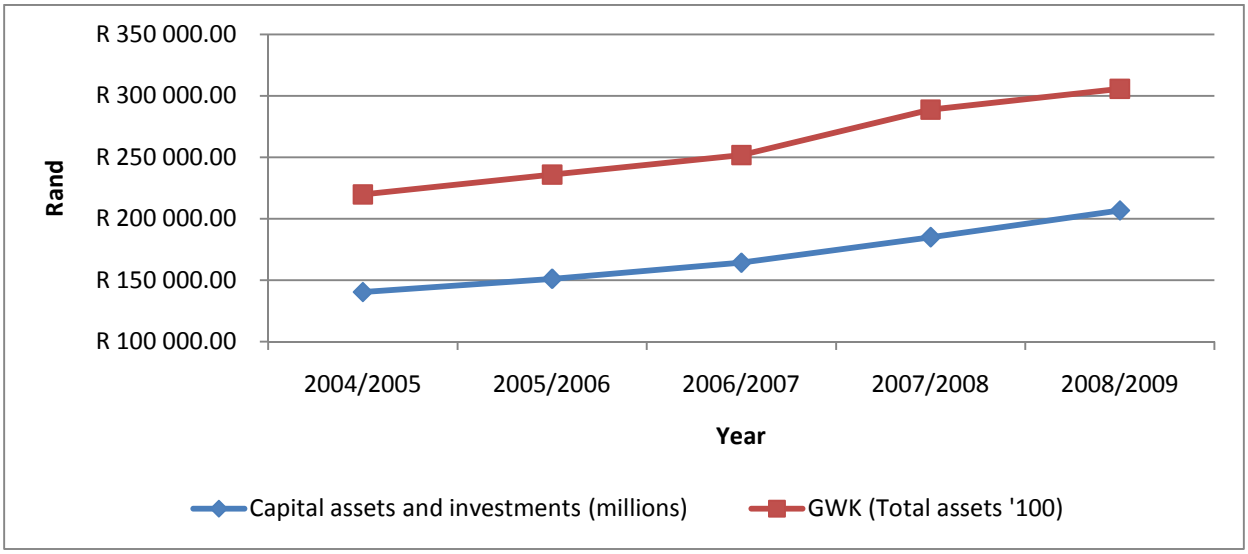

Figure 4.7: Capital assets and investments (RSA agric vs. GWK district)

As mentioned, debt, Long and short term, plays an important role in agriculture. Most of the equipment used in farming is expensive and financing by way of debt is necessary. Other important uses of debt are in production loans; these loans are used to finance the production process in farming. The factors that influences the cost of debt must also be considered, this means that the fluctuations in interest rates must be examined. When considering the debt levels, which are illustrated in Figure 4.8, it can be seen that the level of debt for the RSA agriculture had increased over the five year period. The

producers of the GWK district had increased from the 2006/07 season, reaching the highest level in the 2008/09 season.

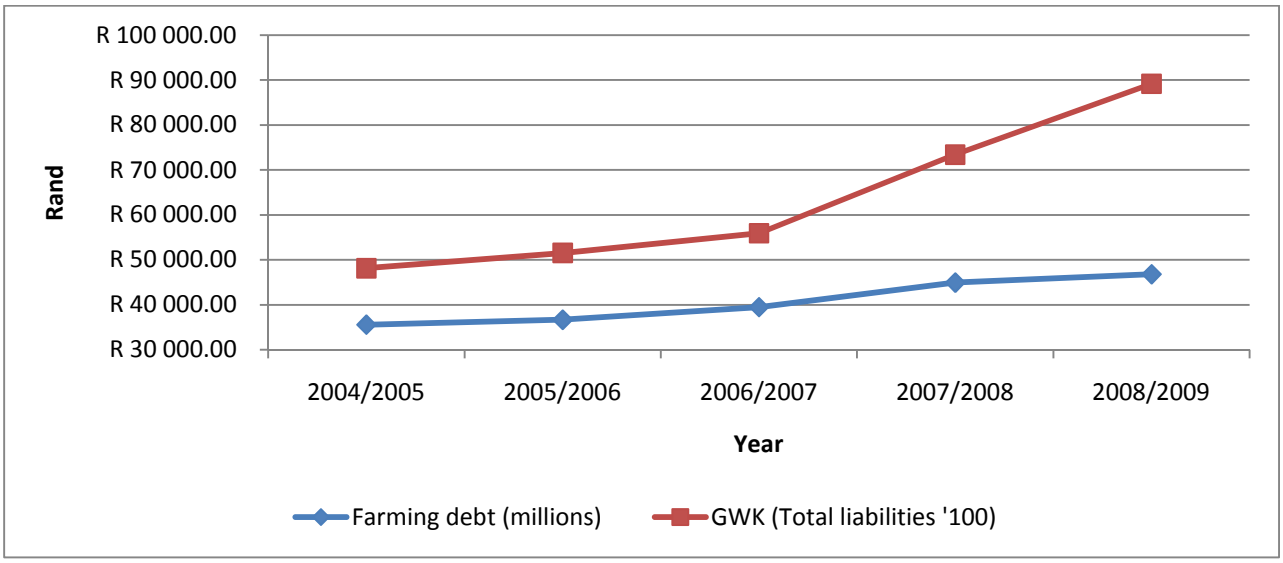

Figure 4.8: Farming debt (RSA agric vs. GWK district)

Now that the level of debt had been discussed, the interest rates will be showed in Figure 4.9. In Figure 4.9 the interest rate from 3 different sources are shown as well as an average of the different sources. The graph indicates that the interest rates started at a higher point with a slight decrease and from there onwards it was increasing till the end of 2009. The lower levels of interest rates in 2005 and 2006 can be the cause of the higher levels of debt that was seen in the GWK district from the 2006/07.

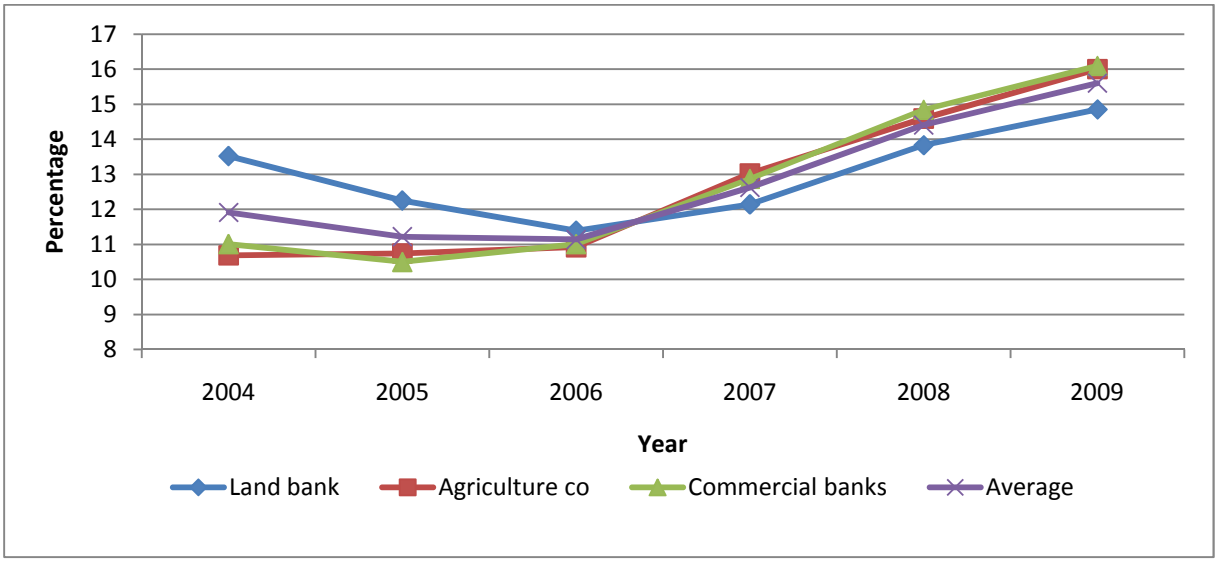

Figure 4.9: South African interest rates

4.5. Conclusions

With the patterns now visible for each of the different factors, it assists in gaining a better understanding on why there was better or worse performances by individual producers. Seeing that there was an overall decline in the gross value of production for the one season in the South African agriculture sector, one can almost be certain that most of the producers would have had a decline in their individual gross value of production as well and this will also be displayed in their financial measures.

