RISK-RETURN ANALYSIS OF HIGH PERFORMING ORGANIC AND CONVENTIONAL MEAT PRODUCTION SYSTEMS

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ABSTRACT

Demand for organic meat is growing rapidly and so is the interest of New Zealand farmers in producing it. However, information on the advantages of such a system is limited. Studies that have evaluated organic farming systems were either carried out overseas under different conditions or were solely based on comparisons of before versus after the conversion to organic farming, instead of organic versus alternative investment options. The present study examines the economic viability of options available to commercial meat producers of high performance organic systems and a high performance conventional farming system in New Zealand. This involved a robust analysis evaluating the risk-return profiles of strategic enterprise changes and linking these to the risk-preferences of the managers. The Stockpol® model was used to simulate the biological feasibility and undertake a preliminary economic assessment of the alternatives: (i) Full organic and (ii) Intensive beef cattle and lamb finishing systems. A spreadsheet (Excel®) model was developed to undertake a full economic and risk analysis (@Risk®) of those options. Both the full organic and intensive conventional options had a greater chance of achieving long-term target sustainable business growth (SBG) for both case study farms than their base systems (status quo). Continuation of the base system had lower net operating profit after tax (NOPAT) for both case study farms and a lower probability of achieving acceptable levels of business growth. On Case Farm One, the NOPAT mean of the conventional was higher and exhibited greater variation than the full organic alternative. On Case Farm Two, the NOPAT mean of the full organic was also slightly lower than the conventional option but both options exhibited a very similar risk-return profile. The sensitivity regression analysis revealed for both farmers that market uncertainty had the greatest impact on NOPAT mean variability followed by premium price for organic farms, then production risk. So, premium price is an important factor influencing farm profitability. The Activity-Based Costing (ABC) has shown that organic farming had higher production costs than conventional farming because of changes in the enterprise structure. The cumulative distribution function of production costs showed greater variability for lamb meat under the full organic option while beef production costs has more variation under the conventional alternative. The challenges of organic farming are significant e.g. animal health, weeds, and marketing. Therefore, it requires progressive managers to develop business skills associated with strategic management to enhance their proactive production approach. Managers must be thinking differently in terms of product and market and an open mind and willingness to learn are essential requisites to cope with organic farming. Further research could involve this approach using other livestock enterprises and the models developed could be used to quantify the benefits gained from improvements to the system such as selection for parasite resistance.

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CHAPTER ONE

1 INTRODUCTION

1.1 The New Zealand Livestock Industry

The New Zealand economy is based on agricultural production and export, with the agriculture sector in turn dominated mainly by livestock production based on grazed pastures. Farming and food production has to remain in its current position as one of the mainstays of the New Zealand economy, a major export earner, and must be recognised by all New Zealanders as being as important to the country's well-being as the cities and urban lifestyles.

In 1996 pastoral industry exports accounted for 80% by value of agricultural exports and 44% of total exports from New Zealand. In 1999 there was a slight increase for pastoral industry exports, up to 82%, and the contribution of total agricultural products reached 54% of total export receipts from merchandise trade. Export receipts for the pastoral sector for 1998/99 was $9.2 billion (NZWBES, 1999).

In 1999, the total meat sector was responsible for 41.4% of New Zealand pastoral exports (New Zealand Meat Board, 1999). Meat exports reached $2.84 billion in 1999 and it is projected out to reach $3.45 billion in 2003, a rise of 22% due to higher expected beef prices and lamb volume sales (SONZAF, 1999).

Export dependence implies that there is the need to be competitive in a world market quite often restricted by tariff and import barriers and also compete with subsidised product of the local industry. To this end, New Zealand has achieved the competitive ability through developing low-cost production systems based on grazed pasture with high output per hectare and per labour unit. In the past 30 years the New Zealand pastoral sector has moved away from being a supplier of bulk product to the commodity markets of the world and focused on markets that are prepared to pay for product quality and customer service.

Historically, sheep meat exports were largely as frozen carcass to UK. Nowadays, meat is exported as cuts rather than in carcass form (e.g. Lamb exports in 1996 were 10%

chilled, 25% frozen carcass, 51% frozen cuts and 14% frozen boneless). In 1980, 20% of sheep meat exports to the European community were in cut forms. This figure increased to 60% in 1990 and 75% in 1995 (Burt & Francis, 1996). In 1999 frozen lamb carcasses made up only 11% of the export market (Davison, 2000a).

Beef exporting also changed significantly with the opening of the US market at the beginning of the 60s. In the early 90s, only 50% of New Zealand beef meat was measured up to the required industry standards for tenderness. By the year 1997 this figure had improved to 86% and currently 98% of New Zealand beef meets the required industry standards for tenderness (Packard, 2000).

New Zealand livestock products are exposed to economic circumstances as well as market situations (Martin, 1996). Sheep meat, beef and wool prices are highly dependent on world production, weather conditions, currency exchange rates, economic growth and tariff barriers constraining access to different markets. Domestic issues such as trends in stock numbers and the financial health of processors affect primary product prices in New Zealand. The New Zealand livestock industry has for years been an industry based on solid scientific knowledge. Without advances in science and technology it will be difficult for New Zealand to continue being the world leader in lamb and beef production (Davison, 1999).

1.2 Problem statement

The challenges facing organic farming are considerable. Conversion from conventional practices involves significant restructuring of the farm system and changes in production methods. Consequently, it also requires the producer to develop new skills and approaches and be thinking differently in terms of product and market (Mackay *et al.* 2000).

Once converted to an organic system, farmers can face loss of yield (Aitchinson, 1999), due to problems such as pest and parasite control. The extent of yield loss will vary depending on factors such as, the inherent biological challenges and farmer skills through to the degree to which chemicals have been previously used (Berentesen & Giesen, 1999; Fitzgerald, 1997). On the other hand, a focus group discussion in New Zealand developed a plan for conversion and suggested that a loss in production did not have to be accepted (Mackay *et al.* 2000).

In order for organic farming to progress as a sector it needs to provide at least the same, if not higher returns, than conventional farming practices (measured as operating profit ($/ha), for instance). In New Zealand, of the few studies done to date, evaluating organic farming returns have compared them to the "status quo" or the production system prior to the conversion, rather than alternative investment options.

There has been no attempt to objectively compare a range of high performance organic farming systems with a range of high performance 'conventional' farming systems. If it could be proven that high performance organic farming provides sustainable higher returns than high performance conventional farming, then the move into organic would become more attractive (J. Anderson, April, 2000, personal communication).

Farmers and the New Zealand livestock industry need to find out about the economic benefits, challenges that they might face in the future and long-term advantages and disadvantages of supplying product to an organic supply chain. The ability to supply these organic specifications is seriously constrained by general lack of information among producers of the issues that must be assessed in conversion to a low-chemical system, and the lack of "real working examples" (Mackay *et al.*, 2000)

There is a perception that organic farming is more profitable than conventional farming. However, there is virtually no data to support this claim, or even a framework for perspective producers, interested in conversion, examine the economic feasibility of converting to organic supply (A. Mackay, July, 2000 personal communication)

The additional labour costs and decreased level of output involved in organic livestock production requires a higher retail price for the final product. This is known as the organic premium (Farodoye, 1999). Studies from UK reported that profitability for organic meat production is strongly associated with the opportunity the farmer has to receive an organic premium for his product. Therefore, the assessment of the cost of production for organic lamb can be useful for premium price negotiation with retailers.

Marketing channels for organic meat are an important part of the process. It may involve sales by the producer to an abattoir or meat processor who takes over ownership of the livestock and arranges slaughter, processing and sale. In this case, meat contracts would be a mechanism for the abattoir to reduce the uncertainty of supply of organic meat, while farmers may benefit from them through a guarantee of more attractive prices over the normal market. So, assessing the cost of organic farming production might be useful as a negotiating tool for forward contract prices with meat processors.

There is a lack of data regarding production levels and production costs of organic farming in New Zealand. There is little technical information formatted to assist organic producers and there is little information with regards to the impact of a reduction of animal performance in terms of profitability of organic farming enterprises.

1.3 Purpose of this study

This research intend to review the management responses and risks of entrepreneurial New Zealand farmers running their properties in an organic system in response to an existing demand for this type of product.

The project will give an overview of the biological feasibility of organic farming, as well as the major production costs, sources of risk associated with the changes in husbandry practices and an estimate of the profitability of the organic system. The case study approach will be used to obtain relevant qualitative and quantitative data. This information aims to provide examples of potential economic benefits for producers supplying organic products in New Zealand livestock industry. The approach is a modelling one, where computer software programs for risk assessment and profitability and feasibility analysis will be used to evaluate the information obtained during the interviews.

The use of organic systems represents a rapidly expanding opportunity to increase farmers' income and long-term production sustainability. However, higher levels of income are dependent on price received for the product. This income must offset the costs likely to incur due to change in the management system. Many issues, mainly profitability, have an important influence on a farmer's decision to implement management changes in their system (Reid *et al.* 1993). These range of factors are determined and defined under farmer circumstance, and include biophysical factors, market opportunities, farmer goals and values and resource base (Byerlee, 1980).

1.4 Hypothesis

The aim of the research is to assess the feasibility and profitability of an organic beef and sheep enterprise compared with other progressive livestock investment options under New Zealand conditions. The hypothesis to be tested in this research is:

"Organic beef and sheep enterprises compared with other progressive livestock investment options under New Zealand conditions are both economically feasible and profitable"

1.5 Research objectives

The objectives of this research are to address knowledge gaps among livestock producers of the relevant issues and challenges that must be considered in conversion to an organic system, and to generate production and financial data from "working examples and models" of low-chemical and organic sheep and beef farming.

The specific research objectives include:

- To define and identify, through a literature search, the skills of progressive managers and determine their strategic plan and business views
- Assess the production costs associated with meat production of an organic sheep and beef farming systems.
- Utilise risk analysis in estimating the profitability of an organic and conventional sheep and beef farming systems.
- Assess the feasibility and profitability of an organic and conventional sheep and beef farming systems.
- Assess of resources and performance of organic farms and compare with well-managed conventional farms

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Organic production systems

2.1.1 Introduction

World-wide interest in reducing or eliminating chemicals on farming practices has been growing. In New Zealand, this interest is gaining importance due to New Zealand's unique pastoral characteristics, which will enable it to produce clean food.

Organic agriculture has appeared in the last few decades. First the primary interest in such issues was due to farmer's concerns about the risk to health and environment from the abusive use of chemicals in the system (Yoneyama, 1994).

In the 90's, there was an additional concern in organic issues. While farmer's concerns regarding health and environment still remain associated with the organic philosophy, the increased consumer awareness about the risk to health and the environment due to the use of synthetic chemicals is the major driving force behind the renewed interest in growing organic products. This situation has resulted in an increased consumer demand for organic products, thus encouraging farmers and producers to shift to chemical free production systems (Thompson, 1998; Hennesy, 1997, Kortbech-Olesan, 1998, Tregear *et al.*, 1994). In addition, an increasing number of organic producers perceive the availability of market premiums and more secure markets as a strong reason that motivates them to convert their production system. (Rigby, 2000)

Niezen *et al.* (1996) cited several other factors as causes of growing concern about current conventional farming practices in beef & sheep enterprises:

- Increasing world-wide demand for low chemical residues
- Increasing resistance to anthelmintics, insecticides and herbicides
- Growing concern with regards to food safety and quality issues
- Increasing withholding periods to chemicals on livestock
- Concerns regarding the environment

Food demand is evolving from an ordinary mass commodity market into an array of niche markets. Customers are demanding healthy, nutritional and convenient food products (Barkema &Drabenstott, 1995; Royer, 1995). Consumers throughout the food supply chain are demanding "best products" - products which meet their preferences, offering benefits throughout the year over the undifferentiated goods (Barkema &Drabenstott, 1995; Royer, 1995). Taylor (1997) stated that the challenge facing New Zealand farmers is to cater for a growing number of consumers with rising incomes who demand higher quality food products.

2.1.2 Factors associated with growth in organic goods

At the consumer end, much of the growth has been motivated by fears created by food scares, issues about chemical residues such as pesticides and antibiotics, and environmental concerns. Recently, polemic discussion with regard to genetically modified food has contributed to the increase in demand for organic food (Farodoye, 1999).

In the past, the slow uptake of organic food by consumers was caused by a number of factors. Usually, organic foods tended to be more expensive than conventional ones (Farodoye, 1999, Latacz-Lohmann, 1997, Tregear *et al.*, 1994).

Organically produced food is more expensive due to a decrease in terms of output and the utilisation of economies of scale being limited. As the demand for organic food is greater than supply, scarcity is also a factor contributing to the higher prices. Transportation cost is significant too because organic products must be processed by certified processors and this may sometimes require product to travel large distances (Farodoye, 1999).

The limited availability of outlets in supermarkets has been another factor contributing to the slow uptake of organic foods. The majority of retailers are really interested in increasing stock levels and product ranges in their stores, but they are still restricted by supplies (Latacz-Lohmann, 1997). In addition, strict controls and lengthy periods for conversion are some of the major obstacles faced by organic meat producers (Farodoye, 1999).

The figures from the British Soil Association in 1999 reports that in UK, despite the fact that the area converted into organic production is likely to increase from 120,000 ha to 240,000ha during 2000/2001, demand is growing faster (40%) than supply (British Soil association cited by Rigby, 2000)

2.1.3 Definition of organic production systems

The USDA provide the following definition for organic farming:

" Organic farming is a production system which avoids or largely excludes the use of synthetically compounded fertiliser, pesticides, growth regulators and livestock feed additives. To the maximum extent feasible, organic farming systems rely on crop rotations, crop wastes and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients and to control insects, weeds and other pests."

Frazer & Aspin (2000) wrote a guideline for organic meat production in New Zealand. They summarise organic agriculture as follows:

" ...production system seeks to achieve ecologically sound and sustainable outcomes. This farming system is based on the dynamic interaction between the soil, plants, animals, humans, the ecosystem and the environment. The approach encompasses minimal use of external inputs and avoids the use of synthetic fertilisers and pesticides, drenches, herbicides etc. It emphasises the use of management practices in preference to off-farm inputs. This is accomplished by using, where possible, cultural, biological, and mechanical methods as opposed to using synthetic materials to fulfil any specific function within the system"

Both definitions emphasises the exclusion of agricultural chemicals, reduced external inputs, adoption of environmental friendly practices and developing harmony between the soil, plants, animals, humans, the ecosystem and the environment. Organic production is simply working in harmony with the land's capabilities to keep animals and crops in peak condition (Aitchison, 1999). Organic producers make use of principles of science and technology, they present a proactive action adopting preventative strategies rather than quick fix solutions. Organic meat production in particular, refers to the way animals are raised and handled, what food they eat and what remedies are administered (Aitchison, 1999).

2.1.4 Physical Performance in Organic farming

There are two organic farm units in New Zealand. AgResearch's Ballantrae Hill Country Research Station, which is located near Palmerston North and AgResearch's Winchmore Research Station located near Ashburton in the South Island. Most of the quantitative data regarding organic production system in New Zealand were produced in these two research stations.

(i) AgResearch's Ballantrae Hill Country Research Station

Ballantrae farm is on medium steep hill country in the Southern half of The North Island. The research project compared production system on two 25 ha blocks run conventionally and organically.

Lambing percentage is an important measure of profitability. Throughout the study, reproductive performance on the organic unit ranged between 87 and 119% for sheep and 90 to 100% for cattle. The six years (1991-1997) average lambing performance of the organic unit at Ballantrae Research Station was 108%. There was no difference in lambing performance between the farmlets. Grazing management was the main tool used to control parasitism in the organic block. In the conventional unit, parasites were controlled by five drenches per year. Dry matter was measured in both systems. The estimated herbage production was similar in both blocks, which suggested that animal production was not affected by dry matter yield. Live weight gains of replacements tended to be lower in the organic block, which resulted in lighter lambs at 12 months of age. The most significant difference in terms of live weight was observed in young sheep in the 2-8 months after the weaning. This was a result of higher faecal egg counts (FEC) in the chemical free farmlet than conventional block (Niezen *et al.* 1996).

In terms of wool production, there was little difference in mean greasy wool production of the mixed age ewes, two tooth ewes and lambs at weaning between the two farm systems. The live weight gain for wethers on the chemical-free farmlet was 21% lower than those animals reared in the conventional block. Wethers from the organic block were slaughtered in March and June and weighted 25% less (19.6 kg vs. 17.7 kg) than their counterparts reared in the conventional unit. Average fat depth was greater on drenched stock (5.2 mm) than animal not receiving any chemical treatment (3.8 mm) in May (Niezen *et al.* 1996).

Cattle production, especially steers, seems to be less satisfactory on the free-chemical system. In the first year of the experiment, over half of the young stock required "recovery" drench. After three years in the trial, live weight deficits ranged from 4 to 9%. However, because of the small number of cattle involved in the trial few conclusions can be draw from any differences in cattle performance on the two system (1998) (Niezen *et al.* 1996).

(ii) AgResearch Winchmore Research Station

This unit was established in 1988 and since then has been run according to the guidelines of the New Zealand Biological Producers for Organic Food Production. The total area was initially 40 ha, but it was reduced to 20 ha in 1995. The research unit is located in mid-Canterbury with an annual rainfall of 760 mm and 60 drought days. The lambing performance for Winchmore Research station was 135%, above the average producer in the region.

Stock numbers and performance and financial returns for the 200 ha working irrigated organic sheep and beef operation scaled up from Winchmore Organic unit (20ha) using Stockpol® are showed in Table 2.1. The level of livestock performance was based on the long-term averages (1991-98). The price information for all stock is based on conventional prices at the time the analysis was carried out.

Table 2.1 Stock number and performance for a 200 ha working irrigated organic sheep and beef operation scaled up from the Winchmore Organic Unit (Mackay *et al.* 2000).

Farm Area	200 ha
Total SU	3378
SU per hectare	16.9
Sheep:Cattle ratio	58:42
Total Sheep Sales	$73,254
Store lambs @ $28	$6,916
Finished lambs 1060@ $42 (13.9 kg CWT)	$44,467
Wool Sales (9996 kg)	$29,605
Purchase 160 steers @ $500 (210 LWT)	$80,000
Sales Cattle 156 @ $759 (244.7 kg CWT)	$118,476
Net Cattle Income	$38,476
Gross Margin	$122,030
Gross Margin per Hectare	$610,15
Total Pasture Production (kg DM/ha/yr)	$12,671

NB 70% of lambs and cull ewes reach the organic specification
100% of wool reach the organic specification

The main concern in the system is the lamb performance and cattle growth rates after weaning (Mackay *et al.* 2000; Niezen *et al.* 1996) As grazing management is a key issue for parasite control, the level of management expertise required is high. The manager is required to have greater ability and skills, particularly in the first year which is the most difficult. Knowledge regarding parasite and larval contamination should be included in grazing management decisions. The establishment of different pasture species in conjunction with genetic resistance for parasites also helps to decrease the risk associated with the production system.

Finally, the production levels (short and medium-term) obtained in these research farmlets shows some promising results and enthusiastic confidence about organic farming as an alternative production system (Niezen *et al.* 1996). It was demonstrated that it is possible to operate a chemical-free organic sheep and beef livestock system expecting acceptable levels of performance of breeding stock (Mackay *et al.* 2000; Niezen *et al.* 1996).

In Europe, Berentesen & Giesen (1999) reported that Dutch dairy farmers faced an inevitable decrease in physical production in order to accomplish the requirements and standards for organic farming. The authors suggested that compensation will arise from a higher price for biologically produced foodstuffs. They state that as organic farming leads to a decrease in terms of overall output, it must be compensated by premium prices if the maintenance of profitability is desired.

Aitchison (1999) also agrees that if premiums can be achieved they are often just a compensation for a loss in production. The same author mentioned that government support in Europe is common due to the loss in production during the conversion period. In New Zealand, producers face more risk, as there is no support over the conversion period.

2.1.5 Financial Performance in Organic farming

Using data from Winchmore and Ballantrae research station, Richardson (1997) carried out a financial analysis comparing conventional and organic sheep farming. Using prices and costs from Lincoln University Budget Manual 1997, returns per stock unit for the organic unit were 7% lower than conventional farming.

The return per hectare for organic farming was 16% less than the conventional unit, suggesting that farming organically provides a less attractive option than conventional practices, based on return per stock unit and area. Therefore, it is important to recognise the need for a premium price for organic products in order to offer more attractive returns. In a situation where there are no clear definitions with regards to premium prices, it could affect those farmers who have mainly economic motives to consider the change from conventional to organic farming.

The same author stated that to match the conventional per stock unit level the organic farm would need a 7.5% premium price for meat. A price premium of 20% for meat was required to match the conventional per hectare return. This study provided some useful information with regards to financial aspects of organic farms.

An important aspect of the profitability of organic firms is the opportunity of a greater diversity of markets for receiving premium prices for organically produced goods over conventionally produced ones. Offermann & Nieberg (1999) provided an overview of the economic performance of organic farming in Europe. They found out that premium prices are very high for most crops while the average premium prices for livestock products are generally lower. The average farm gate price for organic beef exceeded conventional prices by 30%. They also stressed that prices for some crops came under pressure, while for livestock products, premium prices can increasingly be realised. The same authors pointed out that the support payment programme in most of the countries in Europe has a significant influence on economic performance.

Aitchison (1999) reported the premium prices at retail level in UK as being 100% for beef and 20-40% for lamb. Niezen *et al.* (1996) reported premium prices for lambs ranging from 10-30% of carcass value in New Zealand. Aitchison (1999) believes that there is a window of opportunity for organic beef and lamb for approximately the next three years at high premiums and beef for the next six years. However, as the production of organic goods increase, the premium price is predicted to soften. Hutchins & Greenhalgh (1997) reported that consumers are willing to pay 20-30 percent more for organic meat. Perhaps, this consumer behaviour is a result of recent scares and they are keen to pay more in order to protect their health. However, there is no evidence that organic meat decreases the health risk.

Full premium prices can only be received after three years, the on-farm conversion process time frame, when product can be classified as "organic". The amount of premium varies according to the market and time (Aitchison, 1999).

Fitzgerald (1997) looked at financial profitability during the conversion of a typical farm in the uplands in England. When farmed conventionally, the farm has 90 hectares, which supports 25 finishing calves at 18 months and 680 ewes. Once converted into organic, the farm could support 25 finishing calves at 18 months and 480 ewes. Assuming no price premium for beef and sheep, this farm has slightly reduced its income due to the conversion achieving £486 per ha compared with £ 496 when farmed conventionally. Using a premium of only 10 percent on beef and sheep sales, an extra £ 35 per ha would be received. Aitchison (1999) reports that in Sweden organic producers have been attaining better gross margins than conventional farmers.

2.1.6 Certification

The label "organic" denotes that the product is produced in accordance with organic production standards and it is certified by a certification body or authority. The certification process was created in order to protect the status and credibility of organic products. Products must have the label of an approved certification agency for the consumer to guarantee its authenticity.

The certification process involves meeting standards covering the following stages:

- Registration
- Conversion
- Full certification

In the world, there are many differing organic standards in place. Some standards differ little from conventional practices while others obey very strict regulations. A huge variety exists between hundreds of certification agencies. In some countries, there is government intervention specifying minimum standards for organic products. Government standards are valid in countries such as the EU, Australia, US, Canada and Japan. In New Zealand, there are no government regulations regarding organic practices. However, New Zealand producers dealing with overseas customers are supposed to meet the standard regulation imposed by them.

There are two main international certification agencies, which aim to reduce the variability in standards and inspection systems.

- The International Federation of Organic Agricultural Movements (IFOAM) – A non- government institution located in Germany. They have developed a "basic standard" for organically produced foods and also provide an "accreditation program" for member organisations. This aims to promote the "equivalency" between the certification programmes established by different institutions

- Codex Alimentarius (Food Code) – A branch of the Food and Agricultural Organisation and World Health Organisation. They also set a guideline of organically produced foods. The objective is to create an official harmonisation for organic products in terms of production and marketing, inspection arrangements and labelling requirements.

There is also the UK Soil Association standards. This is a well regarded certification institution. Their standards have been adopted in a number of countries.

Currently, there are three certification agencies in New Zealand. They are:

- AgriQuality New Zealand Ltd.
- BIO-GRO New Zealand Inc.
- The Bio-Dynamic Farming & Gardening Association (Demeter)

Both BIO-GRO and Demeter have developed their set of standards based on IFOAM basic standard. BIO-GRO is IFOAM accredited. AgriQuality New Zealand provides an organic certification service to organic producers and processors through its certification business Certenz. They have been auditing organic operations for a number of years and have recently formalised this process with the establishment of an independent certification body, Certenz and developed the AgriQuality Organic Standard. The AgriQuality Organic Standard is based on the international Codex

Alinorm 99/22, EU Regulations and the Australian National Standard. (AgriQuality, 2000)

Certenz, AgriQuality's new certification business has gained the international recognition, ISO 65, required to ensure market access for certified produce into the European Union. Certenz provides organic certification to the AgriQuality Organic Standard (AgriQuality, 2000).

2.1.7 Marketing of organic products

In the UK, the supermarkets play an important role in terms of marketing of organic food. They are the largest distributors of organic food and account for more than 60% of organic produce sales (Latacz-Lohmann & Foster 1997). Despite that, supermarkets still cannot meet the demand for organic food and farmers seems to be dissatisfied with their relationship with retailers (Latacz-Lohmann & Foster 1997).

Supermarkets require a guarantee of product supply with certain specification and adequate price. The lack of supply or discontinuity of organic produce food is a major reason that explains their inability to meet demand (Coombes, 1996 cited by Latacz-Lohmann & Foster 1997). In addition, the reduced amount of product increases marketing costs leading retailers to move away from the market (Lampkin & Pandel, 1994).

This lack of supply is due to the fact that many organic producers face difficulties achieving supermarket standards and specifications, resulting in a high proportion of out grades or rejection (Latacz-Lohmann & Foster 1997). However, supermarkets have their own understanding of quality which might be slightly different for organic products. Aspects of health and nutritional value of chemical free products should also be emphasised and not only appearance. This suggests that the marketing structure, producers and supermarket, might be one of the causes of the supply problem. Both parties must join forces and find a straightforward solution (Latacz-Lohmann & Foster 1997).

Group marketing and forward contracts could be a way of dealing with discontinuity of supply (Lampkin, 1997cited by Latacz-Lohmann & Foster 1997). Forward contracting has been successfully implemented in Germany between producers and processors. Group marketing, through a co-operative, could not only offer reliable and adequate supply but also bargaining power. More variety of organic products could be available and marketing costs reduced (Range, 1996 cited by Latacz-Lohmann & Foster 1997)

Direct marketing is a well established marketing strategy for organic product trading implemented in Germany and in the UK. The most common forms of direct sales are farm gate sales, farm shops and farmer's markets. More recently, box schemes and pick your own have been developed. These last two forms of direct marketing are trying to make organic products more accessible, especially to urban dwellers, by bringing it to the consumer (Latacz-Lohmann & Foster 1997). There is also an increase in more professional direct marketing such as supplying restaurants and the establishment of "exclusive" farm shops.

An important advantage of directing marketing is the opportunity of high profit margins offered to the organic producers. However, the main disadvantage in direct marketing seems to be related to inconvenience. In a survey carried out in Germany, inconvenience was the reason of 39 percent of population for not buying directly from the producer (Latacz-Lohmann & Foster 1997).

2.2 Progressive Farmers and the Decision making process

2.2.1 Introduction

Farmers have different capabilities and personalities. This section describes and enumerates some of the key qualities that can be found in a good farm manager. A progressive farmer is synonymous to superior manager or entrepreneur in this text. It is assumed that superior managers are more likely to change their production system, challenge themselves and produce using alternative techniques to conventional practices. Farmers that may consider changing their current production system or converting to a free-chemical system may be regarded as progressive farmers. This section reviews the importance of managerial ability of farmers. Subsequent discussion addressed the decision making process in the farm context. Finally, the main psychological traits observed in successful managers are enumerated.

2.2.2 Management Capacity

Management capacity is defined as having the appropriate personal characteristics and skills to deal with the right problems and opportunities in the right moment and in the right way (Rougoor, *et al.* 1998). The manager is someone who has certain qualities and his decision-making process intend to optimise (or at least influence) the technical and biological processes. These processes are controllable to a certain extent and they ultimately determine both technical and economic results of the farm. Unpredictable elements such as weather, pests, market volatility also play an important role in the system causing risk and uncertainty for the decision-making process.

Boehlje and Eidman (1984) distinguish four major dimensions: environment (water and land regulations), social environment (family of the farmer), physical environment (weather) and the economic environment (price of inputs and products). Personal characteristics and skills are important for a successful manager and can explain the differences in outcome or success between farms (Figure 2.1).

ENVIRONMENT

Institutional | Social

Personal aspects manager
- Drivers and motivations
- Abilities & capabilities
- Biography

↓

Decision-making process
- Planning
- Implementation
- Control

↓

Technical & Biological processes

↓

Farm Results
- Technical efficiency
- Price efficiency
- Economic efficiency

Physical | Economic

Figure 2.1 Management Capacities in relation to environment, biological processes and farm results (Rougoor, *et al.* 1998)

2.2.3 Managerial ability on farms

Managerial ability has been recognised as an important parameter in agricultural production (Nuthall, 1999, Fairweather & Keating, 1994, Kotey &Meredith, 1997, Kaine *et al.* 1994). Most studies have focused on descriptive aspects of management processes and abilities. Not much attention has been paid to develop methods and procedures for improving the level of individual manager's ability (Nuthall, 1999).

Malcolm (1990) reviewed a lot of farm management studies carried out in Australia and noted that despite all the research and development on decision-making models, the farmers still rely on their intuition, experience and simple budgeting functions. Nuthall and Benbow (1998) also agree that budgeting is the main analytical tool used for New Zealand farmers followed by financial recording.

Preston (1996) pointed out that farming success is a function of hard work (both with brain and physically), timing (right decisions at right time) and achieving consistently high physical production parameter such as gross profits per stock unit, reproduction rates and livestock performance. Kotey & Meredith (1997) also agree that progressive manager place more emphasis on hard work than less successful managers.

Most of New Zealand farmers obtain management skills through "on the job" experience. Furthermore, the increasing number of farm managers graduating from universities (27.2% of farmers according to Nuthall and Benbow, 1998) do not have exposure to other than a few theoretical aspects of ability. Therefore, Nuthall (1999) stated that management ability would be seen as an area for rewarding development.

In contrast many universities and research centres in New Zealand have been running practical courses and research programmes for technology development linking theory with practical aspect of farming. Learning and understanding the current technology available for farming is a crucial point for manager's competence. Learning about such technology is one aspect of managerial skills that determine a good manager (Nuthall, 1999).

Psychological factors are key drivers in the farm decision-making process (Willock, 1997). Willock (1997) identified farmers that change plans more quickly than others. Their psychological attributes were extrovert, outgoing and likely to communicate the change to a number of other farmers.

Also important for managerial ability is the managers' inherent capacity to manage. Rougoor *et al.* (1998) studied this topic and note that capacity could be divided into (i) drivers and motivation e.g. goals and risk attitudes; (ii) abilities, e.g. cognitive and intellectual skills (iii) biography, e.g. background and experience. They observed a clear correlation between level of education and farm efficiency. However, unclear conclusions were observed on the relevance of age and experience. Ohlmer *et al.* (1998) also recognised that "education" is a fundamental factor when it comes to improving management ability.

Most studies on the decision making process suggest a linear sequence of events through planning, execution and control. Ohlmer *et al.* (1998) identified a more complex system made up by various phases and sub-processes. In addition, they also identified five other characteristics exhibited by their case study farmers (p. 288): "continual updating, qualitative approach, a quick and simple approach, small tests and incremental implementation." In other words, farmers continually up date their problems perceptions, ideas, plans and expectations when additional information is obtained. Farmers often use a qualitative approach to forming expectations and estimating consequences. In many situations, farmers prefer a "quick and simple approach" rather than detailed and elaborate approach. Farmers often check clues for their long-run actions assessment rather than carry out a post-implementation evaluation (Ohlmer *et al.*, 1998).

2.2.4 Understanding individual goals and values

According to Nuthall (1999) every farmer aims to achieve his or her goals. Such goals are influenced by family member desires and wants. He described this point of view as an equation:

Achieve goals/objectives = *f* (goal/objective recognition, resources available, farm environment, regulations, managerial ability)

Values are the framework people use to assess their lives and the lives of others (Parminter & Perkins, 1997). Values express the individual's needs while goals and objectives are identified as the method to follow those values (Ohlmer, 1998, Gasson, 1973). Managers with clear and well-established values are able to formulate concrete goals (personal and business) and objectives. They are confident and believe strongly in what they are doing, they pursue a realistic approach for their decisions and are aware about what they want (Entrialgo *et al.*; 2000, Olsson, 1988).

For managers having such characteristics goals are formed with strategic thought and the actions are more likely to result in success and accomplishment of the goals. In the similar vein, managers with vague values put in place action with little thought of how they want the business to achieve and as a consequence they have misdirected goals (Olsson, 1988).

Olsson (1988) stated that there are cases where farmers are achieving their goals and therefore consider themselves successful managers but are unaware that they are weakening the long-term sustainability of the business. The short-term success is achieved at the expense of long-term business sustainability.

Identifying the values of each member involved in the farm enterprise is essential for the success of business (Shadbolt & Rawlings, 1999). Gasson (1973) created four major categories for values commonly found in farming (Table 2.2).

Table 2.2 Dominant values associated with the farming occupation (Gasson, 1973)

Value Category	Values
Instrumental	Making maximum income Making satisfactory income Safeguarding income for the future Expanding the business Providing congenial working conditions- hours, security, surroundings
Social	Gaining recognition, prestige as a farmer Belonging to the farmers community Continuing the farming tradition Working with members of the family Maintaining good relations with workers
Expressive	Feeling pride of ownership Gaining self respect Exercising special abilities and aptitudes Chance to be creative and original Meeting a challenge, achieving objective, personal growth
Intrinsic	Enjoyment of work tasks Preference for healthy, outdoor, farming life Purposeful activity, value in hard work Independence- Freedom from supervision and to organise time Control in variety of situations

The instrumental value presents farming as a definite function- generating income and productive working conditions. Social values address issues of enjoyment of work and community aspects of farming business. Expressive values refer to individual self-expression and personal fulfilment. Intrinsic values suggest that farming is an activity in its own right and an essential to the basic needs of the person (Revell, 2000).

2.2.5 The decision making process and its element functions

Many ways to define management decision are found in the literature. Ofstad, (1965, p.5) define the decision making process " to make decisions means to make a judgement regarding what one ought to do in certain situations after having deliberated on some alternative courses of action".

Recently, Harrison (1999) stated a definition for decision as: " a moment in an ongoing process of evaluating alternatives for meeting an objective, at which expectations about a particular course of action impel the decision maker to select that course of action most likely to result in attaining the objective".

There is no doubt that decision-making is the most significant task performed by managers in any type of organisation. The importance of decision-making derives from the fact that such decisions affect all of the business (Harrison, 1999). The elements of the decision making process and its element functions are illustrated in Figure 2.2.

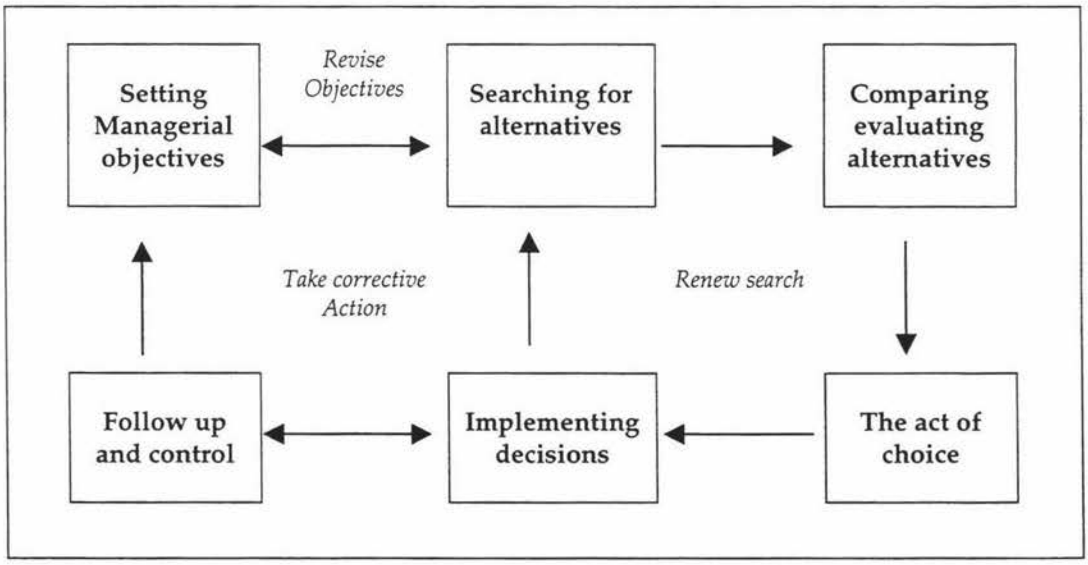

Figure 2.2 The managerial decision making process (Harisson & Pelletier, 2000)

In short, the decision-making process starts with the setting of objectives. Search involves scanning the internal and external environment for important information and formulating alternatives likely to attain the objectives that initiated the cycle. Then, alternatives are compared and assessed using criteria related to the primary objectives. The farmer selects a course of action from among a set of alternatives. The plan is then implemented and the outcomes monitored.

The process of management decision-making is interrelated and dynamic. If the alternative, selected and implemented, does not produce the desired result, the manager can put in place a corrective action, gathering more information and revising objectives. The dynamics of the process results from the effects of each step simply and in combination. The dynamics of this process is the synergy that is produced by the interaction of different elements.

2.2.6 The Classification of management decision

Harrison & Pelletier (2000) suggest two basic types of decisions. The first type is routine and recurring with reasonable certain outcome (Category I). The second type is non-routine and non-recurring with a very uncertain outcome (Category II).

Generally, this decision type "Category I" occurs at low levels of management and does not require high level of expertise. It is part of the daily routine and tactical decisions made on farm. As an example on farm context, it might include decision such as shifting mobs, a budget exercise and drenching stock.

In contrast, decision "Category II" is made at a higher level of management and the outcome from such a decision is highly important for the farm. "Category II" decisions are usually made by higher level farm managers. For example, a management decision in this category would be a decision about an expansion plan or diversification such as investment opportunities in different enterprises.

2.2.7 Psychological traits of superior managers

Many studies have observed a close relationship between the manager's traits and company performance (Entrialgo *et al.* 2000). By the same logic, a similar relationship could be expected for farm managers and their business environment', e.g. desirable personality traits will reflect positively in the farm performance. In contrast, conservative personal values could be linked with reactive strategies and ultimately less efficient properties. Literature on the psychology of managers presents three main personality traits: need of achievement, tolerance of ambiguity and internal locus of control (Entrialgo *et al.* 2000). Kotey &Meredith (1997) suggested the owner's personal values influence enterprise strategies and consequently the performance of their business. Basic relationships among personal values, business strategy and enterprise performance is illustrated in Figure 2.3 (Kotey &Meredith, 1997).

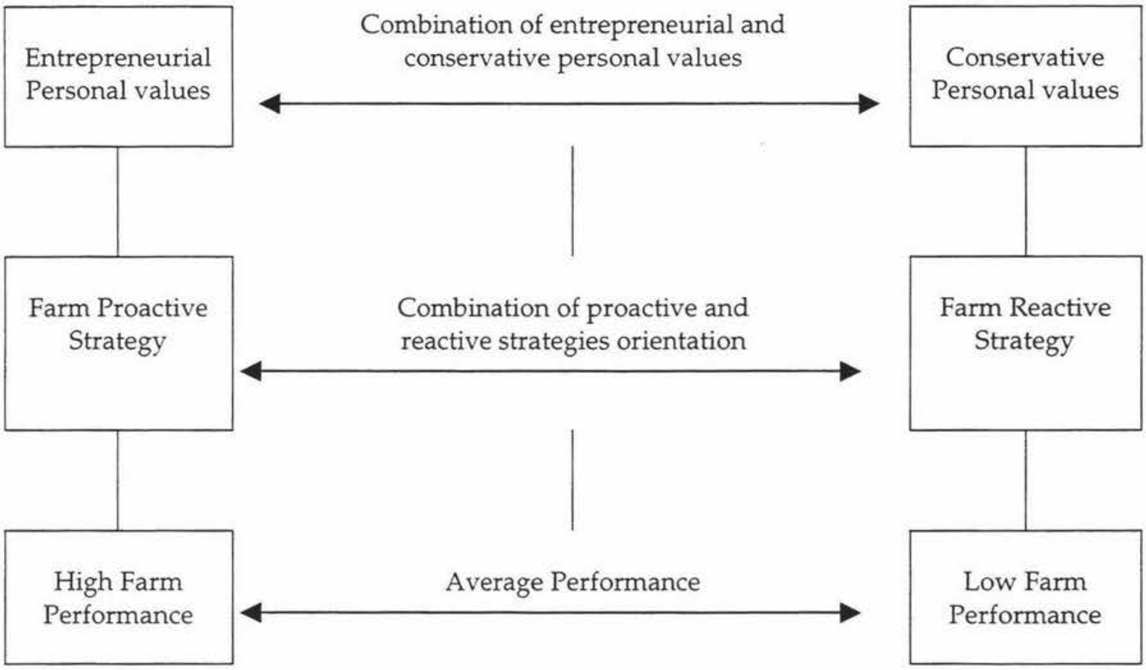

Figure 2.3 Association between dimensions or personal values of owner/managers, business strategies, and enterprise performance (adapted from Kotey &Meredith, 1997)

Kotey & Meredith (1997) state that successful managers place high value on ambition, achievement, reliability, responsibility, hard work, competence, optimism, honesty, innovation, creativity, social recognition and growth. In reality, a good manager is made up of a combination of all these characteristics.

According to the model depicted in Figure 2.3, superior managers are more proactive due to their personal values. Proactive farms are more likely to use technology and management strategy. They believe that they can influence their business performance and therefore they use risk management strategies, plan ahead and forecast scenarios, they monitor their business and anticipate problems. They want to achieve above-average performance. These managers take more risk while conservative managers are more risk averse. Progressive farmers tend to take more initiatives; thereby they are more willing to change their production system. They want to be ahead of their competitors selling differentiated products. They are also likely to employ more technology and have more control than low performance or average farms.

In comparison, reactive farmers believe that they can have little influence on their business performance. They have limited horizon and their business is basically guided by tactical decisions. They assume a very conservative posture avoiding risk and placing less value in the effectiveness of their business. They react passively to certain events and tend to follow rather than lead competitors (Kaine *et al.* 1994).

To pursue new initiatives requires capital investment. Reactive farmers are less likely to use debt to finance an investment. As already mentioned, conservative farmers are risk averse and prefer to avoid debt financing. In contrast, progressive managers are always looking for new initiatives and they are more likely to use debt for financing projects.

The internal belief of an individual that he himself rather than external factors are in control of his destiny denotes his internal locus of control (Entrialgo *et al.* 2000, Kaine *et al.* 1994). These authors report that the majority of superior managers have been described as people with high internal locus of control.

Farmers who express an internal locus of control are likely to be more proactive strategists. They believe that they can influence the performance of their business and for instance they are more likely to adopt risk management strategies and employ planning aids. Managers with greater internal locus of control are more innovative and they are convinced of their abilities to influence their business. Furthermore, farmers with greater internal locus of control are able to have a vision of the future, plan ahead and formulate long-term strategies for their business.

On the contrary, reactive farmers assume a conservative posture and they are more passive. They think that such strategies will be a problematic exercise. They believe that an event is a result of forces beyond their scope of influence. In this case, they are expressing their external locus of control (Kaine *et al.* 1994).

Entrialgo *et al.* (2000) report a positive association with need for achievement and proactive strategies. Progressive farmers in this situation will exhibit ambition and desire to have great control over their business. The same study shows that the individuals who best tolerate ambiguity are more innovative, less risk averse and present more proactive behaviour.

Nielson (1961) stated a few hypotheses that characterise superior managers on farm. He attempted to make a distinction between a superior and inferior manager. The key features that he identified in his set of hypotheses were: formulating goals, perception, gathering information, use of computers and applying economic principles and evaluation of outcome of their decisions.

The formulation of goals is essential in effective management because goals provide a direction to the whole management process. Superior managers will constantly formulate goals attaching priority to certain goals to avoid conflicts with each other. Superior managers will perceive the problems arising as well as opportunities for improvement. Consequently, managers will formulate a plan to overcome the difficult situation and still be able to accomplish their objectives.

Managing a farm presents a continuous stream of opportunities for making decisions. A manager is constantly gathering information and applying theoretical principles for every decision. Superior managers recognise the limitations of human mind and they will make use of technology to help them increase their overall efficiency. A computer could be an example of a simple aid to management. Farmers could use computers for storing valuable information and also assessing different scenarios and alternatives.

Better managers will be permanently performing systematic evaluations of the outcomes resulting from their decisions. They will perceive errors and then be able to take corrective actions producing more desirable results. It is also a learning experience that contributes much to the improvement of managerial processes in the future.

Olsson (1988) described four types of farm managers each with different values, goals, risk attitudes and probability of achieving success:

- Defensive strategist

- Gambler
- Cautious strategist
- Entrepreneurs

The defensive strategist has risk-averse behaviour and often low capital is reinvested in the business and there are rundown farm resources (Olsson, 1998). An example of this is to postpone fertiliser application and deplete soil fertility because of the belief that benefits of additional fertiliser will not be turn out in profit. On the other hand, the gambler is an optimist who may overestimate the business ability. He is willing to take the risk and therefore would invest large amount of capital in fertiliser without understanding soil nutrient requirements. Olsson (1988) defines cautious strategists and entrepreneurs as more successful farm managers than the other two previous categories. This author stated that cautious strategists see themselves as producers who farm for lifestyle with little use of outside information. However, these farmers participate in discussion groups and some literature is read.

The entrepreneur is an agricultural producer and businessman with a clear set of goals and objectives for their business. They are willing to take more risk but all decisions and scenarios are carefully analysed based on considerable literature. They think in a long-term perspective and considerable time is spent in planning, implementing and controlling functions of the business (Olsson,1988). In short, Table 2.3 presents a summary of attributes covered in this section that characterise a superior manager (Insulander *et al.*, 1986).

Table 2.3 Characteristics of the entrepreneur and the cautious strategist observed in Swedish farmers (adapted from Insulander et al., 1986)

	Entrepreneurs/progressive managers	Cautious strategist/ "average" farmer
Value and personal characteristics	• Farming is a business • Stable base of own, clear-cut values • Manager with overall responsibility • Realist who knows own limitations • Self-confidence, good judgement • Creative enthusiast, full of initiative • Talent for business	• Farming is lifestyle • Stable base of common values • Values characterised by caution • Farmers with instinct for preserving resources • Stable with "both feet on the ground"
Business idea	• Conscious and clearly formulated idea	• Motivate to preserve the farm for next generation

Goals	• Clear formulated strategic and tactical goals • Checks goals achievement	• Has goals but not clearly formulated • Survival, inheritance and environment important
Strategy	• Evaluated alternative courses of action • Proactive strategies • Sees potential and discover obstacles • Adheres to a decide course of action	• Cautious in choosing an action • Sees obstacles and avoids them • Reactive strategies
Planning	• Formal, structural planning and analysis • Formal budget in readiness to use in decision-making	• Informal planning and analysis • Budget "in the head'
Risk taking/ financing	• Ability and competence to handle significant risks • Good ability to acquire capital • Not afraid of incurring large debt	• Unwilling to take risks • Economic and financial caution • Self financing as a motto
Information gathering	• Active choice of advisors • Ability to find "right" information • Sensitive to signs from external environment • Thorough knowledge of the firm's strengths and weakness already during establishment/expansion phase • Well prepared for internal and external disturbances	• Wide information gathering • Uses group extension • Information and inspiration from study groups and magazines • Thorough knowledge of the firm's resources
Production	• Is a means to goals	• Production is the goal
Locus of control	• High locus of control	• External locus of control

2.2.8 Summary

Managerial ability has been recognised as an important parameter in agricultural production. There is strong evidence suggesting business strategy is influenced by manager's personality values. Decision-making is a very important part of any business. Harrison (1999) stressed decision is the most significant activity engaged by the manager. In short, the decision process and strategies set by the firm are products of manager's visions, which in turn originate from their personalities. The success of a firm is a product of his decisions over time. The process of management decision is interrelated and dynamic involving strategic (long-term) and tactical decisions (short-term). Successful managers implement proactive strategies and they aim for high performance. They have more propensity to take the risk and present a high internal locus of control.

