Management Systems and Price Risk Management in multi-site Dairy Operations

A report for

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Executive Summary

Large scale dairy businesses throughout the world monitor and manage the margin between the inputs and outputs from the business. In order to do this, they need real time data for both physical and financial parameters so that the people who are working at the operational, tactical and strategic levels can make informed and timely decisions.

This study focused on New Zealand and the United States of America (USA). The purpose of visiting these countries was to see large dairy businesses that cover the range of dairy production systems from fully pasture fed to fully confined. New Zealand produces about 20 billion litres of milk and exports 95% of total production; the majority of farms are pasture based. The USA dairy industry produces around 85 billion litres of milk and exports about 15%. The majority of farms have free stalled cows fed on a total mixed ration (TMR).

Within both countries, there are many large businesses that manage multi-site farming operations. In the USA, one business had 60,000 milking cows on eight farms (in two states) and had had young stock in four states. In New Zealand, the government owned business Landcorp had 59 farms from the top of the North Island to the bottom of the South Island and had peak cow numbers of 55,000. These businesses, and all businesses visited, made use of commercially available software and hardware systems to manage different parts of the total business such as cows, feeding and financials. Many of the large New Zealand businesses had developed their own ways of linking these many programs into a portal so people at all levels of management could access the information needed from a common source. However, all the businesses that had done this had internal dedicated human and financial resources to collate and support this information. Furthermore, external suppliers (of farm inputs such as fertiliser, fertiliser spreading, semen and artificial insemination (AI)) had built their own systems, which were used extensively by corporate farmers.

The context of milk pricing and price risk management for New Zealand and the USA are substantially different. There are federal government margin protection mechanisms in the USA, whereas New Zealand has no price support to the farmer. The percentage of the national milk pool that is exported from each country also affects the exposure to changes in world prices of dairy commodities, with New Zealand very exposed. Due to these differing contexts, approach to price risk and increasing or decreasing production relative to milk and

other commodity prices vary between the countries. The majority of New Zealand businesses focus on being "a low cost producer", with very few businesses using forward pricing or hedging tools (and only a few tools are available). In comparison, a dairy farmer in the USA has many and varied tools available to manage price risk. Most large dairy businesses had a dedicated person monitoring a variety of input (feed) prices and milk prices, and selling, buying or taking future price positions on milk and or feed.

There are many management systems available for measuring and managing the different parts of the dairy business, but as yet, nothing is commercially available that brings these different systems together. For all systems, Internet access in New Zealand, Australia and parts of the USA is impairing the roll out and utilisation of these systems for data collation and use. A software business has the opportunity to develop a tool that links the key tools used by farmers. Large and corporate dairy businesses are building their own systems as they have concluded that a central portal, and the linking of systems have benefits for their business. However, businesses that implement any animal, feed, financial or other system must put sufficient resource (time, human and financial) to implement and then support the system.

The debates and views of the relative merits of each farming system (from 100% pasture to 100% TMR) in Australia and New Zealand have been well researched and documented. The key finding is that the differences in median profits achieved between farms using low/ moderate or high concentrate feeding are small compared with the variability in profit within each concentrate feeding level. This suggests that the farmer can choose any system and gain similar returns, provided they have the required skills and the standard of management is high. Therefore, the farmer, whether a small family business or a large corporate business with multiple sites and tens of thousands of cows must know their farming system intimately. They need to understand, measure, monitor and manage their key physical and financial metrics regularly, with a focus on lead indicators. They must also have clearly defined decision-making points for input costs (feed, fertiliser, energy) and milk, and documented action plans. They also need to evaluate and understand the price risk management tools available to them, and establish a framework or business philosophy on their use.

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Foreword

When I left high school, all I wanted to do was work in the sheep industry. Now, 23 years later, all I want to do is stay in the dairy industry. Being awarded a Nuffield Scholarship has transformed my life. I have been able to meet and learn from numerous passionate, intelligent and committed people. I am very grateful for this opportunity.

After four years outside agriculture, I joined the Van Diemen's Land (VDL) Company in March 2011 as Business Manager- Dairy. At that time, VDL had 23 farms, milked 17,000 cows and produced 5 million kilograms of milk solids. It was a very steep learning curve, and I was very lucky to have a good team, including the very knowledgeable and hardworking Hugo Avery. With the VDL Dairy Operations team, we set about developing, implementing and refining the management systems for the people, cows, inputs and assets to measure, monitor and manage the business.

As the business developed more systems, the management team developed a greater understanding of the key profit drivers within the business. As with many farming businesses, we were exposed to variations in rainfall and commodity prices. Our challenge was to understand and adjust the risk profile of the business. Our objective was to make the business flexible to react to both increasing and decreasing milk price, and increasing and decreasing input prices.