The overall performance of the South African agriculture places the performance of the GWK producer marginally more in perspective as it indicates that the overall average performance of the GWK producers is comparable with the overall sector. This helps to indentify some changes in the performance of individual farms when they are compared to other farms.

Now that it has been established that the financial indicators of producers of the GWK district had followed the same pattern than the agriculture sector as a whole, the analysis of the individual producers can be done. This analysis will help to develop the benchmarking system, determine the correlation between the ratios and to rank the producers according to their efficiency when they are compared to one another.

The financial position of a group of farms or industry must be analyzed, taking into account macro or external factors that can influence the financial performance of these farms, as it is not just farm management decisions that influence the financial performance of a farm.

Chapter 5
Results

5.1. Introduction

In this chapter, the developing of the benchmarking model will be discussed. The results will be discussed by starting with the cut-off norms for the benchmark performance groups. After determining the cut-off norms, the efficiency of the producers are determined using DEA; this is also an alternative method of benchmarking. Lastly, the correlations between the measurements have been tested.

The benchmarking cut-off norms are calculated to place each producer into a performance group according to his performance relative to the other producers included in the data. When a producer is allocated to a specific performance group, his performance can be evaluated in relation to the other, to establish in what performance group he is operating. If a producer is not in a performance group the different aspects that needs improvement can be identified, using the benchmarking data and the producer can focus on those areas. An important factor to remember is that the financial statements are linked and a change in one area can influence other areas of performance and therefore correlation between the measurements and determinants are also calculated. Knowing what correlation between the measurements is, contributes to better decision-making opportunities and thus a better financial performance of a farm.

The farms will be analyzed according to their operating efficiency using DEA. DEA provides the opportunity to distinguish between farms that can be classified as efficient and inefficient relative to each other. It is imperative to remember that the benchmarking done is relative to the farms that are included in the data. When a farm is identified as being inefficient, it does not indicate that this farm cannot continue to produce efficiently. The inefficiency only indicates that relative to the other farms included in the data, the farm is not performing at the same levels as the efficient farms.

The differences in performance can be seen when the factors in section 2.6 are examined and explained. The factors include the capital structure (leverage), efficiency (asset turnover ratio) and net income. The differences are in the financial structures of the farms.

The cut-off norms for all the farms will be discussed first and will be followed by each of the enterprises in the following order: Firstly, the developing of the cut-off norms for the specific enterprise, followed by the results of the DEA to justify the results from the cut-off norms. When each enterprise was discussed, the correlation between the measurements and their determinants will be explained. At the end of the section an example will follow how the benchmarking system works, by means of using an example farm from the GWK trading area.

5.2. Benchmarking of farms

5.2.1.1. Cut-off values benchmarking

The first part of each section that follows will discuss the cut-off benchmarking values (norms) that were calculated for each of the measurements and will be used as norms when farms are benchmarked. These cut-off values are calculated in order to divide the producers into three categories: top, mid-point and bottom performance groups. The top group is the best third of the producers, while the middle third is in the mid-group and the bottom third in the bottom group. Some of the measurements are currency values; one must be careful to use these values as a benchmark. When these values are used as a benchmark it can give a misleading picture as the difference between farms, relative to size (hectares) and operational capacity are not taken into account. For the next discussion the currency values are also given for the border cut-off points, but this is only for illustration purposes.

5.2.1.2. Data Envelopment analysis

The second part for each section will be the use of DEA to support the cut-off measurement benchmarking system. With the use of DEA the farms can be ranked using each other as a benchmark to determine which farms are efficient in their enterprise groups. For each year the farm was ranked to establish how efficient the farm was over the five year period. DEA divide the farms into two groups: efficient and

inefficient. This method can be used to support the cut-off benchmarking method in order to determine the operating efficiency of a farm. When a farm is being benchmarked by using the cut-off benchmarking tool, and most of its measurements are in the top third performance groups, it would most likely be identified as an efficient farm by the DEA model.

The objective of DEA is to use linear programming techniques to find a set of weights for each farm that maximizes the efficiency score for those farms. This score is subject to the fact that no farm can have a score higher than 1 at the specific weights. The weights for each farm varies in such a way that the individual farm's performance compares at the farm's highest efficiency score to the other farms. Each farm's score is the highest possible score obtainable for the specific year and is compared to the other highest possible scores of the other farms included. Farms that are identified as being efficient are the ones with the highest possible scores from the given financial measurements of the specific year.

The formula used in the DEA model was used as described in Chapter 3. The linear program was built in GAMS and the models were run 15 times, once for every year for each of the different enterprises. This provides data results for the five years to see the changes in performance for each of the different farms, when the farms where efficient/inefficient in relation to the other same enterprise group and how that position had changed over the years.

One of the important factors to remember when using DEA is that the farms are being compared in relation with one another. When a farm is identified as being inefficient/efficient this is in relation to the other farms in the enterprise category. These farms are being benchmarked, according to the performance of its overall ratios, to the other exact enterprise farms.

5.2.2. Cut-off values

The cut-off value benchmarking is firstly done for all the farms. This is done to indicate the differences between the cut-off values for all the farms compared to values when

divided into different enterprise groups. The all-farm category is only used for the cut-off benchmarking, not for the DEA benchmarking.

5.2.2.1. All farms

The norms determined for all the farms in the GWK trading area are shown in Table 5.1. Of all the measurements that were calculated and illustrated in Table 5.1, there is only one lower than those set out by Blocker *et al.,* (2003), this is the current ratio. Even with the lower current ratio, the asset turnover ratio, net income ratio, ROA and ROE are higher than the norms by Blocker *et al.*, (2003). The norms indicate that the overall financial performances of these farms are good. However, there are some individual farms that are not in an adequate performance position, that place them in the bottom performance groups.

Table 5.1: Cut off measurements for all farms

	GWK trading area					Blocker *et al.*, (2003)				
	Top	Cut off	Mid	Cut off	Bottom	Top	Cut off	Mid	Cut off	Bottom
Liquidity										
Current ratio	>	1.76	< <	0.78	<	>	2.00	< <	1.00	<
Working Capital	>	R 563 457.53	< <	R -406 696.98	<	>		< <		<
Solvency										
Debt against asset	<	15%	< <	33%	<	<	30%	< <	60%	<
Equity against asset	>	85%	> >	67%	>	>	70%	> >	40%	>
Debt against equity	<	18%	< <	49%	<	<	43%	< <	150%	<
Profitability										
ROA	>	24%	> >	13%	>	>	5%	> >	1%	>
ROE	>	23%	> >	13%	>	>	10%	> >	5%	>
Operating profit margin	>	48%	> >	37%	>	>	35%	> >	20%	>
Net farm income	>	R 5 986 989.96	> >	R 1 975 166.13	>	>		> >		>
Repayment Capacity										
CDRC	>	R 4 209 789.01	> >	R 1 167 612.51	>	>		> >		>
Financial Efficiency										
Asset turnover ratio	>	53%	> >	37%	>	>	40%	> >	20%	>
Operating expense ratio	<	16%	< <	21%	<	<	60%	< <	80%	<
Interest expense ratio	<	2%	< <	5%	<	<	10%	< <	20%	<
Net income ratio	>	51%	> >	36%	>	>	20%	> >	10%	>

When the producer benchmarks his performance to the performance of the other group, the producer must remember to use historical performance data as well. The historical data provides the producer with the opportunity to assess whether there was an increase in the farm's own relative performance.

These figures from Table 5.1 must not be used as a comparison for the different enterprise groups because of the differences between the enterprises. Comparing the norms that were determined for the GWK trading area to those set out by Blocker *et al.*, (2003), the GWK trading area producers are in a adequate performance level. All of the norms are the same or in a better position than the norms identified to be acceptable over the five year period.

5.2.2.2. Mixed enterprise farms

a. Cut-off values

Table 5.2, **mixed enterprise farms**, is indicating that the current ratio is once again lower than the norms set out to be acceptable. But the other measurements are all better when compared to the acceptable norms. Further investigation of the current assets and current liabilities revealed that short-term creditors are on average 60% of the total current liabilities, with cases where the creditors are as high as 100% of the total liabilities. When the total short-term creditors, especially Agribusiness short-term loans, are compared to the total short-term assets, they have an average of 74%.