2.3 Beef and sheep intensification

Commonly, intensification is related to lifting soil fertility, subdivision, and improvement of water supply and better pasture control (Ogle, 2000). The process of intensification aims to maximise pasture utilisation, achieve higher meat production per area and higher profits are expected (Smeaton 1999; Ogle, 2000). Brown (1996) pointed out that intensification is one of number of ways available for farmers to maintain long-term profitability.

Farm business is changing quickly. High value markets are demanding top quality products. Markets require consistency and reliability. Scale – volume of product - is necessary to reduce transaction costs to better manage supply. So, closer relationship between farmers and meat companies have been established as a strategy to improve supply efficiency (Manhire, 1999).

To be successful and competitive in this new business environment, essential skills are necessary. These skills enable farmers to meet market requirements and contractual commitments for their produce. Some management action for intensification of production system are listed below: (Adapted from Chisholm & Weir, 1999, Grigg, 1999).

- Subdivision of the farm
- Setting and monitoring animal growth paths
- Set goals and targets
- Plan ahead and take proactive actions based on data collection
- Employing consistent weighing protocol and regular feed budgeting

2.4 Risk and uncertainty in Agriculture

2.4.1 Introduction

It is widely accepted that risk and uncertainty play a crucial role in agriculture world-wide. Risk in agriculture is captured essentially by the variability of expected returns. This risk is a function of variability in output price, production, input prices and input quantities (Blank *et al.* 1997). Risk analysis is important because the main resources in any agricultural system are subjected to non-controllable variables such as weather, variable costs, product prices and yields (Montes de Oca 1999). Considering risk is important when making day-to-day farm management decisions. The accumulated effect of the choices may have a significant impact on overall business performance (Backus 1997, Hardaker, *et al.* 1998).

Risk and uncertainty often are used with the same meaning, although Knight (1921) distinguished the terms based upon the type of the data available. Risk is a term used for describing a situation where an investment is being considered or undertaken whose outcome (return) is not known in advance with absolute certainty (Levy & Sarnat, 1994). Moreover, risk refers to a situation where possible alternative outcomes and their probabilities are known, whereas uncertainty is a situation in which the possible alternative outcomes are known but not their probabilities, e.g. the probabilities of each possible outcome cannot be estimated objectively. (Blank *et al.* 1997).

Although, Backus *et al.* (1997) pointed out that distinction between "risk" and "uncertainty" is relevant for the knowledge that the probability of an event has a certain value, modern discussion in agricultural risk does not distinguish between the terms "risk" and uncertainty and subjective assessments are often made of probabilities thereby lessening the distinction between the two technical terms (Boehlje & Eidman, 1984).

Barry *et al.* (1995) identified two schools of thought with regards to the estimation of probabilities. The first group advocates that probabilities do not accurately describe the outcomes of an event. This traditional group argues that statements could only be made about the frequency of the occurrence of events, not about the probabilities of a single event. Also, probability distribution cannot be perfectly estimated due to lack of sufficient historical data.

The second school of thought has been more generally accepted. It advocates that the decision maker can formulate subjective probabilities, which can be based on, but are not limited to, historical frequencies. Subjective probabilities represent the degree of belief or the strength of conviction that an individual has about an event (Barry, 1984). It is based on his/her judgement, experience and amount of information available. According to Barry *et al.* (1995), future expectations based on a combination of historical data and subjective assessments may be the most effective approach.

Martin (1996) identified the types of risk, risk control and risk management strategies found in New Zealand pastoral farm systems. Risk can be divided into, business risk and financial risk as shown in
Figure 2.4 (Dake, 1994; Martin, 1996).

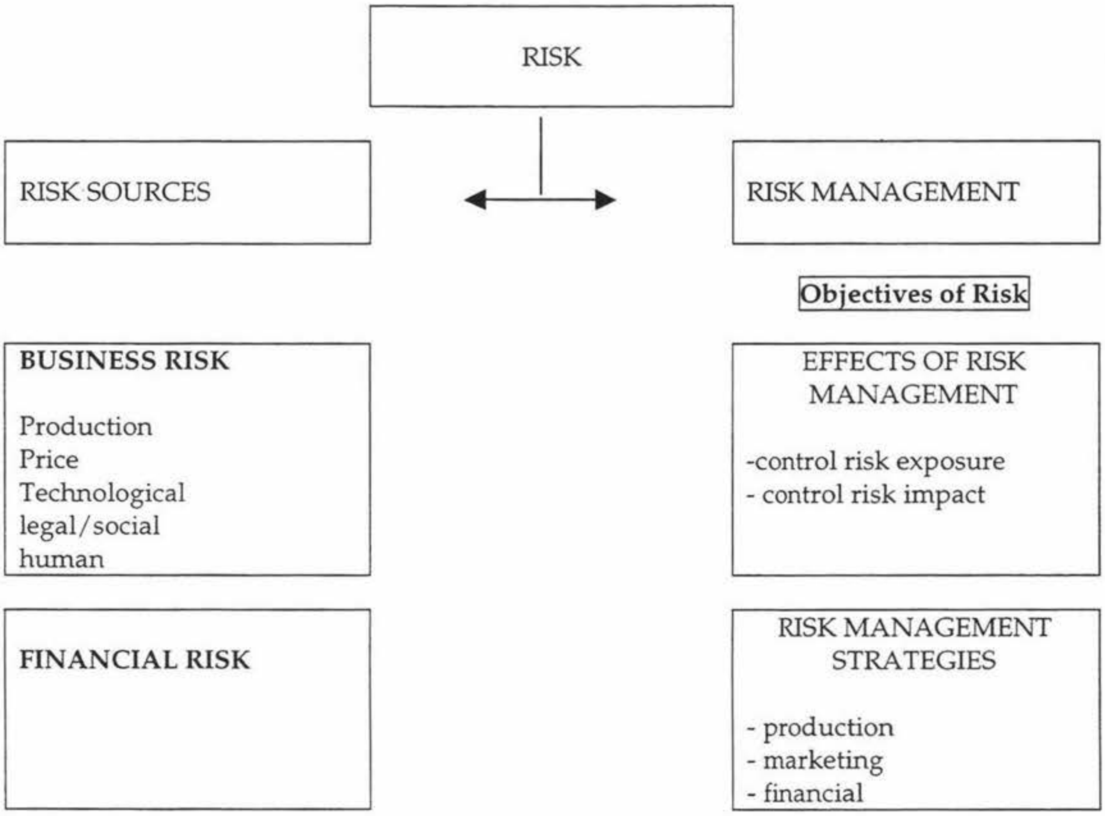

Figure 2.4 Concepts of Risk and Risk Management (Martin, 1996)

2.4.1.1 Business Risk

Business risk aggregates effects from five forces; production, market, technological, legal, social and human. Business risk influences measures of farm business performance such as net operating income generated by the enterprise. The business risk faced by the farm could be determined from the variability of this net operating income, which might be a function of both production risk and price risk. Moreover, business risk is the risk faced by the firm independently of the way it is financed (Boehlje *et al.* 1984, Hardaker *et al.* 1998).

Production risk is the result of variation in the production levels caused by factors beyond the manager's control. It includes weather conditions, pest outbreak, diseases and other unpredictable factors. Production risk is evidenced by the variation in yield of crops, daily gains, weaning weights and other variables used to quantify physical outputs.

Market risk (price) is associated with variability in production and input/output prices. Current economic situations, local and offshore, and exchange rates contribute to market risk. These are important issues as farmers are increasingly being exposed to unpredictable competitive markets due to the globalisation process taking place. Weather conditions also have a significant impact on pasture supply and therefore supply of or demand for livestock; climate is also a key point in determining price variability as well as physical output (McDermott, 1995).

World-wide supply and demand also creates an effect on price movements. When global weather conditions are favourable, then commodity supply is increased which usually causes a drop in market price. Under this low price scenario, primary products become cheap and if the stockholding is large enough, prices continue to fall. On the other hand, under unfavourable weather conditions, strong demand or a rundown in stock can provoke a sudden increase in commodity prices (Kingwell 2000). Under favourable agricultural prices, farmers can have the chance to capitalise their business and create wealth that can be used to help them to bear with risk in subsequent leaner years (credit reserve).

According to Martin (1996) the technological risk situation is the probability of the assets being out of date due to the fast technological advances. Also, McDermott (1998) stated that technology risk may arise due to misuse or the inability to utilise new technology.

Legal and social risk is related to the use of contractual mechanisms like forwards contracts and the use of non-farm resources of capital. Similarly, human risk is characterised by the ability, availability and reliability of labour. In summary, human risk is associated with the labour and management functions of farming such as carelessness by the farmer or farm workers, knowledge and ability of the manager, health issues and family business succession.

Environmental risk is derived from changes in government law and regulations concerning the environment. New policy areas such as water pollution control and waste management impose new challenges to producers and at the same time offer a sort of risk (Harwood *et al.* 1999).

2.4.1.2 Financial Risk

Financial risk is the probability of being unable to service the business fixed commitments with the cash generated by the enterprise. Although, the debt servicing commitments are often thought of as the most significant component of these business commitments, the cost of equity also plays a key role. The cost of capital depends on interest rates, capital position of the firm and capital structure.

An example of increasing financial risk could be illustrated with two situations. Firstly, the initial debt situation of the firm determines how much of the profit will be used to service the initial debt and how much of the profit will be available for the investment. Secondly, an investment that requires a considerable amount of initial capital and returns are delayed (Forestry) can influence negatively the cash flow and liquidity making it difficult to service the debt (Silva, 1997 a,b). In addition, both political and economical situations determine the cost of debt.

Recently, vertical integration and production contracts have been used in order to control both business and financial risk (OECD, 2000; McDermott, 1998). Quality risk, investment risk and contractual risk are all associated with these two strategies. Quality risk is when the farmer cannot meet the quality issues specified in the contract. Investment risk is linked to investments made by producers to comply with the contract. Finally, contractual risk is the possibility of the contract being terminated at short notice (OECD, 2000).

2.4.2 Elements of Risk Analysis

The risk analysis process can be divided into three phases: Risk assessment, risk management and risk monitoring and review (Hardaker, *et al.* 1998).

2.4.3 Risk Assessment

The risk assessment is the process of identifying and estimating the risks associated with the business and evaluating the consequences of taking those risks (Caswell, 2000). Risk assessment is the primary step in the risk analysis process and represents an evaluation of the probability of the occurrence (likelihood) and severity (magnitude) of known or potential adverse effects from exposure to any kind of risk (MAF Food 1999).

2.4.4 Risk Management

The identification, documentation and implementation of the measures that can be applied to reduce the risks and their consequences. In other words, identifying the range of options for responding to each individual source of risk, then assessing those options and finally selecting the most suitable one for implementing.

2.4.5 Risk monitoring

Once the risks are identified and the management decision plan has been implemented, it is necessary to assess if the risk management plan is working and to identify the adjustments that may be required. Monitoring and review processes are an essential part of risk management success. Management decisions must be revisited and if necessary further decisions need to be made in order to deal with a particular situation properly. The elements of risk are illustrated in Figure 2.5.

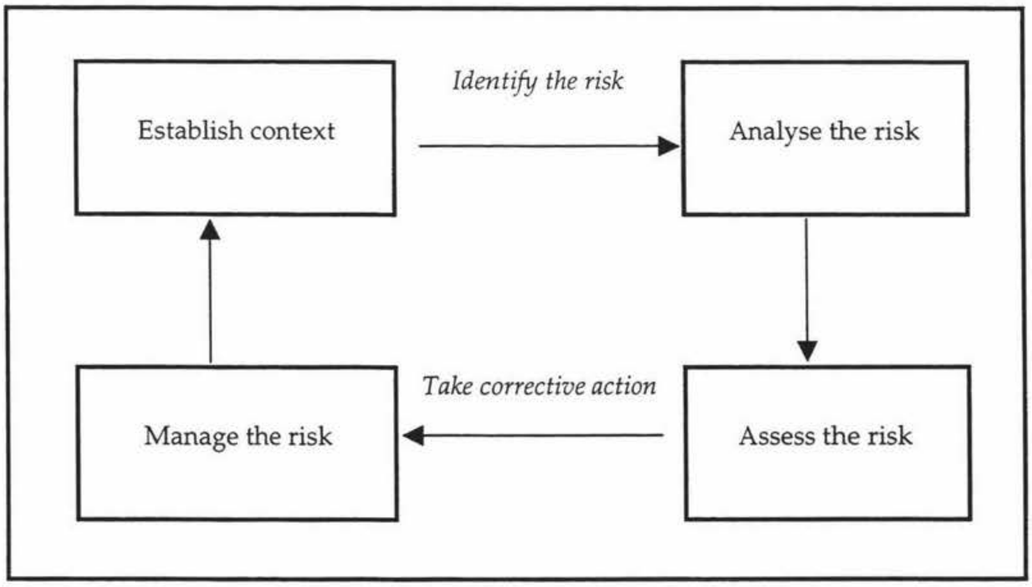

Figure 2.5 An outline of steps in Risk Management (Hardaker, *et al.* 1998)

2.4.6 Risk Management in Agriculture

The objective of risk management is to reduce the chances of a vulnerable situation where the business can be threatened while achieving the highest possible returns for the owners of equity consistent with their attitudes towards risk (Martin, 1996). The use of risk management does not necessarily avoid risk altogether, but it balances risk and return consistent with a farm operator's capacity to withstand a wide range of outcomes (Harwood, *et al.* 1999).

Jolly (1983) stated that managers can respond to risk in two broad categories: by attempting to control risk exposure or by controlling the risk impact on the agricultural business. Business risk exposure for example can be controlled by manipulating the probability distribution facing the farm business, e.g. smoothing out yields and prices or cutting off troughs in these. It is also possible to transfer a share of risk outside the farm through forwarding contracting or hedging (Martin, 1996; Jolly, 1983).

A nation-wide survey in 1992, presented by Martin (1996) illustrated forward contacting as being very unpopular among farmers as a market risk management tool. Farmers managed the risk using market information, spreading sales and short-term flexibility as an attempt to obtain best prices out of the market. Such risk management strategy has changed since then and farmers are now making more use of forward contracting for dealing with their risks as reported by McDermont & Shadbolt (1998) and Montes de Oca & Shadbolt (2000).

Enterprise selection and diversification, different marketing options, insurance and government programs all may alter the underlying distribution of prices and yields and are some of the ways to control risk exposure cited by Jolly (1983).

On the other hand, managing to reduce risk impacts on the business does not decrease the variability of the probability distribution of prices and yields. Strategies in this category give the business the capacity to cope and absorb unfavourable downturns. Such strategies influence the business' capacity to withstand adverse or exploit favourable events. An example for coping with this risk is to increase production efficiency in order to raise operating income, matching debt repayment to income levels and maintaining credit reserves (Hardaker, 1998; Jolly, 1983).

2.4.7 Risk Management in New Zealand pastoral farms

The agricultural sector now faces a deregulated domestic economy, with open capital markets and a floating normal exchange (Sandrey & Scobie, 1994). The economic reforms, introduced in late 1984, have had a significant impact in the pastoral sector provoking major transformation at the farm, processing and market levels (Davison, 2000b). As a result of such changes in agricultural policies leading to price liberalisation there is more exposure of many farmers to competitive market forces (Hardaker *et al.* 1998, Martin 1996). As the farmers now operate in a more deregulated market environment, marketing strategies for managing risk assume importance (Martin *et al.*, 1998, Martin & Shadbolt, 2000).

Martin (1996) carried out research with the objective to assess the importance attached to both different risk sources and different risk management strategies adopted by New Zealand farmers. The population chosen covered 8 farm types including all major types and a number of minor farm types which illustrate the diversity of New Zealand farming activity.

The results showed that market risk (price variation) was ranked as very important among farmers' risk concerns. Blank *et al.* (1997) observed similar results when surveying growers across California, USA. Producers ranked risk associated with output prices as first in order of importance. Despite assessing risk over a range of different commodities, price risk seems to be greatest the source of risk.

For sheep and beef farmers, routine spraying and drenching and strategic feed reserves were considered an important risk response. These strategies aim to decrease the impact of risk by maintaining physical performance. The risk responses for these farmers also included market information in conjunction with an ability to react quickly to price fluctuation allowing prices to be improved (Martin *et al.*, 1998).

Spreading sales as well as enterprise diversity are also risk response strategies used by the farmers. Financial strategies such as keeping debt low, contracting, insurance, managed capital spending are also practices adopted by pastoral farmers in order to deal with the risk (Martin, 1996). According to Martin & Shadbolt (2000), the effectiveness of risk management relies not only in the ability of managers to identify risk factors but also the management response required to buffer the risk consequences.

Recently, there has been more integration between farmers and processors through supply contracts (McDermott & Shadbolt, 1998). Vertical co-ordination can be used to spread risks over several stages of the food supply chain (OECD, 2000). To this end, reciprocal trust between two parties is crucial for effective profit and risk sharing. However, the New Zealand livestock industry has been operating in an adversarial commodity market that has created a strong distrust between farmers and processors. As a result of this lack of trust such risk management strategies have been limited (Boehlje *et al.* cited in Martin & Shadbolt, 2000). However, more intensive industries such as broiler and pork, have found that production contracts can reduce the income risk faced by producers (Harwood *et al.*, 1999).

2.4.8 Factor influencing farmer's risk profile

Martin and Mcleay (1998) carried out cluster analysis in order to determine the variation within sheep and beef farmers with regards to their risk management practices in New Zealand. The study grouped five main risk management dimensions: income spreaders, capital managers, part-timers, debt and market risk managers and production managers.

Age of farmer has an influence in how risk is managed. Older farmers are more concerned about their retirement. They try to protect their capital base through planned capital spending and also investing off-farm as a part of their portfolio. On the other hand, young farmers operating in high debt situation tend to put more focus on debt management and market risk reduction. Farm size also has an impact in terms of risk management strategies. Small farms, for instance, place greatest emphasis on off-farm income, but also attach some importance to market reduction strategies.

Level of debt can influence the range of risk management strategies a farmer uses. Under a high level of debt, farmers place a strong focus on debt reduction. Their preferred strategies are income spreading, capital management, pest and disease management and feed management. Farmers running their business in low debt scenario tend to concentrate more on pest and disease management and feed management strategies for controlling production risk. Moderate emphasis is attached to debt management and market risk.

Herd composition also affects the risk management strategy adopted. Those farmers running large numbers of cattle have more flexibility for income spreading throughout the year facilitating a steady cash flow. Cattle stock provides more flexibility to the business as animals can be kept on farm or sold depending on market prices and feed situation. A selection of a less intensive production system, such as organic farming system, may have more production variability than conventional farms.

Once converted to an organic system, farmers can face loss of yield, due to problems such as pest and parasite control. The extent of yield loss will vary depending on factors such as, the inherent biological challenges and farmer skills through to the degree to which chemicals have been previously used. (Berentesen & Giesen, 1999; Fitzgerald, 1997). As a consequence, these organic farmers face more production risk. Niezen *et al.* (1996) reported reduction in the growth and productivity of cattle in organic system is a major concern as it can affect profitability.

This observation suggests that risk management strategies adopted by organic farmers may be slightly different from those conventional farmers (Richardson, 1997; Berentesen & Giesen, 1999; Niezen *et al.* 1996). An example of proactive risk management strategy could be the introduction of nematode-resistant rams in the flock (Niezen *et al.* 1996).

2.5 Farm Business Analysis

2.5.1 Strategic Planning

Strategic business planning is about setting a direction for the farm business: a direction to which everybody, family members and employees, cam become committed, a direction that will ensure every part of the company is in harmony, moving towards a clear business purpose that will give it a competitive advantage and improve its performance.

Strategic management is concerned with the overall management of the business, therefore strategic management is a process by which the organisation:

- Determines its vision, sense of purpose and values, and strategic intent
- Establish long-term and short-term performance objectives
- Develops programmes and courses of action that will allow strategy to be acted on in a meaningful way
- Implements strategy
- Establishes styles of leadership and management and develops organisational structures and cultures that best support and promote strategies; and

Continually evaluates performance, reviews the situation and initiates required adjustments (CCH 1992).

Rea and Kerzner (1997) presented the main components of strategic planning and describes the products that evolve from each phase (Table 2.4).

Table 2.4 Process and products of Strategic Planning (Rea and Kerzner, 1997)

PROCESS	PRODUCT
SWOT Analysis ----------------------------------	Identifies critical issues or problems confronting organisation
Mission Statement ------------------------------	Clarifies the purpose of the organisation and whom it serves
Vision Statement --------------------------------	Proclaim the desired state of affairs or what organisation wants to become
Strategies --	States what the organisation will do to resolve critical issue/problems so that its vision will be fulfilled
Performance Measures ------------------------	Critical indices help the organisation monitor program toward achieving its objectives

2.5.2 Introduction

The use of a range of financial and non-financial indicators to measure farm progress is only part of the overall strategic management of a business. The benefit of assessing business performance through these indicators is the possibility to identify the key components that significantly affect progress toward its goals. It is essential to select those indicators that are aligned with business and personal goals. This section presents the tools used for farm business analysis. Financial and non-financial indicators are presented and detailed information about growth and value creation is provided. Additional, information about interpretation and calculation methods for these indicators is showed in Appendix one. Furthermore, the concept of the Activity Based Cost (ABC) system for determining cost of production is introduced.

2.5.3 Financial Indicators

Shadbolt (1998a) stated that farm business is made up of two "profit centres": Farming business and Land-owning business. Both "profit centres" have different visions, goals and measures (Appendix one). Boehlje (1994) stated that operating profit margins, capital turnover and leverage are the three driver indicators that generate returns on business equity. Each of these drivers is affected by decisions regarding cost control, efficiency and productivity. He provides a comprehensive overview of the main financial performance indicators of the farm business as shown in Table 2.5.

Table 2.5 Financial indicators for farm business (Boehlje, 1994 cited by Shadbolt, 1998a)

Risk Bearing ability (Solvency) • Total Assets • Total liabilities • Owner's equity • Debt to asset ratio	Profitability • Gross Revenue • Total expenses • Net income • Return on assets • Return on equity
Capital Efficiency • Asset turnover ratio	Labour Efficiency • Revenue per employee
Debt Servicing capacity • Current ratio • Debt income ratio	Revenue generation & cost control • Operating profit (EFS) • Operating profit margin
Saving behaviour • Re-investment	Cost composition • Fixed cost percentage

2.5.4 Growth and Value Creation

The basic concept of growth is the increase (or decrease) in productive assets after servicing all operating expenses, debt obligations, tax and drawings by the owner (Stantiall & Shadbolt, 1998). Business growth is essential for long-term business sustainability (Revell, 2000). Parker (1997) suggested that growth should be at least at the rate of inflation (currently 1-2%). However, 4 to 6% of growth rate per year should be preferred in order to keep ahead of competitors. The opportunity to increase business growth and maximise market value is desirable for any farm business (Shadbolt, 1998a). Growth and value creation is achieved when operating profit is enough to cover fixed commitments of the business. Financial sustainability occurs when equilibrium between NOPAT and cost of capital is created (Shadbolt, 1998d).

There are different measures to indicate growth, which may be physical or financial, focusing on input and outputs (Costa, 1999). Physical indicators might be useful when comparing distinct types of farms. On the other hand, financial measures seem to be adequate to compare different types of businesses (adjustments must be done). Barry *et al.* (1995) reported that total assets and level of net worth are indicator' of business size, particular for creditors while change in equity is useful for measuring business growth.

Cost of capital is the cost associated with financing of the operation. It is the cost of debt and cost of equity combined. World and local political situations influence the cost of debt (interest rates) and equity cost is influenced by stage in lifecycle and lifestyle expectation. The capital structure of the business is formed by cost of debt and cost of equity. Cost of debt is the interest and rent paid with the tax taken off. The cost of debt is easier to determine than the cost of equity (Shadbolt, 2001).

Cost of Debt = interest payments x (1- Notional tax rate)

The cost of equity is not as easy to quantify as the cost of debt. The cost of equity has a cash (extracted) and non-cash component. The estimate must be made of capital gain/losses to determine the non-cash component. The cost of equity is an indication of the opportunity cost of equity capital i.e. what equity would yield from comparable investment.

The extracted cost of equity is a measure of the cash extracted from the business by the family, the provider of funds over and above a reward for labour and management. The extracted cost of capital (debt and equity) measured on New Zealand farms is often low, 2-3% (post tax values). Shadbolt, (1998e) summarised that sustainable business growth is generated when the operating profit after tax exceeds extracted cost of capital. The calculation for the extracted cost of equity is according to Shadbolt's (1998b) recommendation, which is based on the Gordon growth model e.g. family requirements excluding capital gains.

Cost of equity = (Drawings – (family labour &management x (1- Notional tax rate))+ Debt Repayment)

Taylor (1994) stated that value can be created when operating profit is greater than the full cost of all capital employed in the business. It is the amount left after operating expenses, debt servicing, drawings and tax payments. The Value created is a concept derived from economic value added (EVA) performance measurement system. This measure of growth is illustrated below:

Value Created = NOPAT - Cost of capital (debt and equity)

The cost of capital is calculated by adding the costs of debt and equity. Value is created once the business is able to service both cost of debt and cost of equity and still expand its asset basis or improve return to the shareholders (Morris, 1999). Positive figures means that business is growing, a zero value suggest the business is stable and negative value might suggest that the business is unsustainable (Taylor, 1994).

EVA provides an inside picture of business long-term sustainability (Kirton *et al.* 1994). The use of EVA as a performance measurement linking strategy to value is a key to creating wealth (Van Zyl & Perkins, 1994). Desirable figures for value created may not be achieved due to low NOPAT or high debt and equity costs (Morris, 1999).

In summary, a sustainable business requires a long-term perspective that is achieved by a balance between NOPAT and cost of capital overtime. Such balance is created due to a profit maximisation, reducing risk impact and exposure and maintaining the productive asset basis (Shadbolt, 1998a)

2.5.5 Non- Financial Indicators

Kaplan & Norton (1992) agree that overemphasis in the traditional financial performance measures are not completely adequate for the contemporary management style in farm business. They developed a balance scorecard, which is a set of financial and non-financial performance measures that are considered crucial for business success. The scorecard provides a balance of short-term and long-term measures and incorporates indicators for the non-financial dimension of the business (Parker, 1999). There are three perspectives of the balanced scorecard that have non-financial performance indicators: productivity and efficiency, customer (external perception) and learning and growth.

The challenge is to find performance indicators that measure the drivers and the outcomes required to assess customer and learning and growth goals. Shadbolt (2001) suggests that it may involve measures such as weekends off per month or outcomes like strategic alliances with milk and meat processors. A set of non-financial indicators developed by The Australian Dairy Research and Development Corporation (DRDC) is showed in the Appendix one.

2.5.6 The activity-based cost (ABC) system

The cost of any product is determined by four types of costs: direct costs, direct labour, variable overheads and fixed overheads. Direct expenses are relatively easy to assess, but overheads are more complicated as a decision has to be made on how much of each overhead expense should be charged to each product produced by the farm.

In industry, traditional cost systems are based on volume of production and have some disadvantages because they over estimate the costs of high-volume production and under-estimate low volumes ones.

In farming, allocation of fixed costs, if it happens at all, is often on per hectare or stock unit basis; this may not fairly reflect resources cost allocation to enterprises (Kirton *et al.*, 1994). The allocation of fixed costs is particularly relevant to agricultural system because farming is characterised by a high fixed cost industry (Boehlje, 1984).

The ABC system enables the analysis of resource utilisation as the basis for allocating cost to different farm products. Thus, it is based on what really drives costs and charges a cost object only the overhead it actually consumes. It might be a useful approach for diversified farms where the resources are shared by many production activities and products.

ABC system is well known in manufacturing enterprises and it can be applied to pastoral farming (Montes de Oca, 1999; Kirton *et al.*, 1994). It aims to estimate the real cost drivers of the production system and thereby helps farmers to improve farm economic efficiency.

The general model of the Activity-Based costing system is depicted in Figure 2.6.

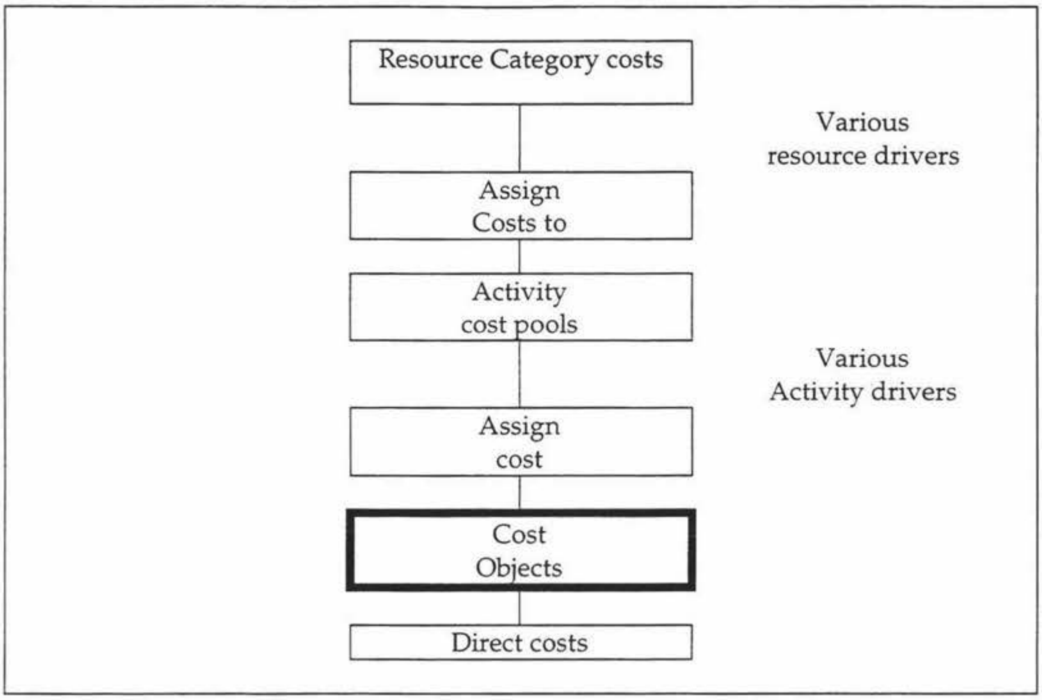

Figure 2.6 The general model of the Activity-Based costing system (Burch 1994, p 446)

Efficiency in sheep and beef livestock system is generally expressed in terms of economic and biological efficiency. Gutierrez *et al.* (1991) cited lambing percentage, lamb growth rates and lamb survival as being important measures for biological efficiency of sheep systems. Indeed, economic efficiency is determined by the cost of production per weight of live animal sold, net return to the sheep enterprise and return on investment.

The cost of production is determined by the amount of feed produced, quality issues and utilised (weather and management skills) and the biological efficiency of all animals farmed. Production records and financial information can be used to determine the cost of lamb and beef production applying the ABC system.

Once the production cost for a lamb enterprise is determined, a cost-volume profit (CVP) is obtained. CVP creates an equation that is used to predict profits. Basically, it is a function variable cost per unit, fixed costs, volume, product mix and product price (Burch, 1994). Such an equation also accounts for effects of changes in livestock policies, biological efficiency and weather variability. Once the production cost is know and consequently the return equation is defined, new market channels for lambs or beef can be evaluated.

2.5.6.1 Cost Elements

The main cost components of lamb production operation are: costs associated with running the breeding stock such as direct expenses including animal health, shearing, freight, amount of feed consumed by the lamb and steers before selling.

Using an industry analogy the lamb and beef production system, lamb meat or beef might be considered the final product and therefore the breeding ewes/cows are considered the "production department". The final product also accounts for the cost associated with running replacements, dry stock and ram/bull (non-productive departments) (Montes de Oca, 1999).

The production cost of the lamb operation is the result of the direct expenses of a sheep and cattle breeding enterprise and a proportion of farm overhead expenses. Overhead expenditure and direct costs are shown in Table 2.6.

Table 2.6 Costs associated with a sheep and beef breeding enterprise (Montes de Oca, 1999)

Direct expenses	Farm overhead expenses
Shearing costs	Wages
Woolshed expenses	Electricity
Animal health	Repairs and maintenance
Cartage	Vehicle expenses
Selling charges	Administration
Livestock purchases	Insurance
Breeding expenses	Depreciation
Forage crop costs	Rates
Grazing and feed costs	General expenses
	Management reward
	Tax
	Cost of capital

The total operating cost is made up of direct expenses and overheads costs excluding tax and cost of capital. Cost of capital for primary industry can be estimated simply as a percentage charge on total assets. However, changes in asset values are not always followed by changes in cost of capital in farming business, which suggests that such an association may be inadequate. An alternative approach to use is extracted cost of capital, a measure developed to estimate the funds extracted by the two providers of funds to the business – banks (Cost of debt) and the business owner (Extracted cost of equity) (Shadbolt, 2001). Please refer to Section 2.5.4 for further details.

2.5.6.2 The ABC system applied to pastoral farming

The main overhead cost in farm enterprise is dry matter production (DM). Dry matter produced on farm is used by different stock enterprise and conservation practices such as hay or silage. In the ABC system perspective, the identification and definition of activities that use this main resource is fundamental to allocating cost accordingly (Montes de Oca, 1999). The ABC system applied to a lamb and beef production system is illustrated in Figure 2.7.

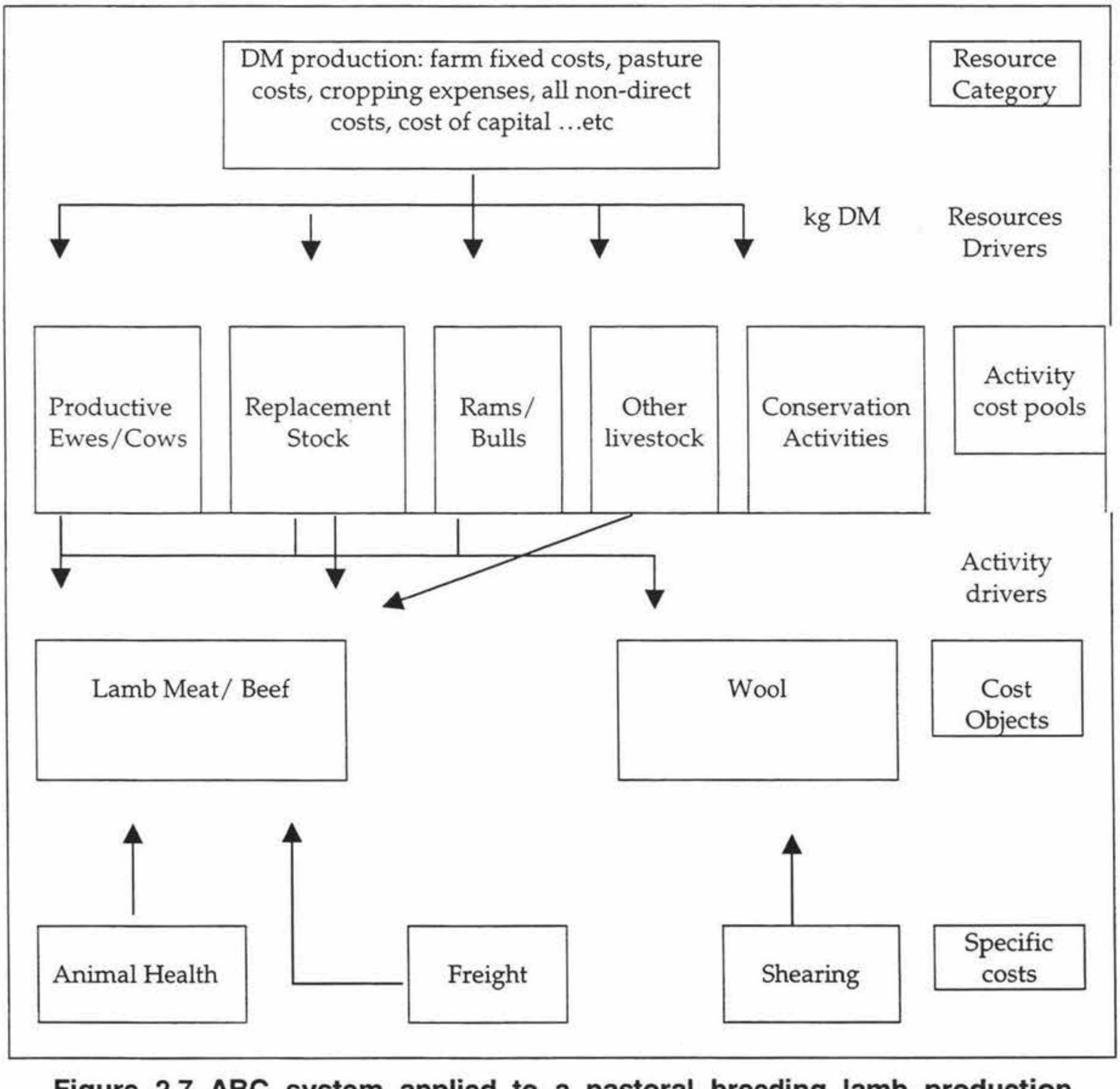

Figure 2.7 ABC system applied to a pastoral breeding lamb production system (adapted from Montes de Oca, 1999)

2.5.6.3 Resource Categories

Resources categories are made up by all source of cost associated with all activities. The main physical resources of farm businesses are land, building and equipment.

2.5.6.4 First-stage resource drivers

Activity drivers are used to assign resource cost to activities. In pastoral system, the main purpose of land is to produce dry matter to allow animal production. Therefore, dry matter intake, measured in kg DM, is a good activity driver.

Total overhead costs of DM production could be allocated to the different stock enterprise on farm depending on their consumption as well as conservation practices. Each stock class is considered an activity cost pool. Total overhead expenses are apportioned according to the total kg of DM consumed by the different activities and the kg of DM used for conservation. Dry matter quality is measured in MJME/kg DM. The dry matter consumed is affected by herbage quality and it varies throughout the year.

2.5.6.5 Activities and activity cost pools

An activity is defined as what enterprises do to convert inputs to outputs. An activity cost pool is the result of assigning resources costs to an activity. The activities for a lamb and beef production system are breeding ewes and cows, replacement stock and rams/bulls and other livestock classes on farm and conservation activities (Montes de Oca, 1999).

2.5.6.6 Second-stage activity drivers

Overhead costs allocated to the sheep and beef enterprise were divided into those with wool, lamb meat and beef. Second-stage activity driver allocates the costs in "activity cost pool" to the cost objects, meat and wool. The energy requirement for biological processes in livestock animals is obtained from the consumption of herbage (DM). Such energy is used for maintaining basic biological processes, which includes maintenance, growth, pregnancy, lactation and wool growth. The energy requirements for these biological activities could be used as drivers to assign costs to the cost objects, which are meat and wool. In the ABC system, costs are supposed to be allocated according to the rate of utilisation. Costs associated with lamb meat and wool could be determined by the energy requirements of sheep to produce meat and wool.

2.5.6.7 Cost objects

Cost objects are where activity costs are assigned. Cost objects are the final products of the farm e.g. beef, lamb meat and wool. Other products such sheep skins and culled animals are considered as by-products. Montes de Oca (1999) determined wool should also be considered a by-product, as for most farms in New Zealand, it is not the main purpose of production.

2.6 Modelling Concepts

2.6.1 Introduction

Computer modelling and simulation gained great importance just after World War II. It was developed in order to assist war game problems, military analysis and military research (Martin, 1968). This section reviews some important concepts of models in agriculture.

2.6.2 Modelling Definition

Since the 1980's, computers have become cheaper, faster, powerful and more friendly for use by the non-expert. The numbers of farmers using microcomputers has increased dramatically (Shadbolt, 1987). Primarily, business use of the computer on New Zealand farms is financial recording, budgeting, and word processing (Nuthall & Bishop-Hurley, 1995). Cook and Russel (1993) defined a model as a " representation or an abstraction of an object or a particular real-world phenomena". Bio-physical models usually are limited to biological and physic variables representing only a small part of the overall systems. Mathematical models are designed to represent the major components of farm system and relationship between them in quantitative terms (Pandey & Hardaker, 1995).

The model primary propose is to investigate possible improvements in the real-world or to analyse the effect of different policies on the system under study (Pidd, 1984, Pandey & Hardaker, 1995). The farm simulation model analysis has the advantage of incorporating risk aspects involved in farm production (Nyangito *et al.*,1995). Real-world experiments are difficult, usually expensive and slow, particular if they are carried out with real farm conditions. As a consequence, such practical limitations restrict the number of experimental treatments as well as the number of replications. In contrast, computer modelling simulation is easy, cheap and speedy (Bowden, 1992) Pandey & Hardaker (1995), pointed out that models have three major implications in the process of farming system research:

First, model formulation requires that the system must be deeply studied and well understood. Secondly, a model allows a useful identification of the technology options and management practices available. Also, a model can help to identify the constraints as well as perspectives of proposed technologies. Consequently, on-farming testing can thus be concentrated on "best-bet" solutions. In other words, models are useful for screening technologies. Thirdly, models also help in identifying the reason that recommended management practices are not adopted by producers. The model can reveal inconsistencies between the farmers' needs and technologies recommended. (Nyangito, 1995, Richardson, *et al.* 1991).

2.6.3 Reasons for Modelling

A common reason for modelling is that it provides a better understanding of the factors that contribute to the system behaviour. Also, models allow the investigation of dynamic aspects of system variables and their effects on decision-making. The use of simulation in the study of systems has become popular in many areas within agriculture including land care research, grazing-livestock operation, plant physiological systems among others (Dent & Blackie, 1979).

Dent & Blackie (1979) stated that the widespread application of models is due to the following reasons:

- It permits experimentation where real life studies would be expensive, or even, impossible
- It enables the study of long-term effects on systems
- It forces model builders to examine the system objectively and as a consequence undertake a thorough and critical review of knowledge regarding the system

Computers are a powerful means for farming system analysis, not only when designing databases but also when developing models to study the impact of alternative interventions (Udo & Brouwer, 1993)

2.6.4 Model Characteristics

Models can vary between each other depending on their size, that is the extent of reality they represent and also the degrees to which they convert the real world environment to a realistic dimension (Cunha, M.S. 1995). Models can be classified into three different categories, namely: iconic, analogue and symbolic (Dent, 1986, Pearson & Ison, 1987).

Iconic models are those which use the physical data aiming to minimise the system or object under study. Research carrying out on farmlets, in order to simulate the real system of large commercial firms would be cited as an example. Analogue models represent the whole system. Such as system is represented by structures and processes. In this case, a farm map is an example because it shows paddocks, soil types, locations and so on.

Symbolic models are characterised by an enormous range of mathematical equations and statistical relationships, which are used for planning processes and also represent the real world. Producers can use modelling for planning processes, the model chosen would take into account the type of the problem which must be solved. Symbolic models can be developed for optimisation or simulation purposes. Optimisation is recognised as a normative and the model chooses from a range of useful available courses of action, the best solution according to the managers' objective.

As complete information about the problem, objectives and constraints is required, this technique is suitable for structured problem solving. Linear programming is an example of optimisation. Originally, developed for military use for minimising travelling distances, linear programming has been applied successfully to agricultural problems such as maximising output per hectare or minimising cost of ration for dairy cows (Dent, 1986).

2.6.5 Simulation Modelling

Simulation modelling is a method which attempts to reproduce the real system with the objective of investigating possible options for a specific decision problem (Martin, 1968). The model builder can modify the system as well as other environmental parameters to simulate desired conditions that normally would not be manipulated in a real system.

The computer simulation would consider short and long periods and can also be replicated as many times as desired. Simulation models are normally employed where the system is far too complex for mathematical description. Usually, it does not produce the optimum solution for a particular situation, but utilises a "what if" approach to test different policies for the system (Angus-Leppan, 1984).

2.6.6 Modelling Variation

Pidd (1984) stated that a deterministic system is that where behaviour can be expected or totally predicted. The model builder enters a single value for each input like sales volume, operating costs of a particular item (Angus-Leppan, 1984). In contrast, stochastic systems are those whose behaviour could not be forecasted, though some statement may be made about how some events could behave (Pidd, 1984).

To model stochastic systems some probability distribution of likely values is required. The user must specify a range of values and their associated probabilities for each input which may vary. As the functional relationship depends on chance parameters, the outcomes for a given set of inputs can be predicted only in the context of probabilities (Martin, 1968).

2.6.7 Monte Carlo Simulation

Originally, this technique was developed for the atomic bomb during World War II (Martin, 1968). Such a technique has been accepted in farm planning since the mid 1960's, mainly due to less complicated computer routine than those required for linear programming. Monte Carlo simulation is suitable for situations which are characterised by difficult probability equations. This technique requires that users enter probabilities for each variable factor over the range of values that they may assume (Martin, 1968; Angus-Leppan, 1984).

2.6.8 Financial Simulation Models

Financial simulation models aim to describe the financial structure of a particular enterprise. Usually, a financial model is made up by a mathematical structure that can be used to help business managers plan and monitor the financial sector of a firm (Angus-Leppan, 1984). Such models are normally used in the planning process to study the effects or impact of different actions on the farm's accounting future through the application of budgeting techniques. They are often linked to physical models to get ranges of "what if" scenarios.

2.6.9 Model Evaluation

Evaluation of the model is an important phase in the model building process. In this phase, the modeller tests of whether outputs from the model deliver results within a reasonable margin of error. This is quite important in financial modelling as business decisions are taken based on numerical information generated by the model.

Validation is also important for model evaluation due to the uncertain environment of financial models. The validation process is more difficult and the level of confidence could be low, therefore the end-user should be aware of that. The validation could be carried out in four different steps (Angus-Leppan, 1984) as follows:

First, historical data for a particular output can be compared with model results. Second, the model can be run using different inputs and so the output could be analysed to see if it confirms to that which is expected. Third, the particular policy assumptions and inter-relationships can be discussed with the managers. Fourth, the adequacy of the relationships can be evaluated through statistical methods and then compared with observed historical data.

2.7 The use of Stockpol®

2.7.1 Introduction

Stockpol® is a software package that was designed for decision support on sheep, beef and deer enterprises. It was designed for use by consultants who give advice on stock policy decisions (McCall *et al*, 1993). The software can be used to compare the profitability of different stock policy options for a farm. Stockpol® provides a biologically realistic model for a complex farm system. The main use of this software in this study will be for testing the biological feasibility of alternative livestock systems

User-defined target live weights and performance levels will be considered to calculate energy requirements (in MJ ME/d). In conjunction with the number of stock in each class, these values will determine pasture DM intake (Marshall *et al.* 1991). The model calculates the minimum pasture cover required to achieve these intake levels. Pasture and animal growth are dynamically simulated and the software reports a farm system as being feasible or infeasible by comparing the minimum pasture cover required by livestock with the "actual" pasture cover calculated by the model. The accuracy of the results relies on the reliability of the input data to reflect the real behaviour of the farm system. The structure of Stockpol® is shown in the Appendix three.