When Anthony Brandsema (2006 Scholar) suggested to me I apply for a Nuffield Scholarship in June 2013, I was unsuccessful in convincing him that I was too busy. At that time, we had just built our second new dairy conversion, were in a capital raising program and the business had just come off a considerable loss. Sure, I had time!

In our discussion, Anthony encouraged me to think about what I could learn by travelling abroad. Very relevant to my situation was gaining an understanding of how other businesses managed multiple site animal operations and adjusted their businesses to changes in commodity prices. This report outlines my findings.

In December 2014, the Directors of VDL made my role redundant, and I left the business in March 2015. VDL are on track to produce over 7.4 million kilograms of milk solids from 20,000 cows on 25 farms, and deliver the second consecutive year of profit.

Every country has a different operating context. The variables that need to be managed and controlled are different in every country and often different in regions of countries. However, the principles to identify and address these business challenges are the same. It is with this worldview, that I will move to China in April 2015 to lead the development of new dairy farms. I am looking forward to the next chapter of my life.

Acknowledgments

The generosity and support of many people made my Nuffield experience a fantastic and rewarding one.

I am very thankful to Anthony Brandsema, Nuffield Scholar from Turner's Beach in Tasmania who encouraged me (and twisted my arm) to apply. Without his persistence, this would not have happened.

To the other nine Scholars of the India 2014 Global Focus Program- I enjoyed our journey and now have friends throughout the world

Within the USA, the genuine and friendly offers of assistance were great. Some of the key people who helped arrange my trips included Robert Chesler from FC Stone, Trevor Slegers and Brian Rice from Rice Dairy and Mark Doornick from Valley Ag Software. A special thanks to Charlie Perotti and Eddie Ormonde for hosting me in California, Mary Ledman for opening her home to a complete stranger and Larry van de Valk, and Ann and Tom Shepard for their assistance in New York state.

In New Zealand, Greg Hamill and Garth Stearn from LIC arranged a fantastic trip and connected me with many key people. Louise Cook, Matthew Johnson and Mark Julian from Landcorp were both generous with their time and information sharing. Colin Glass from Dairy Holdings was very open about how they operate and manage their business. It was great to catch up with former colleagues Erin O'Conner and Laura Johnston who were great hosts and helped make connections.

The people in the engine room of Nuffield also helped considerably throughout the whole Nuffield experience. For me, this was Jim Geltch, Terry Hehir and Jane Bennett.

Our sponsors, in my case Dairy Australia, invest heavily in the Nuffield program. A special thanks to Ian Halliday, Shane Hellwedge and Bernie Baxter for their support, contacts and encouragement.

Lastly, and most importantly, thank you to my fantastic wife Alice and children Lachie, Darcy, Adelaide and Ted. Thanks for all the smiles, FaceTime calls and hosting what we hope is a regular flow of visiting Nuffield Scholars from around the world.

Abbreviations

AI	Artificial insemination
APC	Average pasture cover
BST	Bovine somatotropin
BW	Breeding worth (New Zealand)
CCTV	Closed circuit television
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CME	Chicago Mercantile Exchange
DAL	Dairy Automation Limited (New Zealand)
DC 305	Dairy Comp 305
DFA	Dairy Farmers of America
DM	Dry matter (expressed as a percentage of the total weight)
DPR	Dairy production reporting (Landcorp, New Zealand)
EBIT	Earnings before interest and tax
EBITDA	Earnings before interest and tax, depreciation and amortisation
EID	Electronic identification
FCE	Feed conversion efficiency
FMS	Farm management system (Landcorp, New Zealand)
FY	Financial year
GIS	Geographic information system
GPS	Global positioning system
Ha	Hectare
IRMP	Integrated Risk Management Program
Kg	Kilogram
KPI	Key performance indicator
lb	Pound (weight)
LIC	Livestock Improvement Corporation (New Zealand)
ML	Megalitre

MOFC	Margin over feed costs
MPP	Margin protection program (USA)
NAIT	National Animal Identification and Tracing (New Zealand)
NLIS	National Livestock Identification Scheme (Australia)
NZD	New Zealand dollar
P & L	Profit and loss
PKE	Palm kernel extract
PMR	Partial mixed ration
PW	Production worth (New Zealand)
RFID	Radio frequency identification device
ROA	Return on assets
ROE	Return on equity
SCC	Somatic cell count
SMP	Skim milk powder
TMR	Total mixed ration
TOP	Traits other than production (New Zealand)
T4C	Time for Cows (Lely)
USA	United States of America
USD	United States of America dollar
VAS	Valley Ag Software
VDL	The Van Diemen's Land Company

Objectives

The objectives of this study were to:

- Understand how large agricultural business have the right information in the hands of the right people at the right time to make change to a business
- Understand the management systems used to manage multiple site dairy businesses
- Understand how businesses measure, monitor and manage changes in input and output pricing
- Understand how businesses are set up to adjust or change when input and output pricing changes

The aim of answering these questions was to develop and implement a business-wide tool for VDL to monitor the physical and financial performance of each farm, and adjust the farming business depending on commodity prices. However, this piece of work is also relevant to other multiple site businesses. It is also relevant to all dairy businesses. Every business needs to know how changes in input and output pricing affect profitability and how the business *can* change in response.