Table 5.2: Cut off measurements for the Mixed enterprise farms

	GWK trading area					Blocker *et al.*, (2003)				
	Top	Cut off	Mid	Cut off	Bottom	Top	Cut off	Mid	Cut off	Bottom
Liquidity										
Current ratio	>	1.10	<	0.73	<	>	2.00	<	1.00	<
Working Capital	>	R 38 384.00	<	R -1 149 610.69	<	>		<		<
Solvency										
Debt against asset	<	22%	<	33%	<	<	30%	<	60%	<
Equity against asset	>	78%	>	67%	>	>	70%	>	40%	>
Debt against equity	<	29%	<	50%	<	<	43%	<	150%	<
Profitability										
ROA	>	25%	>	16%	>	>	5%	>	1%	>
ROE	>	22%	>	17%	>	>	10%	>	5%	>
Operating profit margin	>	44%	>	36%	>	>	35%	>	20%	>
Net farm income	>	R 9 614 822.66	>	R 5 577 496.25	>	>		>		>
Repayment Capacity										
CDRC	>	R 6 564 678.68	>	R 3 423 924.86	>	>		>		>
Financial Efficiency										
Asset turnover ratio	>	57%	>	42%	>	>	40%	>	20%	>
Operating expense ratio	<	16%	<	20%	<	<	60%	<	80%	<
Interest expense ratio	<	3%	<	5%	<	<	10%	<	20%	<
Net income ratio	>	44%	>	34%	>	>	20%	>	10%	>

The highest percentage of the short-term loan in relation to total short-term assets is 320%, followed by percentages of over 200% and 100%. These percentages indicate that the short-term loan is in some cases two and even three times more than the total current assets. This is an indication that short-term loans, or production loans, has a very important role in determining the liquidity measurements. Total short-term assets are mainly influenced by the value added to the standing crops[4] and marketable livestock with an average of 71% of the total short-term assets. In some cases standing crops and marketable livestock is the only short-term asset available on certain farms.

b. Data Envelopment Analysis Mixed enterprise farms

The mixed enterprise group has only one farm that was identified as being efficient for each year over the five year period. This was farm number **25.** Analysing the financial measurements of farm 25 over the five years, indicates all of the financial measurements are in adequate positions, when comparing to the norms set out by Blocker *et al.,* (2003) and those calculated as norms for the GWK trading area for mixed enterprise farms. There were also improvements in the performance of the farm from the first to the last year. The efficiency scores for the mixed enterprise group are shown in Table 5.3.

Table 5.3: Efficiency score of the Mixed enterprise farms

Farm nr.	2004/05	2005/06	2006/07	2007/08	2008/09
2	0.959	0.994	0.909	0.946	0.917
3	0.986	1	0.949	0.998	0.957
6	0.959	1	1	1	0.978
7	1	1	0.996	1	1
15	0.935	0.952	0.944	0.996	1
18	1	0.984	0.976	1	0.968
22	1	1	0.962	1	0.988
25	1	1	1	1	1
31	1	1	0.971	1	0.942
33	0.98	0.974	0.979	0.978	1
35	0.992	1	1	1	1
61	1	0.998	1	1	1

[4] Standing crop is the crop that has not been harvested at the end of the financial year.

Other farms that also performed well according to their efficiency scores are farms 7, 25, 35 and 61 - over 4 years efficient; 6, 22 and 31 - over three years efficient. Of all the mixed enterprise farms there was only one that never had an efficiency score of 1 in any of the five years, namely farm 2. Three farms were only efficient in one year, farms 3, 15 and 33, while the rest of the farms were efficient in two or three years, illustrated in Table 5.3. When the financial performance measures of the farms that were only efficient in one or two years, are compared to those efficient in four or five years, the differences are quite clear.

The farms identified as being efficient over all five years are the farms in the top performance group, or at the top of the midpoint performance group, according to the cut-off measurements calculated for the mixed enterprise farms. There are years when some of the measurements of these farms declined in performance, but they still remain in an adequate performance position relative to the other mixed enterprise farms. The total efficiency score obtained, from different index weights than the previous years, was still higher than the other inefficient farms. The remaining farms are mostly in the midpoint or bottom performance groups. These farms are those whose performance are not in the top third of the mixed enterprise farms in the GWK trading region and can improve their performance to enter the top third performance groups.

The differences in performance between the efficient and non-efficient farms are illustrated by investigating the differences in their capital structure, turnover and net income. These factors were also identified, in Chapter 2[5], as starting point on how to improve the financial performance of the farm. To understand the difference between the efficient and inefficient farms, the average of each one of the four measurements in Table 5.4 was calculated for all of the efficient and inefficient farms. Differences in the capital structure can be seen in the average debt against assets, debt against equity, asset turnover ratio and net income ratio. Averages for these ratios for the efficient and non-efficient farms are shown in Table 5.4.

[5] Chapter 2, section 2.6

Table 5.4: Difference in performance of Mixed enterprise farms

Measurement	Efficient farm average	Non efficient farm average
Debt against asset	22%	29%
Debt against equity	30%	48%
Asset turnover	58%	44%
Net income ratio	40%	36%

Results shown in Table 5.4 indicate that the efficient farms have more equity than debt in their capital structures, with debt being half the value of equity. Table 5.4 also indicates that the efficient farms use their assets more effective than the non-efficient farms with higher asset turnover ratios and this is also reflected in the net income ratios difference between the farms.

5.2.2.3. Crop enterprise farms

a. Cut-off values

Some of the aspects that have already been discussed with the Mixed enterprise farms are also applicable to the **Crop enterprise farms,** Table 5.5. The first aspect is the liquidity measurements and the proportions of the short term loans of short term liabilities and standing crops as a proportion of the total short term assets. Once again, the standing crop is a great portion of the total short-term assets, with an average of 68%, with the highest percentage once again being 100% and the lowest 0%. Short-term loans are on average 57% of the total short-term liabilities. This is lower than with the Mixed enterprise farms, but the spread of the percentage is also high from 100% of short-term liabilities, to as low as 0%.

The short-term loans as a percentage of total short-term assets are very high, 298%. This very high average is caused by a couple of the farms that has a very high level of short-term loans, where the short-term loan is 143 times larger than the total short-term assets available. These high values are an indication of the dependence of crop farms on their production loans.

Table 5.5: Cut off measurements for the Crop enterprise farms

	GWK trading area					Blocker *et al.*, (2003)				
	Top	Cut off	Mid	Cut off	Bottom	Top	Cut off	Mid	Cut off	Bottom
Liquidity										
Current ratio	>	1.59	<	0.77	<	>	2.00	<	1.00	<
Working Capital	>	R 886 702.86	<	R -406 696.98	<	>		<		<
Solvency										
Debt against asset	<	17%	<	43%	<	<	30%	<	60%	<
Equity against asset	>	83%	>	57%	>	>	70%	>	40%	>
Debt against equity	<	20%	<	76%	<	<	43%	<	150%	<
Profitability										
ROA	>	25%	>	14%	>	>	5%	>	1%	>
ROE	>	28%	>	12%	>	>	10%	>	5%	>
Operating profit margin	>	45%	>	30%	>	>	35%	>	20%	>
Net farm income	>	R 5 720 035.42	>	R 1 975 166.13	>	>		>		>
Repayment Capacity										
CDRC	>	R 4 279 374.92	>	R 1 140 743.30	>	>		>		>
Financial Efficiency										
Asset turnover ratio	>	63%	>	40%	>	>	40%	>	20%	>
Operating expense ratio	<	18%	<	24%	<	<	60%	<	80%	<
Interest expense ratio	<	2%	<	6%	<	<	10%	<	20%	<
Net income ratio	>	45%	>	30%	>	>	20%	>	10%	>

b. Data Envelopment Analysis Crop enterprise farms

When benchmarking the crop enterprise farms using DEA, the three farms that stand out are farms nrs 13, 14 and 16. These three farms were identified as the most efficient over the five years relative to the other crop enterprise farms. Another farm that also performed well over the 5 year period was farm nr 20, which was efficient four of the five years. In the one year farm nr 20 has an efficiency score of 0.998 that was identified as not being one of the most efficient farms. Owner's withdrawals, relative to farm profit, for farm 20 was very high in 2004/05 and this related to worse measurement positions compared to the other years. Over the last three years, from 2006/07, farm nr 24 was rated as one of the most efficient farms. For the first two years this farm was not efficient. This improvement of performance is reflected in the ratios, with significant improvements in each one of the ratios and measurements. The Crop enterprise farm results are shown in Table 5.6.