2.7.2 The use of Stockpol® in the literature

Webby *et al.* (2000) investigated the opportunities to improve the profitability of pasture-based sheep enterprises by modifying the seasonal supply of forage and nutritive values of the diet harvested by the animals. The analysis was carried out using the Stockpol® computer model in conjunction with spreadsheet models. Pasture growth rate data for the three regions were sourced in the Stockpol® database.

The model generated information about lamb carcass weight, value per head and gross margin (GM) per hectare. Improving the feed quality had the greatest effect on farm gross margin. The financial advantages due to the increment of forage quality ranged from $110 to $148/ha.

Sherlock & Parker (1998) assessed the financial and biological feasibility of out-of-season (OOS- August to October) beef cattle production systems. Three case farms were studied using Stockpol®. The model described the farm system in terms of pasture cover, pasture quality, live weight changes, final carcass weight and gross margins. They concluded that OOS production decreased the biological efficiency of all the alternative cattle policies tested. Poor pasture utilisation and less conversion of pasture into meat were suggested by the model. Under a no premium price scenario, the OOS seemed to be more risky and less profitable than the traditional cattle policy, in which beef supply occurs from January to May.

Ogle & Tither (2000) used Stockpol® and the RANGEPACK model to assess the effects of climatic and market risks on the financial aspects of intensive beef production systems. The production parameters were obtained with farmers who had intensified their production system and then the two systems were modelled. They compared the traditional bull beef system with the Technosystem™. Technosystem™ involves intensive subdivision resulting in consistency of nutritional level, which allows better meat conversion and pasture growth and pasture utilisation is optimised.

Pasture information data were subdivided in three quartiles. Each quartile was used to develop pasture growth rate to represent a Good, Okay and Poor year. Three models were built using Stockpol® to calculate the effect of climate on stock performance. This information was used in conjunction with the RANGEPACK model to assess financial cash flow performance over a period of 10 years. The intensification process improved the cash flow scenario and net worth for the beef farmers provided they achieve stocking rates of 4 bulls per hectare. The average net worth for the Technosystem™ at year 10 was 72% higher than the traditional bull beef system. Intensification of production has provided satisfactory returns on investment and although risks are increased (measured by price and climate variability), the likelihood of being worse off post-development is low.

Montes de Oca (1999) used Stockpol® for quantifying the performance of the biological systems in a range of different farming systems in New Zealand. The author determined differences in terms of dry matter utilisation and revenue composition for each farm class tested. For instance, South Island high country farms had the largest pastoral area and the lowest DM utilisation per hectare (520 kg DM/ha), which reflects the extensive conditions of this farm system. On the other hand, intensive finishing farms had the smallest pastoral area and utilised more dry matter (over 8 tonnes/ha). This highlights the high capacity of this particular farm class to convert pasture into meat.

In the same study, Stockpol® was used to simulate a production system considering three mating dates under different dry matter production scenarios. This analysis generated a lamb grading system and drafting policy under three mating options subject to the dry matter availability. According to each dry matter production scenario, a lamb draft policy (e.g. 35 kg live weight) was established and stock numbers were adjusted. Thus, Stockpol® enabled the end-user to select drafting policies according to specific product requirements such as live weight, carcass weight, fat depth, selling options (store or works). The results have shown that break-even price for lamb meat was always lower on April 10 than late or early mating options.

Barker *et al.* (1999) used Stockpol® to test the following hypotheses (a) introducing a more productive grass (Wana Cocksfoot) would increase livestock performance and (b) this introduction is cost-effective compared to the financial return expected from investment in phosphate fertiliser application. The productive parameters were obtained in the farmlets containing Wana Cocksfoot grass and resident pasture (mainly browntop).

Stockpol® was validated using actual pasture data and bull performance measured to achieve a feasible result for the resident pasture and Wana in the farmlets. This phase established the minimum pasture cover to allow intakes necessary for animal performance and the number of animals that can be carried by each system.

In the second phase, prediction, four hypothetical farms were simulated (Wana, no P, Wana 40kg P/ha, Resident pasture no P, and Resident 40kg P/ha) using the information obtained in the validation phase. The increment of number of bulls and sheep were predicted based on pasture growth rate data measured in the farmlets and used in the model. The authors reported that the data provided by Stockpol® were in agreement with those actually measured in the field trial. The financial return per hectare due to Wana investment was similar to that actually observed in the practice. The financial gross return per hectare calculated by Stockpol® in the Wana block was 80% higher compared to Wana nil fertiliser. This denoted a highly profitable investment.

2.8 The use of @Risk® software for risk analysis

Risk results from the inability to forecast the future. It indicates a degree of uncertainty about a specific event. The future risk in this study will be assessed using @Risk® computer program, a risk analysis software add-in to Microsoft Excel®. (Palisade, 1997). Risk analysis in @Risk® is a quantitative method that seeks to determine the outcomes of a decision situation as a probability distribution. There are four basic steps for risk assessment using @Risk®.

Developing a model: identify the problem or situation and its respective variables.

Identifying uncertainty: specify the possible values that each variable can assume and their probability distribution.

Analysis through the simulation: to determine the range of probabilities of all possible outcomes for the results.

Making decisions: decision is made based on personal risk-return preferences and results obtained in the previous steps.

2.8.1 Stochastic simulation

The use of stochastic simulation to assess risk has been proposed by many authors (Hardaker *et al.* 1991, Hardaker *et al.* 1998, Anderson & Dillon, 1992). Murphy (1969) argues that stochastic simulation gives a clear insight into the nature of the investment and how the future performance would be affected by the stochastic influences.

Pidd (1984) stated that a deterministic system is used when behaviour can be expected or totally predicted. The model builder enters a single value for each input like sales volume or operating costs of a particular item (Angus-Leppan, 1984).

In contrast, stochastic systems are those whose behaviour could not be forecasted, though some statement may be made about how some events could behave (Pidd, 1984). To model these systems some probability distribution of likely values is required. The user must specify a range of values and their associated probabilities for each input, which may vary. As the functional relationship depends on chance parameters, the outcomes for a given set of inputs can be predicted only in the context of probabilities (Martin, 1968).

For the stochastic variables it is necessary to describe the nature of their uncertainty. This is done through probability distributions, where each variable assumes minimum and maximum values or a mean and standard deviation with the likelihood of occurrence of each of these values also determined. One example of an stochastic variable could be the use of rainfall data (Angus, 1991). Each month can be described by a probability distribution of rainfall. Farmer's knowledge (subjective judgements) in conjunction with historical data can also be used to determine stochastic inputs to build a probability distributions (Purvis *et al.*, 1995, Torkamani & Hardaker, 1996). This type of information is relevant especially in situations where many data are not available (Orskov & Viglizzo, 1994).

The variable could be dependent and independent. A useful tool of @Risk® software is the correlation matrix, where correlation ranging from –1 to +1, between input variables can be inserted and then accounted for during the simulation process (Costa, 1999). Output results are probability distributions of the possible value, which could occur, based on input values.

The probability distribution is entered directly in the spreadsheet using distribution functions of @Risk® where data are not available. The distribution function could be triangular and the shape of the curve will be made by the minimum value, the most likely value and the maximum value.

When the risk analysis is run the spreadsheet is calculated several times- a process called "iteration"- with a set of new possible values sampled from each input distribution each iteration. Each iteration will result in new possible values for output cells (Palisade, 1997)

The simulation results are presented graphically. The graphs represent frequency distributions of possible outcome values, cumulative probability curves and graphs that summarise changing risk across a range of output cells. @Risk® can also produce sensitivity analysis and scenarios. The sensitivity analysis identifies the most significant distribution input in determining the output variable. Scenario is the best combination of input distribution which determines a target output established by the user (Palisade, 1997).

2.8.2 Decision criteria for the stochastic model

The stochastic simulation generates many probability distributions which may have to be assessed by the decision-maker to select the best option based on the data analysed. This type of decision-making is referred to as efficiency criteria. The efficiency criteria eliminate those actions that are dominated by other actions being considered. The decision-maker is then left with a small set of actions to choose from. Efficiency criteria take into account the trade-off between the expected outcome and its variation. There are two ways to make a decision using efficiency criteria: Expected value-variance and degree of stochastic dominance.

2.8.2.1 Expected value-variance (E-V)

Variance is the most common statistical summary of dispersion. The consideration of the expected value and the variance is a simple way to assess both the expected outcomes and the dispersion of outcomes (Boehlje & Eidman, 1984). The strength of the E-V analysis and the development of the efficiency frontier is in defining efficient alternatives for consideration in decision-making. The E-V is effective in identifying the systems having the greatest expected value for any level of variance (Boehlje & Eidman, 1984). McDermott & Shadbolt (1998) used the E-V curve to determine the best mix of spot market and contractual arrangements for the lamb finisher. They showed that neither the alliance nor market strategies implemented individually by the finisher are as risk efficient as a combination of both co-ordination strategies.

2.8.2.2 First degree stochastic dominance

This stochastic dominance criteria uses the cumulative distribution function (CDF). First-degree stochastic dominance has a very reasonable assumption that decision-makers prefer more than less in terms of profit if this is the outcome (risk taker). For instance, the cumulative distribution function F(y) is preferred to a second alternative with cumulative distribution G(y) if F(y) ≥G (y) for all possible values of y from 0 to 1, and if there is inequality for the distributions for some value of y. (i.e. F and G do not overlap) (Boehlje & Eidman, 1984)

2.8.2.3 Second degree stochastic dominance

If the two CDFs overlap, then second degree stochastic dominance must be applied. The selection rule for second degree stochastic dominance (SSD) denotes a decision-maker as risk averse. However, the application of this rule might exclude some action preferred by the risk neutral decision-makers. Under second-degree stochastic dominance, for all risk averse decision-makers, alternative F(y) dominates G(y) if:
$_0\int^x [F(y) - G(y)]\, dx \geq 0$ for all levels of x in [0,1) and if there is inequality for some value of y (Smidts, 1990)

CHAPTER THREE

3 RESEARCH METHODOLOGY

3.1 Introduction

The chose of research method depends on the objectives and purpose of the research. There are a number of different research methods, which include experiments, surveys, and the use of case studies. Each particular method has its own strengths and weakness. Research method is a necessary tool for providing answers for questions such as who, what, where, how and why (Yin, 1989).

3.2 Case study

Maxwell (1986) stated that case studies could be used to analyse information about the characteristics of farming in a particular study area. It is possible to collect both quantitative and qualitative data at farm level in order to get a better understanding in many aspects about the case examined. For this research project it is important to gather the farmer's strategic intent (qualitative data) as this will determine the most relevant financial drivers for the business (quantitative data).

Case studies could provide significant detailed information in a holistic investigation of the situation as defined by Casley & Lury (1982). Such in-depth investigation brings disadvantage as only a small number of cases can be examined (Maxwell, 1986). However, case study analysis has an advantage over other research methodology such as a survey in that more information sources with respect to each case can be used (Yin, 1994, Maxwell, 1986, Casley & Lury, 1982).

In addition, case study farms are not randomly selected, so it does not represent the population accurately and therefore the findings cannot be extrapolated to a whole population. However, a set of case study farms could have similarities and therefore, could be considered as a representative group within a population. A group may be formed based on their economic characteristics, similar constraints and facing similar challenges (Maxwell, 1986).

Case study research also provides an opportunity for the farms to take part in the research process. The participatory nature of the case studies, allows a farmer's valuable knowledge to be incorporated into the research (Sherlock, 1997)

Yin (1994) provides a technical definition for a case study. He states a case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". Casley & Lury (1982) also define a case study as " the detailed study of a small number of units, selected as representative of the group or groups relevant to the issue under consideration, but not necessarily representative of the population as a whole".

A common criticism of case study as a research methodology is the opportunity for bias. However, this weakness is not exclusive of case study research. Bias can be perceived when using other research methodologies such as questionnaires, conduct of an experiment or a selective reporting in a historical study (Yin, 1994)

The major objective of this study is to assess the financial profitability and variability of economic outcomes of an organic farming system. The use of experiments is not an option because the investigator did not want to control the process. A survey based research approach was ruled out because this type of research method could not provide sufficient in-depth information about the system. In addition, time and costs are two major constraints in the current project. The case study method provides an optimal combination of time, cost, coverage and accuracy (Maxwell, 1986). A case study research could involve interviews with producers, documentation of facts, simple observation and participatory observation (Yin, 1989).

3.3 Research Techniques for gathering data

Several data sources can be used for measuring the management capacity of farmers. Some techniques are grouped in four major groups and listed in the Table 3.1 (Rougoor, et al. 1998)

Table 3.1 Research techniques used to assess management capacity of farmers

Research Techniques	
GROUP 1 - ANALYZING EXISTING FARM DATA 1-Primary source: written plans, calculations, records kept...etc. 2-Secondary source: tax data, accounting data...etc.	GROUPS 3 – LONGITUDINAL ON-FARM OBSERVATION 5- Unstructured observations (participation) 6- Structured observation 7- records kept by farmers on request (panel data)
GROUP 2- SINGLE ON-FARM INVESTIGATIONS 3-Interviews 4-Questionnaires	GROUP 4 - OFF-FARM EXPERIMENTS 8- Tests 9- Role-playing, gaming, simulation 10- computer experiments

The group 1 uses the data records already elaborated by the farmer himself or by a farm accountant. A substantial advantage is the low cost associated with this type of data collection. However, they usually do not cover all the research questions completely. The data methods in group 2 can be complementary. Interviews and questionnaires can be elaborated in such a way that they entirely cover the research question with relatively low cost (Rougoor, et al. 1998). The reliability and accuracy of such a method can be questioned as the respondent may give "socially desired" answers or answers that avoid cognitive dissonance. The data methods in group 3 and 4 are suitable for more in-depth research, but they are relatively expensive.

Longitudinal on-farm observations are based on repetitive data collection throughout a certain period of time. The regular contact with the farmer provides a good opportunity for studying decision-making processes, as this is a continuous and dynamic process. The off-farm experiments take the farmer to a "laboratory" equipped with computers and other devices and study his management capacity through (personality tests) or computer experiments under controlled conditions (Rougoor, et al. 1998). Off-farm experiments will be carried out using two computer models eg. Stockpol®, to assess the feasibility of different stock policies and @Risk, to account for the variability of the outcomes. Given to the objectives of current research project, the research techniques in the group 1, 2 and 4 were chosen for this study.

3.4 Selection of Case study farms

An important issue when implementing a case study technique is the selection of the case study (Maxwell, 1986). The selection criteria used to the case study farm was based on:

- The property must be operating in an organic system
- Proactive managers with a strong degree of confidence in their businesses
- The willingness of the case study in sharing personal information in their set of accounts

The selected case study farms were introduced by a scientist who was working with two organic focus groups. One farm is located in the North Island and the other is in South Island. The selected properties do not represent the whole organic industry in New Zealand. However, the case study approach was chosen to test the objectives of this study with "real working examples".

3.5 Data collection

Five years of farm accounts were obtained and analysed by the researcher. The analysis took place soon after the first visit. The initial fieldwork was preceded by a letter to the farmer providing additional information about the research as well as a checklist for the information required. The letter outlined the objectives of the research as well as the information required, the assurance of confidentiality (human ethic approvals) and the level of commitment by the farmer in terms of time. Some discussion and clarification issues regarding the study occurred before the first visit through a telephone conversation. The first two interviews occurred in April and lasted for two days due to the long distance from Palmerston North. The second interview occurred in July. The visit involved discussion and semi-structured interviews. Part of the discussion was recorded on a Dictaphone after permission for recording was obtained from the interviewees.

The interview and discussion occurred as follows:

General discussion about the production aspect and management practices on farm. This occurred while driving through paddocks on the farm. The farmers were very keen to share any information. The farmers explained the current stock policies and particularities of the organic system. This part of the visit was essential to get a better understanding of the whole system and all issues involved with the farming business.

All the information obtained during this first part of the interview was transcribed later in the same day.

Discussion then moved to the main house where the questionnaire previously sent to the farmer was discussed. It was followed by some clarification about the research objectives and confidentiality issues following the Massey University human ethics code. The researcher provided reading material considered useful for the case study farmer to improve his understand about the research purpose. The next phase of the interview process involved discussion concerning the human dimension of the business. The farmer was asked about family issues as well as farm and personal goals. These goals were further discussed in more detail. The final phase of the interview looked at the main challenges of the business as well as future opportunities and marketing aspects of organic product, particularly beef and lamb.

A written self-assessment questionnaire (Appendix one) was used to assess the importance of proactive management strategies, risk management strategies, the strategic intention of the business and entrepreneurship characteristics of two case study farmers. A set of proactive management strategies emerged from the Meat New Zealand Organic beef and sheep focus group (Mackay *et al.* 2000). A list of risk management practices was built based on the finding reported by Martin (1996). The questionnaire asked farmers to rate their opinion (1= not at all important to 5= very important) regarding the importance in a range of risk management strategies and proactive management practices. The framework used for assessing farmer's values and business views was based on Gasson (1973). A list of characteristics associated with successful farm managers was based on Cummings (1999). In this case, farmers were asked to rate their appropriate level of agreement (1= Strongly disagree to 5= Strongly agree) that reflects their qualities as a manager.

The self-assessment questionnaire method was considered the most practical given time and resource constraints. As there were just two farmers, the data were not submitted to descriptive statistic analysis. Therefore, the results are just an indication of their attitudes and these finding would not be generalized. It is important to mention that the self-assessment questionnaire approach express farmer's views of farming. The diagram below outlines the qualitative analysis framework

3.6 Steps in the Analysis of Farm Business Health

Information available that helped to build the strategic plan for both case study farms was obtained from the set of farm accounts, interviews, self-assessment questionnaire and literature. The first step in the business health assessment was to determine the vision of the enterprise e.g. what the business is expected to be, how it is expected to be performing and what it is expected to be delivering to the shareholders. The business vision expresses farmers' dreams and aspirations for the future. A mission statement was also developed. It consists of a concise summary of the overall purpose of the farm. It defines why the farm business exists and is reflected on the values and beliefs of the owners.

The next step in the process of assessing business health was to carry out an internal and external audit of the business. The internal audit identified key issues concerning financial sustainability of the business, which involved 6-7 year of farm accounts. Financial indicators were very similar to those described by Boehlje (1994). These are: solvency, debt servicing, capital efficiency, revenue generation and control, cost composition, profitability and sustainable business growth. Trends in productivity were also considered in the analysis.

The farm business analysis aims to provide a comprehensive view of the business health of the case study farms. Most of the financial information presented was collected from the annual farm accounts, which sometimes can be confusing for decision-making process. The analysis may provide some early warning signs such as the extent of cash shortfall unbalance between income and expenditure. Therefore, initiate appropriate action and contingency plans may take place to ensure long-term business sustainability. Time series analysis was carried out to assess financial and productive performance of both case study farms. Analysis of trends is used to establish direction of the business and provide a better understanding of changes in financial and productive performance over time. Care should be taken when performing trend analysis as it has some disadvantages. For instance, if the past performance is poor, and present situation good, comparing current performance with historical data may encourage a degree of complacency. Also, economic conditions e.g. inflation or strong farm prices may cause apparent improvement or downturn rather than management efficiency (Westwick, 1987). Efficiency ratios and financial indicators were calculated using information provided by the set of account from 1994 to 2000.

The external audit of the business was carried out using the PEST analysis e.g. political/legal, economical, social/cultural and technology factors. The challenge was to identify opportunities and threats created by the macro environment. In addition, the SWOT analysis was completed in order to add important issues and clarify relevant aspects of the internal and external analysis process.

Stockpol® model software was used with the objective to assess the biological feasibility preliminary economic returns of alternative policies for both case study farms. Based on the knowledge and information regarding soil resources, pasture production, farming aspects for each property and Alec Mackay (AgResearch scientist) support, the options were formulated for both situations as follows:
Case study one: the farm has a potential to intensify the beef cattle enterprise.
Case study two: the farm has room to lift sheep performance and increase productivity through intensification.

Basically, intensification means lift animal production through reproduction rates, stock growth rates, weaning weights, stock numbers, carcass weights. The analysis created by the model was carried out in two steps. First, the "status quo" situation of the farm was defined using current stock numbers, pasture production and animal performance. Second, the farm was modelled using production parameters forecasted for the next five years under two scenarios: full organic status and a well-managed conventional farm (based on farm's production capacity potential). The policies were then compared in terms of gross margins (direct costs). A more in-depth economic analysis was carried out by using Excel® spreadsheets and @Risk.

The future risk associated with the current farm system and alternative policies was analysed using the @Risk® software which is an add-in to Microsoft Excel®. The uncertainty was related to sale price of each stock class as well as the production variability (number of animals sold).

An Excel® spreadsheet was developed to calculate the income and expenditures for each year from 2002 to 2016. Each input cell was specified with its respective risk function distribution. The extracted cost of equity increased over the years as a result of family commitments related to children education and better standard of living for the family. The assumptions for debt cost as well as equity costs are shown in the Appendix three.

Input variables were selected for each year and a probability distribution was specified and entered in each cell. The triangular distribution was chosen as a distribution function for the price and production variables e.g. lamb prices, cattle prices, number of animals sold etc. This function shows the maximum and minimum value and most likely value. The market price data was fitted to a probability distribution. This was done using the Best Fit® tool in order to get the best modelling results by representing more accurately the possible price for the risk analysis (Palisade, 1997).

The market price data was provided by the Meat and Wool Economic Service of New Zealand (R. Davison, June, 2001 personal communication). The data contains mid month price quotations for lamb, mutton, cow, steer and heifer and wool from 1984 to June 2001.

The prices were deflated in order to get "today" values using the combined annual index. This index is based on 2000-01 and combines the on-farm prices paid for farm inputs index and the consumer price index in proportion to farm expenditure and net farm profit respectively (R. Davison, June, 2001 personal communication).

The production risk was quantified using Stockpol® software based on pasture production variability. This was carried out running 15 sets of different pasture growth rate profiles in the model. Each simulation produced a distinct dry matter scenario. Then, sheep and cattle numbers were adjusted to make the system biologically feasible.

This generated different drafting policies and stock performance for the farming systems tested. The results were used to determine the minimum, most likely and maximum value for the triangle distribution of animals sold. The pasture variability for CSF one and two were estimated based on the historical pasture growth measurements carried out by Gray *et al.* (1987) and McNamara (1992), respectively.

Premium prices are uncertain. Therefore, they were considered as discrete variables e.g. the probability of occurrence of each premium price in the worksheet. For example:

Premium Price	Chance of occurrence
Ten percent	20%
Twenty percent	50%
Thirty percent	50%
Forty percent	20%
Zero premium	20%

Latin Hypercube was the sampling technique used as this method recreates the input distribution sampling with less iteration than the Monte Carlo Simulation. Simulation refers to a distribution of possible outcomes being generated by letting the computer recalculate (iterate) the worksheet over and over again, each time using different sets of values from the probability distributions in input cell values (Palisade, 1997).

The simulation model also accounts for the correlation between input variables. This procedure is useful because in real life prices for different stock classes (inputs) are not independent variables. For example, when the lamb price increases the ewe price is likely to increase too. Therefore, it is important to recognize the dependency relationships between input variables. The @Risk software has a useful tool where a correlation matrix is easily constructed by the user.

The results are presented using probability theory. It is crucial therefore to understand probabilities when assessing the riskiest situation. Probabilities are strengths of belief about an event happening and these are expressed as a rating from zero (no chance) and to one or 100% (certainty) (Makeham and Malcolm, 1993).

CHAPTER FOUR

4 RESULTS

4.1 Qualitative Analysis of Case Study Farms

4.1.1 Proactive Management Strategies

The proactive strategies were grouped into four categories: animal health, pest and weeds, pasture and soils and business management and marketing as showed in Table 4.1.

Table 4.1 Farmer's self assessment of their proactive management strategies

Proactive Management Categories	Farm One	Farm Two
Animal Health	3.85^{2}	5.0^{1}
Pest and Weeds	2.0^{4}	3.4^{2}
Pasture and Soils	3.6^{3}	5.0^{1}
Business management and Marketing	4.0^{1}	5.0^{1}
Weighted average	3.29	4.5

$^{1,2,3 \text{ and } 4}$superscripts denotes ranking

The weighted averaged score for the four categories for case study one was 3.29. Based on case study one's opinion strategies relating to the animal health and marketing categories are very important in his proactive behaviour. The score for these two categories were 3.85 and 4.0, respectively. Management strategies involving pasture and soils and pest and weeds scored 3.6 and 2.0, respectively. The low score for pest and weeds is due to an intrinsic factor of the farm. Currently, the farm has no major problems controlling weeds. The bush area surrounding the property also helps to prevent weed infestations according to the farmer.

Case study two placed equal emphasis on animal health, marketing and pasture and soils as a focus of his proactive management strategy. Those categories receiving a score of five suggest a considerable degree of importance to the farming system in case study two's opinion. Similarly to case farm one, pest and weeds issues seem to be relatively less important. Thistle is the main weed on his farm and currently it is successfully controlled using breeding cows to clean up pastures.

The self-assessment by both farmers suggests that proactive actions concerning animal health and marketing issues are very relevant strategies for their farming systems. Their concern with animal health is mainly related to the internal parasites affecting lamb growth rates and therefore making it more difficult to achieve specific carcass weights without drench intervention. Marketing also seems to be an imperative for achieving acceptable farm returns. Marketing of organic meat and wool is still not fully developed despite an increasing demand for this type of product in high value markets like the UK. However, case study two has been successfully selling organic lambs with a 40% premium price over conventional ones. He is a member of Southern Organic Farmers cooperative, which is delivering organic meat to a supermarket chain in UK.

4.1.2 Risk Management Strategies

Risk management strategies were divided into seven categories (Adapted from Martin, 1996): (1) Income Spreading, (2) Debt management, (3) Pest, disease and animal health, (4) Capital management, (5) Market Risk Reduction, (6) Off-farm income and (7) Feed Management. The weighted average of case study one's self-assessment for all categories was 3.28. The ranking of importance and average figures are shown for case study farm one (Table 4.2). Further details in each risk category is provided in the Appendix one.

Table 4.2 Case study one self-assessment of the importance of risk management strategies

Risk Management Categories	Ranking	Average
Income Spreading and Debt management	First	3.75
Pest, disease and animal health	Second	3.33
Capital management, Market Risk Reduction and Off-farm income	Third	3.0
Feed Management	Fourth	2.67
Weighted average		3.28

The analysis suggests that income spreading and debt management are important risk management strategies for case farm one. Feed management strategies, through supplementary feed, seems to be less important, particularly, maintaining feed reserves (e.g. hay, silage). This item received a score of 2.67 and it is likely to be related to the contour of the property, which is not suitable for making supplements. However, the risks associated with feed are also managed through flexible stock policies, changes in stocking rates, strategic sales, shut up paddocks for forage conservation.

From an animal health perspective, ensuring adequate nutrition and introducing rams with parasite resilience are relevant management strategies for case farm one. These two items received a score of five. Concerning market strategies, both forward contracts and vertical integration scored 4. These two options seem to be attractive tools for reducing the market risk. Vertical integration allows greater control over the business. It can be achieved by direct sales such as supplying restaurants and through the establishment of "exclusive" farm shops (Latacz-Lohmann & Foster 1997). Martin (1996) revealed forward contracting as being not popular among farmers. However, McDermont & Shadbolt (1998) and Montes de Oca & Shadbolt (2000) shows that forward contracting is increasingly being used for dealing with the inherent risks of farming business. Risk management analysis for case farm two is shown in Table 4.3.

Table 4.3 Case study two self-assessment of the importance of risk management strategies.

Risk Management Categories	Ranking	Average
Pest, disease and animal health	First	4.16
Income Spreading	Second	4.0
Feed Management and Market Risk Reduction	Third	3.67
Debt management	Fourth	3.5
Capital management	Fifth	2.67
Off-farm income	Sixth	1.0
Weighted average		3.48

The weighted average score of case study two's self-assessment of all risk management categories was 3.48. Management practices related to pest, disease and animal health are very important for case farmer two. Such management practices include: intensive health monitoring programme through faecal egg counts, development of decision rules for drenching animals and adequate nutrition to minimise health problems. Income spreading is also an important tool for decreasing the business risk. Both feed management and marketing strategies were considered useful tools in the risk management programme. Feeding supplements and reserves is particularly important in this case as the farm is located in the bottom of the South Island where low temperatures over the winter occur. Both capital and debt management seems to be relatively less important. This is a reflection of the attitude towards risk of case farmer two. He made the decision to run the business in a moderate to high debt situation as long as the farm generates sufficient income to service interest commitments without being concerned about debt repayments. Currently, off-farm income is not an option as all family members are pretty much involved with farm activities.

4.1.3 Characteristics attributed to successful farm manager

As stated earlier, the level of entrepreneurship of the case study farmers were self-assessed by a questionnaire using statements found in the literature and the descriptive characteristics of successful farmers as described by Cummings (1999). A brief description of each category can be found in the Appendix one. The results of the analysis are showed in Table 4.4.

Table 4.4 Results for the characteristics attributed to successful farm manager

	Farmer one	Farmer two
BASIC KNOWLEDGE	Average score	
Command of basic facts	3.25	3.5
Relevant Professional Understanding	2.5	3.5
Continuing sensitivity to events	4.0	5.0
SKILLS & ATTRIBUTES		
Analytical, problem solving skills	3.0	4.0
Social skills & abilities	3.5	4.0
Emotional Resilience	4.0	4.0
Proactive inclination	3.8	4.0
LEARNING CULTURE		
Creativity	4.0	4.0
Mental Agility	4.0	4.0
Balanced Learning habits & skills	3.67	5.0
Self knowledge	5.0	5.0
Weighted average	3.57	4.09

Case farm one assessed himself as having a low score for relevant professional understanding. The professional understanding is related to all technical issues e.g. technology, management practices, marketing, etc. Farming organically is quite challenging as it requires a totally different approach in comparison with conventional systems. Some technologies readily available for conventional farms are not allowed to be used in the low chemical system. Niezen *et al.* (1996) and Mackay *et al.* (1998) found grazing management as a key issue for parasite control in farming systems without chemical products. To learn such skills and change the approach of farming takes time and the manager recognizes that he is still in a "learning process" farming without chemicals.

His proactive inclination scored 3.8, which suggests that the manager is very focused and has set clear goals as identified during the interview. Although it might not be formal written goals, the manager has a very good idea where his business is heading in the future. These desirable qualities are typically described as entrepreneurial in other studies (Insulander *et al.* 1986, Olsson, 1988)

Both creativity and mental agility scored four. Mental agility is an essential quality of a good manager due to the hectic nature of the farming business. Problems must be identified quickly and decisions made. A decision regarding drench intervention for example highlights the importance of this quality in successful managers. Creativity is related to the innovative ways to respond to a problematic situation. Innovation is regarded as one of the main sources of business competitiveness (Kajanus, 2000). As primary product markets are dynamic, the farm operation needs a continuous process of innovation while limiting imitations, which can reduce competitive advantages (Kajanus, 2000).

Case farmer two had a high score for most of the statements describing qualities associated with progressive managers. This result is an expression of the farmer's opinion and how he sees himself running the business. The manager of case farm two is confident in his business decisions while exhibiting a great sense of mission for his business. These issues were clearly identified through the interview process and establishment of business and personal goals. The lowest score was observed in "professional understanding". Similarly to case farmer one, he also thinks that he is still learning about the organic system and how to deal with it.

4.2 Case study One

The researcher developed the vision of the business and mission statement based on the information collected in the questionnaire and the interview process.

4.2.1 Vision

"We intend to run an organic farming business that promotes the long-term financial, production and environmental sustainability as well as achieve full Bio-Gro specification for our land and stock and market the product with our own brand."

4.2.2 Mission statement

"To provide a good standard of living for me and my family through the sale of excellent quality and healthy organic stock meeting Bio-Gro specifications. We will continue to grow and have financial security and an enjoyable and stimulating work environment. To achieve the long-term business sustainability we will place emphasis on sourcing for right genetics, adequate organic management practices and promoting the value of our product respecting the environment. Our business is based on honesty, trust and loyalty"

4.2.3 Farm Goals and objectives for Case study one

Goals relating to the family

GOAL A: *"To have a good standard of living, healthy and well educated family to spend time together"*

Objectives

- Have a minimal level of personal drawings of $45.000 annually
- Visit family once a week in town and enjoy off farm activities with children
- Complete the house in town in 2001
- Have time for travelling with family within New Zealand during school holidays
- Ensure quality education for our children

Environmental goals

GOAL B: *"Run the farm in environmentally friendly way to preserve the available resources for future generations"*

Objectives:

- To have a high fertile soils achieving Olsen P levels of 20 by 2005 by applying 250 kg/ha of RPR annually
- To have effective erosion control through planting of willow and poplar tree in the erosion prone areas

Goals relating to the expansion

GOAL C: *"Expand the production basis of the business without tieing up more capital in land"*

Objectives

- Have a new block of land leased by 2004.

Goals relating to the production

GOAL D: *"To be a successful as an organic farmer achieving a balance between production, financial and environment sustainability"*

Objectives

- Breeding and finish 70 % of lambs at Bio-Gro specification with 16 kg LW in 5 years
- Receive a 30% premium price for those lambs reaching Bio-Gro specifications
- Sell elite rams with genetic resilience to parasites in the next five years
- Breeding and finish 150 steers by 2002
- Get minimum 20% of premium price for cattle reaching Bio-Gro specifications
- Have Bio-Gro full certification status for the whole farm in 2003
- Lambing percentage 120% by year 2002
- Calving percentage of 90% by year 2001

GOAL E: *"Improve pasture production and quality"*

Objectives

- Continue fencing and increasing paddock numbers
- Using beef cows to clean up pasture
- Produce 10 tonnes of DM/ha/year with annual utilization of 65% by 2008

GOAL F: *"Improve animal health status"*

Objective

- To plant alternative plant species such as sulla, chicory and lotus in autumn 2001 that will be functioning as "hospital" paddocks (10 ha/year)
- Drench intervention in sheep based on visual assessment, FEC results, season conditions and body weight (drench when FEC higher than 700 gr/sample)
- Increase pre-grazing levels for young sheep stock, i.e. 1500 kg DM/ha in the 2002 season
- Keep the animals as clean as possible through crutching lambs
- Selection of "non-daggy" animals as a replacements

GOAL G: *"Place strong emphasis on marketing for organic products"*

Objectives

- To sell product under our own brand by 2005
- Complete a business plan for marketing our organic products after full certification status in 2004
- Employ a full-time manager to run the farm and have time for marketing and promotion activities. This is to happen after full certification for land and stock is achieved in 2004
- Travel overseas, UK, for marketing research in two years time, i.e. 2004 within a budget $7000

4.2.4 SWOT Analysis

SWOT analysis	
Strengths • Business is operating in a low debt situation • Very focused and orientated manager with strong confidence in organic production • Good fencing and subdivision (more subdivision is to happen) • Manager has a lot of experience and has been in the farm business throughout his life • Wife heavily involved in the strategic farm decisions and couple is working as a team • Passion for farming and outdoor life • Weed infestation is a minor problems and it is totally under control • Farm location is very isolated with Pinus tree areas around • High altitude contributes with less larval parasite infestation • Use of a very resistant sheep breed (Perendale) • Manager is keen to be joining research projects • Quarantine area allows a flexible policy for finishing stock that lost organic status • The whole farm will achieve full certification status in 2004 • Strong financial position • A quality hill country resource with a history of regular P applications • Good botanical composition formed by white clover and ryegrass as dominant species • 60 inches of annual rainfall evenly distributed throughout the year	Weaknesses • Erosion prone areas • Property is situated far away from the major cities (potential consumers) • Commercialisation relies on small butchers shops • Very little development in market issues for organic beef and lamb. • Steep contour makes difficult to use pasture for conservation activities • Informal feed budget • Struggling to control pasture surplus in the quarantine area • Struggling to achieve good lamb growth rates in 2001 • Low P levels in some paddocks • No historical fertilizer application in the most fertile paddocks

Opportunities	Threats
• Land suitable for an introduction of deer enterprise • Supply chain for organic beef and lamb (distribution systems) • Demand for organic certified stock • Quality assurance programmes • Rapid increment in demand for food safety products • Technology and better management practices specifically for organic farming systems • Trade name (brand) • Traceability	• Environmental Factors (drought, wind chill factor, snow falls) • Market Fluctuations • Lack of buyers acquiring organic products all year round • Government Policies (RMA, ACC, Employment Contract, Conservation Issues) • Exchange Rates • Interest Rates • Input Price Increases (fertiliser, fuel ... etc) • Pressure groups - animal welfare • Shortage of production • Market saturation

4.2.5 Production analysis

The Table 4.5 shows the main physical production indicators for the business over the past seven years.

Table 4.5 Sheep production analysis for case farm one

Production Analysis		1994	1995	1996	1997	1998	1999	2000
Effective area (ha)		1256	1256	1256	1256	1136	1136	1136
Livestock Units								
	Sheep	5038	5273	5041	4745	4738	4262	4042
	Cattle	3037	3650	4386	4756	4869	4163	4044
Total Wintered		8075	8923	9427	9501	9607	8425	8086
SU per effective hectare		6.4	7.1	7.5	7.6	8.5	7.4	7.1
Lambing Percentage		114%	96%	107%	109%	101%	94%	112%
Lambs death rate (%)		3.6	4.5	1.9	3.7	3.8	3.4	1.9
Sales								
Ewes (all ages)		753	1197	673	810	1192	1277	826
Average price ($)		33.43	22.29	27.78	43.47	30.04	30.67	35.66
Fat lambs		3437	2349	3391	2735	2817	1552	2587
Average price ($)		33.6	26.1	33.8	45.4	26.6	45.1	45.7
Sales as a % of sheep wintered		79.0	62.6	73.1	68.8	77.3	62.4	74.9

The effective area has decreased 120 ha over the past years. This is mainly due to the forestry programme taking place. The stock units wintered have oscillated between 8000 and 9500 stock units wintered. The average lambing percentage over the period considered was 105%. The lambing percentage fluctuates between 94 and 114%. This fluctuation is a reflection of management practices and seasonal effects. This production indicator is still below what the business is targeting at 120%. The number of animals sold as a percentage of sheep wintered ranges from 62 to 79%. The average price received for fat lambs is $36.6. However, there was two years of low prices, 1995 and 1998, which had a negative financial impact on the business. Both wool production and wool productivity (kg/SU) have decreased at an annual rate of 6% and 1%, respectively (Table 4.6).

Table 4.6 Wool production for case farm one

Wool	1994	1995	1996	1997	1998	1999	2000
Weight of clip (Kg)	33906	25081	22177	25893	21147	23568	22014
Weight per SU	6.73	4.76	4.40	5.46	4.46	5.53	5.45
Average price ($)	2.65	3.93	3.12	2.92	2.67	2.34	2.45

The wool prices peaked in 1995 and has been decreasing since then. This could be attributed to the weak prices in the international market and increase in fibre diameter due to exotic breeds introduced to improve meat production (Table 4.7).

Table 4.7 Cattle production analysis for case farm one

Cattle	1994	1995	1996	1997	1998	1999	2000
Calving percentage	85%	86%	88%	89%	79%	78%	80%
Deaths & Missing %	0.3	0.3	1.9	1.3	0.9	0.9	6
Weaner heifers	70	59	75	91	0	141	34
Average price ($)	292	201	134	180	0	216	270
Weaner steers	157	78	38	289	242	79	33
Average price ($)	385	240	203	258	224	284	368
Sales as a % of cattle wintered (%)	62.5	28.4	35.2	52.4	55.2	40.8	27.7

The annual average calving percentage is 84% (Figure 4.1). Reproduction rates seem to present a decreasing trend for the last three years. It could be partially attributed to the drought in 1998 and problems caused by leptospirose. The number of cattle sold has been decreasing since 1997. This is associated with the policy of increasing cattle numbers on farm and reducing sheep. In 1997 52% of cattle wintered was sold in the market while in 2000 this figure was just 28%. The annual average price for weaner steers is $280. This varies between $203 and $385 (Table 4.7). Probably, most of this fluctuation is associated with market demand.

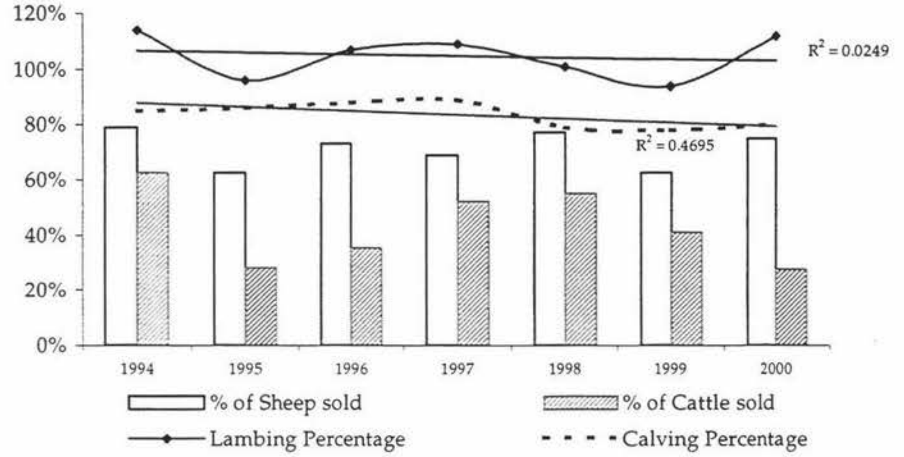

Figure 4.1 Reproduction rates and animal sales for case farm one

4.2.6 Balance Sheet and Solvency analysis

The balance sheet summarizes the financial condition of the business at a point in time (Kay & Edwards, 1994). The balance sheet for the business is shown at June 30th from 1997 to 2000 (Table 4.8). The key strategic indicators here are the net worth and trends in equity levels. The balance sheet is also useful to measure liquidity and solvency of the business. Equity peaked in 2000 at $1.363,516. This was due to the reduction in total liabilities of $89496 since 1997 and $300.000 capital introduced in the business by the year 2000.

Table 4.8 Balance Sheet and Solvency analysis for case farm one

Years	1996	1997	1998	1999	2000
Balance sheet					
Current Assets	$23,458	$1,344	$3,772	$47,620	$40,919
Total Assets	$1,089,987	$ 1,715,671	$ 1,615,394	$ 1,706,834	$ 1,973,485
Current Liabilities	$37,619	$ 55,504	$ 76,150	$ 122,674	$ 38,259
Total Liabilities	$669,329	$ 657,214	$ 647,860	$ 694,384	$ 609,969
Solvency					
Debt:Assets	N/A	38%	40%	41%	31%
Debt:Equity	N/A	62%	67%	69%	45%
Net worth (equity)	$420,658	$ 1,058,457	$ 967,534	$ 1,012,450	$ 1,363,516
Change equity	N/A	$637,799	-$ 90,923	$44,916	$ 351,066
Equity %	N/A	61%	60%	59%	69%
Equity growth	N/A		-8.6%	4.6%	34.7%
Net Indebtedness	N/A	$ 655,870	$ 644,088	$ 646,764	$ 569,050
Change indebtedness			-$11,782	$2,676	-$ 77,714
Interest	N/A	29678	21663	16890	13155
Debt Servicing:GFI	N/A	7.0%	11.7%	5.7%	3.4%

Equity growth has been increasing at an annual average rate of 10.2% since 1997 while equity percentage averaged 62%. In 2000, the net worth increased by $351.000 as a consequence of a substantial volume of capital (as cash) introduced in the business. Total assets have increased 18,2% on average during the period considered.

There was a significant capital gain through land and building revaluation in 1997 increasing the net worth by 151,2%. In this year, the fixed asset value increased by $544.010 to $1715.671. It should be noted that this capital gain is a result of asset revaluation and therefore reflects the improvement that occurred on farm over a number of years before 1997.

Solvency measures the liability of the business relative to the owner's equity invested in the business. It also provides an indication of the business's ability to meet all its financial obligation e.g. debt to asset ratio, debt to equity ratio (leverage) and debt servicing to GFI. Debt to asset and leverage are decreasing over the time which is a positive factor as smaller values are preferred denoting the business is solvent.

Debt servicing to GFI also has a decreasing trend over the period considered except in 1998. In this particular year, the peak of debt servicing ratio, 11,7%, was due to the low GFI generated (drought) rather than increase in interest payments (Table 4.8). This scenario indicates that the business is reducing its debt commitments and going towards a less risky financial position. The decrease in the interest figure support this information. In addition, the debt servicing ratio is well below the boundary set by the National Bank, which considers that 30% is indicative of business vulnerability (NBNZ, 1999).

Liquidity measures the ability of the business to service financial commitments as they come due without influencing the normal operation of the business (Kay & Edwards, 1994). The current ratio is less than one in four out of five years indicating that the current liabilities are greater than current assets (Table 4.9).

Table 4.9 Liquidity analysis for case farm one

Liquidity	1996	1997	1998	1999	2000
Current ratio	0.62	0.02	0.05	0.39	1.07
Working capital	-$ 14,161	-$54,160	-$72,378	-$75,054	$ 2,660

Also, the working capital is negative in the same years suggesting no cash funds available. However, care should be taken with these two particular measures because they reflect a position of the business in a specific time during the year.

Due to the nature of the farming business and its seasonal income these two measures are more useful when followed monthly with the farm cash flow.

Gross farm income (GFI) oscillated from $142342 to $421363. The lowest GFI was obtained in 1995 and it was caused by a number of reasons. The sheep income was affected by low productivity (lambing percentage 96%) and modest lamb prices ($26,08) (Table 4.10).

Cattle income also decreased dramatically as a reflection of low prices. The peak of GFI was in 1997 when lamb and ewe prices were strong in comparison with the years before.

Table 4.10 Profitability analysis for case farm one

Profitability	1994	1995	1996	1997	1998	1999	2000
Gross Farm Income	388324	142342	247487	421363	185690	296626	388265
Total Expenses*	299905	277237	254996	236428	238399	216085	245895
Net Farm Income	N/A	N/A	43466	59072	-7386	27202	30514
Farm Cash Surplus	N/A	N/A	N/A	-40000	-18219	-2667	77713

* Operational cost, interest, depreciation

The trend in gross farm income (GFI), operating profit (EFS) and total expenses is shown in Figure 4.2. Regression analysis suggests a modest increasing trend for both GFI (R^2=0.0306) and operating profit (R^2=0.0174) and a declining trend for expenses (R^2=0.50).