Table 5.6: DEA results for Crop enterprise farms.

Farm nr.	2004/05	2005/06	2006/07	2007/08	2008/09
4	0.983	0.97	0.982	0.984	0.992
5	0.99	0.917	0.937	1	0.878
8	0.951	0.947	0.944	0.976	0.956
9	0.981	0.901	0.895	0.921	0.956
13	1	1	1	1	1
14	1	1	1	1	1
16	1	1	1	1	1
17	0.819	1	0.993	0.966	0.986
20	0.998	1	1	1	1
21	0.885	0.891	0.937	0.981	1
23	1	0.955	0.961	0.981	1
24	0.986	0.997	1	1	1
27	1	0.947	0.961	1	0.997
29	1	0.947	0.984	0.982	0.983
38	0.954	0.963	0.894	1	0.902
44	0.961	0.943	0.96	0.941	0.908
69	0.709	1	1	0.982	1

Four farms of the Crop enterprise group were inefficient in all 5 years. These farms are numbers: 4, 8, 9 and 44. When the performances of these farms are compared to the performance of the farms that were efficient, the difference is visible. When these farms are compared to the cut-off value benchmarking system, they are in the bottom or mid-point performance group for that respective year. All four of these farms are thus not in the top performance group and can improve their position to be in the same performance group as the best in their district. When the efficient scores are compared to the benchmarking measurements that were calculated earlier, it can be seen that these farms, 4, 8, 9 and 44 are in the bottom or mid-point performance groups for crop enterprise farms.

When the capital structure is compared between the efficient crop enterprise farms and the inefficient farms, it can be seen that the efficient farms are less reliant on debt than the non-efficient farms. This indicates that the efficient farms have more own equity in their capital structure than the non-efficient farms. These differences are shown in Table 5.7, where the averages of the efficient and non-efficient farms are shown for certain measurements over the five years. The difference is, these structures can lead

to the difference in performance between the farms, but the income that is being generated by these structures is also important. To see what the incomes in relation to assets are, the asset turnover ratios can be analyzed. Asset turnover ratio is an indication on how effective assets had been used to generate income. Another ratio that can indicate the difference between the efficient and non-efficient farms is the net income ratio. Net income ratio indicates how much of the gross value of production is left after all the payment of farm expenses had been made.

Table 5.7: Difference in performance of Crop enterprise farms

Measurement	Efficient farm average	Inefficient farm average
Debt against asset	22%	29%
Debt against equity	30%	87%
Asset turnover	62%	51%
Net income ratio	43%	33%

From Table 5.7 the differences in the financial structure of efficient and inefficient farms are clear and this provides good information on why the efficient farms are in the top performance groups and the non-efficient farms in the bottom performance groups.

5.2.2.4. Livestock enterprise farms

a. Cut- off values

The difference between the **Livestock farms,** Table 5.8, Mixed and crop enterprise farms are that the Livestock farms have marketable livestock instead of standing crops. Marketable livestock as an average of the total short-term assets is 67%, which indicates that the marketable livestock is the dependable factor of the short-term assets. There are some of the producers, like in the previous two cases, where the marketable livestock (standing crops) is the full value of the short-term assets and then where the value is zero.

Short term loans as a percentage of the total short-term liabilities of the Livestock enterprise farms have an average of 21%; this is completely different from the other two enterprise groups. This is caused by the fact that livestock producers are not as

dependant on short-term production loans as with crop producers. The average short-term loan as a percentage of total short-term assets is even lower at 4%.

Table 5.8: Cut off measurements for the Livestock enterprise farms

	GWK trading area					Blocker *et al.*, (2003)				
	Top	Cut off	Mid	Cut off	Bottom	Top	Cut off	Mid	Cut off	Bottom
Liquidity										
Current ratio	>	11.56	<	1.93	<	>	2.00	<	1.00	<
Working Capital	>	R 491 438.50	<	R 232 400.97	<	>		<		<
Solvency										
Debt against asset	<	2%	<	12%	<	<	30%	<	60%	<
Equity against asset	>	98%	>	88%	>	>	70%	>	40%	>
Debt against equity	<	2%	<	14%	<	<	43%	<	150%	<
Profitability										
ROA	>	20%	>	10%	>	>	5%	>	1%	>
ROE	>	20%	>	11%	>	>	10%	>	5%	>
Operating profit margin	>	69%	>	54%	>	>	35%	>	20%	>
Net farm income	>	R 1 750 361.25	>	R 937 892.92	>	>		>		>
Repayment Capacity										
CDRC	>	R 1 468 538.00	>	R 748 167.82	>	>		>		>
Financial Efficiency										
Asset turnover ratio	>	30%	>	20%	>	>	40%	>	20%	>
Operating expense ratio	<	15%	<	21%	<	<	60%	<	80%	<
Interest expense ratio	<	0%	<	2%	<	<	10%	<	20%	<
Net income ratio	>	75%	>	65%	>	>	20%	>	10%	>

b. Data Envelopment Analysis Livestock enterprise group

The last enterprise group is the Livestock enterprise farms. There are only 9 Livestock enterprise farms that were analyzed, of which four was efficient five out of the five years. All of the farms had an efficiency score of 1 at least once over the five year period. The efficiency scores for the Livestock enterprise farms are shown in Table 5.9.

Table 5.9: Efficiency scores of the Livestock enterprise farms

Farm nr.	2004/05	2005/06	2006/07	2007/08	2008/09
30	1	1	1	1	1
32	1	0.979	0.968	0.978	0.957
34	1	0.963	0.966	1	0.991
40	0.91	0.842	1	0.965	0.897
43	1	1	1	1	1
45	1	1	1	1	1
49	1	1	1	1	1
50	1	1	1	0.995	1
54	0.976	1	0.969	0.957	1

As in the case of the Crop and Mixed enterprise farms, the farms that were identified as being the efficient ones over four to five years, are the one in the top of the mid-point or in the top performance groups according to the cut-off benchmarking calculations. The farms that had an efficiency score of 1 in three or less years are the ones in the bottom of the mid-point and bottom performance groups. These farms can still have measurements that are in the top performance group in any specific year, but most of the performance measurements are in the bottom performances of the enterprise group.

The capital structure of Livestock enterprise farms varies from those of Crop and Mixed enterprise farms. The debt levels on the Livestock farms are normally lower than on the other enterprise farms. The difference in capital structures can also be seen in both the average values of the efficient and inefficient farms with debt against assets and debt against equity values that are a lot lower than those of Crop and Mixed enterprise farms. Once again, the difference in the performance of the efficient and inefficient Livestock farms can be seen in the values shown in Table 5.10. For each one of the values shown in the table the efficient farms are much better than those of the inefficient farms.

Table 5.10: Difference in performance of Livestock enterprise farms

Measurement	Efficient farm average	Inefficient farm average
Debt against asset	3%	16%
Debt against equity	4%	20%
Asset turnover	28%	24%
Net income ratio	73%	57%

The income generated by the efficient farms is higher than those of the other farms, and this is reflected by the higher net income ratios and also by the fact that the assets are being used more efficiently as shown by the higher asset turnover ratios.

5.2.3. Summary of benchmarking

When considering that the different enterprises have different operating structures, one expects that there would be difference in the benchmarking border values. This can be seen in the current ratio and the solvency measurements of the financial analysis, but all the other measurements are more or less at the same levels. These levels are not

exactly the same, but the difference is very small. These small differences can be seen in the ROA, ROE and operating expense ratio. The operating profit margin for the Mixed and Crop enterprises shows very small differences, but differs from the Livestock enterprise. The operating expenses of the different enterprises may differ, but when they are calculated as a percentage of the gross margin (operating expense ratio) it is clear that the operating expenses are at the same levels over the enterprises.