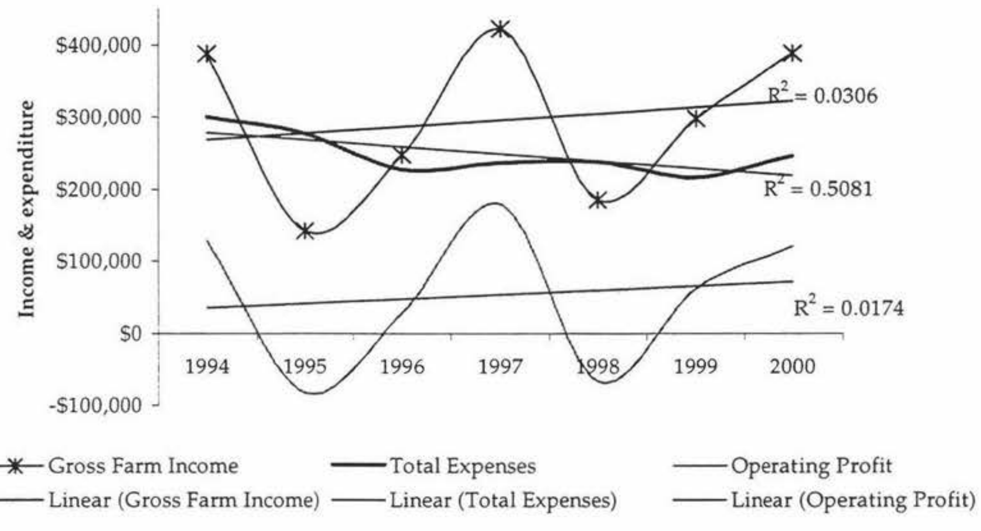

Figure 4.2 Income and expenditure trends for case farm one

Operating profit shows substantial fluctuation ranging from a negative value of $82050 in 1995 to $179.613 in 1997 (Table 4.11). This is a concern because a negative operating profit indicates that the business is not generating enough income to meet its operating costs. Therefore, there were no funds available for development, debt servicing reductions and other expenses.

The factors causing the fluctuation observed in the operating profit and NOPAT are similar of those affecting GFI as explained earlier in this section. The operating profit margin has exhibited a significant variation ranging from 11.5% to 42.6%.

These indicators averaged 26.5% over the last five years (excluding 1998). The average figure is below the 35% level recommended for the pastoral industry (NBNZ, 2000).

Table 4.11 Revenue generation analysis for case farm one

Revenue Generation	1994	1995	1996	1997	1998	1999	2000
Economic Farm Surplus	128573	-82050	28531	179613	-66046	62431	120525
Operating Profit Margin	N/A	N/A	11.5%	42.6%	-ve	21.0%	31.0%
NOPAT	90001	N/A	19972	125729	-46232	43702	84368

Because substantial capital gains can mask poor results in the farming business, both return on asset (ROA) and return on equity (ROE) indicators were calculated in two ways: (a) considering capital gains, which reflects the property business efficiency (please refer to section 2.5.4), (b) without using revaluations which reflects the farming business earning capacity (constant land values e.g. no capital gains included). (Table 4.12).

Table 4.12 ROA and ROE for the property business and farming business

Years	1996	1997	1998	1999	2000
EFS	28531	179613	-66046	62431	120525
NOPAT	19,972	125,729	- 46,232	43,702	84,368
Total assets (Market Value)	1,709,434	1,715,671	1,590,659	1,699,066	1,673,485
Property business ROA post-tax	0.4%	-7%	7%	-2%	5%
Farming business ROA pre-tax	1.7%	10.5%	-3.9%	3.7%	7.1%
Combined post-tax return	2%	0.04%	4%	1%	10%
ROE	-1.4%	14.2%	-9.3%	4.5%	10.1%

* Asset value in 2001 was estimated in 1,757.159

Return on assets for property business ranged from -7% in 1997 to 7% in 1998 with averaged at 3.3% in the last three years. On average, the business is returning 3.3 cents for every dollar invested in the operation.

The property business is achieving modest returns. The farming business return ranged from 1.7% in 1996 to 7.1% in 2000. The negative figure in 1998 is due to the sever drought conditions in this year. The pastoral industry should be targeting 8 to 11% ROA (NBNZ, 1999).

The combined return (change in asset values plus NOPAT) varies from zero to 10%. Return on equity averaged 6.9% over the period considered (excluding negative figures in 1998). A substantial increase is observed in 2000, due to increase operating profit and debt service reduction.

Overall, there is an upward trend, which suggest that business is being more efficient in generating income form its assets. This was mainly due to the improvement in revenue generation rather than drop in asset values.

Capital turnover ratio averaged 20 % over the last six years. This indicator shows a decreasing trend since 1997 with a slight recovery in 2000. This was mainly due to GFI figures increasing faster than total asset values (Table 4.13).

Table 4.13 Capital efficiency analysis for case farm one

Capital Efficiency	1994	1995	1996	1997	1998	1999	2000
Cash farm exp. % GFI	70.7%	N/A	67.4%	45.6%	109%	62.3%	53.0%
Capital Turnover Ratio	25.1%	N/A	22.7%	24.6%	11.5%	17.4%	19.7%
Revenue per employee	129441	N/A	82496	149715	73111	98875	135239
Fixed cost %	30.5%	N/A	31.2%	23.2%	20.5%	20.3%	21.9%

The lowest capital turnover ration was observed in 1998 as consequence of El Nino. Cash farm expenses denote that a significant proportion of gross farm income is used to cover cash operating expenses. The fixed cost percentage averaged 24.6%. The business is managing the fixed costs well with a decreasing trend since 1996. It suggests a satisfactory production scale for the size of this business.

4.2.7 Sustainable Business Growth

The sustainable business growth (SBG) is an important key performance indicator as case study one has a goal of maintaining resources for future generations. This indicator measures the "value creating activity" which is related to the sustainability of the farming system or the enhancement of future values towards security, succession or retirement (Kirton *et al.* 1994, Parker *et al.* 1994).

The cost of debt (interest) for this business is exhibiting a decreasing trend since 1996 (Figure 4.3). Most term liabilities are free of interest (family loan) and there is no rent costs. The percentage cost of debt dropped from 4.5% in 1996 to 1.5% in 2000. On the other hand, the extracted cost of equity has increased over the same period going from 2.51% in 1996 to 6.79% in 2000.

As personal drawings have been quite consistent without substantial fluctuations, the increment observed in equity costs was mainly due to debt repayment in 1998 and 2000. The level of personal drawings varied between $36.000 and $43.000

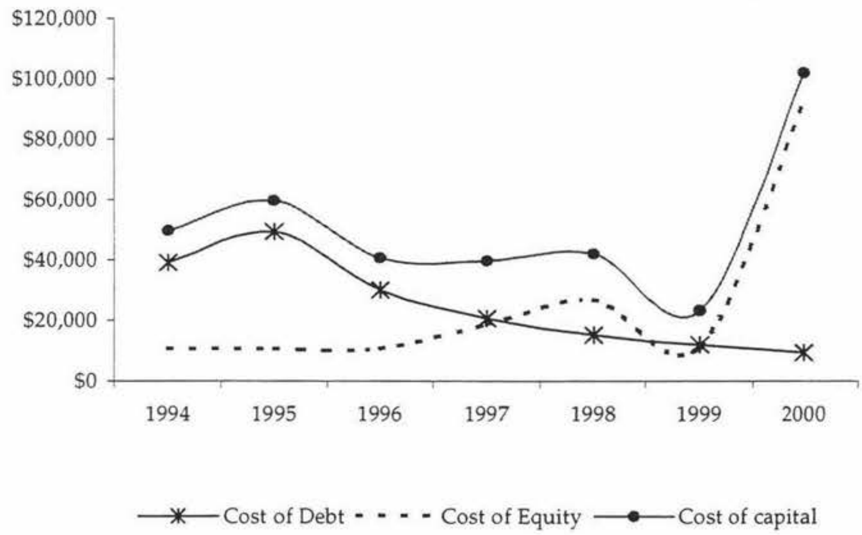

Figure 4.3 Cost of capital analysis for case farm one

The indicators of business growth are presented in Table 4.14. The extracted cost of capital averaged 3.0% over the period considered and it peaked at 5.16% in 2000 in response to a good EFS.

The sustainable business growth figures indicate that there has been a cumulative divestment in the business of $19810. The extracted cost of capital is greater than NOPAT in 1996, 1998 and 2000 as showed by the negative value created (Table 4.14).

Reinvestment was only possible in two out of five years of analysis. Therefore, the NOPAT must increase for the business to maintain its financial sustainability. The decreasing trend of cost of capital (Figure 4.3) and increasing trend of operating profit suggest that the business will remain sustainable.

Table 4.14 Sustainable business growth analysis for case farm one

Growth	1996	1997	1998	1999	2000
Cost of Debt					
Total Cost of debt	30128	20775	15164	11823	9209
Cost of debt (%)	4.5%	3.2%	2.3%	1.7%	1.5%
Cost of equity					
Extracted cost of equity	10566	18856	26914	11326	92588
Cost of Equity (%)	2.51%	1.78%	2.78%	1.12%	6.79%
Extracted cost of capital	40694	39631	42078	23149	101797
Extracted cost of capital (%)	3.73%	2.31%	2.60%	1.36%	5.16%
Sustainable Business Growth	(20,722)	86099	(88,310)	20553	(17429)
NPV (productive value)	534,941	5,443,010	N/A	3,222,236	1,635,596

4.2.8 Summary

The business has a reasonable level of equity averaging 62% with some debt interest free. Debt servicing levels are decreasing trend denoting the business do not have much interest payments. However, there is room to improve animal production, particularly lambing percentage and lamb growth rates. In addition, it is expected to increase the number of lambs being traded as organic and therefore a premium price will have a positive impact on the financial performance of the business. The extracted cost of capital is about 3% percent, which is manageable. Similarly, the level of equity cost is low but it is expected to increase as children get older and the family pursues other leisure activities. Operating profit has been moderate and in conjunction with the low cost of capital there is a good balance between the operating and funding sides of the business. The business could be considered a high cost operation as a result of the cash operating expenses figures, which varies between 53% and 109% of gross farm income. ROA and ROE were calculated considering capital gains (property business) and without taking into account such land valuations (farming business). In both situations figures have exhibiting an increasing trend for the last three years of the analysis. Value has been created in two out of five years. However, a negative value created in 1996, 1998 and 2000 equates to a divestment of $19,810. The physical production performance is stable and there is room to improve, particularly, lambing percentages. Finally, the operation is in a stable financial position and the overall performance of the business suggests that the farming family will be able to achieve their goals.

4.3 Case study Two

4.3.1 Vision

"We will have a long–term financial and productive viable business adopting environmentally friendly organic farming practices and marketing our products internationally in high value markets in Europe"

4.3.2 Mission statement

"The mission statement of our farm is to produce financial security to all family members through the commercialisation of top quality organic lambs, wool and beef meeting the CERTENZ specifications. Achieving a successful financial farming business will allow us to support our three children education and other family pursuits of enjoyment. Our business is based on loyalty, truthfulness, responsibility and enthusiastic motivation"

4.3.3 Farm Goals and Objectives

Goals relating to the family

GOAL A: " To have a health, well educated family with time to spend together and enjoy off-farm leisure pursuits"

Objectives

- Provide financial support to our three children throughout their education life ensuring $15000 per year
- Ensure a minimal level of personal drawings of $50000 annually
- To work five and a half days per week
- Build the new family house by the year 2006
- To allocate time and funds for travelling overseas visiting Europe and South America after the whole farming development by the year 2008

Environmental goals

GOAL B: *"To have high fertile soils, increasing its production capacity preserving this resource for future generations"*

- Achieve soil Olsen P levels of 20 by the year 2006 through systematic top dressing of 250kg/ha of RPR annually

- Achieve pH level of 5.8 through application of 500kg/ha/year of lime by 2006
- Annual soil test for close monitoring of soil production capacity: Olsen P levels (20), pH (5.8) and trace elements

Production goals

GOAL C: *"To run an organic farming system producing top quality organic lambs, wool and beef"*

Objectives

- Breeding and finish 80 % of lambs at CERTENZ specifications with at least 15 kg CW in Autumn 2002
- Introducing the new rams genetics to improve lambing percentage (Finn sheep) and increase lamb growth potential (Texel and Suffolk crossbreeds)
- Achieve growth rate of 250grams per day in top lambs by the 2002 season
- Achieve 140% of lambing percentage by the year 2004
- Achieve calving percentage of 90% by year 2001
- Finish 68 steers (250kg CW) by the autumn of 2002 (18 months of age)
- Finish 30 heifers (220kg CW) by the autumn of 2002 (18 months of age)
- To have 5000 stock units on farm by the year 2005

GOAL E: *" Adopt proactive management strategies (monitoring) to anticipate problems"*

Objectives

- Regular and constant monitoring of stock condition (every two days, subjective assessment) particularly, young stock anticipating problems
- Keep the animals as clean as possible through strategic shearing
- Culling "daggy" individuals
- Drench intervention when FEC over 700 eggs/sample
- Change the sheep:cattle ratio to 40:60 to help parasite control

GOAL G: *"Improve pasture quantity and quality"*

Objectives

- Fencing and increasing paddock numbers
- Using beef cows to clean up pasture and maintain quality
- Applying RPR at 250 kg/ha annually
- To grow 15 ha of forage crops (Pasja/Sweeds) annually

GOAL H: *"Maintaining the economic viability of the business generating sustainable income"*

- Focus on positive sustainable business growth annually
- Generate a Gross Farm Income of $1000/ha by the year 2003
- Generate an annual Net Operating Profit After Tax of $100,000 by the year 2003
- Get a 40% premium price for cattle and lambs reaching CERTENZ specifications

GOAL I: *"Promote marketing to guarantee organic product access in UK"*

Objective

- Sell our organic products through the Southern Organic co-operative
- Build a strong commercial link with the clients in UK over the years
- Guarantee evenness of supply every season

GOAL J: *"Improve facilities to make farm job easier"*

Objective

- Build a new cattle and sheep yard in the new block
- Good permanent fences

4.3.4 SWOT Analysis

SWOT analysis	
Strengths	Weaknesses
• Long farming experience (35 years including 3 years in stock firm) • Manager complete the Diploma in Agriculture, Diploma in Rural Farm valuation • Member of the Southern Organic Farmer cooperative which is responsible for marketing their product • Very enthusiastic manager with strong confidence in a successful organic production • Weather conditions are very kind for sheep production with no incidence of facial eczema • Recent acquisition of new block to increase production scale • Topography allows cultivation of land • Thistles are only significant weed and has been efficiently controlled by grazing paddocks with breeding cows • Low temperatures contributes to a	• Tuberculosis risk area • Cold and frosty winter period requiring supplements • Risk of contamination from neighbouring farms • Poor facilities in the new block • Very undeveloped market for organic wool • Calves were sold in the conventional store market

low parasite population • The whole farm achieved full certification status in October 2000 • Debt is manageable • A quality hill country resource with a history of regular P applications • Organic certification through the CERTENZ providing some flexibility (one drench) • Located near a meat works which has been buying organic meat • Regular monitoring of stock class weights • Monitoring FEC and using this information for drenching interventions	
Opportunities • Organic deer production • Direct marketing to maximize return • Rapid increment in demand for food safety products • Technology and better management practices specifically for organic farming systems will be available • Brand name • Traceability	Threats • Environmental Factors (drought, snow falls) • Market fluctuations • Government Policies (RMA, ACC, Employment Contract, Conservation Issues) • Volatility of exchange rates affecting return • Interest Rates • Input Price Increases (fertiliser, fuel ... etc) • Animal welfare issues • Shortage of production • Market saturation in future, then premium prices will be reduced

4.3.5 Production analysis

The grazeable area is about 500 hectares. The stock units wintered (based on opening stock numbers) have been increasing since 1996. They went from 2800 to 4000 in 2000. The target is to achieve 5000 stock units once the whole farm development (fencing & fertilizer) has taken place. The average lambing percentage is 127%. The lambing percentage fluctuates between 120 and 131% (Table 4.15). There was a slight decrease in lambing percentage since 1998 mainly due to bought-in ewes. The number of animals sold as a percentage of sheep wintered is high ranging from 82 to 97%. The 97% figure in 1999 can be misleading because there was a substantial purchase of ewes in this particular year. As a result there was an increase in the volume of lamb sales.

The average price received for fat lambs has improved going from $36 to $45 dollar per head in 2000. This is the effect of current strong stock prices in the market. These lamb prices do not include "organic premiums" and this was only possible in the 2000/01 season. Unfortunately, this information is not available for the analysis. The increase in the number of lambs sold after 1998 is mainly due to ewe purchase rather than an improvement in production base. About 490 ewes were introduced in 1999, therefore number of lambs sold has moved from 2023 in 1998 to 2437 in 1999.

Table 4.15 Sheep production analysis for case farm two

Production Analysis		1996	1997	1998	1999	2000
Effective area		400	400	400	500	500
Livestock Units						
	Sheep	N/A	2264	2264	2264	2877
	Cattle	N/A	621	723.5	941	1122.5
Total Wintered		2879	2885	2988	3205	4000
SU per effective hectare			5.8	6.0	6.4	8.0
Lambing Percentage			120%	131%	128%	127%
Sales						
Ewes (all ages)		461	531	697	124	104
Average price ($)		34	46	44	27	22
Hoggets						149
Average price ($)						51.05
Fat lambs		1613	1796	2023	2437	2471
Average price ($)		36	41	35	32	45
Sales as a % of sheep wintered		N/A	82%	95%	97%	82%

Both wool production and productivity figures have remained quite stable without significant variation. The weight of clip ranged from 12.000 kg to 14.000. There was a significant drop in 2000 and it was caused by the recent change in shearing policy. Traditionally, the shearing occurred every 8 months and now it is carried out every six months.

Table 4.16 Wool production for case farm two

Wool	1996	1997	1998	1999	2000
Weight of clip (kg)	11815	12815	12885	14317	10182
Weight per SU (Kg)	N/A	5.7	5.7	6.3	3.5
Average price ($)	3.47	3.04	2.83	3.14	2.81

The annual average calving percentage is 80% (Figure 4.4). This indicator was calculated based on the number of calves sold and number of breeding cows. Therefore, it takes into account deaths and missing animals. Calving rates seems to be exhibiting a downward trend, particularly after 1999 and 2000. This situation can be attributed to two main reasons: (a) the breeding cows (71) purchased in 1999 have had some fertility problems; (b) as this indicator is calculated based on the number of calves sold showed in the account, if farmers decides to keep some calves and sell them in the following season, calving percentage (calves sold plus replacements divided by breeding cows) is reduced.

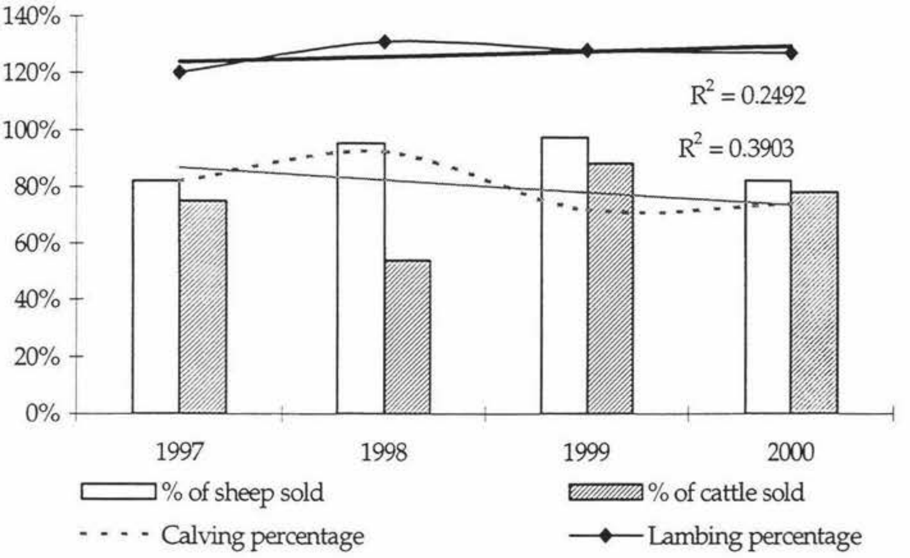

Figure 4.4 Reproduction rates and animal sales for case farm two

Table 4.17 reveals a substantial improvement in stock prices, especially in 2000 e.g. weaners were $290 and moved to $491. Similar price improvements occurred with other stock categories. The sale as a percentage of stock wintered shows a high turnover in the farm operation.

Table 4.17 Cattle production analysis for case farm two

Cattle	1996	1997	1998	1999	2000
Calving percentage	N/A	82%	92%	72%	74%
Breeding Cows	10	13	20	18	11
Average price ($)	197	226	272	385	600
Heifers	N/A	N/A	41	33	13
Average price ($)	N/A	N/A	394	655	567
Steer & Bullocks	N/A	N/A	12	64	25
Average price ($)	N/A	N/A	402	493	681
Weaners	68	67	0	52	117
Average price ($)	225	265	N/A	290	491
Sales as a % of cattle wintered	N/A	75%	54%	88%	78%

4.3.6 Balance sheet and solvency analysis

The balance sheet for the case study two is shown as at August 31st from 1996 to 2000. The financial figures showed here were consolidated into one summary due the nature of multi-entity enterprises. Those three entities are: Farming partnership, family enterprise (providing off-farm income) and trust (formed in 1999).

Equity figures peaked in 1998 at $622,445. The net worth has increased since 1996 maintaining equity percentage figures around 55% until 1998. After this year, the net worth decreased steadily reaching the lowest level in 1999 at $392.384 and equity to asset ratio at 33%. This substantial reduction was influenced by the loss in revaluation ($191,000) and additional borrowings ($250,000) to purchase the new block. A significant proportion of equity growth was promoted by capital introduced rather than share of income.

Capital introduced equals $150,000 in the last five years and it came from other business entity. Despite this capital introduced, equity levels are trending down due to an increased level of liabilities. The total asset value has been increasing over the period considered. The devaluation of the land in 1999 was offset by the purchase the new block, which added $200,000 dollars to asset figures (Government valuation). However, additional borrowing of $250,000 pushed down the equity level ($392,384).

Debt to asset ratio has increased while equity ratio decreased in the analysis. The debt to asset ratio presents an increasing trend going from 44% in 1996 to 65% in 2000. Such situation is leading the current business to a more vulnerable and financially risky situation. This increasing trend in the debt to asset ratio might suggest that the business can become insolvent in the future.

However, the purchase of the new block has contributed to most of this debt and this block hasn't achieved its full production potential to generate income and therefore reduce liabilities. Improving production in this new block will bring additional income and cutting costs will help to improve the solvency ratio.

Equity reduced from 56% in 1996 to 35% in 2000. This was due to the fact that liabilities increased at a faster rate than total assets. The leverage ratio for 1999 and 2000 indicates that lenders provide significant capital for this business (Table 4.18).

Table 4.18 Balance Sheet and Solvency analysis for case farm two

Years	1996	1997	1998	1999	2000
Current Assets	28331	15208	15072	18121	6682
Total Assets	1012920	1111194	1118819	1191507	1231358
Current Liabilities	80149	50513	61315	58306	85150
Total Liabilities	447102	528354	496373	799123	805099
Solvency					
Debt:Assets	44%	48%	44%	67%	65%
Debt:Equity (leverage)	79%	90%	80%	204%	189%
Net worth (equity)	565818	582840	622446	392384	426259
Change owner's equity		17022	39606	-230062	33875
Equity %	56%	53%	56%	33%	35%
Equity growth		3.0%	6.8%	-37.0%	8.6%
Net Indebtedness	403087	488522	456265	755769	760633
Change in net indebtedness		85435	-32257	299504	4864

Liquidity is the ability of the farm to meet financial obligations. A current ratio larger than one is desirable denoting the business is more liquid (Table 4.19). Both current ratio and working capital suggest poor liquidity of the business as at June 30th. However, those two measures can be misleading due to the seasonality of income in farming business. Usually, the farm business experiences poor liquidity most of the time because the cash inflow is concentrated in just three to four months per year. Despite the increase in debt, the debt-servicing ratio has remained relatively stable as a proportion of the gross farm income. This is because the gross farm income is growing faster than interest obligations. The increase in level of debt therefore is not as risky if the debt servicing capacity is not increased correspondingly.

Table 4.19 Liquidity analysis for case farm two

Debt Servicing	1996	1997	1998	1999	2000
Liquidity (current ratio)	0.35	0.30	0.25	0.31	0.21
Interest	39055	39619	38398	43938	58979
Working capital	-51818	-35305	-46243	-40185	-67029
Debt Servicing:GFI	26.1%	24.0%	22.9%	24.1%	26.9%

Gross Farm Income (GFI) has increased from $149,779 to $219,470 in 2000 (Table 4.20). These changes are attributed to changes in production, volume of sales (1613 lambs in 1996 compared to 2471 in 2000) stock prices and changes in inventory. For instance, sheep income reduced by 22% in 1999 due to weak lamb prices ($32/hd). However, it increased by 48% in 2000 given better lamb prices at $45/hd. On the other hand, cattle remained quite stable until 1998 around $22.000 per year. It increased by 129% in 1999 compared with the previous year. This was due to increased volume of steer sales and combination with strong stock prices in comparison with 1998 season. Wool income has ranged from $36.000 to $45.000. However, there is a substantial reduction by 36% in 2000 caused by the new shearing policy every 6 months.

Similarly to GFI, total expenses (operating costs, depreciation, interest) follow a similar upward trend but increasing in a faster rate. Total expenses peaked in 2000 due to the increase in interest and rent commitments and working expenses after the new block was purchased. The farm costs exceed the available gross farm income in 1998 and 1999. It may suggest that this business is dependent on funds from another source and additional borrowings to maintain liquidity.

Table 4.20 Profitability analysis for case farm two

Profitability	1996	1997	1998	1999	2000
Gross Farm Income	149,779	165,394	167,891	182,413	219,470
Total Expenses*	138062	160737	196561	212799	214236
Net Farm Income	16288	9155	-25910	-28892	8590

*Operating costs, depreciation, interest

Trends in GFI, total expenses and operating profit (EFS) is illustrated in Figure 4.5.

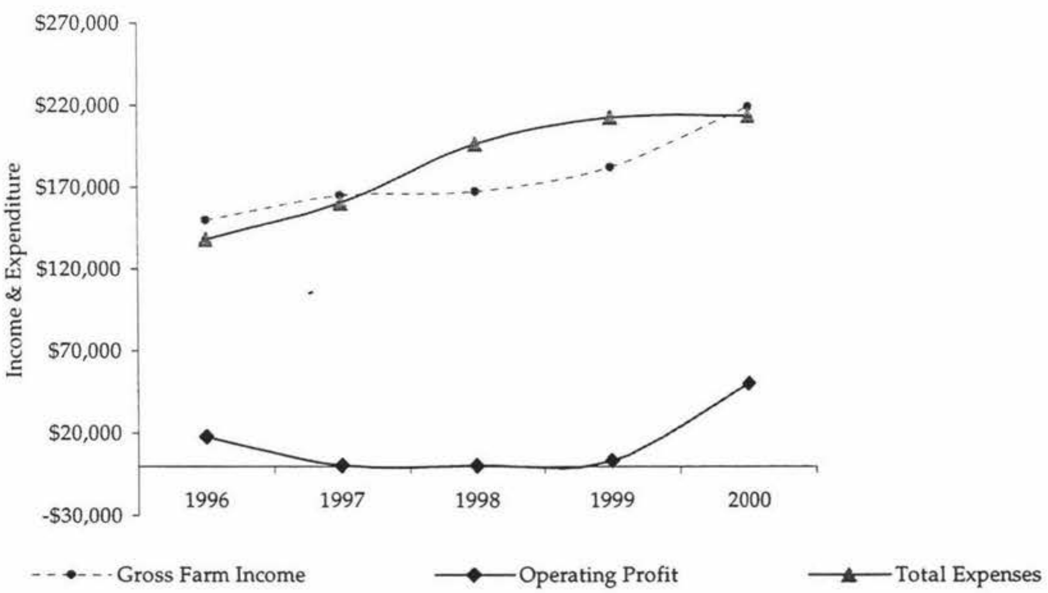

Figure 4.5 Income and expenditure trends for case farm two

The lack of balance between gross farm income and total expenses is revealed in the chart. This has come through the average increase of operating expenses by 15% in these two years (1998 and 1999) while the gross farm income improved by only 5%. The Economic Farm Surplus shows a discernable upward trend.

Operating profit (EFS) exhibited a significant variation dropping to values close to zero in 1997 and 1998, and going up to $50,000 in 2000 (Table 4.21). The operating profit is very low for the last four years, except for 2000. It increases risks and questions the operating sustainability of the business. Operating profit margin figures are poor ranging from 0.1% to 23%. It means that very little money generated by sales is left as an operating profit.

Table 4.21 Revenue generation analysis for case farm two

Revenue Generation	1996	1997	1998	1999	2000
EFS (adjusted)	17,465	110	655	3,941	50,085
NOPAT	12226	77	458	2444	35059
Operating Profit Margin	11.7%	0.1%	0.4%	1.9%	22.8%

Return on assets (ROA) and return on equity (ROE) were calculated excluding and including farm capital gains and losses (See 4.2.5). Return on assets for property business ranged from -7% in 1997 to 4% in 2000. The return for farming business varies from zero to 4.5%. These indicators are very low due to low operating profit.

The combined return has modest figures, which results from the low return on both property and farming businesses. ROE is negative for all years. This is result of low operating profit and higher interest commitments due to the significant increase in liabilities.

Table 4.22 ROA and ROE for property business and farming business

	1996	1997	1998	1999	2000
EFS (adjusted)	17,465	80	630	3,366	50,055
NOPAT	12,226	56	441	2,356	35,038
Total assets (Market Value)*	1,709,434	1,715,671	1,590,659	1,699,066	1,673,485
Total liabilities	447,102	528,354	496,373	799,123	805,099
Property business ROA post-tax	0.4%	-7%	7%	-2%	4%
Farming business ROA pre-tax	1.6%	0.0%	0.1%	0.3%	4.5%
Combined post-tax return	1%	-7.28%	7%	-1%	6%
ROE	-1.7%	-3.3%	-3.5%	-4.5%	-1.0%

*Total assets in 2001 was estimated in 1,740,424

Table 4.23 give a summary of the business's capital efficiency. Capital turnover ratio has remained quite stable without significant improvements. It averaged 15% over the last five years. It indicates that the increase in gross farm income generated was proportional to the increase in the asset values.

Table 4.23 Capital efficiency analysis for case farm two

Capital Efficiency	1996	1997	1998	1999	2000
Capital Turnover Ratio	15%	15%	15.0%	15%	18%
Fixed Cost %	37%	39%	29%	34%	40%
Cash operating exp. % GFI	63%	63%	87%	80%	62%

Similarly, fixed costs remained relatively constant. However, it peaked in 2000 at 40% mainly due to interest commitments as new borrowings were made. Cash operating expenses remain high consuming a significant proportion of the income generated. They increased from 63% in 1996 to 80% in 1999 dropping to 62% in 2000.

4.3.7 Sustainable Business Growth

The indicators of business growth are given in Table 4.24. The Sustainable Business Growth figures have been consistently negative over the past four years. It reveals that the business is not being able to generate sufficient income to create value; therefore the long-term financial sustainability is under threat. This issue should be addressed focusing on debt reduction, improving operating profit and rationalizing expenditure.

Table 4.24 Sustainable business growth analysis for case farm two

Growth	1996	1997	1998	1999	2000
Cost of Debt					
Total Cost of debt	27339	27733	26879	30757	41285
Cost of debt (%)	6.1%	5.2%	5.4%	3.8%	5.1%
Cost of equity					
Extracted cost of equity	(22,053)	(20,832)	16,560	(13,218)	7,495
Cost of Equity (%)	-3.90%	-3.57%	2.66%	-3.37%	1.76%
Extracted cost of capital	5286	6901	43440	17539	48780
Cost of capital (%)	0.52%	0.62%	3.88%	1.47%	3.96%
Sustainable Business Growth	6,940	(6,824)	(42,981)	(15,095)	(13,721)
NPV (Productive Value)	2,342,911	12,398	11,800	166,016	884,996

The cost of debt averaged 5% over the past five years and it is expected to grow in future due to new borrowings. Cost of debt is showing an upward trend (R^2= 0.65) as illustrated by Figure 4.6. Equity costs are negatives due to off-farm income coming from another source. In 2000, the business decreased its reliance in off-farm income resulting in a positive equity. Equity cost is also expected to increase as a result of education commitments as they wish to provide full support to their children.

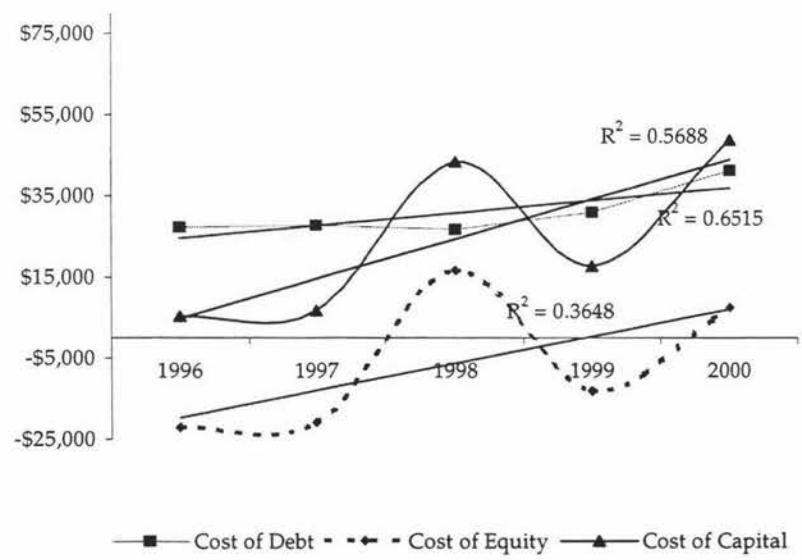

Figure 4.6 Cost of capital analysis for case farm two

Despite low contribution of off-farm income in 2000 year, it is more than likely that the business will continue to finance its activities using income from another source.

Overall cost of capital averaged 2.0% and it has been trending upwards as shown by Figure 4.6 (R^2= 0.57).

4.3.8 Summary

Financial figures derived from multiple-enterprises were consolidated for the sake of simplicity. Business structure is represented by three entities e.g. farming partnership, family enterprise and family trust.

Asset values have improved over the last five years despite a significant capital loss that occurred in 1999 due to government revaluation. Such a loss was offset by the acquisition of a new block that added $200.000 dollars to assets. However, it required an additional borrowing of $250.000. Liabilities have been trending upward. This was driven by additional borrowings made in 1999 that increased debt level by 70% going from $469.374 in 1998 to $799.123 in 2000. The current debt level is still high and the business has a debt to asset ratio of 65%. This is leading the business into a financially risk position but debt servicing capacity is still below 30%.

Gross farm income and farm expenses exhibit an increasing trend. GFI has increased due to expansion of production basis (number of animals sold), production efficiency and strong stock market prices. The total expenses matched GFI in 1997 and exceeded it in the following two years, 1998 and 1999. Consequently, operating profit was very low and reduced to zero over this period. The low operating profit indicates lack of business profitability. Similarly, operating profit margin is poor. However, it showed a substantial increase in 2000 to 23% compared with the previous year.

Due to the low operating profit (EFS) both property and farming businesses ROA are very low ranging from negative values to 4%. ROE has shown negative values for all financial years analysed due to increase in interest commitments. Capital turnover indicator has remained stable at 15%. This is because GFI has increased in a similar proportion of total asset valuations.

Sustainable business growth figures suggest that the business is not sustainable. Reinvestment in the business was only possible in the first year of the analysis. The last four years the operating profit generated has been insufficient to meet the funding cost of the business. Care should be taken when interpreting these financial results. Some poor performance indicators are the result of several interacting factors, as follows:

Transition – The farm has experienced a radical transformation since 1999. There was a production base expansion, a new sheep breed has been introduced, the cattle policy is changing and breeding ewes and cows were introduced from other properties.
Investments- As the new block was purchased in 1999; there were a lot of investments and capital expenditures. Some of these items are quite hard to be identified in the farm accounts, which may be inflating farm expenditures. Also, it adds an additional difficulty in making accurate adjustments. In addition, the farm had a transition period to organic farming.
Debt commitments- there is no doubt the farm operation increased its debt situation over the last years. A significant part of this debt was due to acquisition of the new block of land. It is expected that when this piece of land achieve its full production capacity, the whole farm will gain in terms of scale and additional income will be created. In the long-term perspective, case study two should be looking on improving production efficiency (lambing and calving percentage, improved pastures, building soil fertility), and rationalize farm expenditures, restructure debt (lengthen term, reduce interest).

4.4 Modelling Analysis

4.4.1 Introduction

Analysis of the farm systems was undertaken using the decision support model Stockpol®. The current enterprise was modelled as the "base", then alternative systems were constructed to answer "what if" scenarios in relation to that base. Stockpol® was used to test the both biological feasibility and undertake a preliminary assessment of direct costs of the alternate policies. The production and management options were then compared to the base. The model also allowed the performance of the alternative farm management options; (i) Intensive beef cattle and lamb finishing systems and (ii) organic to be assessed.

The preliminary assessment of profitability of the alternative systems was compared by Stockpol® using the gross margin analysis within the model. Gross margin is the difference between gross income earned and variable cost incurred. A full economic and risk analysis was completed in the next section, using Excel® spreadsheets and @Risk software. The alternative options for investment were formulated based on the information collected during the interviews and discussion with Alec Mackay, scientist from AgResearch.

4.4.2 Modelling Case Farm One

4.4.2.1 Farm description

Farm one is situated in Hawkes bay, North Island. The hill country property supports a sheep and beef cattle breeding unit with some finishing. The resources description is as follows:

Effective hectares	1130 ha
Number of paddocks:	53 (2-120 ha)
Altitude:	500-600 meters above sea level
Contour:	1% flat and 99% hills
Soils:	50% papa soils (erosion prone) hill country and 50% fine pumice and light ash soils (free draining qualities on a rolling to hill landscape)
Olsen P and pH:	7 to 11 and pH 5.6
Average rainfall:	1500 mm
Climate:	Characterized by cold winters and predictable wet summers.

4.4.2.2 Enterprises

Sheep policy: The property wintered 2800 mainly Perendale breeding ewes and 850 ewe hoggets replacement in 2001. Most of the non-replacements are sold from January to May and some are carried out over the winter and sold as wethers. Ewe lambs are not mated. Lambing begins August 26. Average lambing percentage is 110%. Better feeding of hoggets and ewes is one of the key objectives of the stock management policy.

Beef policy: The beef enterprise is based on approximately 410 breeding cows. Historically, an Angus cow herd with Angus bulls. Calving begins August 30 and replacement heifers are bred on the farm, first mated 26 months. Calving percentage averages approximately 85%. All calves are now left entire. Some weaners are sold at the autumn due to feed shortages or market reasons. Remaining non-replacements are wintered twice and sold at 26 months.

4.4.2.3 Modelling Results for Case Farm One

Table 4.25 summarises the current state of the farm "base" and the two alternative policies investigated: (i) Full organic and (ii) Conventional with beef intensification.

"Base": Currently, farm is a breeding unit with some finishing stock. This was considered the "base" system. In five years, it was forecasted that this property could increase stock numbers, change sheep to cattle ratio, raise production levels in conjunction with animal performance and finish all cattle.

Table 4.25 Stock numbers and performance for alternative course of actions for Case Farm Study (CFS) two

	"Base"	Full organic In five years	Beef intensification In five years
Total SU	8522	10001	11173
Total ha	1130	1130	1130
SU/ha	7.5	8.9	10
Sheep SU	3722	3900	4800
Beef SU	4800	6101	6373
SC Ratio	44:56	39:61	43:57
Yield (kgDM/ha/yr)	8165	8488	9266
1st July Pasture cover	1476	1589	1864
Lamb Wean %	106.5	120	120
Lambs Weaning weight (kg)	22.7	22.0	26.3
Calf Wean %	86.4	85	91.3
Calves Weaning weight (kg)	213	242	242
Wool kg/SSU	5.7	5.8	5.8
Lamb Sale Wt	31.5	31.8	41.4
Beef Sale Wt	335.7	262.7	501.5
GM/ha ($)	**380.2**	**550.8**	**649.9**

(b) "Full organic: Under full organic status, the production base will increase through both an increase in stock numbers and reproduction rates. Stock units per hectare increase from 7.6 to 8.9. The model considered all the cattle stock being killed at 18 month rather than being sold in the store market. The lambing percentage increase by 10% and lamb growth rates improved by 24% (85 vs. 107 grs/day) due to better pasture management (more cattle in the system) and introduction of Texel rams over 70% of the flock, which bring hybrid vigour. Premium prices assumed for each policy are shown in the Table 4.26.

In order to finish all the stock a terminal sire, Charolais, was introduced over 60% of herd to promote faster live weight gains and hybrid vigour in the calves. This strategy allows the steers to be killed at 18 months (260 kg cwt) while in the current system the animals are traded in the store market (458 kg Lwt). Cattle growth rates ranged from

0.3 to 0.8 kg/day. The current situation assumes that only 20% of the lamb crop achieved Bio-Gro organic standard (conversion process) with a price premium of 30%.

Five years under the organic option, 70% of all finishing stock will achieve Bio-Gro specification with a premium of 30% for lambs and 20% for cattle. Further details about premium prices and proportion of animals reaching organic standard is provided in the Table 4.26.

Table 4.26 Summary of price premium assumptions and percentage of stock reaching organic standards

Stock Class	Proportion reaching Organic Standard (%)		Organic premium (%)
	Base	Organic	
Wool	0	70	20
Cull Ewes	0	100	20
Lambs	20	70	30
Cull cows	0	100	10
Steers	0	70	20
Weighted average		Farm one	16
		Farm two	17

(c) Intensive beef: Option two assumes a more intensive finishing cattle systems carrying more stock unit per hectare (10 SU/ha). This policy considers the property as being farmed conventionally using all the technology available without any premium prices.

The lambing and calving percentages are 120% and 92%, respectively. Nitrogen is used strategic on 35% (400ha) of the farm twice a year, autumn (40 kg N/ha) and spring (40 kg N/ha), to maintain cattle and lamb growth rates along with drench treatment.

Both enterprises, sheep and beef, used terminal sires. Live weight gains for cattle ranged from 0.5 to 1.2 kg/day. Growth rates for lambs averaged 160 grs/day ranging from 80 to 250 grs/day.

Table 4.27 Summary of stock sales from each policy for case study farm one

Stock policies for CSF one	
Base	• 1304 lambs @ 15 kg cwt • 155 cattle as R1 & R2yr steers @450 kg Lwt store market
Full organic	• Finish 1704 lambs @ 16 kg cwt • 100 cattle as R1yrs heifers @ 200 kg cwt • Finish 20 cattle as R2yrs heifers @ 220 kg cwt • Finish 105 cattle as R1yrs steers @ 260 kg cwt
Intensive beef	• Finish 2532 lambs @ 17 kg cwt • Finish 28 cattle as R2yrs heifers @ 242 kg cwt • Finish 267 cattle as R1yrs steers @ 281 kg cwt

Both the full organic and intensive beef (conventional) were biologically feasible by the Stockpol® model. They required, however, an adjustment in pasture production to meet animal demand. Pasture production under full organic increased by 4% (8165 vs. 8488 kg DM/ha/yr) compared to the "base" system. Similarly, intensive beef by carrying more SU/ha and higher animal performance required an improvement of 13.5% in dry matter production compared to the base system (8165 vs. 9266 kg DM/ha/yr), respectively.

Profitability analysis reveals that both the full organic and intensive beef improved the financial returns of the property. Modelling with Stockpol® found gross financial return increased by $170/ha and $270/ha with the implementation of full organic and intensive beef, respectively. The substantial increase in the financial returns is mainly due to the lift in stock numbers and prices received for stock. Improvements in stock prices were the result of a higher proportion of animals reaching Bio-Gro standard after five years for full organic policy. For intensive beef, stronger prices were due to heavier carcass weights (Table 4.27).

4.4.3 Modelling Case Farm Two

4.4.3.1 Farm description

Farm two is situated approximately 120 km South of Dunedin, South Island. The hill country property supports a sheep and beef cattle breeding unit with some finishing.

The resources description is as follows:

Effective hectares:	500
Number of paddocks:	90 (2 - 30 ha)
Altitude:	0 – 300 meter asl.
Contour:	10% flat, 20% rolling and 70% hill
Soils:	Yellow brown earth
Olsen P and pH:	10 to 15 and pH 5.3 to 5.8
Average rainfall:	850 – 1000 mm
Climate:	Mild winter with moisture summer

4.4.3.2 Enterprises

Sheep policy: The property wintered 2650 mainly Romney x perendale breeding ewes and 800 ewe hoggets replacement in 2001. Rams were Finn x Texel and Texel x Suffolk. Better feeding of hoggets and ewes is a priority. Stock is closely monitored, with weighing, assessment of feed intake, assessment of parasite levels as a regular activity, etc. Lambing begins September 20 and the average lambing percentage is 130%. The first lamb draft occurs in early January. All the non-replacements sheep are sold until May.

Beef policy: The beef enterprise comprises approximately 150 crossbreed cows to which Charolais and a composite breed called Stabilizer have been introduced. Calving begins September. All replacements are bred on the farm and are mated as yearlings. Calving percentage averages 89%. All non-replacements are wintered twice and sold at 26 months. The target is to sell surplus heifers and steers at a finished weight of 260 kg cwt. However, these stock classes can be sold earlier for feed shortage or market reasons.

4.4.3.3 Modelling Results for Case Farm two

Table 4.28 summarises the present situation on the case study farm "Base" along with a full organic in five years and more intensive beef and sheep finishing operation.
(a) "Base": Similar to case farm one the current situation is a breeding unit with moderate cattle finishing. (b) Full organic: Five years out, the option considered the farm to continue being organic with more aggressive finishing policies for beef and lambs. The lambing percentage increased by 7% and sheep to cattle ratio has changed

to achieve better parasite control as grazing pasture with sheep and cattle reduces larval population. Lamb growth rates assumed are higher varying from 80 to 180 grs/day. Lambs were killed at carcass weight ranging from 15.5 to 17 kg. All ewes were crossbreed with a terminal sire Texel. Approximately, 15 hectares of forage cropping ("clean" pasture) are allocated to the lambs over the summer to sustain growth rates. Over the winter, young stock has a priority to graze in Swedes paddocks.

Table 4.28 Stock numbers and performance for alternative course of actions for Case Farm Study (CFS) two

	"Base"	Full Organic	Lamb/beef intensification
Total SU	4548	5126	5767
Total ha	500	500	500
SU/ha	9.1	10.3	11.5
Sheep SU	3287	2921	3242
Beef SU	1261	2205	2525
SC Ratio	72:28	57:43	56:44
DM yield (kgDM/ha/yr)	8287	9211	9409
1st July Pasture cover	1515	1833	1530
Lamb Wean %	127	135	142
Calf Wean %	89.3	93	89.8
Wool kg/SSU	5.9	5.5	6.0
Lamb Sale Wt	35	37	43.9
Beef Sale Wt	221	548.6	565.9
GM/ha ($)	**632.9**	**827.6**	**903.3**

(c) Intensive beef and sheep: Under this option more animals, higher growth rates, greater pasture production and animals are killed at heavier carcass weights. Lambing percentage is 142% and stock numbers increased by 2.4 SU/ha compared to base situation. Beef cattle growth rates improved through the use of terminal sire over dairy crosses dams.

The finishing policies of the three options are summarized in Table 4.29.

Table 4.29 Summary of comparison of stock policies modelled for case study farm two

Stock policies for CSF two	
Base	• Finish 2656 lambs @ 14.5 kg cwt • Finish 29 cattle as R1yr steer @270 kg cwt
Full organic	• Finish 2630 lambs @ 16 kg cwt • Finish 12 cattle as R2yrs heifers @ 280 kg cwt • Finish 97 cattle as R1yrs steers @ 287 kg cwt
Beef & sheep intensification	• Finish 2848 lambs @ 19 kg cwt • Finish 12 cattle as R2yrs heifers @ 310 kg cwt • Finish 107 cattle as R1yrs steers @ 315 kg cwt

Premium prices assumed for gross margin analysis were similar to those used for case study farm one (Table 4.26).
The full organic and the beef policy were both biological feasible. It was necessary to increase pasture production to meet the higher animal intakes given to superior stock performance. Pasture production was lifted by 11 and 13.5% for full organic and intensive beef and sheep, respectively. The pasture production improvement from the base was quite realistic as more fertiliser is entering in the system along with more subdivision due to developing program in place.