Analysing the net income of the different enterprises, especially the net income ratio, it is clear that the Livestock producers' ratio is larger than the other enterprises. With the operating expense ratio at more or less the same levels, it is quite obvious that the levels of interest expenses and subsequently debt is one of the important factors that cause the difference in the net income ratio between the enterprises. Another factor, but in a smaller proportion, that can have an influence is the level of rented land and production assets.

In a summary of the benchmarking norms that has now been calculated, it is quite clear that these norms are higher than those set out by Blocker *et al.,* (2003). The farms in the district have adequate capital structure and therefore the debt, equity and assets ratios are all in an adequate position. From the benchmarking figures the difference in capital structures between Livestock and the other enterprises is quite clear. The debt levels of the Livestock farms are significantly lower than the other enterprises and this will also influence the interest expense of the farms.

The efficiency scores that were calculated using DEA, confirmed the cut-off point that was calculated by identifying the top third and bottom third of the farms. Farms that were identified as being efficient, especially over four or five years, are the farms that are at the top of the mid-point performance group or in the top performance group. The opposite was also true, where the farms that never had an efficiency score of 1, or only in one or two years, were the farms in the bottom of the midpoint performance group or in the bottom performance group.

With the benchmarking norms now established, the correlation between the measurements and their determinants will be discussed. This provides information on

what can be expected when a change occurs in the financial position of a farm and how it will affect the whole analysis of a farm.

5.3. Correlation between ratios

When considering improving certain financial measurements for a farm, the question always occurs how the other measurements will react to a change in one of them. Improving one measurement will have an effect on the other measurements as there is a change in the financial position of the farm (Boehlje *et al.*, 1999). When referring to a change, it indicates that certain decisions are made to improve the performance of the farm. To determine what the effect will be the correlations between the measurements are determined. Some of the measurements are very strongly correlated, for instance the debt against asset and equity against asset ratios, as both of the ratios are affected by the level of total assets. In the following section the correlation between the measurements will be explained and the factor/s that can have the largest influence on the correlation.

5.3.1. Liquidity measurements

The correlation between the two liquidity measurements, current ratio and working capital is positive. When considering the positive correlation between these two measurements it is self-explanatory as both include current assets and current liabilities. Current assets and current liabilities are positively correlated with each other, which indicates that, when there is an increase in current assets there will also be an increase, but smaller, in current liabilities. This is important when considering any changes in the short-term, as it also affects the total assets of the farm and in turn, other measurements that will be discussed. The correlation between current assets, current liabilities, current ratio and working capital is illustrated in Table 5.11.

Correlation between these measurements can help with the prediction changes in measurements, when a producer knows there will be an increase (decrease) in his current assets, the current measurement will decline (increase) and working capital will increase (decrease).

Table 5.11: Correlation between liquidity measurements and determinants

	Current Assets	Current Liabilities	Current ratio	Working Capital
Current Assets	1			
Current Liabilities	+	1		
Current ratio	-	-	1	
Working Capital	+	+	+	1

A change in the current assets will also have a direct effect on the debt against asset, equity against asset, ROA and the asset turnover ratio. A strong positive correlation exists between current assets and total assets, as can be expected. With an increase in current assets the total assets will increase.

5.3.2. Solvency measurement

Correlation between the three solvency measurements differs. The debt against assets and equity against assets are negatively correlated, while the debt against assets and equity against assets are positively correlated. The correlations between the determinants for these measurements are illustrated in Table 5.12. Correlation between the determinants of the solvency measurements is positive. This is an indication that when there is an increase in total assets, it can be expected that total liabilities and total equity will experience an increase. A change in one of the determinants will have an effect on all three the solvency measurements, but the net effect will not be the same.

An increase in total assets and equity (liabilities) will cause a decrease (increase) in the debt against assets and debt against equity ratio while there will be an increase (decrease) in the equity against assets ratios. Changes in the liquidity measurements will therefore also have an effect on the solvency measurements. A change in the current assets or liabilities has an effect on the total assets and liabilities and an influence on the solvency measurements (Table 5.12).

Table 5.12: Correlation between solvency measurements and determinants

	Total Assets	Total Liabilities	Total Equity	Debt against assets	Equity against assets	Debt against equity
Total Assets	1					
Total Liabilities	+	1				
Total Equity	+	+	1			
Debt against assets	-	+	-	1		
Equity against assets	+	-	+	-	1	
Debt against equity	-	+	-	+	-	1

Debt against assets and equity against assets ratios are exactly negatively correlated, as the total assets are being financed with either debt or equity. An increase (decrease) in total assets will cause a decrease in the debt against assets and debt against equity while the equity against asset ratio will increase (decrease).

5.3.3. Profitability

Profitability is measured by four measurements of which three are ratios. The correlation between the profitability measurements and the determinants for each measurement is shown in Table 5.13. Net farm income is a currency value that indicates the amount of currency that is left after operating expenses have been paid. ROA is calculated by dividing net farm income from operations plus farm interest expense minus owner's withdrawals by total assets. Correlation between the determinants of ROA is all positive, with interest expenses having the lowest level of correlation and total assets the highest. The correlation between these measurements indicates that whenever there is a change in the determinants of ROA, the ratio will change with total assets and owner's withdrawals being the two largest correlated factors.

Table 5.13: Correlation between profitability measurements and determinants

	Net farm income	Interest expense	Owner's withdrawals	Gross revenues	Total Assets	Total Equity	Net farm income	ROA	ROE	Operating profit margin
Net farm income	1									
Interest expense	+	1								
Owner's withdrawals	+	-	1							
Gross revenues	+	+	+	1						
Total Assets	+	+	+	+	1					
Total Equity	+	+	+	+	+	1				
Net farm income	+	+	+	+	+	+	1			
ROA	+	+	-	+	+	+	+	1		
ROE	+	+	-	+	+	-	+	+	1	
Operating profit margin	+	+	+	+	+	+	+	+	-	1

All the factors that have been mentioned for ROA are also applied to ROE. The only difference is that interest expense plays no role and total assets are substituted by total equity. Owner's withdrawals are negatively correlated to these two measurements; an increase in owner's withdrawals will have a negative effect on measurements.

5.3.4. Capital debt Repayment capacity

Capital Debt Repayment Capacity (CDRC) is being measured by the debt repayment ability measurement. The determinants of this measurement are: net farm income, other income and expenses, non-farm income, tax, owner's withdrawals and interest. The two factors that are very strongly correlated, are the net farm income and owner's withdrawals; the correlation is positive that indicates as the net income of the farm increases the owner will withdraw more money for own personal use. Other factors that are very strongly correlated are other income and other expenses, the correlation between these factors is also positive, which indicates as other income increases the other expenses will also show an increase. Correlations between the other determinant factors are mostly positively correlated, even thought not very strongly. The correlation

between the capital debt repayment capacity and the determinants is illustrated in Table 5.14.

Table 5.14: Correlation between Capital debt replacement capacity and determinants

	CDRC	Net farm income	Other income	Other expenses	Owner's withdrawals	Interest paid	Misellaneous Revenues and Expenses
CDRC	1						
Net farm income	+	1					
Other income	+	+	1				
Other expenses	+	+	+	1			
Owner's withdrawals	+	+	+	+	1		
Interest paid	+	+	+	+	-	1	
Misellaneous Revenues and Expenses	+	+	+	+	+	+	1

Capital debt replacement capacity's correlation with the determinant factors is all positive. The two factors that have the strongest correlation are net farm income and interest paid. Other determinant factors' correlations to the measurement are not as strong but can still have an influence.

5.3.5. Financial efficiency

The first financial efficiency ratio will be the asset turnover ratio. To calculate the asset turnover ratio, gross revenue is divided by total assets. A positive correlation exists between the two determinants of this ratio. This in effect means that as total assets increase, gross income will also increase, but less than total assets, and vice versa. The effect of this correlation on the asset turnover ratio is that any increase in either of the determinants will results in an increase of the ratio. The size of the increase will be larger with an initial increase in gross revenue. The correlations between these factors are illustrated in Table 5.15.

The operating expense ratio is determined by dividing operating expenses by gross revenue. Gross revenue and operating costs are positively correlated; with an increase

in operating costs, the gross revenue will also increase, but less than the initial increase of operating costs. An important factor to remember is that the operating expense ratio and the interest expense ratio must be less to be in a better position. Given this to be in a better position, these ratios must decrease and not increase as with the other measurements. The effect of a change in operating expense will have a negative effect on the operating expense ratio, meaning that the ratio will increase and be in a worse position.

The other ratio that has to be preferably lower for a better performance is the interest expense ratio. Interest expense ratio is calculated by dividing the interest expenses by gross revenue. Correlation between the determinants of the ratio is positive. With a change in interest paid, the effect on the interest expense ratio is positively correlated. This indicates that with an increase in interest paid on a farm the interest expense ratio will be higher and in effect be worse off. Correlation between gross revenue and the interest expense ratio is just the opposite; an increase in gross revenue will cause a decrease in the interest expense ratio and a better position for the ratio.

Table 5.15: Correlation between determinants and measurements for financial efficiency

	Interest paid	Total Assets	Operating costs	Gross revenue	Net farm income from operations	Asset turnover ratio	Operating expense ratio	Interest expense ratio	Net income ratio
Interest paid	1								
Total Assets	+	1							
Operating costs	+	+	1						
Gross revenue	+	+	+	1					
Net farm income from operations	+	+	+	+	1				
Asset turnover ratio	+	+	+	+	+	1			
Operating expense ratio	-	-	-	-	-	-	1		
Interest expense ratio	+	-	-	-	-	-	+	1	
Net income ratio	+	+	+	+	+	+	-	-	1

The net income ratio is negatively correlated with the operating expense and interest expense ratios. Even though the net income ratio is negatively correlated with these two ratios, it is positively correlated with operating costs and interest paid.

The correlation between the measurements can assist to identify a potential chain reaction that can be caused by a change in the performance of the farm. Because the financial performance is seldom a hundred percent predictable, it is difficult to say exactly what will happen, but these can serve as guidelines of what can be expected.

5.4. Benchmarking example

An example is done to illustrate how the benchmarking system can provide support to a producer when it is used to analyze his performance using the cut-off value benchmarking system in coordination with the DEA benchmarking system. The farm used as an example is Mixed enterprise farm nr. 33, known as Farmer John and the financial statements for the years ending 2008 and 2009 will be used.

The financial measurement results for the farm were calculated and are illustrated in Table 5.16. These results will now be completed into the benchmarking system by the producer to be analyzed against the other Mixed enterprise farms in the GWK trading area.

The results from the 2008 year are completed into the cut-off benchmarking model as illustrated in Table 5.16. After completion of the measurements the results of the benchmarking is done by comparing the farm's financial performance to those in the GWK trading area and against the norms as set out by Blocker *et al.*, (2003). The results are illustrated in Table 5.17.

Table 5.16: Financial results of Farmer John in the cut off values benchmarking model for 2007/08 and 2008/09.

2007/08			2008/09	
Name:	Farmer John		**Name:**	Farmer John
District:	GWK trading area		**District:**	GWK trading area
Enterprise:	Mixed		**Enterprise:**	Mixed
Current ratio	0.78		Current ratio	0.75
Working Capital	R -1 404 833.83		Working Capital	R -1 979 561.00
Debt to asset	23%		Debt to asset	22%
Equity to asset	77%		Equity to asset	78%
Debt to equity	29%		Debt to equity	29%
Net farm income	R 6 399 352.67		Net farm income	R 10 712 567.97
ROA	16%		ROA	27%
ROE	11%		ROE	19%
Operating profit margin	36%		Operating profit margin	44%
Capital replacement	R 5 121 070.57		Capital replacement	R 9 008 834.68
Asset turnover ratio	44%		Asset turnover ratio	61%
Operating expense ratio	19%		Operating expense ratio	20%
Interest expense ratio	4%		Interest expense ratio	4%
Net income ratio	34%		Net income ratio	42%

Table 5.17 must be interpreted as follows: The table start at the top left corner with the enterprise that is being benchmarked followed by the identification of the farm that is being benchmarked. The first two columns the different measurements are identified and are followed in the second column by the specific values of the farm's measurements. These are the exact values that are being benchmarked. The first section against which the farm is benchmarked is the other Mixed enterprise farms in the GWK trading area. The name of the producer (Farmer John) is displayed in the specific performance group; for example, the current ratio of 0.7877 is in the mid-point performance group and therefore the farm name is displayed in the mid-point column of GWK benchmarking. The second part is where the farm is being benchmarked against

the norms by Blocker *et al.*, (2003). This time the current ratio is below the acceptable norm and the farm number is in the bottom performance group.

As indicated in Table 5.17, farmer John's performances relative to the other Mixed enterprise farmers in the GWK trading area, was average to poor. This resulted in most of the performance measurements being in the mid-point to bottom performance groups.

As an example of what an important aid a benchmarking system can be to a producer, Farmer John's financial year of 2008/09 was also used in the benchmarking model. This will provide important information of what happened on the farm during the last financial year, whether there were any improvements or did the farm's performance even worsen over the past year. This is a combination of the two benchmarking options available, mentioned in the literature review, namely industry benchmarking and past performance benchmarking.

Table 5.17: Benchmarking farmer John against GWK benchmarking system and norms by Blocker *et al.*, (2003), 2007/08

Mixed	Financial measurements of:	GWK Benchmarking						Blocker *et al.*, (2003)					
		Top		Mid point		Bottom		Top		Mid		Bottom	
Farm name:	Farmer John	Farm	Cut off	Farm	Cut off		Farm	Farm	Cut off	Farm	Cut off		Farm
Liquidity													
Current ratio	0.7877		> 1.10	< Farmer John	< 0.73	<			> 2.00	<	< 1.00	<	Farmer John
Working Capital	R -1 404 833.38		> R 329 925.25	<	< R -1 149 610.69	<	Farmer John		>	<	<	<	Farmer John
Solvency													
Debt to asset	23%		< 22%	< Farmer John	< 33%	<		Farmer John	< 30%	<	< 60%	<	
Equity to asset	77%		> 78%	> Farmer John	> 67%	>		Farmer John	> 70%	>	> 40%	>	
Debt to equity	29%		< 29%	< Farmer John	< 50%	<		Farmer John	< 43%	<	< 150%	<	
Profitability													
ROA	16%		> 27%	>	> 18%	>	Farmer John	Farmer John	> 5%	>	> 1%	>	
ROE	11%		> 27%	>	> 19%	>	Farmer John	Farmer John	> 10%	>	> 5%	>	
Operating profit margin	36%		> 52%	>	> 41%	>	Farmer John	Farmer John	> 35%	>	> 20%	>	
Net farm income	R 6 399 352.67		> R 9 614 822.66	> Farmer John	> R 5 577 496.25	>		Farmer John	>	>	>	>	
Repayment Capacity													
CDRC	R 5 121 070.57		> R 10 052 910.87	>	> R 5 964 909.97	>	Farmer John	Farmer John	>	>	>	>	
Financial Efficiency													
Asset turnover ratio	44%		> 57%	> Farmer John	> 42%	>		Farmer John	> 40%	>	> 20%	>	
Operating expense ratio	19%		< 16%	< Farmer John	< 20%	<		Farmer John	< 60%	<	< 80%	<	
Interest expense ratio	4%		< 3%	< Farmer John	< 5%	<		Farmer John	< 10%	<	< 20%	<	
Net income ratio	34%		> 44%	> Farmer John	> 34%	>		Farmer John	> 20%	>	> 10%	>	

Table 5.18: Benchmarking farmer John against GWK benchmarking system and norms by Blocker *et al.*, (2003), 2008/09