Gross margin analysis suggests that both the full organic and intensive beef and sheep would lift the gross margin over the base by 31 and 42%, respectively over the next five years. Despite the absence of premium prices, the intensive beef and sheep option was the most profitable. This was due to the more intensive stock policy, more animals being finished at higher carcass weights in comparison with the "base" system (Table 4.28). Continuing with the organic policy with more focus on finishing lambs and cattle also produced a significant improvement in gross margin (31%). The improvement of gross margin figure for the organic system is in line with the findings reported by Mackay *et al.* (2000).

4.5 Risk Analysis

4.5.1 Case study One

Both farmers are concerned with long-term sustainable growth for their business. In order to measure the progress of their operations the "Sustainable Business Growth" (SBG) indicator was chosen as an indicator of economic sustainability. This efficiency measure is based on the concept that the income generated by the farm operation must exceed all cash expenses without detrimental effects on the environment, human and financial resources over the time (Shadbolt, 1998d). When the SBG equals zero it means that there is equilibrium but no growth and when this value is higher than zero it means that value has been created. This is a useful measure to assess the business' ability to grow and maintain sustainability finding a balance between human, financial and physical resources.

A target value can be calculated from the simulation results. These target values identify the probability of achieving a specific outcome e.g. the risk associated with a particular outcome (SBG). In this study, the target value chosen was zero (meaning equilibrium but no business growth) and $15.000 and $10.000 for CFS one and two, respectively. Basically, these last two targets mean that the business is developing its physical resources as well as being able to reward its human resources and meet its debt and equity commitments. The complete probability tables are presented in the Appendix three.

Figure 4.7 shows the probability associated with achieving a zero SBG over a period of 15 years for the CSF one.

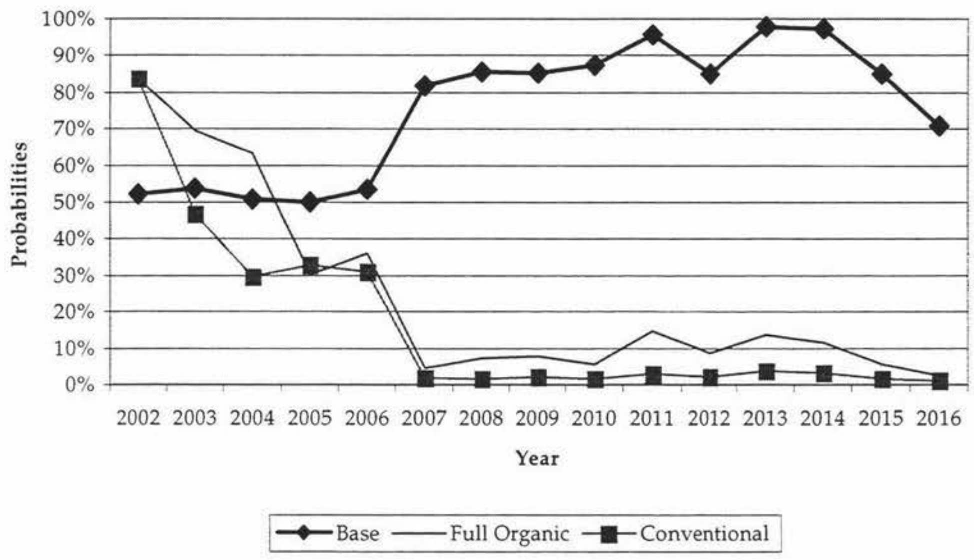

Figure 4.7 Probability associated with achieving a zero SBG or less

The base system shows moderate chances of occurrence of zero growth during the first five years of the analysis. The risk of zero growth increases in the following years due to equity cost requirements due to children education. The base system assumes no improvement in production over the years and a major risk is created by the increasing equity costs and the expenses of employing a manager (Farmer's goal). The analysis shows that this option is very unlikely to deliver a desirable growth for the business denoting an unsustainable economic viability.

The other two alternatives, conventional system and organic with a focus on improving productivity, illustrated a more desirable scenario. The risk is higher during the first quarter of the analysis due to an increase in debt commitments. This debt was created by the investment in fertiliser required to lift animal performance.

As the development is completed by the year 2005, the probabilities of unsustainable growth decline significantly. Despite the increase in labour costs (contracting a manager) by the year 2007 and equity costs in 2011 (children education), the probability associated with zero growth ranges from zero to 10%. It is of interest to note that although the organic option has lower animal production levels compared to the conventional alternative it exhibits a similar risk profile. This is probably associated with better prices due to the premium prices assumed. Therefore, premium price is important in reducing the risk associated with zero business growth.

The risk analysis was then carried out considering the ability of the business to achieve at least $15.000 SBG per year. In theory, this is the capital available for reinvestment in the business after all cash expenses and capital costs are covered. In another words, it means that the farm operation is generating enough income to pay operational expenditures plus cost of capital. The Figure 4.8 illustrated the probabilities associated with achieving a minimum business growth of $15.000 dollars annually.

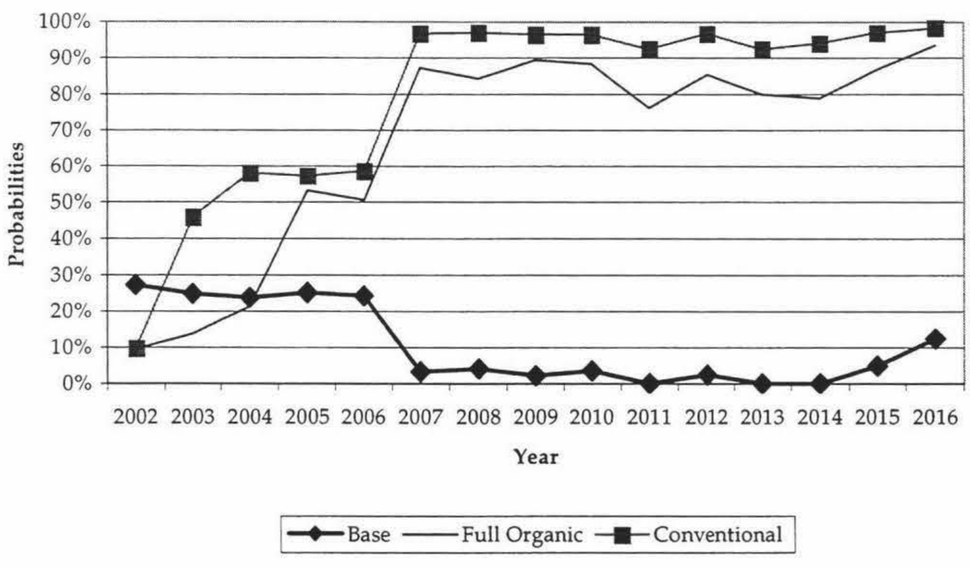

Figure 4.8 Probability associated with achieving a $15.000 SBG

Clearly, the business growth perspective seems to be more desirable for both the conventional and the organic alternatives. Both policies increase their chances of success after full development is finished by the year 2005. The chart shows a slight advantage for the conventional option where there is an approximately 100% chance that the business will delivery at least $15.000 dollars per year from 2007 to 2016.

Meanwhile, uncertainty is slightly higher for the organic option as the chance of creating value ranges from 80 to 90 %. This occurs due to the conventional option producing more consistent outcomes without as much variation as that exhibited by the organic option.

The tolerance of risk is unique for each individual. For instance, during the years 2011 and 2014, the probability of creating value for the business is about 80%. Some farm managers would be very comfortable with this figure while others would prefer to see 100%. This is when the manager's attitude towards risk assumes importance as each individual may interpret the same result differently. Therefore, it could lead to a quite distinct course of business action.

The major risks for both the full organic and conventional operation occur during the development stage from year 2002 to 2007. The risk is significant over this period due to debt repayment and interest commitments related to the actual debt of the farm and the loan necessary to increase fertiliser inputs. Once the debt situation improves, a moderate risk is added during the 2011 and 2014. During this time the increased uncertainty of SBG is due to equity costs as the family is likely to increase drawings to afford children's education. This risk is manageable, a smart decision for this business would be focus on building up cash reserves during the post-development years and consequently improve owner's equity to manage the future risk situation.

The next series of graphs summarize the variation in NOPAT for the base system and the organic and conventional options. The centreline represents the trend in the mean of the NOPAT distribution over 15 years. The two outer bands above the centreline are 1 standard deviation above the mean and 95th percentile. The outer bands below the mean are 1 standard deviation below the mean and the 5th percentile (Palisade, 1997). For instance, if a figure of $100.000 is located in the 95th percentile range, it means that only 5% percent of the figures will be above this value while 95% of values fall below $100.000. The Figure 4.9 shows the NOPAT distribution for the base system over a period of 15 years.

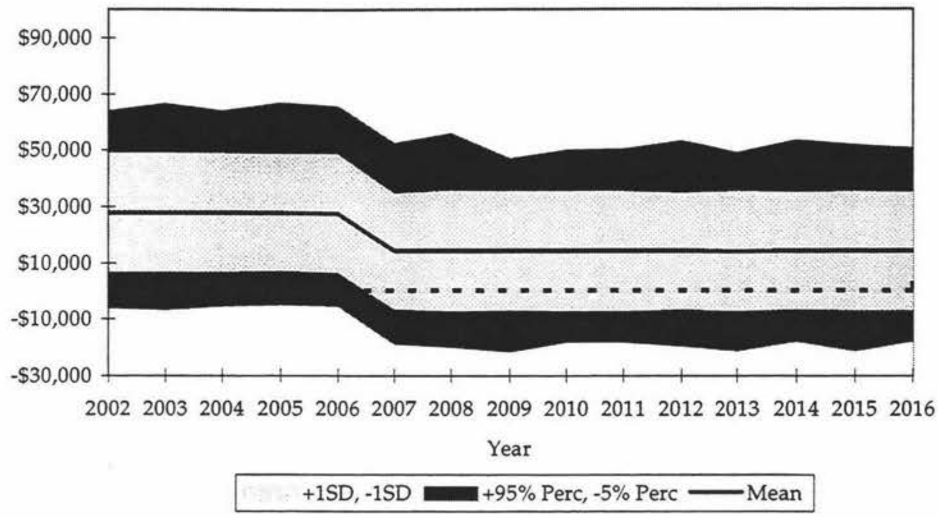

Figure 4.9 NOPAT distribution for the "Base" system

The NOPAT mean decrease after the year 2007 due to the extra costs associated with contracting a full time manager, as the farmer wants to reduce his commitments with farming activities. The range of possible outcomes can show the negative value up to $10.000 to a positive figure up to $70.000 per year.

In another words, the analysis suggests that this system does not produce a consistent positive NOPAT results when the market price variability and production uncertainty is taken into account. Therefore, it will always carry the risk associated with achieving negative returns. This occurs due to a moderate animal productivity and the absence of premium prices. This farm has room to improve production and this scenario was tested as illustrated by the organic and conventional options.

The charts below show the NOPAT pattern for the organic (Figure 4.10) and the conventional alternatives (Figure 4.11).

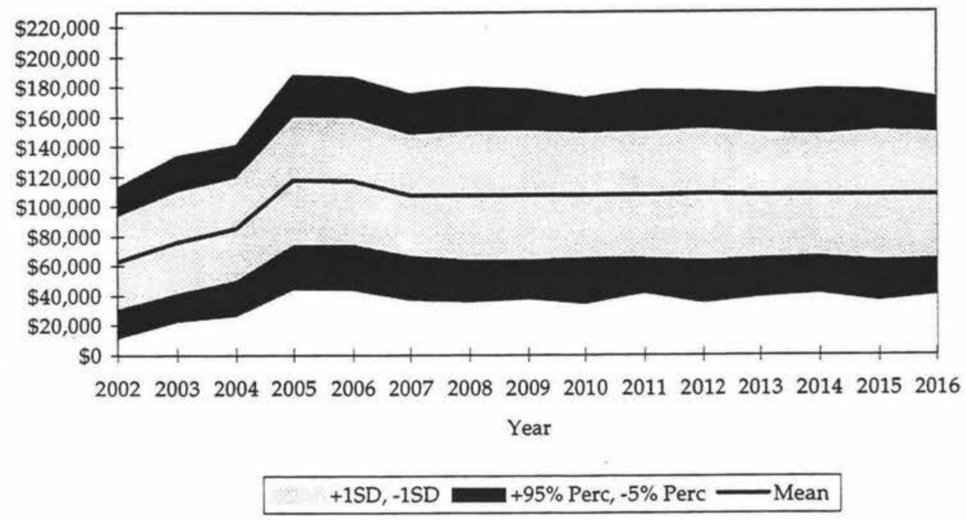

Figure 4.10 NOPAT distribution for the organic system

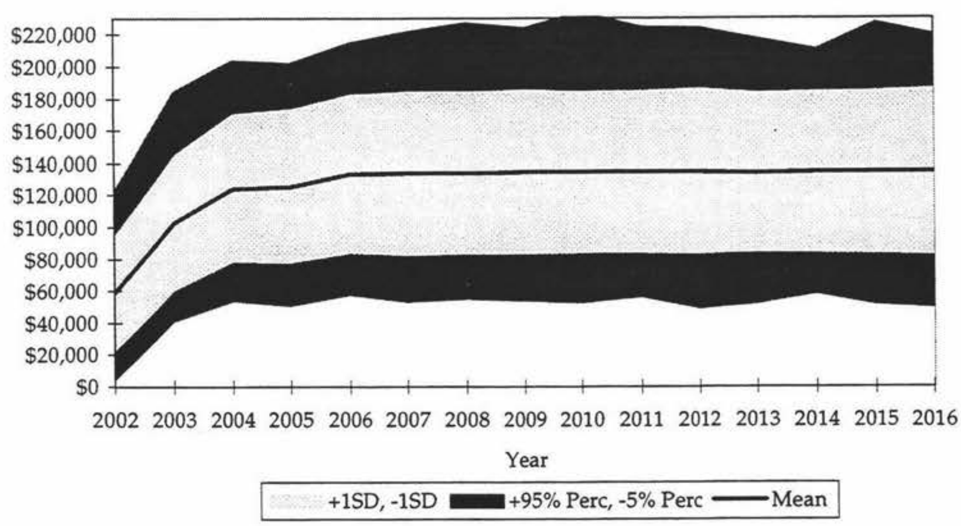

Figure 4.11 NOPAT distribution for the conventional system

Both options exhibit an increasing trend in NOPAT mean due to improved production from the fertiliser investments. The organic system, however, has a slight reduction in the NOPAT mean by the year 2007 when a full time manager is contracted. This business decision is necessary in order to allow the farm owner to reduce his commitment with farm activities and allocate more time for promoting and marketing his products. Consequently, it will bring more certainty to guarantee premium prices, which is important for the profitability of this system.

After the development phase is completed, the NOPAT mean is $107.000 and $134.000 for organic and conventional alternative, respectively. These results were obtained using conservative premium prices as market signs indicate that higher premiums can be achieved (A. Mackay, August, 2001 personal communication). Thus, using better premium prices this NOPAT difference between the two alternatives may not exist.

It is of interest to note that the conventional system has greater (wider band) range of outcomes in comparison with the organic option. This denotes that there is more uncertainty associated with the outcomes produced by the conventional option. This finding fits into case farm one's risk profile. He is a risk-averse manager, therefore he prefers a farm system that offers less variability.

Both systems are exposed to the market risk expressed by the historical price variation assigned by the model. However, the organic system receives a premium price, which may be working as a mechanism to reduce the outcomes variation even when poor market prices occur. The next section highlights the influence of the premium price based on the results obtained with Tornado graphs.

Another possible explanation is that beef prices exhibit greater variability than lamb prices. As the income for the conventional option rely more on cattle operation, this variability may be creating a more risk as observed in the range of outcomes generated. Furthermore, the break-even price analysis for beef has shown more uncertainty associated with the conventional system.

In addition, the conventional system is more intensive in terms of animal production, which demands more dry matter to achieve the specific targets. So, when the different dry matter scenarios were run in the Stockpol®, the years with poor pasture production seem to have a more severe effect on the numbers of animals sold in comparison with the organic system. Consequently, there is more variation in terms of the number of animals sold annually in the conventional option.

The model results are also presented using Tornado graph tool present in the @Risk®. This type of graph shows the sensitivity of each output variable to its input variables.

The most significant input (volume of sales, premium prices and stock prices) is shown at the top of the graph with the longest bar. The X-axis represents the percentage change in the output value (NOPAT in this case) and each input variable is chartered on the Y-axis (Palisade, 1997). The results were calculated for a one specific year in time (2010) after the full development is completed. This was done in order to avoid being repetitive presenting results of 15 years series as described in the model.

The Figure 4.12 shows the effect of input variable influencing the NOPAT. Clearly, market price is the major force determining the outcomes figures followed by volume of sales. Lamb price and wool price were ranked first. Steer and heifer income were ranked in fourth position suggesting that this enterprise is relatively less important than sheep enterprise. This is because in the base system most of the cattle are sold in the store market.

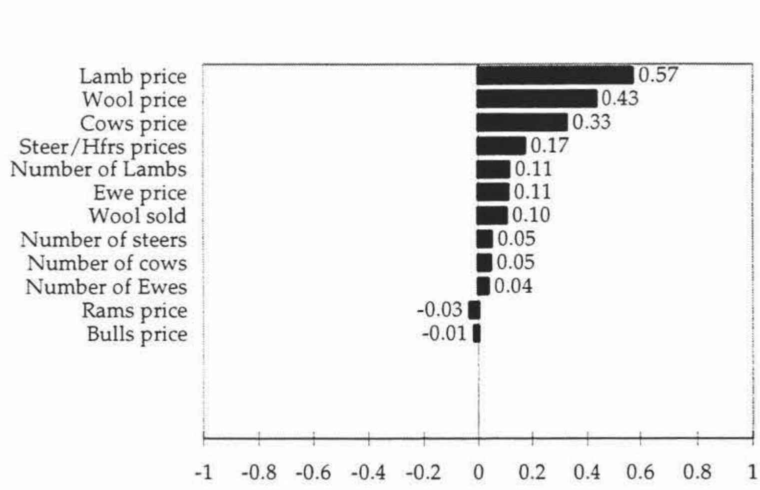

Figure 4.12 Regression Sensitivity for NOPAT – "Base" system

By contrast, the cattle enterprise assumes more significance in the organic system as observed in the Figure 4.13. This is because the organic policy focuses on beef cattle intensification trying to finish most of the steers rather than sell at the store market as occurs with the base system. The model considered premium price as an input variable affecting each income item. Therefore, premium has some influence in the NOPAT for the organic system, particularly, the premium for beef prices. Similarly to the base system, stock prices were ranked first followed by the volume of sale. It highlights the importance of market risk influencing the final results.

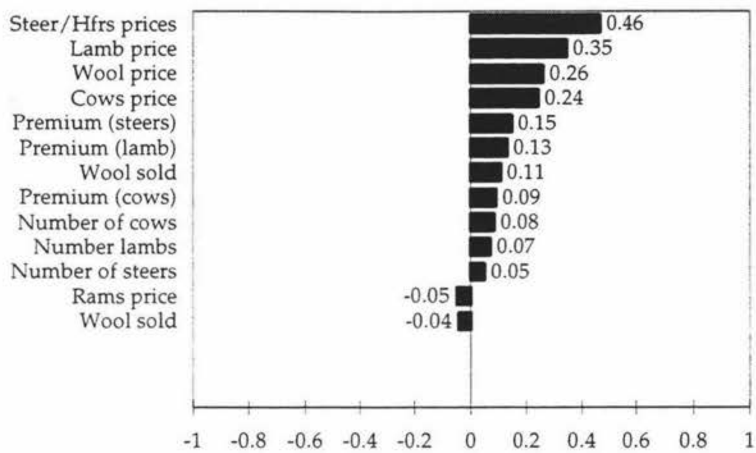

Figure 4.13 Regression Sensitivity for NOPAT – Full organic option

The regression sensitivity for the conventional system illustrated the greater significance of the beef operation affecting NOPAT (Figure 4.14). As can be seen, both steer and cow prices were ranked first suggesting more importance of these two income items. The rank is then followed by sheep returns represented by lamb and wool prices.

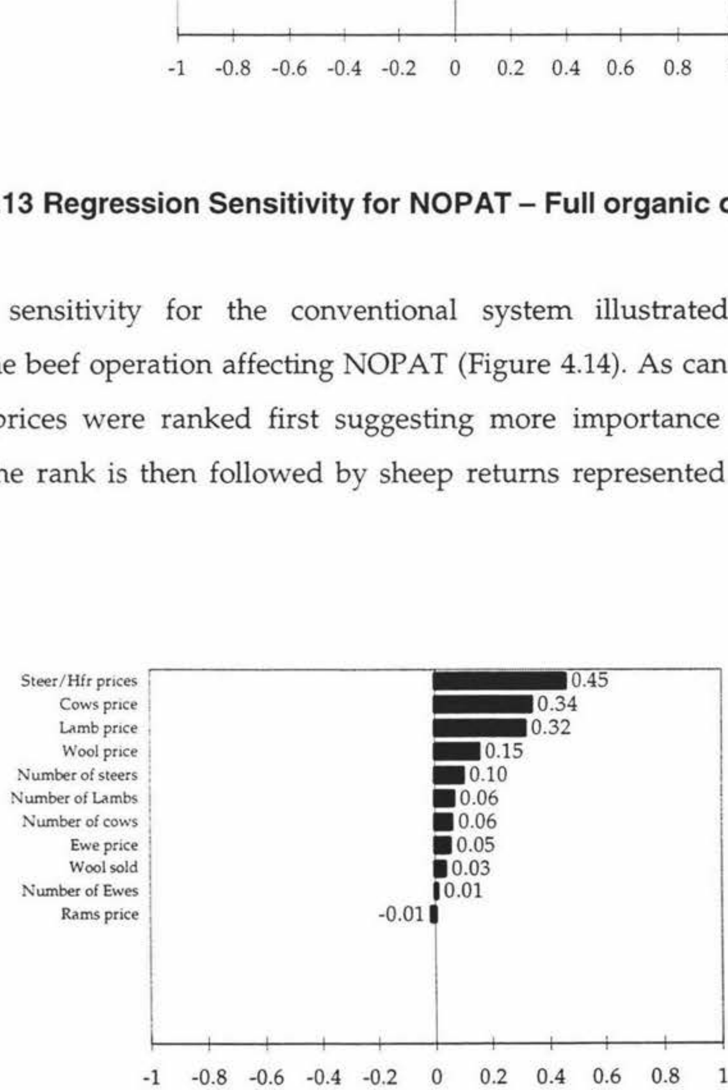

Figure 4.14 Regression Sensitivity for NOPAT – Conventional

4.5.2 Case study Two

The Figure 4.15 presents the risk associated with the three stock policies and its respective farming system and premium price assumptions (Table 4.26).

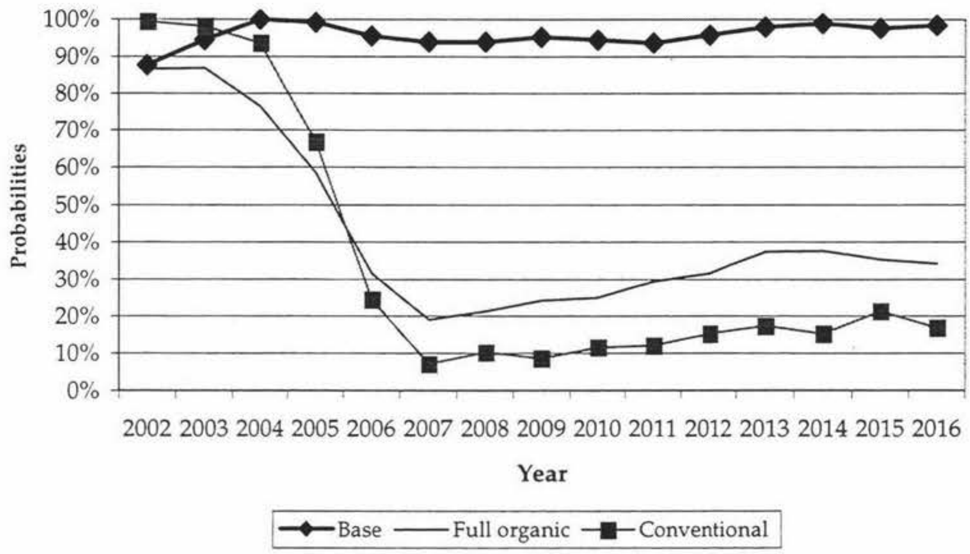

Figure 4.15 Probability associated with achieving a zero SBG or less

The base system option (partial premium), assuming no production changes over the next years, shows that it is very unlikely that the business will be able to generate enough income to be economically viable (Figure 4.15). This reinforces that the business requires adjustments in order to support the current cost structure and achieve growth. Interest commitments and debt repayment are the variables largely responsible for the high cost of capital, which is limiting the growth for this operation.

By contrast, the forecast budget for the conventional and the organic options illustrate a better business position. Both alternatives exhibit a very similar risk profile. The chances of zero growth during the first three years are high due to the absence of premium prices and the continued developing status of production capacity for both options (growth rates, stocking rate ...etc.). After 2005, the production capacity is achieved and the risk associated with zero business growth is substantially reduced (Figure 4.16). The graph below illustrated the probabilities associated with the ability of the business to deliver SBG of at least $10.000 per year.

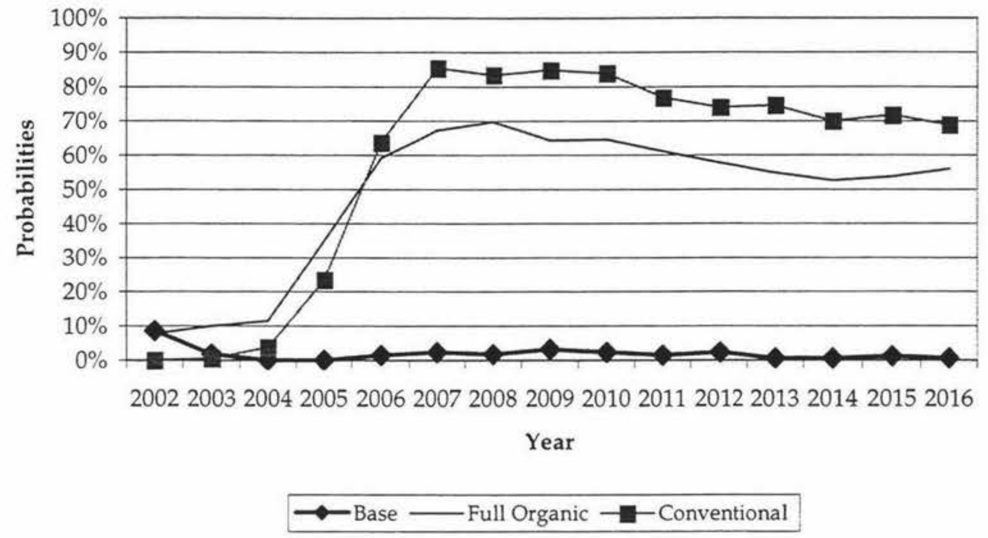

Figure 4.16 Probability associated with achieving $10.000

The base system shows an undesirable scenario where there is zero chance of achieving the target business growth. This system cannot generate sufficient income to pay for all the operational cost and meet the extracted cost of capital.

The other two options, full organic and conventional, increase the chances of creating value of $10.000 per year. This occurs due to the increase in animal production fuelled by fertiliser inputs and management. For the organic option, there is a synergy between production intensification and premium prices for most of the stock classes. However, the probability of achieving at least $10.000 per year ranges between 50% and 65% and 70% and 80% for the organic and conventional alternatives, respectively.

This situation is largely due to the debt commitments of this business as the principal is repaid in the later years. As stated before, risk is interpreted differently by different decision-makers. Some managers would be comfortable with a situation like this while others would prefer to increase the chances of achieving the target sustainable business growth.

The chart below shows the variation in NOPAT for the base system (Figure 4.17). The NOPAT expected values for the base option are described as a flat line with a wide distribution ranging from zero to a maximum value at $80.000. The distribution of the outcomes has a constant variation denoting that risk is involved all over the period analysed.

Moreover, the NOPAT figures are not big enough to promote a sustainable business growth for this operation as observed in the (Figure 4.17).

Also, the low NOPAT ($40.000) values make this operation more vulnerable to unforeseen events (not modelled), which may have a severe financial effect in this business.

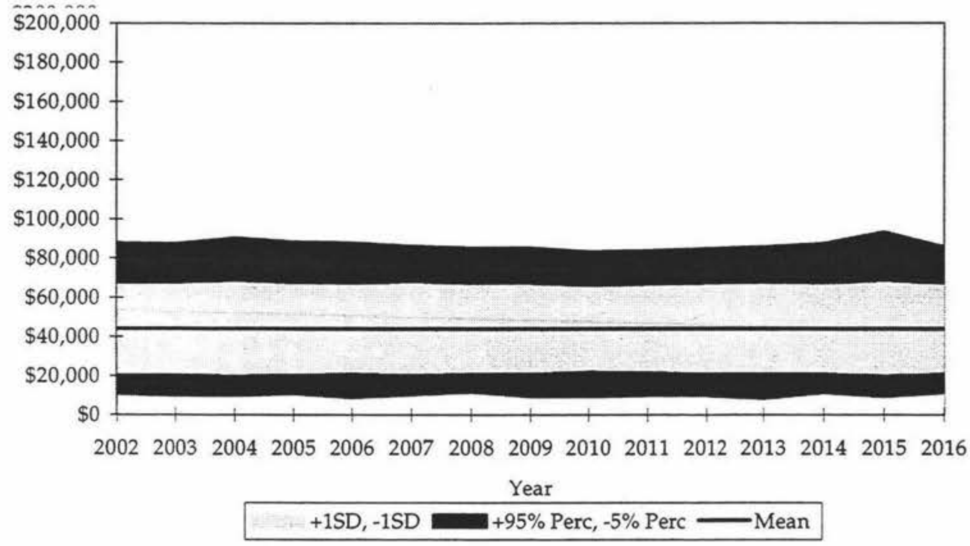

Figure 4.17 NOPAT distribution for the "Base" system

The NOPAT for the full organic alternative increases until 2006 when the full production capacity is reached. The NOPAT mean goes from $40.000 to $120.000 dollars due to improved carcass weights, premium prices for all stock classes and volume of sales (Figure 4.18). Also, the distribution is narrower during the first five years and become wider in the following years denoting more uncertainty over the time.

This uncertainty is probably caused by variation in market prices and premium assumption (modelled as discrete variables).

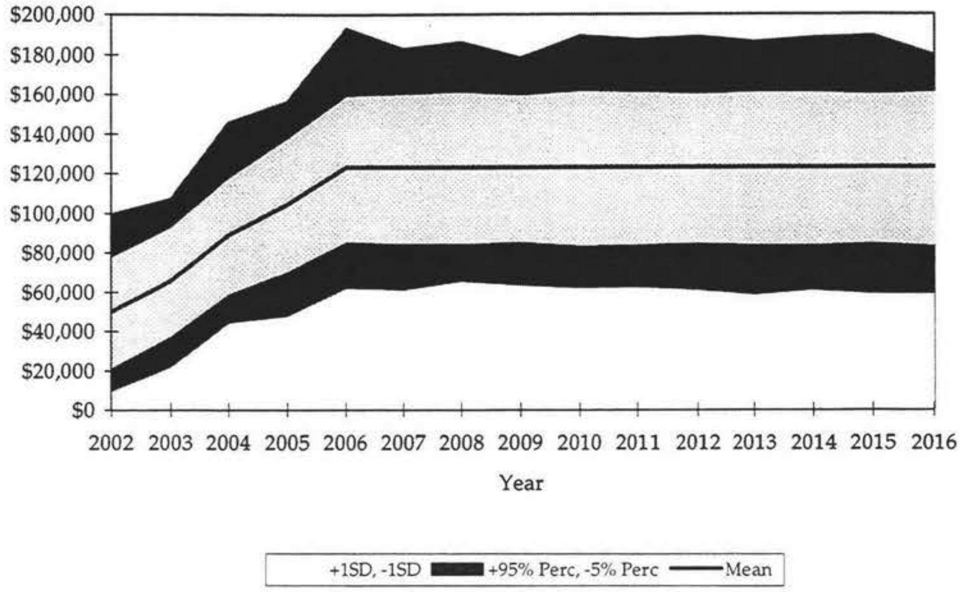

Figure 4.18 NOPAT distribution for the organic system

The conventional option also presented a substantial increase in the expected value of NOPAT (Figure 4.19). The initial level of NOPAT is lower than the other two alternatives (base and full organic) because there are higher costs associated with animal health and nitrogen and forage cropping (all other costs were similar). As the full development stage is completed, the NOPAT mean is slightly higher than the organic policy.

As with the organic alternative, the NOPAT distribution is narrower over the first five years of the analysis and gets wider over the time. In fact, the above outer band (95^{th} percentile) as well as the standard deviation is slightly higher than the NOPAT distribution for the organic alternative. However, both options exhibit a very similar risk profile.

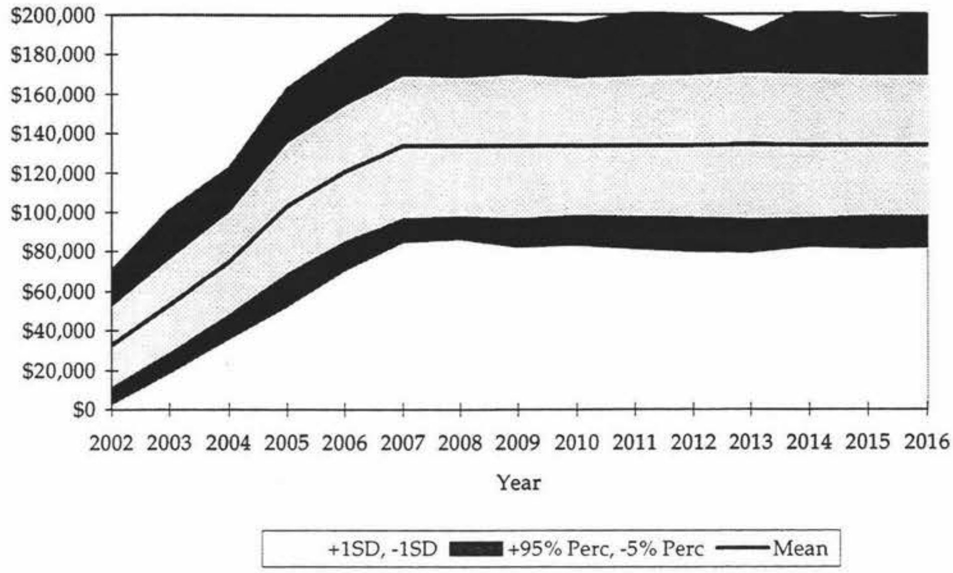

Figure 4.19 NOPAT distribution for the conventional system

The sensitivity regression analysis for the "base" system highlights the importance of sheep enterprise, lamb and wool prices along with number of lambs sold influencing the NOPAT (Figure 4.20). This occurs due to a significant proportion of sheep present in the system as evidenced in the sheep to cattle ratio 72:28.

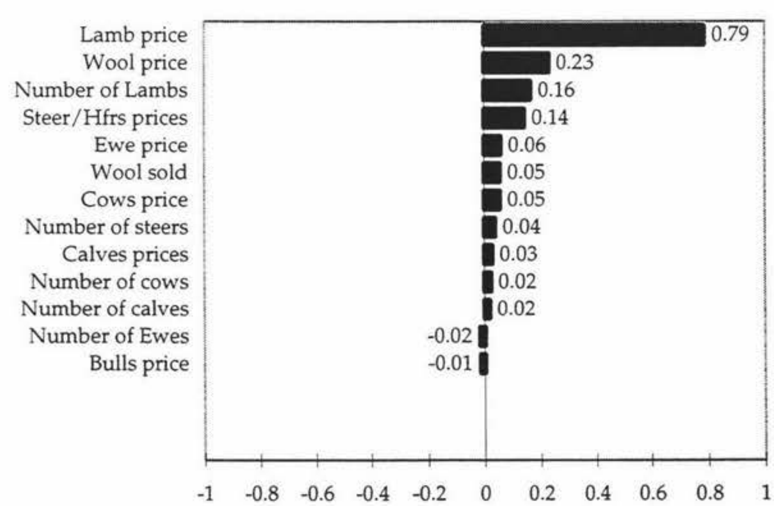

Figure 4.20 Regression Sensitivity for the NOPAT – "Base" system

The Tornado graph results for the organic system are presented in the Figure 4.21. The figure reinforces the magnitude of market price influence in the NOPAT. Lamb prices continue to determine NOPAT outcomes followed by beef prices.

It is interest to note that premium price for lamb also appears as an input influencing the final outcomes. Beef and wool premium were also identified in the analysis although of relatively less importance.

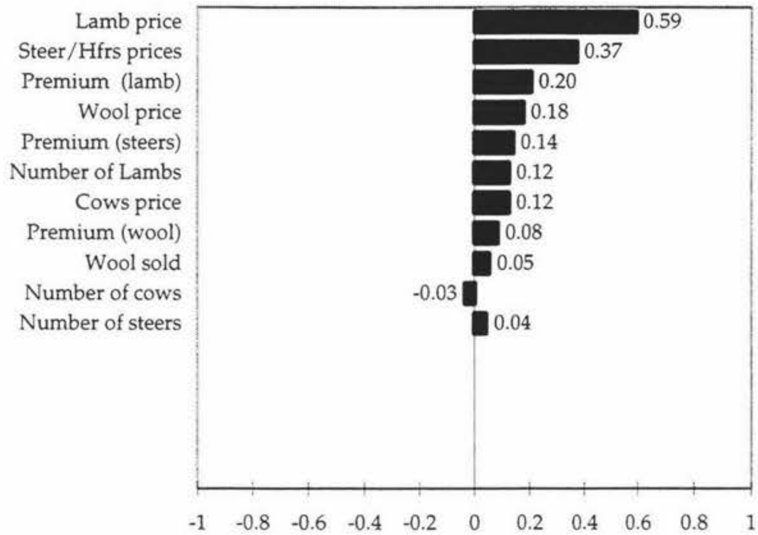

Figure 4.21 Regression sensitivity for NOPAT – Full organic system

The influence of input data in the NOPAT for the conventional system is similar to the organic alternative (Figure 4.22). Stock prices (market risk) seem to be the most important factor determining the final outcome followed by volume of sales (production risk).

The regression analysis shows that the influence of lamb and beef prices is higher in the conventional option rather than full organic system. This may be related to the heavier carcass weights that animals achieve in the conventional system, which in turn increases the financial return per stock.

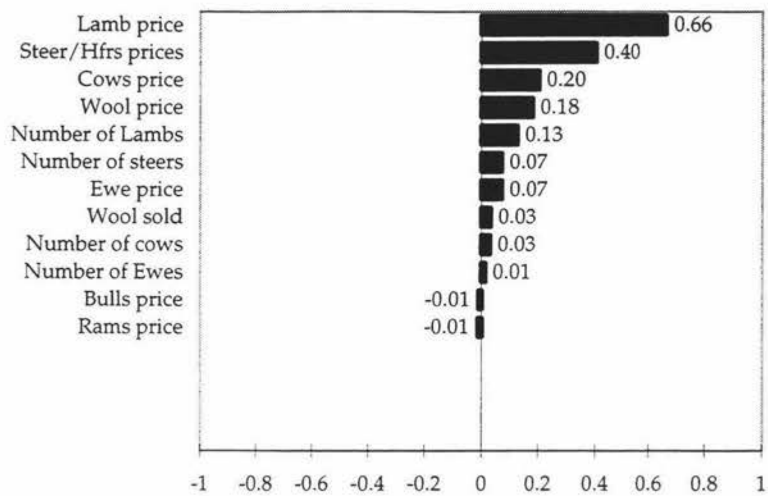

Figure 4.22 Regression sensitivity for NOPAT – Conventional system

4.6 The Activity Based Cost system (ABC)

4.6.1 Case Study one

The main overhead cost in farm enterprise is dry matter production (DM). The relative value of dry matter was also taken into account. The relative value is obtained dividing the average annual pasture growth rate (23.8 kg/DM/day) by the monthly pasture growth rate (PGR). This procedure attaches more value for the dry matter being consumed over the winter (5.29), as PGR is low. In contrast, the spring surplus in November/December is when the pasture consumed has a lower value in comparison with the rest of the year.

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Average
Kg/DM/day	4.5	7.2	17	31	43.4	40	35	24.6	21.3	28	24.4	9.3	23.8
Relative value	5.29	3.31	1.4	0.77	0.55	0.6	0.68	0.97	1.12	0.85	0.98	2.56	

This is an important approach as the farm expenditures are allocated based on dry matter consumed. Therefore, the enterprise, beef or sheep, with greater demand over the winter period for example will "pay" more for the dry matter consumed. Moreover, cost information must be detailed and accurate, therefore farming accounts were used as the main source of production costs. Thus, cost assessment is based on historical analysis from 1997 to 2000. Consequently, it represents costs associated with the conversion period as both participants were in the conversion process over that time.

The farm expenditures were allocated to the different enterprises (beef and sheep) according to the dry matter utilization showed in the Figure 4.23.

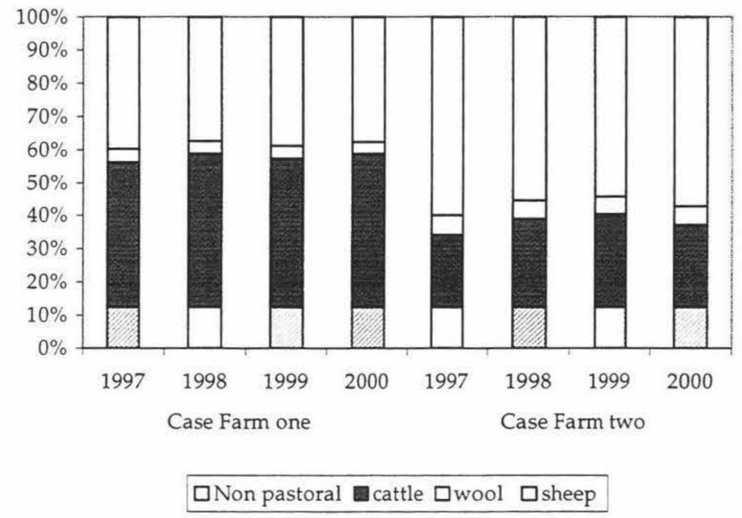

Figure 4.23 Overhead cost allocation for both case study farms

The composition of the cost of production for beef and lamb meat is depicted in Table 4.30.

Table 4.30 Beef (LW) and lamb meat (CW) cost of production for both CSF from 1997 to 2000 season

	Case Farm One				Case Farm Two			
	1997	1998	1999	2000	1997	1998	1999	2000
Lamb Meat								
Operating expenses	39279	41485	50197	58352	72502	61264	85269	74166
Extracted Cost of capital	25744	25653	14630	62447	6472	37908	15054	44158
Beef								
Operating expenses	61089	55149	72230	94825	31659	41801	42702	35018
Extracted Cost of capital	28310	31906	16984	76763	2387	18305	7763	19129

Pre tax operating expenses

The break-even-point (BEP) for lamb meat and beef for both farms are shown in the Table 4.31. These figures represents before tax values, which reflects the sale price in the market. These BEP prices are linked to the sheep and beef cost shown in Table 4.30. It reflects the BEP of each particular product (lamb meat and beef) based on its respective costs. Wool was considered as a by-product.

For the sheep enterprise, the BEP price for meat as the primary product is calculated by deducting the wool income from costs. The BEP occurs when sheep income less sheep cost equals zero (Sheep Revenue – Sheep costs= 0). A similar approach was used to carry out the calculation for beef enterprise.

Sheep income is comprised by meat income and wool income:

Meat income + Wool income – sheep cost = 0. Then,

Meat income (BEP) = sheep costs – wool income

The BEP prices depicted in the Table 4.31 represents the sale price per kg of meat (carcass weight for lamb and LW for beef) necessary to cover all operating expenses including extracted cost of capital.

Table 4.31 Lamb meat BEP results for both CSF from 1997 to 2000

	Case Farm One				Case Farm Two			
	1997	1998	1999	2000	1997	1998	1999	2000
Lambs sold	2735	2571	1552	2587	1796	2023	2437	2471
Wool Income	75608	56462	55149	53933	37015	36465	44390	35968
Total Sheep cost	99655	99512	91991	154940	95958	118407	122740	145421
Lamb meat cost	24048	43049	36842	101007	58943	81943	78350	109453
BEP price Lamb ($/kg)	**0.58**	**1.40**	**1.58**	**2.60**	**2.19**	**2.70**	**2.14**	**2.95**
Total Beef cost	89399	87056	89214	171588	34046	60106	50465	54147
BEP price Beef ($/kg)	**0.89**	**0.96**	**1.45**	**2.37**	**1.60**	**2.93**	**0.89**	**1.16**

The lowest BEP prices for CSF one occurred in 1997. This was achieved due to a combination of moderate sheep costs, maximum number of lambs sold and significant wool income (Table 4.31). This was the year when meat production peaked and maximum number of lambs and steers were sold.

Since 1997, the BEP price for both enterprises has exhibited an increasing trend over the four-season analysis. During the years 1998 and 1999, the increase in BEP price is caused by the substantial reduction in lamb meat and beef production and number of lambs traded, particularly in 1999 (1998/99), when the "El Nino" event severely affected the production.

On the other hand, the lamb meat production has improved by 67% and beef by 17% in 2000 in comparison with the previous year. Despite this increase in production, the BEP price for lamb meat and beef increased due to the higher operating costs and extracted cost of capital in this season.

The CSF two results show less variable BEP prices. The values range from \$2.14 to \$2.95/kg. The lamb meat production as well as total sheep costs have been increasing since 1997. It may be suggested that costs and production have been increasing at a similar rate, which may explain the little oscillation verified in the BEP price for lamb meat figures. By contrast, BEP figure for beef exhibit more variation. This is mainly variable beef production due to different sales strategies occurring with the beef operations. In some years more animals are kept to increase numbers and as a result the farming accounts shows less beef has been sold.

The sheep revenue composition and cost structure for each year is shown in Table 4.32.

Table 4.32 Sheep and beef cost of production composition and revenue composition for both CSF

	Case Farm One				Case Farm Two			
	1997	1998	1999	2000	1997	1998	1999	2000
Sheep sales income	159327	110722	110366	147771	104270	112758	90984	123234
Wool income	75608	56462	55149	53933	37015	36465	44390	35968
Total Sheep revenue	234935	167184	165515	201704	141285	149223	135374	159202
Beef Revenue	122873	144160	102641	112623	23979	27580	75973	89812
Revenue composition								
Wool contribution	21%	18%	21%	17%	26%	24%	33%	23%
Lamb contribution	45%	36%	41%	47%	74%	76%	67%	77%
Beef Contribution	34%	46%	38%	36%	15%	16%	36%	36%
Cost composition								
Wool cost	18%	17%	15%	10%	13%	11%	13%	14%
Lamb meat	34%	36%	36%	37%	61%	56%	58%	59%
Beef	47%	47%	49%	53%	26%	34%	29%	27%

The higher lamb meat cost for the CSF two (Table 4.31) is supported by the cost composition depicted in Table 4.32. Lamb meat accounts for about 60% of all expenses. Wool sale contribution is very similar for both farms. Wool sales make about one-quarter of total sheep income while the lamb sales accounts for 43% and 73% of sheep revenue for CSF one and two, respectively. The beef contribution has been increasing its contribution in the case study two as a reflection of sheep to cattle ratio changes taking place. It increased from 15% in 1997 to 36% in 2000.

Comparative analysis for cost of production between organic option and conventional system was also carried out by the model. The operational costs and extracted cost of capital were based on the 15-year budget built to assess the marketing and production risks. The results of the analysis were expressed as a cumulative distribution function (CDF). The calculation of these CDFs took into account the production variability and effects of market prices. CDF represents the probability distribution of the cost of production for beef and lamb meat in each farming system. The *x*-axis is the cost of production (BEP) and the *y*-axis illustrated the probability of occurrence.

The average cost of production for each farming system is assessed when the probability of occurrence is 50%. The minimum cost of production is represented by the value at the bottom of the line and the maximum value when the line reaches the top of the chart. The more vertical, the less variability there is among the possible outcomes (Kay & Edwards, 1994). The Figure 4.24 shows the possible outcomes for the BEP price for lamb meat in two different systems.

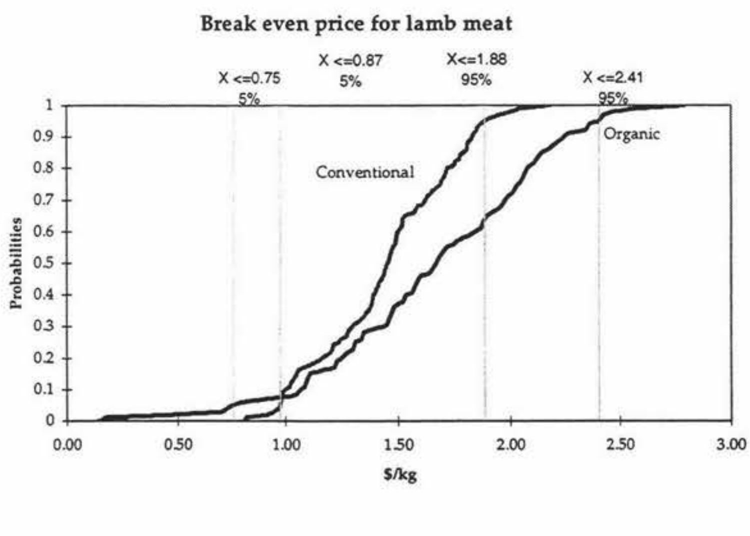

Figure 4.24 Comparison of CDF of break-even price for lamb meat for the CSF one

The delimiters (5% and 95%) for the conventional system are $0.87 and $1.88. The organic system seems to exhibit more variation in comparison with conventional alternative as 90% of the values fall between $0.75 and $2.41.

By contrast, beef operation in the conventional system exhibited greater variation of outcomes when compared with organic enterprise (Figure 4.25). The BEP for the organic option ranged from $0.74 to $0.97 while the conventional systems ranged from $0.47 to $0.74.

The organic alternative seems to have higher production costs both for lamb meat and beef. The higher costs associated with labour may explain some of this difference as CSF wishes to employ a full time manager. In addition, fewer lambs and cattle are sold under the organic policy, which may contribute to a higher cost of production in comparison with the conventional alternative. This can be verified when equal probabilities of occurrence are assigned to each option e.g. at a 50% probability of occurrence, the BEP price is $0.87 and $0.65 for the organic and conventional options, respectively.

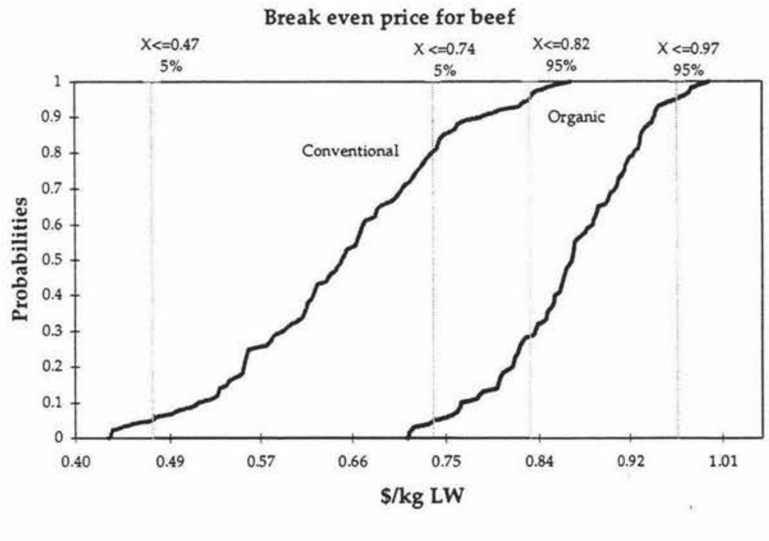

Figure 4.25 Comparison of CDF of break-even price for beef for the CSF one

4.6.2 Case study Two

The BEP price of lamb meat for CSF two is depicted in the Figure 4.26. Lamb meat exhibits a similar variation in both systems. However, the average value is lower for the conventional policy ($2.05), which denotes lower cost of production in comparison with the organic alternative ($2.44).

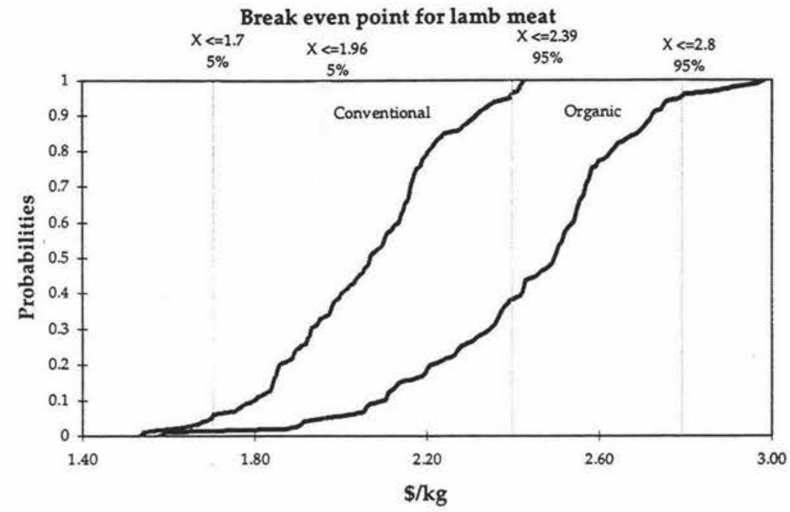

Figure 4.26 Comparison of CDF of break-even price for lamb meat for the CSF two

The beef situation also exhibits a similar variation between the two alternatives. Again, the BEP figures are lower for the conventional system. This is associated with higher animal production, which decreases the cost per unit produced Figure 4.27.

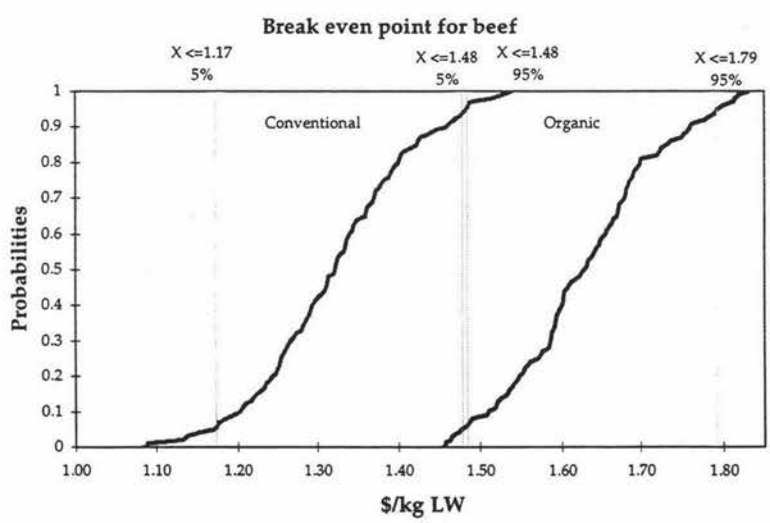

Figure 4.27 Comparison of CDF of break-even price for beef for the CSF two

The CDF analysis shows that the organic system has higher BEP values. Thus, it reinforces that premium price is particularly important for this production system in order to cover operational expenses and extracted cost of capital. The higher BEP values are mainly due to the lower animal production (lamb meat and meat sold) in comparison with conventional system. Therefore, the conventional system has an advantage in terms of lower cost of production in comparison with organic option.

The operational costs are very similar for both systems with the exception of CSF one, where more contracted labour is used for the organic option. The main difference between the systems is in the animal production. The conventional option sells more kg of lamb and beef, which is reflected in the lower BEP prices. This result is driven by the changes in stock policy e.g. more finishing animal in the conventional system. The CDF charts have show a slightly advantage over the organic option in terms of lower cost of production. This is a good example of first-degree stochastic dominance as the lines do not overlays (Boehlje & Eidman, 1984).

CHAPTER FIVE

5 DISCUSSION

5.1 Introduction

This section discusses the research results in light of the hypothesis and research objectives. This study took the case study approach using "working examples" of low-chemical organic sheep and beef farming. Therefore, the results are very specific to the case study farm studied. However, some general issues related to the organic and conventional farming were identified and discussed in the last part of this section. This is an attempt to highlight some of the most important constraints, threats and opportunities associated with both farming systems, which will be of use to all sector interests. The aim of this project was to assess the economic viability of organic beef and sheep enterprises compared to a conventional alternative.

5.2 Macro environment

The decreasing trend of New Zealand dollar is a positive factor affecting farming business. If this situation remains in the future as forecasted, farmers will experience a period of good financial returns. Therefore, this is the moment to make investments such as building soil fertility to continue improvement in the farm production

The level of interest rates is important for the farming business sector. Interest rates have been forecast to remain higher (over 6.75%) compared to 1998 levels (4%). This is particularly relevant to case farm two who operates the business in a high debt situation. The primary concern is to generate sufficient income to cover the interest expenses and keep renewing the long-term debt. This policy is a bit risky as there is constant fluctuation of farm business prices and interest rates. However, the farmer decided to invest in new resources rather than repay debt. He decided to expand his asset base and paying only interest (tax deductible).

Inflation rates reached 4% in December 2000. It was 1% higher than what the government was targeting (under 3%). The high inflation is reflected in the increasing cost of farm expenditures affecting both farmers. On the other hand, stock prices are very strong and offset the higher costs.

Despite the fact that wool is not the main product on both case study farms, wool prices have improved this year. Once again, these prices are mainly influenced by the low New Zealand dollar and the low wool supply of Australia. There is also an opportunity to explore key markets searching for organic wool. UK and Germany are among the top five countries importing a substantial volume of lamb from New Zealand.

The growth in the organic food industry is consumer driven and will continue to be as consumers become more aware about their health, food safety, environmental and animal welfare issues (Richardson, 1999). The existing organic marketing structure in those countries is a positive factor contributing to the expansion of organic meat exports. Developing a strong value chain relationship must be a strategic focus for marketing organic products in Europe. New Zealand beef production relies on US demand. However, there is new market segment arising in Asia, South Korea and Taiwan that can offer potential business opportunities for New Zealand.

The recent episode of BSE in Europe reinforces the importance of health and food safety issues from the consumer perspective. Tracking systems also have been recognized as an important competitive advantage to sustain business relationships. Being able to deliver a healthy product within the quality specifications is crucial to building business relationship.

Weather conditions will always increase production risks. Major climatic events such as El Nino can be predicted in advance with reasonable accuracy and therefore contingency action must be taken. There is a lot of predictive information from weather institutions. This type of information must be used by the farmers for their decision making process for selling and purchasing options.

5.3 Qualitative analysis

The findings of the present study suggest that proactive management strategies related to the animal health and marketing are relevant to organic farmers. Strategies such as grazing management, use of alternative pasture species, use of "right" genetics and faecal egg counts (FEC) are just examples of strategies employed by organic farmers in an attempt to minimize health problems in organic stock.

The information is also used for developing decision rules for treating stock. The objectives of decision rules are to preserve the production base, respect animal welfare matters and decrease production risk. Such rules depend on each farmer's aspirations. Case study two for instance invokes decision rules for drenching based on visual assessment and his practical experience, constant monitoring of FEC, weight and age of animals and history of larval infestation on paddocks. It requires proactive and preventive management and a "different way of thinking". Such a proactive attitude is necessary as unforeseen problems may occur and there is a limited range of allowable responses to fix the problem. Therefore, organic farming requires more intensive monitoring in order to prevent problems rather than cure them using farm chemicals if the organic status of the animals is to be maintained.

Marketing organic products also seems to be a key issue in this business. Most of the meat companies see lack of supply as the main barrier for the growth of the organic sector (Mackay *et al.*, 2000). Forming a cooperative structure with other farmers was a way that case study two found to guarantee reasonable premium prices for its produce and gain market access in the UK.

The participants of this research show a slight difference in terms of risk management strategies. Case study one placed strong emphasis on income spreading and debt management followed by the animal health. Maintaining feed reserves through supplementary feed is ranked as a relatively less important risk strategy by this farmer. The risk management strategies in use by this farm are typical of those attributed to "production manager" type characterized by Martin *et al.* (1998). He runs the business with low debt level, has an average lambing percentage and a moderate emphasis on market risk reduction.

Similarly, case study two recognizes the importance of income spreading but management strategies related to the animal health were ranked in the first position. Debt management strategy was placed in the fourth position. This denotes the willingness of case study two to take financial risks as his business operates in a moderately high debt situation. This risk attitude is commonly observed in more successful managers (Kotey & Meredith, 1997, Insulander *et al.* 1986). Case study two could be considered a debt and market risk manager as described by Martin *et al.* (1998). He has a high fixed commitment and high gross income with some little emphasis on off-farm income. He also is confident of his ability to manage the market risk selling organic meat through a cooperative structure.

Information collected on farm during interviews and answers provided by respondents suggest that they both have the essential attributes of successful managers as described by Cummings (1999), Kotey & Meredith (1997), Insulander *et al.* (1986). Both farmers showed a well-defined plan for their business including goals and objectives. In addition, they have got a clear focus and understanding of what needs to be achieved and they have control systems in place to help them achieve their goals.

Both farmers had no difficulties in providing information for formulating goals and objectives during the discussion. Their businesses and personal priorities were clearly identified through the questionnaire and they also outlined the main components of their vision and mission for the enterprise. These farmers appear to be more future-orientated, pursue innovation and possess some entrepreneurial qualities.

They exhibit a high internal "locus of control" that became more evident as production and management strategies were implemented to cope with the challenges that the organic system offers. These farmers have a well-designed conversion plan for their enterprises and this seems to be an important issue. They have identified the most challenging issues, which include parasite control, "right" genetics, information and knowledge gaps and the marketing structure. They also have set a range of financial and production targets. Both producers recognize the importance of planning and they put a strong emphasis on this aspect. These observations were made during the interview process are in line with entrepreneurial farmer characteristics reported by Tanewski (2000).

The management style used by these farmers is also in line with Fairweather & Keating (1994) findings. These authors described "dedicated producers" as those farmers who place strong value on planning and organization activities. However, both case study farmers are not strongly profit-orientated as observed in "dedicated producers".

Both farmers appear to be looking for a balance in their lives. This means they put moderate effort into the business and take time for family activities as a priority. Moreover, they are also concerned about marketing activities in order to promote their product. These attitudes have some similarities with the "flexible strategists" producers reported by Fairweather & Keating (1994). The same authors also described "the environmentalist" management style, which is associated with the current management style employed by the case study farmers e.g. environment awareness, reduce chemical use, preserve the land resource. Profitability is not the central objective of the management style of both farmers. They show a complexity of goals focusing on family issues and lifestyle, environmental concerns and also financial success. So, profitability is a means to an end, which is made up of primarily non-economic goals.

SWOT analysis brought out a number of issue and performance indicators for the future. As current stock prices are strong it is time to take the opportunity to increase RPR top dressing and consider lime applications. Building up soil fertility may increase the sustainability of the soil resource through more nutrient availability and therefore improved pasture quantity and quality through more clover and ryegrass while increasing production over the winter and late summer. Soil tests can be carried out every two years for regular monitoring of the soil fertility trend. Investments in the business must focus on increasing pasture production, as this is the primary source of feed on farm. In CSF One, pasture quality has not been well controlled due to the restrictions imposed by Bio-Gro regarding stock movements. After full organic certification in 2003 the stock policy is expected to be more flexible.

Pasture budgeting is not formally assessed and this could be considered a weakness. However, this type of information is essential for selling decisions in order to capture strong prices during the year. Pasture budgets force the farm to plan ahead and set targets for weights, growth rates and pasture cover. There is a growing interest amongst sheep and beef farmers to convert to organics. It creates a market opportunity for both case farms supplying live animals with full certification status.

Quality assurance schemes have been becoming common in the meat industry. Some meat companies are offering premiums for adherence to these programmes. In conjunction with that are new marketing perspectives that can be searched for by those companies as they usually have strong relationships with their clients. Farmer skills and management capacity makes an enormous difference to competitiveness. This is important as agriculture becoming more technology intensive, therefore a more intellectually demanding business.

In addition, the challenges of organic farming have become increasingly reliant on educational processes to help farmers with the changes that are occurring in a more complex and uncertain environment. The most significant change requires the new way of thinking regarding to agriculture.

5.4 Modelling

Simulation modelling is a construction of a replica, system or idea, which can be experimented with and tested for alternative courses of action (Shannon, 1975). Simulation models like Stockpol® are basically "input-output" models in that they produce an output from data entered into its interacting sub-systems. By definition a model cannot achieve truthfulness because it is always an abstraction of the reality. Therefore, the quality of input data in achieving accurate predictions is important (Webby & McCall, 1994).

Simulation involving biological systems is imprecise and the degree of lack of accuracy is hard to quantify (McCall, 1984). However, such limitations are acknowledged and simulation can play a useful role in the investigation of the alternative actions of interest. Continual improvement to Stockpol® has occurred to increase the ability to predict biological outcomes on livestock farms. The greatest area of attention is during the spring period (Webby & McCall, 1994). One factor that may be contributing to errors is the lamb pasture intake when exposed to a high larval population. This is a situation very likely to occur under organic system given the absence of chemical drenches. Depression of appetite and consequently reduction of food intake has not been considered by the model.

The Stockpol® model was used to test the biological feasibility of alternative policies and provide some preliminary economic information. The evaluation carried out with the Stockpol® model met these expectations and was useful for practical decision-making. In addition, the usefulness of this model has been validated by many other studies (Webby *et al.*, 2000, Sherlock & Parker, 1998, Ogle & Tither, 2000, Montes de Oca, 1999, Barker *et al.*, 1999).

The increase in gross margin on both case study farms when either full organic or intensive sheep and beef was examined. This increase results from the ongoing investments in hybrid vigour, rams bred for parasite resilience, more efficient grazing management, higher fertiliser inputs, premium prices and more intensive finishing policy. To achieve these outcomes, management skills, competence and management capacity must be lifted.

Stockpol® does not test the farmer's skills to delivery the expected results only test the biological feasibility of the options. Increased skills comprising a range of management knowledge, particularly, with animal health, as it appears to be the main constraint for stock performance, are a crucial point when promoting the intensification of the production base.

Farmers must act proactively providing "safer" pasture (fodder crops) in order to reduce the intake of infective larvae. To achieve this, mature cattle can pre-graze paddocks to remove long grass. Farmers also set up an endo-parasite management programme aiming to reduce the contamination of pasture by infected stock and reduce the exposure of susceptible animals to high parasite areas. They are aware of the importance of good nutrition reducing the stress in stock and they monitor internal parasite levels (FEC test) regularly. Due to this level of commitment with farming activities, the researcher believes that both farmers are able to cope with challenges provided by any of the two alternative stock policies proposed.

Another important on-farm issue is labour and management. Raising stock numbers would increase demand on management, particularly, more adequate pasture management to deliver higher live weight gains. The Stockpol® model did not quantify this additional labour requirement. However, this issue is addressed using an Excel® spreadsheet to carry out a more in-depth financial analysis.

Intensification of the beef cattle and lamb operation increases the production risks. The production risk is mainly associated with higher feed levels required to sustain high stock growth rates through autumn and winter.

Despite a higher financial return obtained with Stockpol® from the conventional system, it is very unlikely that case study farmers would change to this system. This is when their beliefs, values, goals and preferences come into reality and have an important effect on the decisions to be implemented on farm.

Actions and decisions would be based on satisfaction and preference goals that relative to the strategy that is most satisfying or preferred by the farmer and is not necessarily the most profitable option. Both farmers are more than likely to carry on with the organic system with more finishing stock, which they are satisfied with and enjoy. Economic return is not the central objective of their management style (Shulze Pals cited by Nieberg & Offermann, 1999). The sections 4.2.3 and 4.3.3 enumerated a complexity of goals with emphasis on family issues and lifestyle and environment concerns. As stated before, profitability is a means to an end. Both businesses will continue to expand over the next five years through an increase of stock numbers and individual animal performance

5.5 Risk Analysis for Case Farm One and Two

The risk analysis was carried out integrating information from the Stockpol® with Excel® and @Risk®. This was done in order to get a more accurate economic picture from the three different farming systems. The current farming systems is generating enough income to create value to the business as showed in the farm business analysis section. This is mainly reflection of the strong stock prices at the moment, which may mask the real risk associated with the current farming system.

However, the modelling analysis considers the returns of the current farming system taking into account the inherent risk of market price and production variability. In this case, the 15 years forecast budget shows that business is unlikely to grow at a desirable level ($15.000 and $10.000 per year for CSF one and two, respectively). Also, there are greater chances (probabilities) that the current system will achieve zero sustainable growth in comparison with the other two systems. Therefore, the current system has little chance to add value to the business in the future suggesting an equilibrium but no business growth.

The other alternative option is to continue to be organic achieving full premium prices along with improvements in productivity as outlined in the modelling section. The risk analysis results suggest that this is a viable option as there are greater chances to achieve the target sustainable business growth for both case study farms. The lift in animal production is biologically feasible as described by Stockpol® and the possible outcomes generated by the model exceed all operational costs and investments necessary to improve production.

Similarly, the conventional alternative exhibited a desirable scenario regarding the long-term economic viability over the 15 years period. The conventional option illustrated a slight advantage over the organic system as the probabilities of desirable growth are a little higher for the conventional option. In fact, both the conventional and organic options exhibited a very similar risk profile suggesting that these two types of investment are comparable in terms of economic returns.

The NOPAT is also an important financial figure to measure business profitability. For both case studies, the mean NOPAT for organic and conventional is higher than the "Base" situation. This is a consequence of the improved animal performance and additional premium prices over the years. In the case study one situation, the conventional NOPAT mean exceeded the organic NOPAT by about $27.000 ($134.000 vs. $107.000). This difference is mainly due to the differences in number of stock traded.

This difference is smaller for case study two. The NOPAT mean for the conventional option is about $11.000 higher than the organic alternative ($134.000 vs. $123.000). This shows that the organic system is capable of producing sustainable economic results similar to those achieved farming conventionally. Therefore, the organic alternative with premium prices can be almost as profitable as conventional system if a commercial focus with proactive management practices is in place.

It should be mentioned that the premium prices used in the model were conservative compared with the real opportunity created by the strong demand for organic products (A. Mackay, March, 2001 personal communication). Then, the financial figures for the organic system may be underestimated the profitability of this system. Therefore, if the modèl uses higher premium prices the organic option may be able to generate more attractive financial returns than the conventional system.

For the CSF one, organic alternative exhibit less variability of NOPAT in comparison with the intensive beef option (conventional). The premium price paid may be partially responsible for reducing the market risk for this option. Also, this enterprise has more balanced income from different sources, beef and sheep, while the income for the conventional systems rely mainly on cattle stock, which has more price variability.

Organic farming as any other farming business is also affected by weather conditions. A wet year for example can contribute to quick weed growth and high internal parasite in lambs, which can reduce physical production. Under such conditions organic lambs may be more severely affected than drenched animals, making hard to reach optimum killing weights. As result, financial downturn may occur. Alternative treatments with can be prescribed to cope with high larval challenge. However, the effectiveness of such product is still questionable and apparently may work as a health tonic rather than a drench (Robinson, 1998).

Risk-return profiles of each option are closely related to the risk preference of each participant. For instance, case farm one is a risk-averse manager and his operation has exhibited less variability of outcomes. On the other hand, case farm two is a risk-taker operator and his income has shown greater variability. Risk come into all farming aspects and there is no "right" or "wrong" risk attitudes. However, it is important to have a comprehensive understanding of risk attitudes in order to make more informed tactical and strategic decisions (Boehlje & Eidman, 1984).

The model considers mainly changes in physical numbers, which is the result of a complex process of ongoing development. The final results predicted are significantly influenced by the farmer's skills and their management capacity to deliver the desired results. The model only tests what is possible to be achieved in terms of economic results and biological outcomes without a complete assessment of the skills to deliver such results.

However, the interviews with both participants provided evidence of their skills and management capacity qualities. Both participants "think differently" about the way they are farming and are confident and are putting a lot of enthusiasm, clear goals and careful planning into their businesses. They use the information available or seek new information to cope with the substantial challenges provided by organic farming.

The tornado graph analysis revealed the significant influence of market price as the main risk source affecting the farming systems tested in this project. Market risk has been pointed out as a major threat to the farming business by several other authors and this study is not an exception (Martin, 1996; Harwood et *al.* 1999; Hardaker *et al.* 1998; Kingwell, 2000; McDermott, 1998; OECD, 2000).

The activity based cost (ABC) system was applied to the farm in order to accomplish the objective of assessing the production costs associated with meat production of low-chemical sheep and beef farming and intensive conventional systems.

The break-even point (BEP) analysis has shown that the production cost of beef and lamb meat was consistently higher for the organic option than the conventional system in the two case study farms. This occurs because organic farming has a lower physical production due to changes in the enterprise mix e.g. higher cattle ratio of breeding cattle and finishing stock. Higher cost associated with organic systems reinforces the importance of a premium price in order to allow a minimum profit level to this option. Contrary to these findings, A. Mackay (July, 2001 personal communication) states that even if premiums disappear, economic viability would be maintained by efficient producers with adequate management skills.

Lamb meat costs exhibited greater uncertainty under the full organic system. By contrast, beef production costs have shown more variability under the conventional option. Lamb meat cost variation is mainly created by production variability while the beef production cost variation under the conventional system is driven by market price volatility.

Fitzgerald (1997) argues that conversion cost can be enormous given the lack of access to premium prices during the official conversion period and market development costs. This is particularly important when substantial restructuring is necessary. However, both producers are running their farms organically without significant changes in the production structure. A property where the cattle policy is radically altered (e.g. moving from intensive finishing to breeding stock) could increase conversion costs significantly and affect farm profitability. The use of ABC approach to assess cost of production would be useful once farms are fully organic certified. This may help farmers to negotiate a premium price in order to match income and generate a desired profit level (Montes de Oca, 1999).

5.6 General issues of organic farming

This study focused on the alternative course of actions that may be taken by the case study farmers. These actions are: intensify the current organic farming system and or intensive their properties adopting conventional farming practices.

Many of the results produced in this work are very specific to the case study pastoral systems given to their soil characteristics, weather, level of skills and farmer's goals etc. However, these farmers are exposed to risks and also face similar challenges to any conventional producer. Some of the future challenges and opportunities identified from case study farms and literature review commented on this section, as they may be relevant to all primary industry (Table 5.1).

Table 5.1 Constraints associated with each farming system

Issue	Organic	Conventional
Technical Issues		
Soil fertility and health	Research gaps in terms of soil fertility and biology. Limited fertiliser options	Plenty of options in terms of fertiliser and also demands more knowledge regarding soil dynamics & interactions
Animal Health	Internal parasites, flies and lice. Opportunity for alternative remedies	Strong dependence on chemical treatment. Effectiveness is under risk due to resistance

Genetics	Rams with parasite resilience. Opportunity for a gene selection	Genes influencing mainly at the performance level
Weeds	Regarded as a major constraint in some "weedy" farms. Possible biological control for some woody weeds	Rely on chemicals. High cost and risks associated with plant resistance
Farmer's skills	Experience & confidence when taking decisions, proactive, enthusiasm, experience	Farmers need to "rethink" some farming practices due to lack of sympathy from the public
Knowledgeable professionals	Lack of good professionals for advice	High quality professional available
Infrastructure & industry		
Market stability	Market risk always exist	Market risk always exist
Premium prices	How big? How long?	-
Supply chain & Industry strategy	Concerns about size and lack of supply, consistency Modest commitment by the industry	Well developed in New Zealand
Enterprise structure		
Stock policy options	Few options due to enterprise mix required to ensure stock health is maintained	More flexible system, more options to suit different properties
Sustainability		
Environmental concerns & Law regulations	Social acceptable practices working in harmony with the environment	Non-friendly environmentally practices, restriction in use of certain fertiliser and chemicals
Animal welfare	It is an issue specially with ecto-parasites such as lice and flies	It is also recognised as an important issue for some conventional farming practices
Society perception	Substantial support from the general public	Future pressure on current farming practices

An organic focus group pointed out that "having the soil right" is an essential issue on for organic farming (Mackay, *et al.* 2000). Participants of this research also expressed similar concerns. A more comprehensive understanding of the soil is a great opportunity for further research in this area. The dynamics of nutrients, organic matter changes and biological activity are just a few examples that issues, which may be influencing organic farming systems are still not well understood.

The lack of the nitrogen option for the organic system could reduce management flexibility of pasture management while in conventional farms this fertiliser is used as a risk management tool to boost production in the short-term. Unprocessed fertiliser like rock phosphate (RPR) is permitted to be used to build up or maintain fertility levels in the organic system. However, its effectiveness is largely reduced in alkaline soils or high rainfall areas, which may prevent some farmers entering the organic supply chain.

Weed management is another important technical issue for many farms in New Zealand as reported by Mackay, *et al.* (2000) and Niezen, *et al.* (1996). Since chemicals are not allowed the control of woody weeds like, gorse offers a great challenge and may be preventing a lot of farmers from converting to organics. While other weed plants like thistles may be controlled using biological control, the gorse cannot. An option would be possible eradication of weed through the use of chemicals before conversion to organic. Then, the weed population can be controlled through mechanical methods. Both options may be expensive and face constraints in large-scale operations.

Grazing management seems to be an important tool helping to control internal parasite in sheep (Niezen *et al.* 1996). In the conventional system on the other hand this problem can be addressed using chemicals. However, farm chemicals can leave residues in animal products, which may constrain market access in the future. In addition, parasite resistance is a widespread problem, which offers a great risk to conventional farming systems. As a consequence, the effectiveness of the present use of farm chemicals is questionable in the long-term perspective. Selectively breeding animals with genetic resistance against parasite may be an opportunity for both sectors, organic and conventional, to cope with worm challenges.

The attack of these endo-parasites seems to be more severe in young stock rather than mature animals. This could reduce the ability to supply lambs with acceptable killing weights. Lambs under drench intervention lose organic status for 12 months according to the Bio-Gro standards, which remove them from the organic supply chain. This is a minor issue with cattle stock as organic status could be recovered after one year and these animals are finished at older ages.

Beef cattle and sheep farms in New Zealand occupy quite different types of land with great variation in soils, landscape and rainfall. It ranges from large extensive properties focusing on wool production to highly intensive beef cattle farms and breeding operations. The impact of strategic changes in the enterprise mix can have a significant influence on farming profitability e.g. moving from 100% finishing cattle to a 60:40 breeding operation. These strategic changes in structure may be preventing farmers from converting to organic farming.

The changes in production structure may differ in other sectors. For instance, dairy farms are more "standard" farming systems and once converted the production structure remains without significant changes (same infrastructure, number of cows, stock classes …etc).

Gaining knowledge could be time consuming and expensive not only for the farmers but also for their farm staff. There is a lack of professional advice from farm consultants in organic farming, which may be a short-term threat to expansion in this sector but also creates a significant opportunity for young academics starting a career in farming consulting. Conventional farmers in New Zealand are used to taking professional advice and a well-developed farming consulting businesses is already set up. So, the same approach can help the organic sector to flourish if advisory services are available for organic farming.

Both alternatives are exposed to uncertainties caused by market forces. Industry instability is a concern not only for the organic supply chain but also under conventional systems, as international competition is getting harder to beat, especially from countries where organic production is heavily supported by local government. However, organic meat is likely to have greater penetration in some high value markets, which may contribute for more attractive returns even when stock prices are weak.

The premium price is another important issue influencing the profitability of organic farming (see sections 4.6.1 and 4.6.2). It is hard to predict how big the premium will be and for how long it will remain given the dynamics and uncertainties of the international market environment.

Basically, premium price will be driven by market demand and supply relationships and the purchasing power of overseas consumers. The environmental concerns and health consciousness of modern society suggest that and the immediate prospect is for a continuing growth on demand for organic products. Premiums for organic products will only continue to be paid as long as consumers continue to demand the highest quality food. In addition, Richardson (1999) states that farmers motivated only by premiums and who have below average management skills are very likely to fail as organic producers.

The industry also express concerns regarding consistency of supply as there is a small number of producers committed to organic production. Farmer's interests in organic conversion is growing, but there is a risk that some of the new entries may gave up of organic farming due to property suitability and lack of the required management skills, as organics is quite a challenge for most conventional producers. The organic sector lacks strong leadership to promote and encourage good communication and develop key relationship along the supply chain (A. Mackay, August, 2001 personal communication). Leadership is also important to guarantee market access and capture the opportunity of reliable premium prices.

In the future, organic meat may be more acceptable for specific purposes such as delicacy shops while meat produced conventionally would have limited access given chemical residues or consumer's perception. In this sense, conventional products may be more likely to get access to low value markets (e.g. Middle East Countries).

Nowadays, there is a widespread concern about any practice, which may affect the environmental sustainability. Animal welfare, food safety issues and environmental groups are exerting pressure on current conventional farming systems. For instance, nitrogen fertiliser or other acidic fertilisers maybe subject to restricted use in catchments areas near lakes or streams. So, the productivity of systems that rely on these products may be severely affected in the future.

The society is already exhibiting a lack of sympathy for many current conventional farming practices, radical changes may therefore take place in the way conventional producers are farming.

By contrast, consumers are purchasing more organic food not only because they perceive it to be safer but also because of the benefits of organic farming to the environment (Richardson, 1999, Yoneyma, 1994). The public opinion seems to support the "natural image" of organic farming, as people perceive free-chemical products are healthier and with better nutritional value than conventional ones. However, there are a lot of contradictions and inconsistent findings in the literature about the differences in products grown organically. A study carried out in New Zealand found no strong evidence that organic and conventional foods differ in concentrations of various nutrients. Although there is little documentation of residue levels, organically grown foods are likely to have lower chemical residues (Bourn & Prescott, 2001).

CHAPTER SIX

6 CONCLUSION

The results from this study support the hypothesis that organic beef and sheep farms can be both economically feasible and profitable in the long-term. The case studies presented also demonstrated that careful planning and proactive production management practices are essential tools to cope with the substantial challenges of organic farming. This is when changes are implemented and issues such as adequate genetics, build up of natural immunity in sheep, effective grazing management, decision rules assume importance in production management as a whole. These tactical decisions are complemented and strengthened by their strategic approach.

Farm business plans were elaborated with participation of the case study farmers and this will help them to make more informed strategic decisions for their businesses. A complementary part of this plan will be the continued uptake of new technologies and available information for organic farming systems for more effective decision-making processes e.g. alternative remedies, selection for parasite resilience, soil fertility and health etc.

The results derived from the Stockpol® and @Risk® analysis shows that both commercial properties can be economically viable and long-term sustainability of the business is achieved if the existing farming systems continue to expand the production base and animal performance is lifted. For the case farm one the organic option seems to be a less risky alternative in terms of NOPAT values. For the case farm two, the organic and the conventional options have exhibited a very similar risk profile without significant difference in term of NOPAT. The results predicted can never be exactly right given to the complexities of modelling pastoral systems. So, this study provides a framework that could assist farmers to plan with confidence their long-term decision taking uncertainty into account.

In New Zealand little is known about production costs of low chemical farming systems. This research outlines the activity-base costing (ABC) approach that could be used to assess the production costs. The research findings suggested that the production costs of organic option for both case study farms were higher than the conventional alternative. This occurred due to the changes in the enterprise structure. So, the premium price does impact farm profitability.

6.1 Limitations of this study and opportunities for further research

This research may underestimate the financial advantages of organic farming due to the conservative premium prices assumed in the model. Despite case study farmers being granted organic status with different certification agencies, the premium price assumed was the same. In reality, the premium is expected to be different, higher or lower, depending on the market targeted and the recognition of the certification agency in the overseas market. Therefore, the revaluation of the premium would be an area for further investigation.

Internal parasite management is one of the greatest challenges in the beef and sheep sector. There are a number of alternatives for controlling internal parasites using genetics, high tannin plants, biological control, and management changes. Research in these areas should provide a useful framework to design efficient grazing management systems with greater focus on parasite management than forage utilisation.

Marketing organic product is a constraint that may be preventing farmers from converting to organic production. Therefore, it would be useful to assess the risk implications of forming alliances. This would allow an assessment of the benefits of sharing the risk and having a guarantee of product supply, which seem to be a major constraint from the processing industry perspective. The industry can also gain invaluable knowledge from such study.

The research also needs to focus not only on beef and sheep sector but also in other livestock industries like deer and dairy. The present model can easily be adapted for these situations. An examination of the main constraints and challenges related to organic farming in these sectors would provide useful information to dispel myths and encourage more farmers to engage in the organic supply chain.

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8 APPENDICES

Appendix One. Self-assessment questionnaire and qualitative data

QUESTIONNAIRE

STRATEGIES EMPLOYED BY ORGANIC FARMERS
PROACTIVE MANAGEMENT APPROACH
Please note: All information given is strictly confidential.

PHYSICAL DESCRIPTION
Area (effective ha)
Number of paddocks
Paddock size range (ha)
Soil type
Topography e.g. % flat, % hills
Rainfall (mm, spread)
Fertility level e.g. Olsen P, pH
Water supply

Infrastructure (Strength&weakness)
Livestock Inventory
Balance date, stock classes, breeds and numbers
Production level – target and actual
Animal Management Timing e.g. mating, calving, lambing, docking, weaning ..etc

Strategies and management practices
The following questions are about how you manage and implement proactive management practices in your farm system

Strategies and management practices	What is the importance of this risk management strategy to your system? (Please circle one)				
ANIMAL HEALTH	Not at all important			Very important	
Cattle to sheep ratio	1	2	3	4	5
Grazing management	1	2	3	4	5
Change the stocking rates over the farm	1	2	3	4	5
Handling stock to avoid stress	1	2	3	4	5
Use of genetics (rams with resilience to parasites)	1	2	3	4	5
Larvae/eggs counts and monitoring	1	2	3	4	5
Development of decision rules for treating under performing animals	1	2	3	4	5
PEST AND WEEDS					
Short grass limits porina growth population	1	2	3	4	5
Grazing policies that keep thick sward to minimise thistles	1	2	3	4	5
Biological control	1	2	3	4	5
Topping, mowing or grubbing weeds	1	2	3	4	5
Search for education/information to obtain better understanding of life cycle of pest and weeds	1	2	3	4	5
PASTURE AND SOILS					
Knowledge about your soils and their characteristics	1	2	3	4	5
Grow forage plants that may reduce parasites, diseases or toxicity.	1	2	3	4	5

Accurate soil test information, regular monitoring and set up targets for fertility levels	1	2	3	4	5
BUSINESS MANAGEMENT AND MARKETING					
Establishment of co-operatives to get better prices for your product	1	2	3	4	5
Information, market opportunity and cost of production	1	2	3	4	5

Is there anything I forgot? Please use this space to comment:

____

Monitoring programme

We would like to value your opinion on the following production indicators and statements. For each question, please circle the most appropriate level of agreement.

	What is your most appropriate level of agreement?				
Social sustainability	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Are all the individuals on the farm happy?	1	2	3	4	5
I have written a mission statement and values	1	2	3	4	5
We have a clear management structure	1	2	3	4	5
I have a succession plan formed	1	2	3	4	5
I have sufficient knowledge & skills of farming without chemicals	1	2	3	4	5
I am involved with discussion groups for farming without chemicals	1	2	3	4	5

	What is your most appropriate level of agreement?				
Grazing Management	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I have formal feed budget	1	2	3	4	5
Set stocking when pasture supply is higher than animal demand	1	2	3	4	5
Rotational grazing when pasture supply is lower than animal demand	1	2	3	4	5
I have an efficient control of spring surplus	1	2	3	4	5
I have a monitoring programme of pre and post grazing targets	1	2	3	4	5

RISK MANAGEMENT STRATEGIES	What is the importance of this risk management strategy to your system? (Please circle one)				
INCOME SPREADING	**Not at all important**				**Very important**
I run more than one type of operation e.g. finishing, breeding stock, rearing calves ...etc.	1	2	3	4	5
My income relies on more than one enterprise e.g. beef, sheep, dairy grazers, Deer ...etc	1	2	3	4	5
I try to spread sales throughout the year	1	2	3	4	5
I try to get as much market information as I can	1	2	3	4	5
DEBT MANAGEMENT					
I try to manage my debt	1	2	3	4	5
Arranging overdraft reserves	1	2	3	4	5
Keeping debt low	1	2	3	4	5
Having insurance (animal, buildings, machinery)	1	2	3	4	5
FEED MANAGEMENT					
Maintaining feed reserves e.g. hay, silage, supplements	1	2	3	4	5
Having a flexible grazing management policy and having low priority stock for buffering the system	1	2	3	4	5
Not producing to full capacity (less intensive)	1	2	3	4	5
CAPITAL MANAGEMENT					
I try to maintain financial reserves	1	2	3	4	5
I try to plan ahead my capital spending	1	2	3	4	5
I have off farm investments	1	2	3	4	5
MARKET RISK REDUCTION					
Using hedging or futures market options	1	2	3	4	5
Forward contracting	1	2	3	4	5
Vertical integration - Selling "paddock to plate"	1	2	3	4	5
OFF-FARM INCOME					
Other farm members working off-farm	1	2	3	4	5
Main operator working off-farm	1	2	3	4	5
PEST, DISEASE AND ANIMAL HEALTH					
Development of decision rules e.g. if the growth rate of more than 50% of the replacement ewe lambs falls below 50% of the target LW, the whole mob is drenched	1	2	3	4	5
Identification of animal at health risk through an intensive monitoring programme	1	2	3	4	5
Ensuring high nutrition to minimise health problems	1	2	3	4	5
Use rams with merit for parasite resistance	1	2	3	4	5
Explore homeopathic treatment	1	2	3	4	5
Use of alternative therapeutic products (registered by BIO-GROW)	1	2	3	4	5

VISION, MISSION STATEMENT, VALUES & GOALS

In order to set up a strategic plan for your business a vision and mission statement must be developed. A vision of the business defines your dreams for the future. It answers question such as where do you want to be in the future. In other words, the vision expresses your dreams and aspirations for the future.

A mission statement is a concise summary of the overall purpose of your farm. It defines why the farm business exists and is reflected on the values and beliefs of the owners.

Values are the beliefs and standards of the owners about how certain things should be achieved. Who you are and how you live determines your values. They are also perceived in the way you manage your business.

Goals are statements of what the owners and family want to achieve from the business.

This process does require some time if maximum benefits are to be gained from the process. The answer for this question will be the basis for your plan.

There is no right or wrong answer or format to a vision or mission statement. The most important aspect of the vision and mission statements is that they reflect the beliefs and values of those people involved in the business.

Finally, a **vision** should express the answer for these questions: " What do we want to achieve?" and "Where do you want to be in the future"?

A **mission statement** should express the answer for these questions " Why are we involved in farming?" " What values will have adopt to achieve our aims?".

A sample mission statement with its components (how, what and who) is listed below:

" *The mission statement of our farm is to provide above and average standard of living* **for both owners and employees**[2] *through the sale of milk, livestock*[1]*, and crops*[1]*, with* an ***emphasis on breeding a high quality, registered Holstein herd***[3]"

[1] what- [2] **who** *[3] how*

The following questions may help you in identifying your values and goals and ultimately your and vision/mission statement. The first four questions try to assist you in identifying your personal goals. All family members involved in the business should answer them.

What can I contribute? What are the skills and talents that I posses?
e.g. my farming experience, my technical knowledge ... etc.
What is important to you in life? **e.g.: My family, education for the kids, ...etc.**

Note: Questions 3, 4, 5, 6 and 7 should be answered through group discussion with involved family members.

What are we in business to do? What products and/or services does our business provide? **e.g.: we sell top quality lambs, finish heavy bull beef ...etc.**
How do we produce these products? What methods/technologies do we use?
What values do we hold for these products?

Who are our costumers?
What would we like our business to be? Where would we like our business to be positioned in the community and in the industry? **e.g.: to be in the top 10% farmers, to be the best in our district ...etc.**
Identification of Values:
List all of the things and/or qualities that you value as an individual. In another column, list things and/or qualities that you value in your business and in business dealings. Some examples of values are honesty, trust, loyalty, responsibility, versatility, decisiveness etc.

YOU	YOUR BUSINESS

Feel free to develop your own vision and mission statement.
Vision (where do you want to be in the future):

Mission statement (defines why the farm business exists):

GOAL INDENTIFICATION:

1 - What are you're your specific goals that will help you achieve your vision? You can divide in personal goals and business goals.
Examples:
Personal goals: one day per week at children's sport, Three weeks trip with family to Gold Coast by 31/01/2001
Business goals: 50% of male lambs drafted at weaning annually, lambing percentage 150% by 2004...etc.
Personal Goals

Business goals

ENTREPRENEURSHIP CHARACTERISTICS

We would like to value your opinion on the following statements. For each question, please circle the most appropriate level of agreement.

BASIC KNOWLEDGE	**What is your most appropriate level of agreement?**				
Command of basic facts					
I have enough skills in production aspects of my farm	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I have enough skills in economics for managing my farm	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I have a comprehensive understanding about customers relationship	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I have a comprehensive understanding about supply chain of organic	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Relevant Professional Understanding					
I devote considerable amount of time to planning and management	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I see my managerial role as job and NOT as a lifestyle	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Continuing sensitivity to events					
I search for relevant formal information in order to respond and adjust my business	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
SKILLS & ATTRIBUTES	**What is your most appropriate level of agreement?**				
Analytical, problem solving skills					
I have good analytical abilities	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I have good sensitivity towards market signs	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Social skills & abilities					
I have good negotiation skills for resolving conflicts, dealing with people	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

I have good negotiation for selling products	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Emotional Resilience					
I am good at coping with stress caused by the job	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Proactive inclination					
I have formulated concrete, reachable and measurable goals for my business and personal life	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I check goal achievement regularly	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I try to manage my own time	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I am measuring the results of my business	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I am controlling the results of my business	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
LEARNING CULTURE Creativity	**What is your most appropriate level of agreement?**				
I have the ability to come up with unique response to problematic situations	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Mental Agility					
I have the ability to see the whole situation and understand the problems quickly	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Balanced Learning habits & skills					
I am completely convinced that management capacity is essential prerequisites for success	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I am completely convinced business skills are essential prerequisites for success	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I studied relevant literature to improve my business	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Self knowledge					
My management decisions are based on my goals, values, feelings, strengths, weaknesses …etc	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Risk Behaviour					
I am willing to take risks	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I think that my farming system is riskier than others	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Thank you very much for taking the time to complete and return this questionnaire. The results will be of general interest to many people, including other farmers, businesses and policy makers while also assisting us to develop solutions for problems in the livestock industry.