Mixed	Financial measurements of:	GWK Benchmarking						Blocker *et al.*, (2003)					
		Top		Mid point		Bottom		Top		Mid		Bottom	
Farm name:	Farmer John	Farm	Cut off	Farm	Cut off		Farm	Farm	Cut off	Farm	Cut off		Farm
Liquidity													
Current ratio	0.7473		> 1.10	< Farmer John	< 0.73	<			> 2.00	<	< 1.00	<	Farmer John
Working Capital	R -1 979 561.00		> R 329 925.25	<	< R -1 149 610.69	<	Farmer John		>	<	<	<	Farmer John
Solvency													
Debt to asset	22%	Farmer John	< 22%	<	< 33%	<		Farmer John	< 30%	<	< 60%	<	
Equity to asset	78%	Farmer John	> 78%	>	> 67%	>		Farmer John	> 70%	>	> 40%	>	
Debt to equity	29%		< 29%	< Farmer John	< 50%	<		Farmer John	< 43%	<	< 150%	<	
Profitability													
ROA	27%		> 27%	> Farmer John	> 18%	>		Farmer John	> 5%	>	> 1%	>	
ROE	19%		> 27%	> Farmer John	> 19%	>		Farmer John	> 10%	>	> 5%	>	
Operating profit margin	44%		> 52%	> Farmer John	> 41%	>		Farmer John	> 35%	>	> 20%	>	
Net farm income	R 10 712 567.97	Farmer John	> R 9 614 822.66	>	> R 5 577 496.25	>		Farmer John	>	>	>	>	
Repayment Capacity													
CDRC	R 9 008 834.68		> R 10 052 910.87	> Farmer John	> R 5 964 909.97	>		Farmer John	>	>	>	>	
Financial Efficiency													
Asset turnover ratio	61%	Farmer John	> 57%	>	> 42%	>		Farmer John	> 40%	>	> 20%	>	
Operating expense ratio	20%		< 16%	< Farmer John	< 20%	<		Farmer John	< 60%	<	< 80%	<	
Interest expense ratio	4%		< 3%	< Farmer John	< 5%	<		Farmer John	< 10%	<	< 20%	<	
Net income ratio	42%		> 44%	> Farmer John	> 34%	>		Farmer John	> 20%	>	> 10%	>	

The benchmarking results for the 2008/09 period are illustrated in Table 5.18. These results indicate that there was a adequate improvement in the performance of Farmer John, with most of his financial measurements being in the mid-point or top performance group. This is a adequate indication of the improvement in performance from the previous year when most of the measurements were in the mid-point or bottom performance groups

The increase in performance was also illustrated when the financial measurements for the two years were used in the DEA benchmarking system. These results indicated that the farm improved its efficiency score from 0.978 in 2007/08 to being one of the efficient farms in the 2008/09 year (Table 5.3). How did farmer John improve his performance from 2007/08 to 200/09? To answer this question, the financial measurements have to be further evaluated and the financial statements have to be studied to understand the improvements in the measurements.

The worse liquidity measurements were the result of an increase in the short-term credit that caused both of these measurements to be lower. An increase in the total assets of the farm from 2007/08 to 2008/09 was the main influence on the improved solvency measurements. While there was an increase in the total assets of the farm, the total liabilities stayed relatively constant, which indicates that equity grew over the two year period (Asset = Equity + liabilities). This is also confirmed when the status of the South African Agriculture sector is analyzed (section 4.2.5). There was an increase in the total assets and investments from 2007/08 to 2008/09, while debt as a percentage of total assets decreased. This indicates exactly the same situation for both Farmer John and the South African Agriculture.

The profitability measurements for Farmer John increased from the previous year. The main difference from the previous year was an increase in the gross value of production, especially from the maize enterprise. As already mentioned in section 4.2.5, the production costs and other costs also increased during the year and this is also reflected in the increasing of the operating expense measurement. It is Important though is that proportion wise the increase in the Gross value of production was larger

than the increase in costs and therefore the increase in the net farm income, asset turnover ratio and net income ratio.

In conclusion, benchmarking the two years for Farmers John provided him with very useful information. This information summarized the performance of the farm business not only to the other producer, but also indicated that relative to past performance the business is moving forward.

5.5. Conclusions of Chapter

In conclusion, the cut off point for each one of the different enterprises have been calculated and can be used in the future to benchmark farms in the GWK trading area. It remains important to remember that when a farm is benchmarked to other, that the other farms do have the same enterprise/s. When different enterprises are benchmarked the information can be misleading and wrong conclusion can be made about the performance of a farm.

The two different types of analyses that have been done ultimately showed the same results. When the three performance groups were determined, by dividing the top, midpoint and bottom groups, the DEA model also identified the same farms as the top (efficient) and bottom (inefficient) performance farms. Even though a farm was identified as being an efficient farm using DEA, some of the measurements, individually, were not always in the top performance group. The same can be applied to the inefficient, where some of the measurements were in the midpoint or even sometimes in the top performance group. When this happens, most of the other measurements are in the correct group (top or bottom), depending on whether the farm is efficient or inefficient.

Most important factors from this chapter are to remember that when a farm is being benchmarked it must be compared to a similar enterprise. This will assist in better decision making and provide a better picture on what the real performance is when compared to other enterprise farms instead of just being compared to norms that are over several different enterprises. After benchmarking the farm, correlation between the measurements and their determinants provide information on what can be expected to

happen to the overall financial performance of the farm when trying to improve one or more measurements.

Chapter 6
Conclusions and Recommendations

6.1. Introduction

The study focussed on the development of a financial measurement benchmarking system for a specific region of producers in the Northern Cape. The development of the benchmarking system was based on the "Sweet 16" financial measurements that are used by the FFSC in the United States of America to analyze the performance of farms. For these "Sweet 16" measurements there are acceptable norms that can be used as guidelines to assess the performance of a farm. The same measurements have been used to establish a financial benchmarking system for the producers in the GWK trading area. In order to have a better understanding on why certain measurements had changed over the years, the trends that were followed by the GWK producers were compared to the same trends in the South African agriculture sector as a whole. This is to help understand whether the change in performance was an individual change or was it an external factor that influenced all the producers of South Africa. After the trends were compared, the cut off values were determined for benchmarking, correlation was tested between the measurements and their determinants to assist in decision making. Lastly, DEA was used to provide a benchmarking model that ranks the farms according to their operating efficiency and to test the cut off values.

6.2. RSA agriculture sector and GWK producers

The factors compared between the RSA agriculture sector and the GWK producers are the following: gross value of production, net farm income, expenditure on goods and services, capital assets and farming debt. Other factors that were also described for additional information were the prices of the main products that are produced by the GWK trading area producers.

The trends followed by the South African agriculture sector are also followed by the producers in the GWK trading area. These trends become obvious by studying the figures shown in Chapter 4. The identification of any difference in the trends between

the two would assist in identifying any areas that could have influences the performance of a farm that had not been caused by a decision made by the producer. As indicated the trends are similar; when any changes occur in the performance of a farm it is more likely to be caused by a decision that was made on the farm by the producer or the decision-maker.

6.3. Developing cut-off values for benchmarking

After comparing the trends of the South African agriculture sector and the GWK producers, the cut-off values for each of the financial measurements can be determined. The cut-off norms were determined in Microsoft Excel, using the large and small function. This function identifies the third largest or smallest value in a data set. Using the function in developing the cut-off values the function was set to identify the third (⅓) highest and third (⅓) lowest values. By identifying these two values the farms are divided into three performance groups. The measurements with values higher than large ⅓ value identified form the top performance group while the values that are smaller than the small ⅓ form the bottom performance group. All the values in between the large ⅓ and small ⅓ are the mid-point performance group. This process was done for each of the fourteen measurements used in the study and was also repeated for each of the three farm enterprises.

When the financial measurements are used for benchmarking the financial performance of a farm it is essential to make sure that the norms of that farm's performance are being benchmarked with similar enterprises. This is important as there are differences between certain financial measurements, such as the liquidity and solvency measurements. This is very important, as there is a difference in the norms that were determined for each of the three enterprises. Other financial measurements have very small differences in the cut-off values determined for benchmarking. These measurements include ROA, ROE and operating expense ratio. To determine the position of the financial position of the farm, the overall norms can be used as a guideline, but when considering adjusting the financial performance of the farm it must be benchmarked against the same farm enterprise. This will help to realise realistic financial performance levels that are presented by other farms in the specific area.

The cut-off values for each enterprise were determined and are illustrated in Tables 5.1, 5.2, 5.5 and 5.8 in Chapter 5. When the performances of the farms in the different groups are compared to each other it has indicated that there is a difference in the performance between the farms. This is a good indication to assist the objective of the benchmarking tool, which is to provide the farms that are not in the top performance with the information necessary to improve certain areas of their financials.