PROFIT CENTRES AND SHORT AND LONG TERM PURPOSES, GOALS AND MEASURES.
(adapted from Stantiall & Shadbolt, 1998).

	SHORT-TERM	LONG-TERM
Farming Business	**Purpose:** Utilisation of resources to achieve profit **Goals:** **GROWTH** Profit maximisation Service family requirements To enable long-term business goals To maintain/expand the land owning business **Measures:** Profitability, Revenue generation & cost control, Debt servicing capacity, Solvency, Cost composition, Saving behaviour, operational efficiency, Labour efficiency, capital efficiency Growth **RENT**	**Purpose:** Continuation of the business with a family focus **Goals:** Operate a viable business that generate returns to service shareholders requirements, and satisfy the long-term needs of the land-owning business **Measures:** Trends in profitability, equity growth, business longevity, family involvement, satisfied family
Property Business	**Purpose:** Land Ownership- Efficient use of land resource and "good" land "stewardship" Goals: GROWTH To "own" a land resources to operate a farming business and a preferred lifestyle **Measures:** "Rent", capital gain (revaluation), shareholder value, market value of the business equity	**Purpose:** Maintenance of land ownership and the land resource for a sustainable farming business and for future generations **Goals:** To maintain productive potential, to maintain/improve value of land, minimise soils damage and degradation, increase area of land owned **Measures:** "earning worth", productive value, level of maintenance, longevity of sustainable land &resources & improvements, water quality

DRDC RECOMMENDED PERFORMANCE INDICATORS.
(adapted from Cummings, 1999).

People Measures
Key Performance Indicators Holidays in last 12 months (nights off farm) Training days per labour unit per year Hours worked per week per labour unit
Secondary Indicators OH&S – days per annum list dew to accident and illness Do you have a written business plan? Yes/No Staff turnover (average length of service for permanent staff = years per person
Tertiary Indicators Dou you have a written succession plan? Have you updated you wills in the last 5 years? Hours of paid off-farm work per week So you have insurance cover for loss of income?

THE ELEVEN QUALITIES OF A SUCCESSFUL FARM MANAGER (Cummings, 1999)

Basic Knowledge	
Command of Basic Facts	Successful farm managers know what's happening in their business. They have a command of such basic facts as goals and plans (long and short-term), enterprise knowledge, who's who in the industry, the roles and relationships between various supplies and customers, and they define their own job and what's expected of them. If they don't store all this information, they know where to get it when they need it.
Relevant Professional Understanding	This category includes 'technical' knowledge, e.g. production technology, marketing techniques, engineering knowledge, relevant legislation, sources of finance, and knowledge of basis background management principles and theories, e.g. Planning, organising and controlling.
Continuing Sensitivity to Events	Good Farm Managers vary in the degree to which they can sense what is happening in a particular situation. The successful manager is relatively sensitive to events and can tune it to what's going on around him. He is perceptive and open to information - 'hard' information, such as figures and facts, and 'soft' information, such as the feelings of other people. The manager with this sensitivity is able to respond in an appropriate way to situations as they arise. This is especially important in family farming situations where members of the family work closely together and for those farms with a number of employees.
Skills & Attributes	
Analytical, problem solving skills	The job of the manager is very much concerned with making decisions. Sometimes these can be made using logical, optimising techniques. Other decisions call for the ability to weigh pros and cons in what is basically a very uncertain or ambiguous situation, calling for a high level of judgement or even intuition. The manager must therefore develop judgment-making skills, including the ability to cope with ambiguity and uncertainty, striking a balance between the necessity at times to be guided by his subjective feelings without throwing objective logic completely out of the window.
Social skills & abilities	One definition of management often cited is 'getting things done through other people'. This definition may be inadequate, but it does point to one of the key features of the farm manager's job - it requires interpersonal skills. The successful farm manager develops a range of abilities, which are essential in such activities; communicating, delegating, negotiating, resolving conflict, persuading, selling, using and responding to authority and power. Even on properties with little or no employees, these skills are essential for dealing with other family members, contractors, shearing teams, agents, neighbours, etc.
Emotional Resilience	The farm manager's job involves a degree of emotional stress and strain, which arises as a natural consequence of working in situations involving authority,

Resilience	leadership, power, interpersonal conflict, meeting targets and deadlines, all within a framework of a degree of uncertainty and ambiguity. The successful farm manager needs to be sufficiently resilient to cope with this. 'Resilient' means that he/she feels the stress (they don't become thick-skinned and insensitive) but is able to cope with it by maintaining self-control and by 'giving' to some extent, but not so much that they become permanently deformed.
Proactive Inclination	Effective farm managers have some purpose or goal to achieve, rather than merely responding to demand. They cannot plan everything carefully in advance and, at times, they must respond to the needs of the instant situation - but when making such a response the effective farm manager manages to consider the longer term. They relate immediate responses to overall and longer-term aims and goals, whereas the less successful manager responds in a relatively unthinking or uncritical way to the immediate pressure. This category of ability also includes such qualities as seeing a task through, being dedicated and committed, having a sense of mission, and taking responsibility for things that happen rather than 'passing the buck' to someone else or blaming aspects out of their control e.g. weather, government, banks.
Learning Culture	
Creativity	By 'creativity' we mean the ability to come up with unique new responses to situations, and to have the insight to recognise and take up useful new approaches. It involves not only having new ideas oneself, but also the ability to recognise a good idea when it is presented from another source.
Mental Agility	Although related to general intelligence level, the concept of 'mental agility' includes the ability to grasp problems quickly, to think of several things at once, to switch rapidly from one problem or situation to another, to see quickly the whole situation (rather than ponderously plough through all its components), and to 'think on one's feet'. Given the hectic nature of farm management work these are particularly necessary qualities for success.
Balanced Learning Habits & Skills	Successful managers are more independent as learners; they take responsibility for the 'rightness' of what is learned, rather than depending, passively and uncritically, on an authority figure (a teacher or an expert) to define 'truths'. Successful managers are capable of abstract thinking as well as concrete, practical thought. They are able to relate concrete ideas to abstract ones (and vice versa) relatively quickly. This ability - which is sometimes known as a 'helicopter mind' - enables the manager to generate their own theories from practice, and to develop their own practical ideas from theory. The ability to use a range of different learning processes is necessary for farm managerial success. Three such processes are: (a) input - receiving expository teaching, either formal (e.g. on a course) or informal (eg. teaching by a colleague or adviser or mentor); (b) discovery - generating personal meaning from one's own experiences; (c) reflection - a process of analysing and re-organising pre-existing experience and ideas. Successful farm managers are more likely to have a relatively wide view of the nature of the skills of management. For example, they are more likely to recognise the range of managerial attributes as presented in this model, than to believe that management is a unitary activity, involving, for example, dealing with subordinates (.e. needing only a certain set of social skills) or simply involving basic decision making.
Self Knowledge	Whatever the farm manager does is in some way affected by their own view of their position, their role and by their goals, values, feelings, strengths, weaknesses and a host of other personal or 'self' factors. If then, a manager is to retain a relatively high degree of self-control over their actions, they must be aware of these self-attributes and of the part they are playing in determining their behaviour. The successful farm manager must therefore develop skills of introspection.

The Macro environment analysis

The macro environment is related to all the factors outside of the farm business that may affect the farming business (Parker & Shadbolt, 1998). This kind of analysis is important in establishing the opportunities and threats of the business. The challenge is to interpret all changes happening outside of farm business and make an assessment of how such changes could impact the farm's future. This section will discuss issues related to the New Zealand economy (inflation, interest rates and exchange rates), climate, commodity prices and new policy regulations.

The New Zealand economy

The combination of climate, suitable land, technology and management expertise have transformed New Zealand an efficient producer of agricultural products which traditionally make up the export basis of the country's economy. Currently, agricultural industry is responsible for 15% of gross domestic product (GDP) and just over 50% of merchandise trade exports (ANZ, 2000a). Exports from sheep and beef accounted for approximately one-quarter of New Zealand's merchandise exports in 1999 despite of shift away from traditional beef and sheep farming since deregulation in 1984. In order to get an accurate picture of what is happening in the agribusiness sector, it is crucial to have a general understanding about the present and past situation of the New Zealand economy. Inflation, interest rates and exchange rates are the most relevant aspect to the economy.

Most of the increase in livestock prices is directly linked to a low NZD rather than improvement in the underlying market. Exports in December 2000 were up 29% on the same period in 1999 with a further strong rise in export earnings from the agricultural sector, particularly dairy products and meat and manufactured goods. Despite the outstanding performance of the New Zealand export sector the rest of economy is sluggish. The trend is an increase in interest rate and a decrease in the exchange rate. All these economic issues could be translated into low business confidence and many other key indicators are also down (NBNZ, 2000). However, more recent information pointed out that there is a sharp rise in the business confidence in 2001. This is supported by the powerful gains in employment over past six months (ANZ, 2001). Production figures released by the government show growth of 3.4% for the 2000 calendar year. These positive indicators are supported by forecasted economic growth of 3% until March 2002. Slowing economies in Australia and the US are expected to have a slowing effect on NZ growth but only to moderate levels. In summary, New Zealand economy seems to be in good shape (Market update, 2001).

Interest rates

Interest expenses are one of the largest cost item on sheep and beef farms in New Zealand (MAF, 1999). The Official Cash Rate (OCR), introduced in March 1999, is an interest rate set by the Reserve Bank of New Zealand (RBNZ) to implement monetary policy aiming to achieve the price stability (ANZ, 2000a)

The interest rates remained relatively high until the latter part of 1998 although the New Zealand dollar fell substantially over this period. However, by late 1998, short-term interest rates were at a historical low with the 90 day bank bill yield around 4%. Currently, the OCR is 6.50% (since May 2000) and it is expected remain on hold.

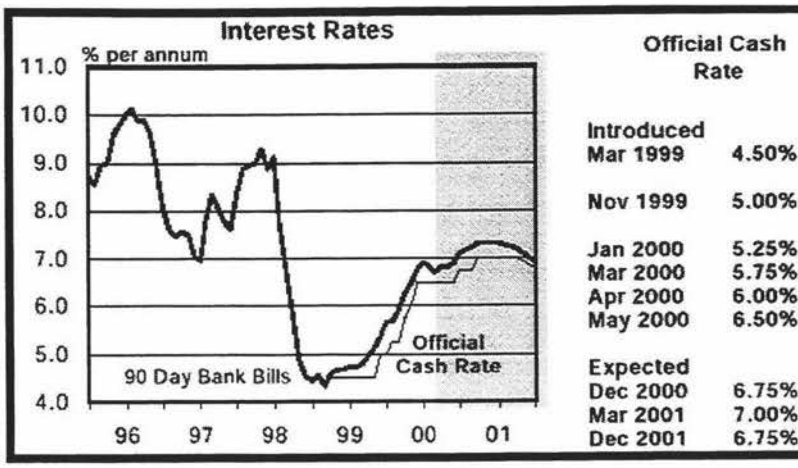


Figure 1- Interest rate trend and Official Cash Rate (OCR) over late 2000 early 2001.

New Zealand's long-term rate is closely linked with US bond market. The signs of slow growth of US economy provided scope for US long-term bond to decrease which in turn dragged down NZ long-term interest rates. Ninety-day interest rates (Rural Base) are forecast to average 7.6% for the quarter ending June 2001. The forecast average 90-day interest rate for the year end June 2000 and 2002 are little changed from those forecast in June 2000 (NBNZ, 2000).

Inflation

Inflation can be defined when the overall prices of goods and service rise no matter the supply and demand forces (Holm, 1998). In times of high inflation, there is an increased uncertainty with the net returns. In the low and stable inflation scenario building up a money reserve has advantage as it comes to purchase an item the price paid has not risen much (Holm, 1998) Low inflation in conjunction with high interest rates as happened over the 90's in New Zealand, there is a increase growth in savings. On the other hand, the financial risk is higher to the borrower as interest is not easily paid off by inflation. Local inflation has continued to going up. After steadily rising through 2000 annual inflation reached 4.0% in December (Reserve bank target band was under 0-3%). Inflation is largely influenced by the low NZD and high oil prices. This inflation rate has reflected on farm expenses. Farm expenses are increasing rapidly (6-8%) driven by the fuel, freight and service costs (ANZ, 2001). On the other hand, improved farm revenues will offset these higher costs.

Trading partners

There are fears of a slowing world growth. It has been intensified after the accumulated signs of a rapidly weakening of US economy. Australian also has slowed its economic growth. Japan has presented a slow recovery and other Asian economies such as Korea, Malaysia and Philippines also seems to be losing some momentum. The prospect of slower growth in these economies concerns New Zealand as they are major trading partners. In 2001 there had been more consistent signs of stronger economy growth.

Sheep, beef and wool prices

Sheep, beef and wool prices are influenced by a large number of macro-environment factors. These factors include domestic economy issues, supply from other competitors countries, exchange rate and substitute products for wool, beef and sheep products.

New Zealand exports the majority of its beef and lamb production. This means that domestic prices are very sensitive to world market prices. It also means that capturing market opportunities through competition advantages in production and proximity to growth markets is crucial.
The effect of these factors is usually estimated and forecast by banks and board organisations. A manager must take into account these evaluations and then decide about changes that must take place on stock policies and sale schedule. This type of entrepreneurial attitude is useful in order to identify the opportunities while decreasing the marketing risk.

Wool outlook
The improvement in wool prices has been sustained and built upon. This is mainly driven by the low of New Zealand dollar, which encourages overseas dealers. However, there are some parallel factors influencing wool prices. Synthetic fibre prices have gone up pushed by the oil prices, cotton fibre prices have lifted 30% and Chinese buying activity has increased (ANZ, 2000b). The lower supply of Australia also contributed positively to wool prices. Overall, the favourable exchange rate and some influence supported by worldwide recovery in wool prices have driven a lift in prices across all micron categories.

Table 1- New Zealand wool prices by micron count

New Zealand Wool Prices by Micron Count Season to 10 November ($/Kg clean)			
Micron	1999/00	2000/01	% Change
18	16.76	26.50	58
19	12.53	17.10	37
21	6.32	8.07	28
25	4.79	6.33	32
29	4.30	6.02	40
37	3.97	4.56	15

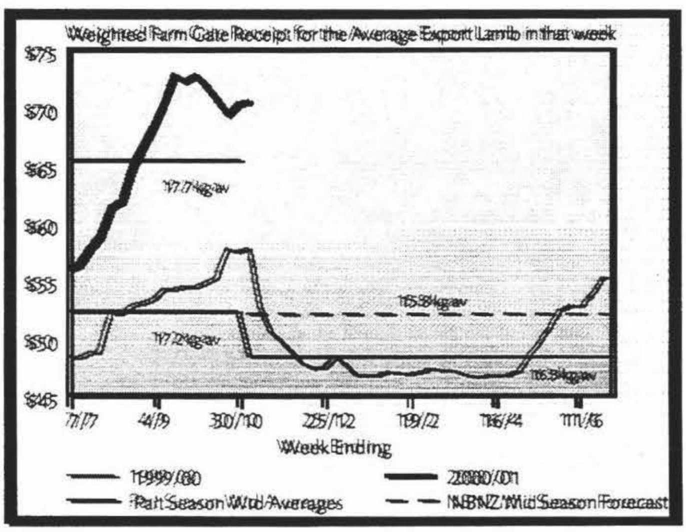
NBNZ, 2000

Key issues affecting sheep demand and prices
New Zealand top five volume and value markets for lamb are the UK, Germany, Saudi Arabia and France. These countries account for about 52% of annual lamb exports. The economic growth in these countries has a strong correlation in high value food items and therefore, direct implications in New Zealand lamb consumption. The UK registered a record low unemployment rate at 3.7% (July 2000) and a forecasted earning growth by 5% in 2001. The strength of the US economy has been well documented. Increase in oil prices rose the purchasing power of Middle East markets. In Europe, France has been experiencing strong consumption growth and improved employment conditions while Germany has a weak consumption and growth. The situations outlined above create some promising opportunities for New Zealand lamb exports.

Consumer trends are also essential elements affecting supply and demand and therefore prices. Consumers are demanding convenience and simplification of meals. Also, there is an increase in demand for organic sheep meat products reflecting environmental concerns and focus on animal welfare and food safety issues. New Zealand has a range of competitive advantages including organised production systems responding quick to consumer demands. On the other hand, the sheep industry is facing substantial competition from alternative land uses and the growth of the Australian industry its major competitor. The key issue for New Zealand sheep industry is to exploit successfully its competitive advantages while remaining one step ahead of market developments and Australia strategies.

A modest lift in lamb prices is expected due to the lower UK lamb production and strong demand in this country. Demand is also up in Europe where red meat consumption had been rising before the latest BSE outbreak. The forecast for the Middle East also looks positive mainly due to the improved revenue caused by oil prices and population growth. Despite restrictions and barriers, the high value US market is strong. The World Trade Organisation decision on the US lamb tariff in favour of Australasia is a very positive factor. These events in conjunction with low inventories in New Zealand and worldwide should push the average export prices up.

Figure 2- weighted farm gate price for export lamb 1999/00 and 2000/01



Key issues affecting beef demand

The beef industry might appear to be a typical mature industry, but there are regional dynamics caused mainly by economic development, technology and communications that add volatility and opportunity. A comprehensive understanding of issues such as price, health and safety, consistency and image are key factors governing the beef demand.

Beef consumption has a strong relationship with per capita income. Consumers react more to price change between substitute meat items than they do to absolute price fluctuations. Therefore, price competitiveness is a key determinant fact affecting beef purchases. In light of this, New Zealand has an advantage as its production is based on grass.

The recent mad cow disease (BSE) crisis in EU is a good example of how health and safety issues can affect beef consumers. An adequate tracking and tracing system is being recognised as an essential element to achieving the future stability and competitiveness of the beef industry. The beef industry has failed in meeting consistency requirements due to fragmented value chains. Consumers are demanding convenience products with excellent eating quality and it must be delivered by the industry. New market segmentations are of interest for New Zealand. Asia for example expanded its consumption of beef at a rate of approximately 6% per annum. The growth prospect in this area of the globe offers a substantial export opportunity to New Zealand.

According to Rabo Bank Report (2000a), there are potential difficulties for New Zealand exports in the low value commodities areas. However, there are opportunities to beef export to target higher value markets, within current commodity markets, in the future by developing strong value chain relationship.

Domestic farm policies, international agreements, environmental concerns and healthy and safety issues along the beef supply chain are major determinants affecting type and volume of sales and prices (Rabobank, 2000a). US is still the main market for New Zealand beef. US market is the destination for almost three-quarters of New Zealand's beef exports (ANZ, 2000). While the American demand has risen there are a concern that an early beef season in New Zealand could clash with the USA cow kill and the increased Australian competition. Demand also has started to rise in Asian markets, particularly in South Korea and Taiwan. However, the competition from Australia, the US, Canada and South America is stiff.

The impact of the problem facing European red meat industry as BSE spread to the main continent is uncertain but it may offer a windfall to the New Zealand sheep and beef industry. Overall, it is expected to have a moderate lift in schedule prices in 2001 consolidating the more significant lift of the previous season (ANZ, 2000b).

Category	1998 actual	1999 actual	2000 forecast	2001 estimated	2002 estimated	2003 estimated
steer&heifers 245-270kg c/kg	206	241	265	273	261	248
Cow M 145-170kgc/kg	178	200	203	207	198	187
Total production (T)	643.000	561.000	623.000	613.000	657.000	694.000

Table 2 -Actual and estimated beef prices and volume of production in New Zealand.

Exchange rate

The New Zealand's foreign exchange rates have seen major fluctuation in recent times. Until 1985 New Zealand had fixed exchange rates. At that time, the New Zealand dollar was tied to the British pound. The government used to control the changes acting as a broker buying and selling currency to export and importers (Woodford, 2001).

The exchange rates are very volatile in New Zealand. It is also hard to predict with accuracy the fluctuations. Even the Reserve Bank of New Zealand recognised the difficulty associated in predicting exchange rate. The volatility of exchange rates used to influence by commodity prices. However, at recent times capital investments, interest rates and economic perceptions of growth prospects are the key issues influencing exchange rates (Woodford, 2001). Trends of New Zealand dollar and the main events influencing its volatility is shown in Figure (3)

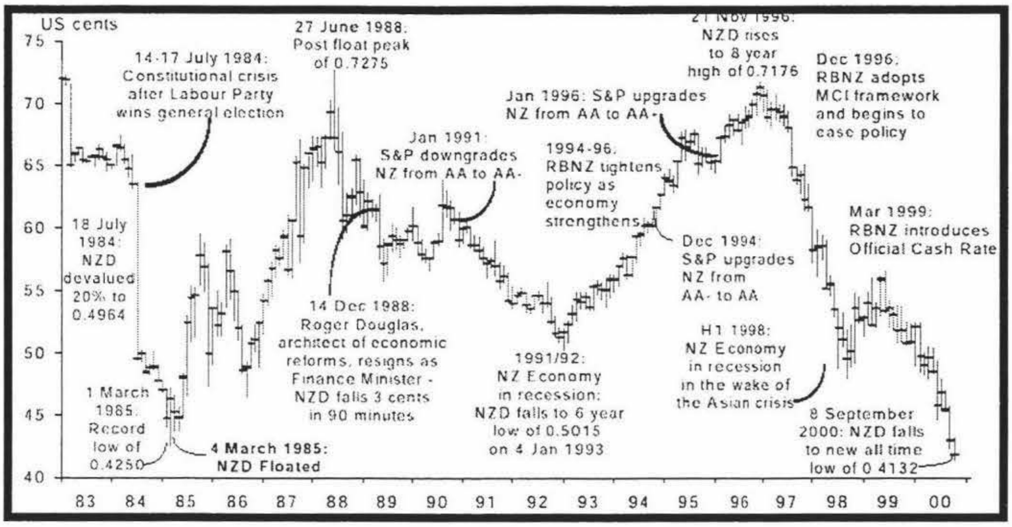


Figure 3- Volatility of NZ dollar since 1983. Source: ANZ, 2000c

Climate

The climate has a marked effect on production and therefore productivity. The recent changes perceived in the current climate conditions can be expected to increase production risks and require changes in the way farmers manage their enterprises. Some of the major risks include:

Increased frequency of droughts, high winds and localised flooding leading to business disruption and infrastructure damage.

Increased pressure on water resources available

Increased pest and disease problems such as facial eczema

On the other hand, some of the potential benefits are also expected:

The expansion of existing crops into new production areas, for example *Pinus radiata* or kiwifruit or maize, may be able to be grown in areas not currently planted due to climatic limitations (MAF, 2001). Rising temperatures and C02 levels may assist the growth of pastoral plants and forestry species.

Agriculture is the main source of greenhouse gas emissions in New Zealand. In 1995 the sector was responsible for more than half (58%) of New Zealand's total greenhouse gas. A number of possible impacts of climate change have been identified. The main impacts are predicted to be temperature increases, sea level rises, changes to rainfall patterns and increased variability of weather events (MAF, 2001). Climate models for the Australia-New Zealand region predict average temperatures to rise between 0.70C and 3.10C over the next 100 years. Globally, rainfall is expected to increase in some areas and decrease in others. Changes are likely to be highly localised.

In New Zealand, climate models predict a decrease in year round rainfall on the east coast of the South Island and in winter rainfall on the east coast of the North Island. Elsewhere, rainfall is predicted to increase. The El Nino that took place in 1998 is a good example of how the farming business can be affected by weather pattern events. Such event could be reflected in the decrease of farm revenues in this particular year. The El Nino induced drought that struck most of the east coast of both Islands. It was estimated the negative effect of El Nino was to reduce farm gate returns $260 million at the year ending 30 June 1998, with a further loss of $170 million over the next few years. As a response farmers can adjust the stock policies based on tactical decisions (anticipate sales or buy in supplements). The drought in 1998 led to the early marketing of livestock and eventually to some disposal of capital stock (SONZAF, 1998).

Politics, Law and Policy Regulations

Law and regulations create restrictions for farming practices and techniques. The Resource Management Act and Occupational Safety and Health regulations is a good example. It places restriction of farming practices and outcomes such as soil contamination due to excessive use of chemical is no longer acceptable. All farming practices must be carried out in a safe manner avoiding any long-term damage to the environment as farmer can be liable. The emphasis on policies concerning environmental issues is supported by the new government given their reliance on the Green Party for support in Parliament (ANZ, 2000a).

World wide animal welfare is gaining importance. Consumers are more concerned about how farming animals are treated and handled and issues such as this are as important as non-tariff barriers in certain markets. There are signs that animal welfare will have the potential to play an increasingly influential role in international trade. It is important then for New Zealand producers to stay responsive to changing consumer attitudes to guarantee market access. In New Zealand, The Animal Welfare Act was launched in 1999. It comprises the principles and details codes of New Zealand's animal welfare performance. Such codes cover a variety of farm practices and management procedures (e.g., tail docking, transport of animals). All farm animals are protected under the Animal Welfare Act 1999 including livestock and working animals such as farm dogs and horses (Ross, 1999).

Appendix Two. Farm business analysis and financial ratios

FINANCIAL PERFORMANCE INDICATORS FOR CASE FARM ONE

	1994	1995	1996	1997	1998	1999	2000
	30-Jun-1994	30-Jun-1995	30-Jun-1996	30-Jun-1997	30-Jun-1998	30-Jun-1999	30-Jun-2000
Sheep							
Closing Balance				177987	124930	126306	122891
Plus Sheep sales				159327	110722	110366	147771
Less Sheep Purchase				-3800	-4365	-5819	-3285
Less opening balance				-112326	-177987	-124930	-126306
Total				221188	53300	105923	141071
Cattle							
Closing Balance				135786	78350	102815	177216
Plus cattle sales				122873	144160	102641	112623
Less cattle Purchase				-38151	-13475	-5460	-7650
Less opening balance				-97394	-135786	-78350	-102815
Total				123114	73249	121646	179374
Wool				75716	56381	55048	53933
Other Farm income							
airstrip				800	2760	1352	3046
rebates				545	0	142	310
goats				0		9825	6548
sharefarming cattle				0		2690	3983
Total				1345	2760	14009	13887
Gross Farm Income	388324	142342	247487	421363	185690	296626	388265
Working expenses	101664	92978	88660	95685	100441	112315	118401
Repair & Maintenance	106670	82805	67548	85840	89088	59901	73523
Financial & Standing Charges	66296	80842	2541	2520	2757	2667	3271
Rates			8142	8286	9787	9855	10660
Depreciation	25275	20612	17065	14419	14663	14457	26885
Operating Expenses (inc.deprec)	299905	277237	183956	206750	216736	199195	232740
Interest			43040	29678	21663	16890	13155
Rent			0	0	0	0	0
Total Expenses	299905	277237	226996	236428	238399	216085	245895
Economic Farm Surplus	128573	-82059	28531	179613	-66046	62431	120525
NOPAT	90001	-57441	19972	125729	-46232	43702	84368
Operating Profit Margin	33.1%	-57.6%	11.5%	42.6%	-35.6%	21.0%	31.0%
Cash farm exp. % GFI	70.7%	180.3%	67.4%	45.6%	108.8%	62.3%	53.0%
Net Farm Income			43466	59072	-7386	27202	30514
Farm Cash Surplus				-40000	-18219	-2667	77713

Balance sheet							
Current Assets			23458	1344	3772	47620	40919
Total Assets	1549072		1089987	1715671	1615394	1706834	1973485
Current Liabilities			37619	55504	76150	122674	38259
Total Liabilities	166567		669329	657214	647860	694384	609969
Change on total assets				57.4%	-5.8%	5.7%	15.6%
Solvency							
Debt:Assets	10.8%	-	61.4%	38.3%	40.1%	40.7%	30.9%
Debt:Equity (leverage)			159.1%	62.1%	67.0%	68.6%	44.7%
Net worth (equity)	1382505		420658	1058457	967534	1012450	1363516
Change owner's equity				637799	-90923	44916	351066
Equity %	89.2%	N/A	38.6%	61.7%	59.9%	59.3%	69.1%
Equity growth				0.0%	-8.6%	4.6%	34.7%
Net Indebtedness			645871	655870	644088	646764	569050
Change indebtedness				9999	-11782	2676	-77714
Debt Servicing							
Liquidity (current ratio)			0.62	0.02	0.05	0.39	1.07
Working capital			-14161	-54160	-72378	-75054	2660
Debt Servicing:GFI			17.4%	7.0%	11.7%	5.7%	3.4%
Capital Efficiency							
Capital Turnover Ratio	25.1%	-	22.7%	24.6%	11.5%	17.4%	19.7%
Revenue per employee	129441	47447	82496	140454	61897	98875	129422
Fixed cost %	30.5%	0.0%	31.2%	23.2%	20.5%	20.3%	21.9%
Growth	1994	1995	1996	1997	1998	1999	2000
Cost of Debt							
Interest	55879	70402	43040	29678	21663	16890	13155
Rent			0	0	0	0	0
Less Tax credits	-16764	-21121	-12912	-8903	-6499	-5067	-3947
Total Cost of debt	39115	49282	30128	20775	15164	11823	9209
Cost of debt (%)	23.5%	-	4.5%	3.2%	2.3%	1.7%	1.5%
Cost of equity							
Drawings	35000	35000	35066	43356	39632	35826	39374
Value of family labour after tax	24500	24500	24500	24500	24500	24500	24500
Debt repayment			0	0	11782	0	77714
Extracted cost of equity	10500	10500	10566	18856	26914	11326	92588
Cost of Equity (%)	0.76%	-	2.51%	1.78%	2.78%	1.12%	6.79%
Extracted cost of capital	49615	59782	40694	39631	42078	23149	101797
Cost of capital (%)	3.20%	-	3.73%	2.31%	2.60%	1.36%	5.16%
Sustainable Business Growth	40386	-117223	-20722	86099	-88310	20553	-17429
NPV (NZ$ million)	$2.8	-	$0.53	$5.4	-	$3.2	$1.6

FINANCIAL PERFORMANCE INDICATORS FOR CASE FARM TWO

	1996	1997	1998	1999	2000
	31-Aug1996	31-Aug1997	31-Aug1998	31-Aug1999	31-Aug2000
Sheep					
Closing Balance		134290	109270	143190	175990
Plus Sheep sales		104270	112758	90984	123234
Less Sheep Purchase		(2,401)	(4,370)	(36,683)	(9,800)
Less opening balance		(134,510)	(112,270)	(115,030)	(167,240)
Total	85053	101,649	105,388	82,461	122184
Cattle					
Closing Balance		49858	57483	97576	128764
Plus cattle sales		23979	27580	75973	89812
Less cattle Purchase		(9,005)	(10,109)	(47,630)	(22,235)
Less opening balance		(42,613)	(51,660)	(72,469)	(131,019)
Total	19180	22219	23294	53450	65322
Wool	40975	37028	36449	45008	28608
Other Farm income				23%	-36%
Saddle sales		187	2760	1352	3046
Trading rebates	4571	4311	0	142	310
Total	4571	4498	2760	1494	3356
Gross Farm Income	149,779	165,394	167,891	182,413	219,470
%change		10.4%	1.5%	8.6%	20.3%
Off-Farm Income	31,415	32,241	24,730	13,718	268
Working expenses	71,539	64,769	99,609	107,176	104,925
Repair & Maintenance	9,239	24,090	35,482	23,797	18,183
Financial & Standing Charges	13,862	15,086	10,141	15,805	13,474
Depreciation	4,367	17,173	12,931	22,083	18,675
Operating Exp. (inc.dep.)	99,007	121,118	158,163	168,861	155,257
%change		22.3%	30.6%	6.8%	-8.1%
Interest	39,055	39,619	38,398	43,938	58,979
Total Expenses	138,062	160,737	196,561	212,799	214,236
Economic Farm Surplus	15772	9276	(25,272)	(21,448)	29213
EFS (adjusted)	17,465	80	630	3,366	50,055
EFS adjustments					
Fertiliser	1,693	(9,196)	3,340	2,252	(1,721)
Contracting	-	-	13,252	13,252	13,252
Drainage	-	-	9,310	9,310	9,310
Total	1,693	(9,196)	25,902	24,814	20,842
NOPAT	12226	56	441	2356	35038
Operating Profit Margin	11.7%	0.0%	0.4%	1.8%	22.8%
Cash farm exp. % GFI	63.2%	62.8%	86.5%	80.5%	62.2%
Net Farm Income	16,288	9,155	(25,910)	(28,892)	8,590

Balance sheet					
Current Assets	28331	15208	15072	18121	6682
Total Assets	1012920	1111194	1118819	1191507	1231358
Current Liabilities	80149	50513	61315	58306	85150
Total Liabilities	447102	528354	496373	799123	805099
Change on total assets		9.7%	0.7%	6.5%	3.3%
Current Investment	15684	24624	25036	25233	26345
Solvency					
Debt:Assets	44.1%	47.5%	44.4%	67.1%	65.4%
Debt:Equity (leverage)	79.0%	90.7%	79.7%	203.7%	188.9%
Net worth (equity)	565818	582840	622446	392384	426259
Change owner's equity		17022	39606	-230062	33875
Equity %	55.9%	52.5%	55.6%	32.9%	34.6%
Equity growth		3.0%	6.8%	-37.0%	8.6%
Net Indebtedness	403087	488522	456265	755769	760633
Change indebtedness		85435	-32257	299504	4864
Debt Servicing					
Liquidity (current ratio)	0.35	0.30	0.25	0.31	0.21
Working capital	-51818	-35305	-46243	-40185	-67029
Capital Efficiency					
Capital Turnover Ratio	14.8%	14.9%	15.0%	15.3%	17.8%
Revenue per employee	59912	66158	67156	72965	87788
Fixed cost %	37.2%	40.3%	28.9%	34.4%	40.0%
Growth	1996	1997	1998	1999	2000
Cost of Debt					
Interest	39055	39619	38398	43938	58979
Rent	0	0	0	0	0
Less Tax credits	(11,717)	(11,886)	(11,519)	(13,181)	(17,694)
Total Cost of debt	27339	27733	26879	30757	41285
Cost of debt (%)	6.1%	5.2%	5.4%	3.8%	5.1%
Cost of equity					
Drawings	33862	35909	33534	25000	32263
Value family labour after tax	24500	24500	24500	24500	24500
Less off-farm income	31,415	32,241	24,730	13,718	268
Debt repayment	0	0	32257	0	0
Extracted cost of equity	(22,053)	(20,832)	16,561	(13,218)	7,495
Cost of Equity (%)	-3.90%	-3.57%	2.66%	-3.37%	1.76%
Extracted cost of capital	5286	6901	43440	17539	48780
Cost of capital (%)	0.52%	0.62%	3.88%	1.47%	3.96%
Sustainable Business Growth	6,940	(6,845)	(42,999)	(15,182)	(13,742)
Net Present Value	$ 2,342,911	$ 9,017	$ 11,349	$ 160,071	$ 884,466

Formulas:

Gross Farm Income

GFI= Total revenues less stock purchases +/- livestock changes

Economic Farm Surplus

EFS= GFI - Operational Expenses (incl. Depreciation) -35.000

NOPAT = EFS – 30%

Return on Assets (ROA)

Property Business=(Closing asset values – Opening asset values)/Opening asset values
Farming Business= EFS/ Asset values
Combined return= NOPAT +Change asset value/Opening Asset value

Return on Equity

EFS –Interest- Rent/Net Worth

Operating Profit Margin= EFS/GFI

Solvency

Debt:Assets= Total liabilities/Total assets

Debt:Equity (leverage)= total liabilities/Net worth

Net worth (equity) = Total Assets – Total Liabilities

Equity %= Net worth/total assets

Net Indebtedness= Total liabilities-(Current assets + liquid invest)

Debt Servicing

Liquidity (current ratio) = Current assets/Current liabilities

Working capital= Current assets-Current liabilities

Debt Servicing= Interest/ GFI

Capital Efficiency

Capital Turnover Ratio= GFI/ Total assets

Fixed cost %= Depreciation+rates+Insurance+interest/total expenses

Growth

Cost of debt= Interest+ rent – tax credits

Extracted cost of equity=Drawings-family labour & Management after tax + debt repayment

Cost of Equity (%)= cost of equity/ net worth

Extracted Cost of Capital=Cost of Debt+Extracted Cost of equity

Cost of capital (%)= Total cost of capital/ (Net worth+Total liabilities)

Sustainable Business Growth= NOPAT- Extracted cost of capital

Net Present Value= EFS/ Cost of capital (%)

Appendix Three. Modelling spreadsheets and assumptions

ASSUMPTION FOR COST OF EQUITY AND INVESTMENTS

Case study one

Year	Drawings	Education costs	Manager
1-3	38000		
4-6	38000		
7-10	38000	17000*	35000
11-13	35000	17000 per child (2)	35000
14-15	40000		35000

* Starting at year 10 – one child

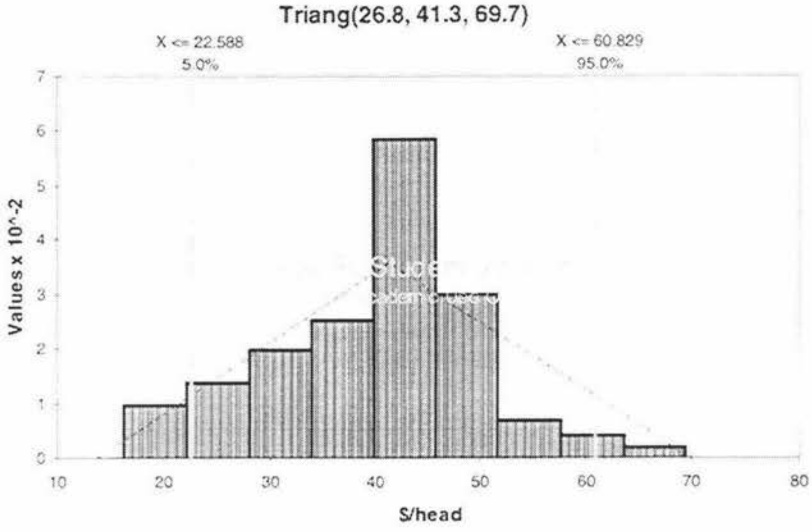
Case study two

Year	Drawings	Education costs
1-3	30000	15000*
4-6	30000	15000 per child (2)
7-10	35000	
11-13	40000	
14-15	40000	

*Starting at year 2 – one child

- The value for reward unpaid labour and management is $35.000 per year. For CFS one, this value decrease to $15.000 as full time manager is contracted. Therefore, case farmer's work input will decline.
- The annual cost for education is $17.000 per child (ranges from 15000 to 17000). It includes university fees and living costs. The university course is assumed to last for three years. (North and South Magazine, February 1997, page 39.
- The current debt for CSF one is assumed to be refinanced for 10 years at 8% interest rate. The loan necessary to lift fertility levels is estimated in $285.000. This money is to be paid in five years at 9% interest rate. This sum was calculated as the cash necessary to fertilise 60% of the best area applying 500 kg/ha of RPR for three years (lift Olsen P from 11 to 20).
- The current debt for CSF two is assumed to be refinanced for 15 years at 7% interest rate. The loan necessary to lift fertility levels is estimated in $90.000. This money is to be paid in five years at 7% interest rate. This sum was calculated as the cash necessary to improve fertility in 80% of farm applying 500 kg/ha of RPR for three years (lift Olsen P from 15 to 22).

AN EXAMPLE OF DATA (LAMB PRICE) DISTRIBUTION USING BESTFIT® TOOL



PRICE CORRELATION BETWEEN THE DIFFERENT PRODUCT

	Lamb	Mutton	Cow	Steers	Wool
Lamb	**1.00**	0.90	0.36	0.38	0.02
Mutton	0.90	**1.00**	0.12	0.15	0.00
Cow	0.36	0.12	**1.0**	0.92	0.28
Steers	0.38	0.15	0.92	**1.00**	0.27
Wool	0.02	0.00	0.28	0.27	**1.00**

THE USE OF STOCKPOL®

Stockpol® is a software package that was designed for decision support on sheep, beef and deer enterprises. It was designed for use by consultants who give advice on stock policy decisions (McCall et al, 1993). The software can be used to compare the profitability of different stock policy option for a farm. Stockpol® provides a biologically realistic model for a complex farm system. The main use of this software in this study will be for testing the biological feasibility of alternative livestock systems. User-defined target live weights and performance levels will be considered to calculate energy requirements (in MJ ME/d). In conjunction with the number of stock in each class, these values will determine pasture DM intake. The model calculates the minimum pasture cover required to achieve these intake levels. Pasture and animal growth are dynamically simulated, and finally, the software report a farm system as being feasible or infeasible by comparing the minimum pasture cover required by livestock with the "actual" pasture cover calculated by the model. The accuracy of the results relies on the reliability of the input data to reflect the real behaviour of the farm system.

STRUCTURE OF STOCKPOL®

A farm system is quantitative described by sub-files within Stockpol®. The sub-files are as follows:

Livestock Sub-files:	**Land Sub-file:**
Weaning percentage	Land block area
Mating, weaning and shearing dates	Monthly pasture growth rates
Animal breed	Topography and aspect
Live weight profile	Pasture quality
Daily live weight gains for growing Stockpol®	Nitrogen applications
Stock numbers (deaths, birth, sales, purchases)	Cropping dates and areas
Stock sale and purchase dates	Pasture conservation dates and areas
Feed Sub-files:	**Price Sub-file**
Type and quantity of bought in supplements	Schedule prices, wool prices, store price
Timing and quantity of fed supplements	Animal health costs
Specifications of feed (DM, prices, quality...etc.)	Interest cost Capital values for the stock Cropping and re-grassing costs Feed conservation costs

When on-farm pasture growth data is not available, the Stockpol® has a pasture and weather database which can be used to generate local pasture information.

MODEL OPERATION

Once the farm system is defined through inputs in the sub-files of Stockpol®, its biological feasibility can be assessed. The basis of Stockpol® is essentially a feed budget equation. This calculates actual pasture cover (APC) at time (t), by subtracting animal intake (I) and adding the net accumulation of pasture, G, (KgDM/ha/day) to APC at time, t-1:

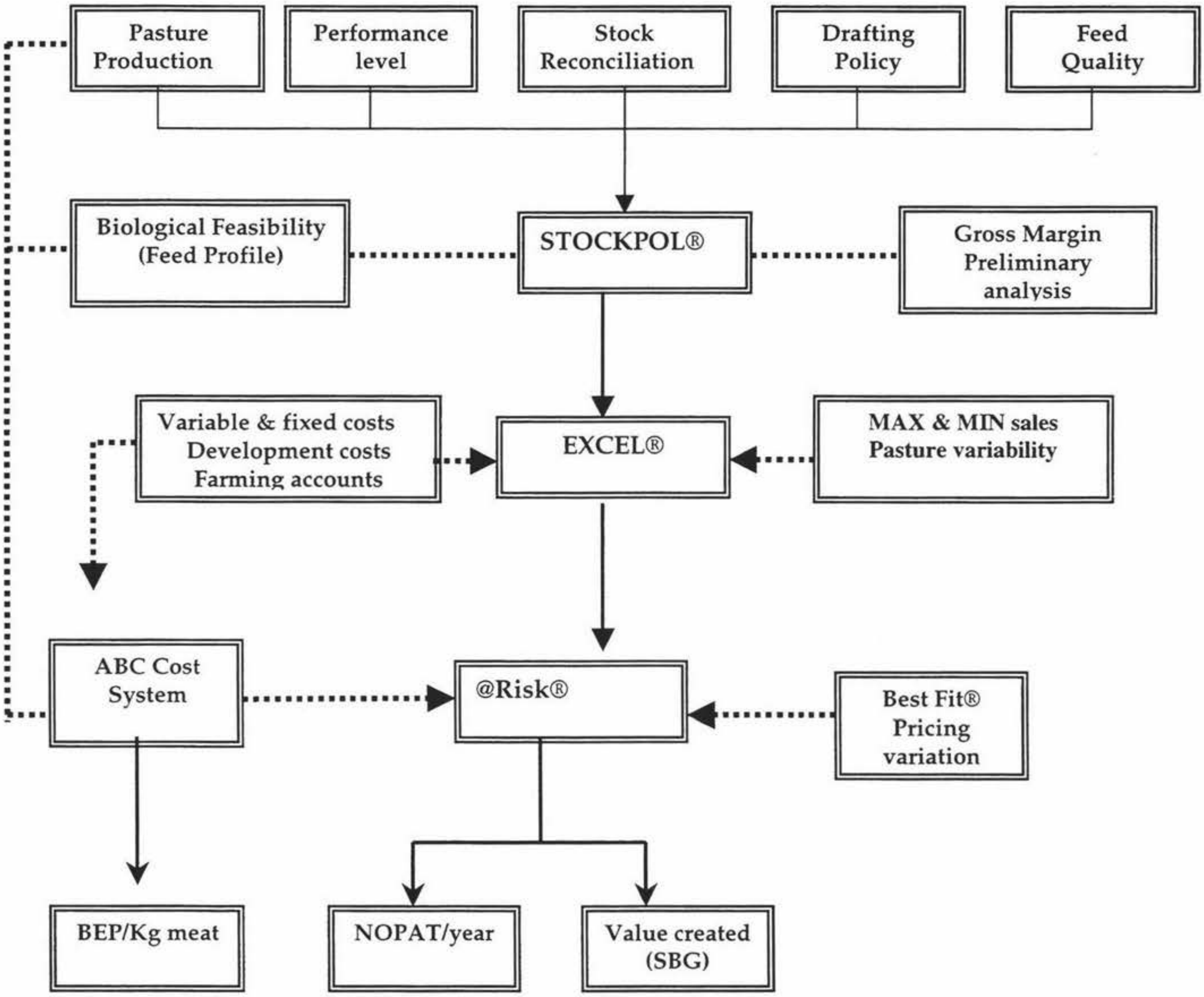
$APC_t = APC_{t-1} + G_t - I$, Where:

APC = actual pasture cover (kgDM/ha) on day t

G = pasture growth (net herbage accumulation, KgDM/ha/day)

I = animal intake (kgDM/ha/day)

SCHEMATIC DIAGRAM OF MODEL INPUTS AND OUTPUTS



AN EXAMPLE OF ABC SYSTEM SPREADSHEET

			non pastoral conservation	Pastoral Livestock			
Effective hectares	500						
Cash crop (ha)	0						
Sheep intake	2034282.3						
% of total	68.9%			Cattle	sheep		
Cattle Intake	834954.69				wool	meat	
% of total	28.3%				9.05%	90.95%	100.00%
Conservation	85000			28.26%	6.49%	65.24%	100.00%
% of total	2.88%		2.88%	27.45%	6.31%	63.37%	100.00%
Total DM utilised	2954237	0.00%	2.88%	27.45%	6.31%	63.37%	100.00%
Intake/ha	5738	14.00%	2.47%	23.61%	5.42%	54.50%	100.00%

Farm expenses								**meat**	**wool**	**Beef**
Wages General	5821	0.00%	0.00%	5.00%	8.60%	86.40%		5029	501	291
Animal Health	12675			28.26%	6.49%	65.24%		8270	823	3582
Pest & Weeds	467		2.88%	27.45%	6.31%	63.37%		296	29	128
Shearing & Crutching	15323				100%				15323	0
Fertiliser	18277	14.00%	2.47%	23.61%	5.42%	54.50%		9961	991	4315
Seed &drilling	1678		2.88%	27.45%	6.31%	63.37%		1063	106	461
Vehicle expenses		0.00%	2.88%	27.45%	6.31%	63.37%		0	0	0
fuel & oil	5115	0.00%	2.88%	27.45%	6.31%	63.37%		3241	323	1404
Electricity	1338	0.00%	2.88%	27.45%	6.31%	63.37%		848	84	367
Feed and Grazing	1282			28.26%	6.49%	65.24%		836	83	362
Repairs & Maintenance	18183	0.00%	2.88%	27.45%	6.31%	63.37%		11522	1147	4991
Cartage & freight	4991			50.00%	4.53%	45.48%		2270	226	2496
Administration	4358	0.00%	2.88%	27.45%	6.31%	63.37%		2762	275	1196
General expenses	6015									
Sub-total working exp.	95523							46098	19910	19594
Standing charges										
insurance	3655	0.00%	2.88%	27.45%	6.31%	63.37%		2316	230	1003
AC levies	847	0.00%	2.88%	27.45%	6.31%	63.37%		537	53	232
rates	4614	0.00%	2.88%	27.45%	6.31%	63.37%		2924	291	1267
Sub total	9116							5777	575	2502
Total Cash exp.	104639							51875	20485	22096
Depreciation	18675	0.00%	2.88%	27.45%	6.31%	63.37%		11834	1178	5126
Reward L & M	35000	0.00%	2.88%	27.45%	6.31%	63.37%		22179	2207	9607
Total Expenses	**158314**							**85888**	**23869**	**36830**
less other income	0	0.00%	2.88%	27.45%	6.31%	63.37%		0	0	
Sheep income										
Wool	12800	2.8100	35968							
Export lambs	2471	44.66	110355							
Store Lambs	0	33.18	0.00							
Other income			12888		9.05%	90.95%		11721.6	1166.4	
Cow income			6600	27.45%						1812
				Operating Costs (pre-tax)				74166	22703	35018
				Adjusted for pos-tax values				51916	15892	
Cost of Capital	48780	0.00%	2.88%	27.45%	6.31%	63.37%	Post-tax	30911	3076	13390
							Pre-tax	44158	4394	19129
					Total Cost (after tax)			82827	18968	
					Total Cost (before tax)			118324	27097	54147

Pre tax figures	
Lamb production (kg)	37065
Wool Production (kg)	12800
BEP price for lamb ($)	**3.19**
BEP price for wool ($)	**2.12**
BEP for Lamb meat only	
Lamb production (kg)	37065
Total costs	145421
Less Wool income	35968
	109453
BEP for Lamb	**2.95**

Stock clas:	**LW (kg)**	**Qty**	
R1 hfr	250	13	3250
R2 str	480	25	12000
R1 str	270	117	31590
			46840

46840

BEP Beef	**1.16**

PROBABILITY (<=) OF NOPAT AND SUMMARY STATISTICS FOR CASE STUDY ONE - Base system

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum	-23034	-21812	-22490	-16611	-23518	-36435	-35379	-34358	-34419	-35238	-31651	-30938	-29053	-32417	-31052
Maximum	100888	95341	91988	94018	102552	83890	79874	88496	78644	82815	72923	73368	86942	85416	82809
Mean	27877	27873	27942	27866	27611	14251	14302	14304	14255	14291	14244	14199	14323	14282	14202
Std Deviation	21018	21167	21185	20900	21120	20589	21433	21140	21282	21372	20652	21302	20850	21083	20910
Mode	16306	26561	29505	24718	16075	7407.8	9256.1	5820.3	2649.1	17927	7724.9	1938.2	35626	14159	15234
5% Perc	-5982.9	-6669.9	-5370	-4934.6	-5372.8	-19076	-20087	-21817	-18288	-18124	-19429	-21213	-17987	-21407	-17826
10% Perc	-464.18	-313.32	-500.92	2283.5	1370.2	-12479	-12130	-11842	-12773	-12111	-11603	-12111	-11471	-12046	-14715
15% Perc	9476.6	7044.5	7973.2	5693.2	9348.1	-4015	-6366.6	-6502.3	-7628.9	-3317.3	-7546.1	-7951.6	-4913.8	-7618	-7407.8
20% Perc	12128	14081	12645	9196.6	10917	-1879.1	-994.58	-3752	-4460.1	-797.61	76.763	-1518	-3094.3	-439.06	-3448.9
25% Perc	14358	15308	13673	13253	14976	1244.5	1136.2	2403.6	534.38	799.49	2090.9	594.29	-911.84	2471.9	865.08
30% Perc	16511	16839	17398	16133	16135	2749.8	3189.1	3805.5	2715.9	2297.9	3829.6	2076.4	3997.3	3153.5	3303.8
35% Perc	19623	18742	19697	20086	19196	6212.9	6415.6	5799.1	5938.3	4525.3	6905.2	3673.3	5962.4	5124.2	6367.6
40% Perc	22805	20784	22748	21422	21452	9065.5	7723.7	8508.2	7138.1	7434.1	9022.9	7102.1	8136.2	6560.2	8110.6
45% Perc	24975	24985	24894	24037	22830	12258	9407.8	11645	10354	10569	9697.6	8951.1	9453.4	10277	10933
50% Perc	26801	26585	26065	25856	26605	12812	13306	12902	13258	11892	11557	12174	12589	12925	13715
55% Perc	28627	27514	27021	27109	29196	13939	14707	16565	14157	13401	14323	14023	13792	14337	15189
60% Perc	30196	29377	29575	29733	29882	16626	16118	17132	16942	16016	15565	15906	16146	16839	16089
65% Perc	32467	31497	30650	32353	31068	19301	19572	17981	20356	17927	17010	17877	18631	19648	18787
70% Perc	34644	34448	33024	37901	34503	21277	21772	20424	22541	21944	19663	23049	23356	22311	19701
75% Perc	38171	40046	40659	41002	40574	24501	25163	26112	25739	25744	26703	27550	26247	24738	24345
80% Perc	42799	44229	41604	43641	42208	28176	28500	27790	29003	32049	30315	29695	28847	30642	28924
85% Perc	47954	49290	48750	46836	47346	32867	31557	34569	35958	37009	34771	35324	35577	35967	37257
90% Perc	56450	56346	61233	55405	58066	43490	42489	44671	44676	44050	42691	46511	43575	42218	44124
95% Perc	63799	66754	63966	67155	65761	52624	55807	46931	50089	50573	53110	49160	53404	51833	50802

PROBABILITY (<=) OF NOPAT AND SUMMARY STATISTICS FOR CASE STUDY ONE - Full Organic

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum	-16344	-4307	2142	13518	14562	-2875	-1690	-954	1365	2371	10106	7604	6643	5684	9691
Maximum	136877	165469	153298	206367	216164	202929	209749	200949	216376	207336	210547	209218	213477	206461	223827
Mean	62622	76094	84963	117914	117385	107532	107670	107603	107535	107626	108026	107308	107359	107570	107258
Std Deviation	31337	34288	34516	42888	42782	41000	43324	43204	42089	42169	44122	42040	40816	43354	42139
Mode	48913	54643	97082	82185	109963	97403	98406	165573	121542	106531	103164	104609	99784	128187	51492
5% Perc	11381	22454	25895	43635	43090	36965	35671	37505	33857	41532	34847	38575	41427	36212	40118
10% Perc	21675	30623	37361	64422	57233	59223	48581	52471	53895	52497	50784	59004	52653	52211	51401
15% Perc	32214	38036	43921	75719	70418	65057	59503	59505	65693	60710	60324	64226	65409	63422	63104
20% Perc	36319	50501	57672	79884	80924	72927	67859	68065	74860	71305	64111	72635	72839	68554	72239
25% Perc	42385	54618	64106	83535	95449	83307	77968	80474	78607	77369	78453	75866	79997	74547	76702
30% Perc	47011	55693	67707	92324	99547	86312	87637	85644	82738	84648	84565	81078	86401	85040	84094
35% Perc	48894	61793	70806	99963	103431	91712	96000	89460	85344	93671	91501	88676	92887	88623	92550
40% Perc	51377	65892	74414	105604	104909	97233	99811	92903	91148	97585	96872	96915	99646	91685	99221
45% Perc	58107	68762	79822	113187	109094	103673	105706	100163	96445	100518	99329	101348	103380	100483	102416
50% Perc	62050	73631	83421	117282	116390	106997	110278	103408	107548	104325	103421	104584	108300	105918	105433
55% Perc	66220	77375	89571	121877	119371	111101	113325	109172	115567	107065	108559	107312	112570	112142	106901
60% Perc	67665	80716	92352	124850	125474	114163	115389	118391	120487	118007	119082	114418	115034	115441	111666
65% Perc	72086	87342	97067	132071	126936	120546	119314	123734	123133	124257	124990	121802	122358	122102	119511
70% Perc	77326	93402	101557	142243	138737	123600	127949	134981	125709	128304	132339	126054	124987	128053	125587
75% Perc	82418	101725	108712	145760	150559	131922	132954	138913	132795	134029	140600	133742	129019	135780	132420
80% Perc	89878	104772	115692	156795	152763	143140	143659	148253	145956	143461	148295	144097	132495	140192	145979
85% Perc	97763	112158	122195	166458	160345	153179	146319	151485	150173	154753	153142	151936	146320	155052	153082
90% Perc	102555	120522	131001	177199	175280	162392	166326	159613	162293	162433	164406	164954	155440	166481	159720
95% Perc	113239	134604	141672	188689	187184	176350	180536	179199	173282	178469	177305	175402	178775	178551	172779

PROBABILITY (<=) OF NOPAT AND SUMMARY STATISTICS FOR CASE STUDY ONE - Conventional

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum	-38372	-2275	12046	7907	11209	15509	16480	7353	9870	13817	10097	9378	13373	15830	12498
Maximum	146344	219506	243982	247030	267760	262045	283368	265876	253557	272625	280415	270344	284340	262255	272942
Mean	58690	102419	124118	125144	132929	133431	133505	134328	134234	134281	134465	133928	134045	134169	134437
Std Deviation	36465	42588	46178	48162	49792	51455	50983	51324	50590	51107	51836	50080	50833	51304	52259
Mode	46814	110107	126698	126497	160511	115112	96417	159207	100456	148510	100032	192321	151053	92322	104763
5% Perc	3515	40708	53639	50054	56997	52476	54515	53407	52189	56031	48535	51375	57424	51114	48880
10% Perc	13022	50047	67018	62197	70877	66615	70548	67831	71539	71597	72628	68818	71260	68820	70792
15% Perc	21102	57740	72729	70939	77927	76816	78059	75440	81218	77110	80204	80869	79793	80790	76912
20% Perc	27294	66008	84282	87744	88045	88591	91007	90678	88316	87645	88530	89882	88692	92329	86250
25% Perc	33819	72456	92511	91440	95480	94866	96356	96004	98864	95551	99919	98534	96374	96852	98787
30% Perc	37999	77345	99603	96913	102827	101723	105941	105565	100527	101655	101675	103609	103685	101787	103714
35% Perc	43179	80462	100964	101110	109398	109183	110589	109981	104755	112590	110331	108400	108671	106322	105672
40% Perc	45812	86668	105526	106652	113064	115038	117802	114375	112905	117202	118019	115028	115044	114901	114330
45% Perc	47068	94151	113967	115280	120982	125582	122754	120665	119279	123139	121974	119884	122137	124332	122382
50% Perc	55728	99515	123199	126500	130200	136993	131183	138621	138355	133884	134336	130689	135290	135206	134014
55% Perc	61905	105613	126595	133331	141277	139434	138961	143184	145883	137300	140707	145208	146462	141744	141723
60% Perc	64207	110179	133783	136881	144707	145726	144158	147699	149293	147457	146857	150826	149544	150618	144599
65% Perc	69849	114598	140056	143367	151990	151066	153407	150743	153862	150777	150702	154784	151212	154462	154758
70% Perc	78323	123913	146135	150107	160166	158953	160579	159039	158671	158939	158543	158376	154456	157763	161601
75% Perc	82261	129303	154715	157497	165042	166166	165757	170048	166249	170706	163512	164730	164212	163328	169513
80% Perc	89099	134568	166338	164240	170597	180586	172840	174519	177756	180162	177263	170309	170547	177414	177764
85% Perc	96895	140143	171524	169480	184909	188992	180136	182777	187846	184837	189556	180264	181220	185637	185348
90% Perc	107614	160776	183519	185242	195342	192758	195081	196830	195831	196936	200315	192743	196512	196626	198542
95% Perc	123069	184456	204319	202588	215236	222237	227282	224330	234260	224908	224709	217723	210888	227503	220198

CASE FARM ONE- BASE SYSTEM FORECAST MODEL

SHEEP	Min	Most likely	Max	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Lambs ($)	27	40	70															
Qty	1422	1580	1738	65649	84687	68171	87479	92502	87817	71874	58300	78445	72341	43688	98421	65845	68816	51106
MA ewes ($)	20	32	44															
Qty	660	740	815	20092	20844	22371	19988	22680	20897	18776	18492	17212	20363	16954	15012	19032	15768	22261
Wool ($)	2.1	3.0	4.5															
Qty	21000	23000	25000	82884	67936	63962	55917	52155	73476	80519	67649	78864	58468	68724	68190	75507	51750	59874
CATTLE																		
Cull cows ($)	239	511	825															
Qty	69	72	80	52562	43314	33626	51175	49626	36011	49600	43858	50375	32476	39456	42499	49690	51062	29723
Steers &heifers ($)	323	641	941															
Qty	140	151	160	42651	44961	57531	45608	45517	50215	44950	42953	44688	43527	42248	51318	47732.14	49279.59	45382.04
PURCHASES																		
Rams ($)	200	300	450	-5254	-4585	-3240	-4453	-5077	-4438	-3871	-4420	-3593	-4978	-4264	-4916	-3887.953	-4376.53	-3991.411
Bulls ($)	1500	1800	2100	-5294	-5555	-5751	-5211	-5611	-5262	-4920	-5002	-5509	-6115	-5285	-5219	-5035.024	-4845.486	-4839.962
Gross Farm Income				**253290**	**251602**	**236671**	**250502**	**251793**	**258714**	**256928**	**221830**	**260482**	**216082**	**201520**	**265304**	**248884**	**227454**	**199515**
Wages General and ACC				27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000
Manager									35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
Shearing & Crutching				18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000
Animal Health				10000	10000	10000	10000	10000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000
Cartage & freight				6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
General Station expenses				4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
Power				5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Administration				4000	4000	4000	4000	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
Vehicle expenses				11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000
Repairs & Maintenance				20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
Fertiliser				40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000	40000
Rates & Standing charges,				10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Total F.WE				155500	155500	155500	155500	156000	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000
Operating Surplus				**97790**	**96102**	**81171**	**95002**	**95793**	**68714**	**66928**	**31830**	**70482**	**26082**	**11520**	**75304**	**58884**	**37454**	**9515**
Depreciation				15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
Management reward				35000	35000	35000	35000	35000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
EFS				47790	46102	31171	45002	45793	33714	31928	-3170	35482	-8918	-23480	40304	23884	2454	-25485
Plus fertiliser adjustments									0	0	0	0	0	0	0	0	0	0
Adjusted EFS				47790	46102	31171	45002	45793	33714	31928	-3170	35482	-8918	-23480	40304	23884	2454	-25485
Tax on EFS (30%)				14337	13830	9351	13501	13738	10114	9578	-951	10645	-2675	-7044	12091	7165	736	-7646
NOPAT				**33453**	**32271**	**21819**	**31502**	**32055**	**23600**	**22350**	**-2219**	**24837**	**-6242**	**-16436**	**28213**	**16719**	**1718**	**-17840**
Drawings				38000	38000	38000	38000	38000	38000	38000	38000	38000	55000	69000	69000	52000	40000	40000
Debt repayment				7593	8201	8857	9565	10331	11157	12050	13014	14055	15179					
Value of family labour after				24500	24500	24500	24500	24500	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000
Cost of equity				21093	21701	22357	23065	23831	35157	36050	37014	38055	56179	41000	55000	55000	38000	26000
Interest				8800	8193	7536	6828	6063	5236	4344	3380	2339	1214					
Less Tax credits				-2640	-2458	-2261	-2048	-1819	-1571	-1303	-1014	-702	-364	0	0	0	0	0
Cost of Debt				6160	5735	5276	4780	4244	3665	3041	2366	1637	850	0	0	0	0	0
Extracted cost of capital				27253	27436	27632	27845	28074	38822	39090	39379	39692	57029	41000	55000	55000	38000	26000
SBG				**6200**	**4836**	**-5813**	**3657**	**3981**	**-15222**	**-16741**	**-41598**	**-14854**	**-63271**	**-57436**	**-26787**	**-38281**	**-36282**	**-43840**

CASE FARM ONE- FULL ORGANIC FORECAST MODEL

SHEEP	Min	Most likely	Max	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Lambs ($)	27	40	70	65391	62052	65172	86569	110186	72729	88867	135945	106026	84336	118514	90838	135342	77026	85189
Qty	1550	1704	2000															
MA ewes ($)	20	32	44	21690	18407	26236	20751	25799	22127	25058	25181	30185	26668	26133	31690	24003	34358	17021
Qty	770	780	860															
Wool ($)	2.1	3.0	4.5	69964	61362	69223	88298	69330	77318	82701	74714	81658	87054	103612	84672	96804	97782	75852
Qty	21000	23000	25000															
CATTLE																		
Cull cows ($)	239	511	825	27207	48676	43467	63517	44194	42777	63392	53268	43474	43067	45463	69651	50629	65404	60529
Qty	76	85	95															
Steers &heifers ($)	323	641	941	124720	86343	129880	148263	126702	178661	122596	143960	125773	146839	154092	163490	200478	141384	195694
Qty	202	220	240															
PURCHASES																		
Rams ($)	200	300	450	-3376	-4542	-4221	-4812	-3076	-3915	-4638	-4198	-5079	-5516	-6236	-5060	-3839	-4248	-5282
Bulls ($)	1500	1800	2100	-5052	-5675	-5421	-5417	-5671	-5419	-5279	-5557	-5129	-5244	-5537	-4706	-5482	-5014	-5171

	Gross Farm Income	**300544**	**266623**	**324335**	**397171**	**367465**	**384277**	**372697**	**423313**	**376908**	**377203**	**436040**	**430577**	**497936**	**406693**	**423832**
Premiums	Wages General and ACC	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000
	Manager						35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
10% premium (all animals)	Shearing & Crutching	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000	27000
30% premium (20% of lambs)	Animal Health	10000	10000	10000	10000	10000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000
20% premium (all animals)	Cartage & freight	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
30% premium (70% of stock)	General Station expenses	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
20% premium (70% of stock)	Power	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
40% premium (70% of stock)	Administration	4000	4000	4000	4000	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
10% premium (70% of stock)	Vehicle expenses	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000
	Repairs & Maintenance	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
	Fertiliser	95000	95000	95000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
	Rates & Standing charges,	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
	Total F.WE	219500	219500	219500	174500	175000	209000	209000	209000	209000	209000	209000	209000	209000	209000	209000
	Operating Surplus	**81044**	**47123**	**104835**	**222671**	**192465**	**175277**	**163697**	**214313**	**167908**	**168203**	**227040**	**221577**	**288936**	**197693**	**214832**
	Depreciation	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
	Management reward	35000	35000	35000	35000	35000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
	EFS	31044	-2877	54835	172671	142465	145277	133697	184313	137908	138203	197040	191577	258936	167693	184832
	Plus fertiliser adjustments	55000	55000	55000			0	0	0	0	0	0	0	0	0	0
	Adjusted EFS	86044	52123	109835	172671	142465	145277	133697	184313	137908	138203	197040	191577	258936	167693	184832
	Tax on EFS (30%)	25813	15637	32951	51801	42739	43583	40109	55294	41372	41461	59112	57473	77681	50308	55450
	NOPAT	**60231**	**36486**	**76885**	**120870**	**99725**	**101694**	**93588**	**129019**	**96536**	**96742**	**137928**	**134104**	**181255**	**117385**	**129383**
	Drawings	38000	38000	38000	38000	38000	38000	38000	38000	38000	55000	69000	69000	52000	40000	40000
	Debt repayment	55214	60107	65435	71235	77551	11157	12050	13014	14055	15179	0	0	0	0	0
	Value of family labour after	24500	24500	24500	24500	24500	10500	10500	10500	10500	10500	10500	10500	10500	10500	10500
	Cost of equity	68714	73607	78935	84735	91051	38657	39550	40514	41555	59679	44500	58500	58500	41500	29500
	Interest	34450	29557	24229	18428	12113	5236	4344	3380	2339	1214	0	0	0	0	0
	Less Tax credits	-10335	-8867	-7269	-5529	-3634	-1571	-1303	-1014	-702	-364	0	0	0	0	0
	Cost of Debt	24115	20690	16960	12900	8479	3665	3041	2366	1637	850	0	0	0	0	0
	Extracted cost of capital	92829	94297	95895	97635	99530	42322	42590	42879	43192	60529	44500	58500	58500	41500	29500
	SBG	-32598	-57811	-19011	23234	195	59372	50998	86140	53344	36213	93428	75604	122755	75885	99883

CASE FARM ONE- CONVENTIONAL FORECAST MODEL

SHEEP	Min	Most likely	Max	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Lambs ($)	27	40	70	69982	107868	141118	85819	107412	88823	122670	142463	104322	111856	139897	94539	85704	96472	123937
Qty	2250	2500	2750															
MA ewes ($)	20	32	44	17140	26270	27526	26379	24069	22295	18102	24915	27265	21966	18228	19699	17171	20255	19189
Qty	726	807	880															
Wool ($)	2.1	3.0	4.5	82727	71785	51082	68556	54791	51811	88419	91171	73932	58690	72729	56069	68111	78045	65113
Qty	20000	22000	24000															
CATTLE																		
Cull cows ($)	239	511	825	59226	84673	130228	136219	130558	129332	113907	106871	59811	85448	92667	60449	92588	48107	108968
Qty	171	190	210															
Steers &heifers ($)	323	641	941	109870	114521	126878	225284	122355	122636	130874	188958	195467	135736	173850	156926	138204	122952	199682
Qty	234	260	286															
PURCHASES																		
Rams ($)	200	300	450	-4602	-5132	-3430	-4791	-3872	-5361	-3644	-3069	-3068	-2728	-3317	-3672	-3591	-2290	-3025
Bulls ($)	1500	1800	2100	-5396	-7705	-9813	-11090	-10645	-11026	-9656	-9692	-10806	-10577	-10083	-9898	-9985	-9753	-9825
Gross Farm Income				328947	392280	463589	526376	424668	398509	460672	541618	446922	400392	483969	374112	388201	353787	504039
Wages General and ACC				27000	27000	27000	32000	32000	32000	32000	32000	32000	32000	32000	32000	32000	32000	32000
Feed & cropping				15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
Shearing & Crutching				29000	29000	29000	29000	29000	29000	29000	29000	29000	29000	29000	29000	29000	29000	29000
Animal Health				14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000
Cartage & freight				7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
General Station expenses				5500	5500	5500	5500	5500	5500	5500	5500	5500	5500	5500	5500	5500	5500	5500
Power				5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Administration				4000	4000	4000	4000	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
Vehicle expenses				11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000
Repairs & Maintenance				20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
Fertiliser				95000	95000	95000	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000
Rates & Standing charges,				12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000
Total F.WE				245000	245000	245000	215000	215500	215500	215500	215500	215500	215500	215500	215500	215500	215500	215500
Operating Surplus				**83947**	**147280**	**218589**	**311376**	**209168**	**183009**	**245172**	**326118**	**231422**	**184892**	**268469**	**158612**	**172701**	**138287**	**288539**
Depreciation				15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
Management reward				35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
EFS				**33947**	**97280**	**168589**	**261376**	**159168**	**133009**	**195172**	**276118**	**181422**	**134892**	**218469**	**108612**	**122701**	**88287**	**238539**
Plus fertiliser adjustments				55000	55000	55000			0	0	0	0	0	0	0	0	0	0
Adjusted EFS				88947	152280	223589	261376	159168	133009	195172	276118	181422	134892	218469	108612	122701	88287	238539
Tax on EFS (30%)				26684	45684	67077	78413	47751	39903	58552	82835	54427	40468	65541	32584	36810	26486	71562
NOPAT				**62263**	**106596**	**156513**	**182963**	**111418**	**93106**	**136620**	**193283**	**126995**	**94425**	**152928**	**76028**	**85891**	**61801**	**166977**
Drawings				38000	38000	38000	38000	38000	38000	38000	38000	38000	55000	69000	69000	52000	40000	40000
Debt repayment				55214	60107	65435	71235	77551	11157	12050	13014	14055	15179	0	0	0	0	0
Value of family labour after				24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500
Cost of equity				68714	73607	78935	84735	91051	24657	25550	26514	27555	45679	30500	44500	44500	27500	15500
Interest				34450	29557	24229	18428	12113	5236	4344	3380	2339	1214	0	0	0	0	0
Less Tax credits				-10335	-8867	-7269	-5529	-3634	-1571	-1303	-1014	-702	-364	0	0	0	0	0
Cost of Debt				24115	20690	16960	12900	8479	3665	3041	2366	1637	850	0	0	0	0	0
Extracted cost of capital				92829	94297	95895	97635	99530	28322	28590	28879	29192	46529	30500	44500	44500	27500	15500
SBG				**-30566**	**12299**	**60617**	**85328**	**11888**	**64784**	**108030**	**164403**	**97803**	**47896**	**122428**	**31528**	**41391**	**34301**	**151477**

PROBABILITY (<=) OF NOPAT AND SUMMARY STATISTICS FOR CASE STUDY TWO - Base system

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum	-9295	-4187	-3780	-7895	-4288	-2890	-1456	-5152	-3410	-3238	-4292	-5099	-2775	-9144	594
Maximum	96485	100540	103841	104106	95856	99186	98857	94624	100855	96404	95336	101962	100141	97430	97600
Mean	44102	44076	44246	44043	44004	44071	43968	44060	43830	43939	44015	44177	43991	44233	44084
Std Deviation	23578	23533	24331	23611	23185	23714	22982	22997	22041	22464	23147	23366	23141	24232	23081
Mode	40476	42740	40312	29488	39592	21426	40939	57803	30631	30318	45698	27725	38822	35043	33239
5% Perc	10617	9312.3	9494	10562	8298.1	10078	11431	8859.6	9127.9	9455	9291.3	7766.4	10831	8768.3	10966
10% Perc	15015	12135	13669	16863	15834	12566	14284	13352	15552	14136	11881	13815	15336	13978	15473
15% Perc	19442	17550	17491	21213	19842	19151	20725	19121	19679	18032	18898	20339	19317	15802	19126
20% Perc	21411	24691	23326	24095	24057	22762	23411	21890	25504	24250	24253	22445	22180	23452	24019
25% Perc	25362	28458	29367	27524	26750	26135	26335	28068	27692	28329	26707	27636	27118	28929	27545
30% Perc	30852	31763	31147	29593	31619	30304	28638	30114	30812	30492	30144	30415	28619	31720	31222
35% Perc	34718	36677	32826	31846	33527	31540	32619	32112	34237	33342	32779	33084	33750	34118	33201
40% Perc	36854	38093	34683	33978	35587	36121	36176	35471	36950	35368	36069	34247	36840	35629	35579
45% Perc	38267	39427	37754	35930	39039	39498	38610	38696	38590	39042	38867	39235	38644	38088	39009
50% Perc	40475	40574	40034	40964	40321	43108	40957	42000	40562	42063	41153	40908	40865	40909	40191
55% Perc	43843	42607	41611	42801	43404	44309	44651	44115	43039	44865	44507	44514	45018	43134	42067
60% Perc	47423	44441	45126	47274	46515	46497	46094	45511	45022	48723	45779	48972	46844	47829	44819
65% Perc	50137	48340	52754	50373	49469	52581	50123	50775	52456	51053	50816	50312	51070	51122	49718
70% Perc	56433	53343	54614	54454	52800	55406	55894	57756	54809	53396	55287	55717	55269	53157	53131
75% Perc	58014	57739	57866	56169	59973	59105	57750	61085	59078	56940	58142	61756	58289	58154	57588
80% Perc	61327	66680	65353	64907	63361	61596	64085	65762	65519	60800	63948	64349	61280	63995	65514
85% Perc	67806	70778	70072	70940	70418	72739	72051	69487	66734	66858	68292	67066	69276	71387	70611
90% Perc	81059	80783	79691	79753	75006	76916	79182	76353	73276	78730	77479	76580	75930	81233	77527
95% Perc	87887	87600	90727	88744	87986	86674	85411	85335	83295	84155	85066	86186	87421	93347	85959

PROBABILITY (<=) OF NOPAT AND SUMMARY STATISTICS FOR CASE STUDY TWO - Full Organic

Yeat	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum	703.73	2647.9	25958	36515	54993	28012	47001	45805	41761	47923	42639	37995	43811	39522	38938
Maximum	113949	138160	164923	202633	211866	208103	216404	205993	217880	216532	212737	216404	208942	205188	240703
Mean	50026	65520	88710	104241	122906	122737	123028	122905	122960	122962	123045	122920	123185	123095	122747
Std Deviation	28241	27727	29210	33773	36811	37844	38329	36866	39100	38520	37574	38490	38495	37520	38851
Mode	20743	82070	76486	74154	94003	101524	140157	93576	187619	150514	130100	104555	124665	152178	168315
5% Perc	10100	22083	44644	47751	62434	61137	65458	63892	62418	62882	61144	59010	61351	59045	59404
10% Perc	17017	32692	50974	62744	77493	67578	79361	76312	70909	75265	73774	75742	71100	75317	71005
15% Perc	20445	38537	57418	71594	86866	81288	82670	85236	79599	82374	83888	85343	81059	83508	80433
20% Perc	21652	42612	64315	74148	94119	99050	88675	90964	92669	87242	90302	88844	89200	88569	90283
25% Perc	24242	47212	67495	77779	95254	100919	94761	94525	95460	91383	98504	96940	91847	94255	92536
30% Perc	31273	50293	73611	85403	101559	101730	98634	97529	100368	95166	101292	98814	102180	105025	95438
35% Perc	38468	52391	75790	88662	103982	104956	107264	106699	104515	101490	105183	102015	106310	111164	103873
40% Perc	40879	57777	76657	93056	107490	109730	110015	109509	108200	110245	110009	104879	110898	113952	108019
45% Perc	43047	58969	80143	98536	109897	113083	111508	114600	112975	114977	112210	112704	115937	117522	113408
50% Perc	43668	62838	85092	101194	114967	117577	118528	118314	118013	120135	116686	118747	119901	120061	124645
55% Perc	46026	66450	90830	106851	117795	129184	125332	122843	120779	124058	122813	127794	124530	122223	128855
60% Perc	55352	69567	93521	110765	125295	134871	128422	128996	129253	132474	129395	129723	127106	126411	133512
65% Perc	59476	76065	95966	113339	132734	137494	133523	136755	135067	136690	135464	135865	136665	132826	139158
70% Perc	63109	78207	101044	120282	137211	141795	140021	143977	141549	143951	141346	143752	140882	140920	145807
75% Perc	69196	82151	106321	123275	149048	146358	144303	156060	149743	149990	151308	150696	147786	149882	149227
80% Perc	73990	88980	111381	132599	154568	154002	155704	161061	155638	150885	157713	157980	157670	153473	157115
85% Perc	85400	92590	115926	138508	166035	166953	170606	165334	166656	165930	162600	163795	171329	160892	166804
90% Perc	94885	104639	129046	150219	178153	175054	178772	168798	182832	181932	174841	173092	177662	172020	168486
95% Perc	99192	107205	145604	155975	193093	182477	186354	178438	189363	187328	188654	186201	188031	189164	179301

PROBABILITY (<=) OF NOPAT AND SUMMARY STATISTICS FOR CASE STUDY TWO - Conventional

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum	-14745	5943	18779	36080	43544	51581	56493	51414	51122	57813	50124	57064	58176	55249	59537
Maximum	83908	107782	143136	185264	207042	224060	230874	226100	212800	217622	217218	229444	225672	224000	213460
Mean	32533	53117	74622	102829	120267	133795	133747	133817	133700	133899	133847	133944	133857	133856	133850
Std Deviation	20303	23383	25829	32865	34191	36146	35147	36300	34622	35565	35922	36718	36418	35403	35267
Mode	10757	53024	73662	77475	123549	145973	143236	115388	106197	122226	103256	140477	181089	136048	90105
5% Perc	3125	18878	36066	52657	70640	85262	86653	82878	83528	81754	80434	79577	82852	81888	82173
10% Perc	7514	25125	44554	60453	76052	91497	91352	86833	89517	91754	89700	86554	87269	92542	90041
15% Perc	10899	29403	48262	67958	82069	94225	95462	92936	96328	97020	94280	96228	93319	99449	92892
20% Perc	13057	33089	52507	75034	92152	98854	102474	101824	101303	102172	103305	100655	102989	103422	105095
25% Perc	18571	35572	56022	78043	94994	102056	106147	107716	107298	105879	108660	106922	109319	106837	109343
30% Perc	19915	38065	56949	80599	101499	108574	109199	111664	112010	111083	111354	110463	111974	110469	112141
35% Perc	23628	40047	58800	83123	105365	113265	111913	115295	119012	116582	114944	113235	114369	113963	113650
40% Perc	25415	43953	62584	93318	109443	119270	118960	118634	122683	121889	122200	117259	118009	119678	118848
45% Perc	28118	47832	68422	96716	114007	128373	128754	130689	130033	125659	127075	126213	128274	125954	125891
50% Perc	30144	52419	72458	102058	116670	132996	135606	135114	131931	130605	131318	133193	132779	132285	131814
55% Perc	33885	54229	73959	104271	123404	136893	136981	140057	135004	134453	136079	137060	135863	135816	137200
60% Perc	36158	58692	79605	107910	125073	141920	140980	142620	138877	139307	142517	140577	138112	138656	139998
65% Perc	38126	60478	84238	112134	127872	146001	143256	144395	142490	143814	145560	145705	143180	142498	143081
70% Perc	41830	62188	85883	116079	136349	151568	145043	146597	148092	149444	147025	148499	149468	146472	148096
75% Perc	44032	64571	88559	122084	144455	153527	153049	150009	154511	152295	152907	155695	153874	151239	156129
80% Perc	48861	68930	96394	128411	151260	161564	162696	159502	163045	164589	164564	165728	164424	161137	161888
85% Perc	52500	77462	102652	138985	158953	169896	170195	175557	174356	173006	174699	178491	177549	177500	171871
90% Perc	60788	84794	110328	146797	165607	180413	179106	185581	180585	181509	183623	185402	181489	182409	179300
95% Perc	70546	101216	122516	162695	182999	201410	197532	197445	195348	201175	199775	190439	204247	197681	199534

CASE FARM TWO - BASE SYSTEM FORECAST MODEL

SHEEP	Min	Most likely	Max	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Lambs ($)	27	40	70	116931	155441	189840	143104	126796	86617	166462	128626	108248	124035	137392	119062	86862	130351	107358
Qty	2250	2500	2750															
MA ewes ($)	20	32	44	10904	13726	14017	8431	8391	12380	11347	13195	10307	13520	8983	13110	12902	8735	10100
Qty	360	400	440															
Wool ($)	2.1	3.0	4.5	53098	56426	51120	45950	44984	47108	40671	44087	45229	38133	44260	34784	35743	41677	37917
Qty	14000	15000	16500															
CATTLE																		
Cull cows ($)	239	511	825	6790	7783	7047	5706	5952	10151	12925	5748	6534	7453	10680	8050	6968	9553	7751
Qty	11	15	18															
Steers &heifers ($)	378	753	1105	20051	24531	28500	16779	15924	19770	25607	19843	21518	22457	23184	24443	20482	27481	21629
Qty	27	30	35															
Calves ($)	240	300	360	12057	15626	16855	14166	14116	14718	17932	15537	14395	12358	12649	16009	15322	13700	15252
Qty	45	50	56															
PURCHASES																		
Rams ($)	200	300	450	-3938	-4685	-5235	-5056	-3883	-4284	-3731	-5423	-6194	-5326	-4592	-5696	-4643	-4510	-4736
Bulls ($)	1500	1800	2100	-5977	-5897	-5253	-5539	-5208	-5438	-5407	-5782	-5639	-6092	-5370	-5026	-4822	-5730	-5083
Gross Farm Income				**209915**	**262952**	**296891**	**223541**	**207071**	**181022**	**265807**	**215830**	**194398**	**206537**	**227186**	**204736**	**168815**	**221257**	**190188**
Wages General and ACC				8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
Contracting				7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000
Seeds				1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Shearing & Crutching				13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000
Animal Health				11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000
Cartage & freight				5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
General Station expenses				5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Power				2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
grazing&stock food				3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Administration				3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
Weed & pest				600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Vehicle expenses				4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Repairs & Maintenance				18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000
Fertiliser				20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
Rates & Standing charges, in				10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Total FEW				112100	112100	112100	112100	112100	112100	112100	112100	112100	112100	112100	112100	112100	112100	112100
Operating Surplus				**97815**	**150852**	**184791**	**111441**	**94971**	**68922**	**153707**	**103730**	**82298**	**94437**	**115086**	**92636**	**56715**	**109157**	**78088**
Depreciation				15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
Management reward				35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
EFS				**47815**	**100852**	**134791**	**61441**	**44971**	**18922**	**103707**	**53730**	**32298**	**44437**	**65086**	**42636**	**6715**	**59157**	**28088**
Plus fertiliser adjustments				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjusted EFS				47815	100852	134791	61441	44971	18922	103707	53730	32298	44437	65086	42636	6715	59157	28088
Tax on EFS (30%)				14345	30256	40437	18432	13491	5677	31112	16119	9690	13331	19526	12791	2014	17747	8426
NOPAT				**33471**	**70596**	**94354**	**43009**	**31480**	**13245**	**72595**	**37611**	**22609**	**31106**	**45560**	**29845**	**4700**	**41410**	**19662**
Drawings				30000	45000	58000	58000	43000	35000	35000	35000	35000	38000	40000	40000	40000	40000	40000
Debt repayment				34368	36430	38616	40933	43389	45992	48752	51677	54777	58064	61548	65241	69155	73304	77703
Value of family labour after ta				24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500
Cost of equity				39868	56930	72116	74433	61889	56492	59252	62177	65277	71564	75048	80741	84655	88804	93203
Interest				48000	45938	43752	41435	38979	36376	33616	30691	27591	24304	20820	17127	13213	9064	4665
Less Tax credits				-14400	-13781	-13126	-12431	-11694	-10913	-10085	-9207	-8277	-7291	-6246	-5138	-3964	-2719	-1400
Cost of Debt				33600	32157	30626	29005	27285	25463	23531	21484	19313	17013	14574	11989	9249	6344	3266
Extracted cost of capital				73468	89087	102742	103437	89174	81955	82783	83661	84591	88577	89622	92730	93904	95149	96468
SBG				**-39997**	**-18490**	**-8389**	**-60429**	**-57695**	**-68710**	**-10188**	**-46050**	**-61982**	**-57471**	**-44062**	**-62885**	**-89204**	**-53739**	**-76807**

CASE FARM TWO - FULL ORGANIC FORECAST MODEL

SHEEP	Min	Most likely	Max		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Lambs ($)	27	40	70		185692	111841	132909	151504	131493	142338	144348	118211	144612	152534	159486	87486	157497	129102	147403
Qty	2385	2650	2915																
MA ewes ($)	20	32	44		15365	16572	13147	12933	12922	16552	13813	15543	12550	18610	11707	19334	12732	13092	13341
Qty	468	520	572																
Wool ($)	2.1	3.0	4.5		81059	67190	64233	81557	53043	54598	72432	55648	76118	57115	70512	63539	47406	64977	65213
Qty	15000	16500	17500																
CATTLE																			
Cull cows ($)	239	511	825		8478	16130	24637	24106	49043	19438	48847	30458	46891	54294	41414	37672	34189	41125	50185
Qty	63	70	77																
Steers &heifers ($)	378	753	1105		29047	39634	52621	95389	103212	83201	125138	111592	98987	73032	104561	105187	85026	114452	90339
Qty	98	109	120																
PURCHASES																			
Rams ($)	200	300	450		-4041	-5101	-4163	-4229	-4336	-4689	-5047	-4545	-5764	-4648	-4326	-3667	-4100	-4238	-3252
Bulls ($)	1500	1800	2100		-5332	-4692	-5305	-5344	-5664	-5070	-5566	-5363	-4842	-5825	-4861	-6004	-5094	-5970	-4755
				Gross Farm Income	**310268**	**241575**	**278079**	**355917**	**339714**	**306368**	**393965**	**321545**	**368551**	**345110**	**378494**	**303546**	**327656**	**352540**	**358474**
Premiums				Wages General and ACC	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
				Contracting	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000
10% premium (all animals)				Seeds	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
30% premium (20% of lambs)				Shearing & Crutching	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000
20% premium (all animals)				Animal Health	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000
30% premium (70% of stock)				Cartage & freight	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
20% premium (70% of stock)				General Station expenses	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
40% premium (70% of stock)				Power	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
10% premium (70% of stock)				grazing&stock food	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
				Administration	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
				Weed & pest	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
				Vehicle expenses	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
				Repairs & Maintenance	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000
				Fertiliser	55000	55000	55000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000
				Rates & Standing charges, in:	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
				Total FEW	149100	149100	149100	118100	118100	118100	118100	118100	118100	118100	118100	118100	118100	118100	118100
				Operating Surplus	**161168**	**92475**	**128979**	**237817**	**221614**	**188268**	**275865**	**203445**	**250451**	**227010**	**260394**	**185446**	**209556**	**234440**	**240374**
				Depreciation	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
				Management reward	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
				EFS	**111168**	**42475**	**78979**	**187817**	**171614**	**138268**	**225865**	**153445**	**200451**	**177010**	**210394**	**135446**	**159556**	**184440**	**190374**
				Plus fertiliser adjustments	35000	35000	35000	0	0	0	0	0	0	0	0	0	0	0	0
				Adjusted EFS	146168	77475	113979	187817	171614	138268	225865	153445	200451	177010	210394	135446	159556	184440	190374
				Tax on EFS (30%)	43850	23242	34194	56345	51484	41480	67759	46034	60135	53103	63118	40634	47867	55332	57112
				NOPAT	**102318**	**54232**	**79786**	**131472**	**120130**	**96788**	**158105**	**107412**	**140316**	**123907**	**147276**	**94812**	**111689**	**129108**	**133262**
				Drawings	30000	45000	58000	58000	43000	35000	35000	35000	35000	38000	40000	40000	40000	40000	40000
				Debt repayment	37949	40262	42716	45320	48083	51015	54126	57427	60930	64648	68592	72778	77220	81934	86937
				Value of family labour after ta	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500
				Cost of equity	43449	60762	76216	78820	66583	61515	64626	67927	71430	78148	82092	88278	92720	97434	102437
				Interest	54300	51987	49533	46929	44166	41234	38123	34822	31319	27601	23657	19471	15029	10315	5312
				Less Tax credits	-16290	-15596	-14860	-14079	-13250	-12370	-11437	-10447	-9396	-8280	-7097	-5841	-4509	-3094	-1594
				Cost of Debt	38010	36391	34673	32850	30916	28864	26686	24375	21923	19321	16560	13629	10520	7220	3719
				Extracted cost of capital	81459	97153	110889	111670	97499	90379	91312	92303	93353	97469	98652	101908	103241	104655	106155
				SBG	**20859**	**-42921**	**-31104**	**19802**	**22630**	**6409**	**66793**	**15109**	**46963**	**26439**	**48624**	**-7096**	**8448**	**24454**	**27107**

CASE FARM TWO - CONVENTIONAL FORECAST MODEL

SHEEP	Min	Most likely	Max	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Lambs ($)	27	40	70	109886	162587	172265	170921	136223	173800	211325	165451	115680	126845	129900	188278	165752	206360	111689
Qty	2565	2850	3133															
MA ewes ($)	20	32	44	11583	13032	11855	16167	10871	18406	16950	16828	13114	15604	13735	17143	15257	15678	16745
Qty	540	600	660															
Wool ($)	2.1	3.0	4.5	60864	70461	65435	68983	47768	56170	62412	50022	58883	58095	62629	58319	72674	72628	41042
Qty	17000	19000	20000															
CATTLE																		
Cull cows ($)	239	511	825	10832	15143	22326	34046	37835	44595	39826	39633	46635	47402	46664	64042	37576	24822	32172
Qty	76	85	93															
Steers &heifers ($)	435	864	1270	35186	45633	53217	42512	63653	72430	63388	101356	70704	112531	131319	97423	117690	140620	110879
Qty	108	120	132															
PURCHASES																		
Rams ($)	200	300	450	-4245	-5767	-6481	-4249	-3828	-4014	-5093	-5527	-4871	-4632	-4439	-3785	-3513	-5195	-4786
Bulls ($)	1500	1800	2100	-5999	-6193	-5679	-5113	-5707	-5403	-5081	-5378	-5115	-5225	-5409	-5199	-5680	-5279	-5015
Gross Farm Income				**218107**	**294895**	**312937**	**323268**	**286817**	**355984**	**383727**	**362386**	**295031**	**350621**	**374399**	**416220**	**399756**	**449634**	**302724**
Wages General and ACC				8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
Contracting				7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000
Shearing & Crutching				13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000	13000
Animal Health				14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000	14000
Cartage & freight				5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
General Station expenses				5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Power				2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Cropping & stock food				11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000	11000
Administration				3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
Weed & pest				600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Vehicle expenses				4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Repairs & Maintenance				18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000
Fertiliser				55000	55000	55000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000	24000
Rates & Standing charges, in:				10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
Total F.WE				156600	156600	156600	125600	125600	125600	125600	125600	125600	125600	125600	125600	125600	125600	125600
Operating Surplus				**61507**	**138295**	**156337**	**197668**	**161217**	**230384**	**258127**	**236786**	**169431**	**225021**	**248799**	**290620**	**274156**	**324034**	**177124**
Depreciation				15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000	15000
Management reward				35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000	35000
EFS				**11507**	**88295**	**106337**	**147668**	**111217**	**180384**	**208127**	**186786**	**119431**	**175021**	**198799**	**240620**	**224156**	**274034**	**127124**
Plus fertiliser adjustments				35000	35000	35000	0	0	0	0	0	0	0	0	0	0	0	0
Adjusted EFS				46507	123295	141337	147668	111217	180384	208127	186786	119431	175021	198799	240620	224156	274034	127124
Tax on EFS (30%)				13952	36988	42401	44300	33365	54115	62438	56036	35829	52506	59640	72186	67247	82210	38137
NOPAT				**32555**	**86306**	**98936**	**103368**	**77852**	**126269**	**145689**	**130750**	**83602**	**122515**	**139159**	**168434**	**156909**	**191824**	**88987**
Drawings				30000	45000	58000	58000	43000	35000	35000	35000	35000	38000	40000	40000	40000	40000	40000
Debt repayment				37949	40262	42716	45320	48083	51015	54126	57427	60930	64648	68592	72778	77220	81934	86937
Value of family labour after ta				24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500	24500
Cost of equity				43449	60762	76216	78820	66583	61515	64626	67927	71430	78148	82092	88278	92720	97434	102437
Interest				54300	51987	49533	46929	44166	41234	38123	34822	31319	27601	23657	19471	15029	10315	5312
Less Tax credits				-16290	-15596	-14860	-14079	-13250	-12370	-11437	-10447	-9396	-8280	-7097	-5841	-4509	-3094	-1594
Cost of Debt				38010	36391	34673	32850	30916	28864	26686	24375	21923	19321	16560	13629	10520	7220	3719
Extracted cost of capital				81459	97153	110889	111670	97499	90379	91312	92303	93353	97469	98652	101908	103241	104655	106155
SBG				**-48904**	**-10846**	**-11953**	**-8303**	**-19647**	**35890**	**54377**	**38448**	**-9752**	**25046**	**40507**	**66526**	**53669**	**87169**	**-17169**