One important aspect to remember before adjusting the decision-making to a specific area of the financial performance is that there is a correlation between the financial aspect of financial statements and the balance sheet. These correlations must therefore be considered to help with what can be done to improve certain areas of the measurements and to understand what the influence of that change would be on the overall position of the financial statements of the farm. This is why it is important to evaluate the correlation of the measurements and their determinants.

6.4. Correlation and improving the measurements

When a producer has benchmarked the farm's performance to the norms that are used in the producer's region, the producer would most likely improve his position when he is not in the top performance group. This can be done by realising some changes in the financial management of a farm. These changes will however, not just influence the target area that needs improvement, but will be followed by a chain reaction throughout the income statement and balance sheet. These chain reactions that are caused in the change of one aspect are of crucial importance to a producer who wants to improve the farm's financial performance. To provide the producer with an idea of what these changes can be and what the expected results of a chain reaction can be, the correlation between the financial measurements and their determinants must be considered.

When a change is made by the producer in the financial management of the farm, the change will be as a determinant factor, like for example, the total production costs of the measurements. The producer will be unable to change net income ratio, but will be able to change the ratio by changing one or both of determinants that are the net farm income from operations and/or gross revenue. This is why it is important to remember

that there are chain reactions in the income statement and balance sheet and this will affect the overall performance of a farm.

The correlation between the determinants and their respected measurements can therefore be used as guidelines. These guidelines can assist a producer to determine what can happen when considering making a change or adjustment in any way to improve his financial performance.

Financial performance cannot always be predicted with absolute accuracy. This will also be the case when predicting how the financial measurement will react to a certain change. The correlation between the measurements can therefore be used as guidelines of what to expect.

6.5. DEA as efficiency benchmarking system

Another tool that can be used to benchmark the farms according to their operating efficiency is Data Envelopment Analysis. As explained, the DEA model adjusts the weights that are applied to each measurement for each farm individually to maximise the farms' operating efficiency. This model does not depend on predetermined weights being applied to each measurement but apply a determined weight to the measurement with the objective to maximize the operating efficiency score for each individual farm.

When the results from the development of the benchmarking system in EXCEL is compared to the results of the DEA model, it was found that the same farms were identified as being those in the top and bottom performance groups. The DEA model only divides the farms into two groups, efficient and inefficient. All the farms that were identified as being efficient were those that were in the top performance group or the best performance of the mid-point performance group; the opposite is also true for the inefficient farms being the bottom performance groups and the bottom part of the mid-point performance group. This is a adequate indication that the farms in the bottom performance group do have the opportunity for improvements in their financial performance.

The factors identified as the ones that a producer can use to increase the performance of the farm are also those that were different between the farms that are efficient and

inefficient. This can be seen in Tables 5.4, 5.7 and 5.10. By just concentrating on some of these factors the performance can be increased and can lead to a more profitable farming business.

6.6. Recommendations and improving financial positions

As mentioned by Vogt, (2010), financial benchmarking is gaining ground in the agriculture sector. Benchmarking provides the producers with an opportunity to analyze their financial positions and at the same time the financial performance can be compared with the same analysis of other farms. This also provides not only the producers with important information on the financial performance of their farm, but can also be used by credit providers and other organizations that would be interested in financial performance of these farms.

The benchmarking system can be used by the producer in the same area or district as the study area. Whenever a producer decides to benchmark his performance to those in the same area, he must also remember to use the farms that have the same enterprise groups. This is imperative, as there are differences in the performance and norms between the different enterprises. When more farms are added to the data set, the benchmarking system will become more effective as it covers a wider range of farms and can even start with new areas outside the GWK trading area. The more farms to be included in the system can help to develop a tool that can be used over a large area of South Africa and even make the model publicly available. When this becomes publicly available the producer can benchmark a farm's performance to those in the same area or a larger district by logging on to the internet and using the tool, similar to the tools that are available in other parts of the world.

Expanding the tool to use more measurements can also be helpful to identify more specific areas that can be improved or changed. This can be done by including more measurements, for example the Legal 21, to analyze the performance. The correlation between the measurements might also provide some difficulties to exactly understand and predict what a certain change in the financial performance will cause, but the basic correlations provide a background on what the expected change can be and this can also assist in improving, preventing and even understanding the financial performance.

Benchmarking can not only be done to compare the financial performance of the farm to those of other farms, but it can be used to analyze the historical financial statements as well. When this is done, the performance of the farm can be analyzed over several years and then it become obvious whether there were any improvements in the financial performance of the farm. Historical financial benchmarking data can also be used to identify certain trends that could exist in the farm that can help with future decision-making. These facts provide good ground on why it is important to a producer to have access to a benchmarking system, that not just analyze the financial performance to other farms but also the historical performance of the farm.

When the producer has benchmarked his farm and identified areas for improvement, the producer must remember that he cannot merely change the identified factors, such as those mentioned in Chapter 2. A chain reaction in the financial statements of the farm exists and therefore one change can have an influence on the overall performance of the farms. It is therefore suggested that the producer must make improvements or corrections on the farm while using the correlation between the financial measurements and the determinants. This can assist in identifying key areas that can be changed and with the chain reaction can correct a greater number of problems than initially anticipated.

The key areas that can be looked at for improvement are discussed in section 2.6 of Chapter 2. These are not the only areas that can be changed, but it provides a starting point from where a producer can start to identify solutions. In summary, the factors include the size of the farm, number of employees in relation to the farm, gross income that are generated relative to the size of the farm and economy of scale. Whenever an excess of labour exists on a farm, the withdrawals of wages and family expenses can affect the performance of the farm. Certain changes in relation to the amount of labour needed on the farm can assist in changes in performance.

6.7. Summary

The primary objective of the study was to develop a financial measurement-based benchmarking system for GWK on the financial status of their producers. Financial benchmarking systems provide the producers with opportunities to evaluate their past

and current financial performance, not only to their own financial status but also to other producers included in the benchmarking data. To have a better understanding of the performance of the farms' financial status and to have a possible explanation of why certain changes had occurred, the first secondary objective was to compare trends of the whole agriculture sector of South Africa with those that occurred to the GWK producers in the study. It was found that the GWK producers had followed more or less the same trends than those experienced by the South African agricultural sector.

After the trends were compared between GWK producers and the South African agricultural sector, the financial statements obtained from GWK Limited, were analyzed by calculating the financial measurements for each farm over the five years. This was done in order to determine the border values that can be used to divide each measurement into three performance groups. These groups will be used to determine the position for each measurement of a farm relevant to the other farms in the benchmarking system. When the producer has seen the indication that a certain measurement is in the mid-point of bottom performance groups, he knows that there are other options available to improve that position, as it is already being done by other producers. This leads to other secondary objectives that were identified and analyzed.

When a producer wants to improve one or even more than one financial measurement, certain changes had to be made that will influence the income statement and balance sheet. As these statements are interactive and a change in one area of the statement will have an influence on the overall results, it is necessary to have an idea or indication of what these influences can be. To provide some background on what the possible outcomes can be, the correlation between the measurements and their determinants where determined. These correlations will provide important information on what the possible results can be of a certain change by a producer on a farm. As the financial market is ever changing the changes cannot always be hundred percent predictable, but one can at least provide an idea of what can be expected.

The last secondary objective is to rank the farms according to their operating efficiency for each enterprise, using DEA. As results indicated, this method of benchmarking can be used in coordination with the border measurement benchmarking system. The

difference that exists is that the DEA benchmarking system only divides the farms into two groups as being efficient and inefficient. These two groups can be compared to the results obtained from the border measurement benchmarking system; the farms identified as being the efficient ones are mostly the farms that had most of their financial measurements in the top performance and the top half of the mid-point performance groups. The opposite is also true for the farms identified as being inefficient.

Recommendations from the study include that a benchmarking system can provide essential information to producers on the performance of their farms, not only on past performance, but also to other rivals. When certain adjustments have to be made to improve the performance of the farm, it is important to remember the possible correlation existing between the financial measurements and what the possible outcomes can be. The correlation between the measurements is also a point available for future research. Lastly, it is recommended that when a farm's financial position is benchmarked to other competitors, more than one benchmarking system is to be used. This will provide more accurate information to the actual performance of the farm, as a wider spectrum is covered by using, for example, the border measurement and DEA benchmarking systems.

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