Chapter 1: Introduction and Context

1.1 The Van Diemen's' Land Company

The Van Diemen's Land Company was formed in London in May 1824 by a group of men closely connected with the wool and textile trades (Pink, 2003). They were granted 350,000 acres of Van Diemen's Land (renamed Tasmania in 1856) under Royal Charter for the "cultivation and improvement of waste lands in his Majesty's island of Van Diemen's Land". VDL is Australia's second oldest company, and the only one to still own and operate farmland that was part of the original land grant (Pink, 2003).

In 2008, the investment arm of the New Plymouth District Council (in New Zealand) became the majority Shareholder (74.33%) in VDL. They brought new capital into the business and sought to improve the physical state of the asset and the financial return of the business. In 2008, the business comprised of 23 farms, 14,200 dairy cows, excluding replacements, with an aggregated production of 3.4 million kilograms of milk solids for the year ending 31st May 2008. The business reported earnings before interest and tax, depreciation and amortisation (EBITDA) of $4.6m with the farm gate price of $6.46.

1.2 The VDL dairy farming system

Each farm has a set amount of land. Therefore the key objective of a pasture based dairy system is to grow and utilise as much feed as possible, per unit of land, as cheaply as possible. The next step is to then match as closely as possible the availability (growth) with the demand (calving time and stage of lactation). Refining and implementing this philosophy has led to the current systems: autumn calving system on most of Woolnorth (summer dry) and spring calving on most off Woolnorth farms (very wet in winter- averaging 120 mm in each of June, July, August and September).

At the start of 2012, VDL had 13,500 autumn calving cows and 6,500 spring calving cows across 24 farms. All farms (except one) at Woolnorth were autumn calving (plus one that was split- autumn and spring). The off Woolnorth farms were all spring calving (from August onwards) and one was split (autumn and spring).

Over the preceding six years, there has been a comprehensive program to increase grass production on VDL farms. In terms of priorities, the approach has been taken to address drainage, soil pH, phosphorous (and potassium and sulphur) levels, and then grass species. This has been implemented as a program of re-grassing about 10% of each farm annually. Novel entophyte, long season perennial rye grasses are sown in the autumn, and reach full production in twelve months.

The VDL philosophy is to grow as much as possible when the conditions are favourable. This means that in the spring, we aim to grow and harvest as much surplus as possible. This conserved fodder is then fed out in the feed gaps. In the spring calving system, the surplus is harvested and fed out in the summer and autumn. In the autumn calving system, the silage is fed in the autumn and winter to fill the feed gap.

With all these management practices, we are now in a repeatable, sustainable production system to grow as much fodder as we can for the least cost. There is now opportunity to further refine the different feed options by analysing historical costs over multiple seasons.

1.3 Making change for variation in commodity prices (milk and feed costs)

With this base model understood and stable, the business now has the flexibility to adjust stocking rates and brought-in feed to capitalise on increased milk prices. Milk price fluctuates between years (as shown in Table 1). This is within a context that most costs on the farm are relatively fixed - labour, shed costs, repairs and maintenance, fertiliser, and pasture renewal. Adjusting cow numbers and additional feed affects feed costs, animal health and breeding, and with large changes in cow numbers, also labour.

This overarching situation has now been well understood within the business for 18 months. This knowledge was applied in November 2013 to January 2014, to plan for the autumn herd. VDL had the situation where we knew we were in a high milk price period and had a

relatively low grain price. Therefore the decision was made to increase the amount of feed (through the use of brought in supplements) fed to autumn calving cows in the autumn and winter to increase the peak and make more milk. The focus of this analysis was the margin over feed costs.

Table 1. Typical factory paid prices by state (Dairy Australia, 2013)

		2007/08	2008/09	2009/10	2010/11	2011/12	2012/13 (p)
NSW	cents/litre	48.6	52.4	48.7	48.3	47.4	46.4
	$/kg milk solids	6.73	7.29	6.72	6.74	6.60	6.45
VIC	cents/litre	50.0	39.1	33.9	42.0	40.6	37.8
	$/kg milk solids	6.68	5.14	4.49	5.58	5.46	5.05
QLD	cents/litre	51.8	57.2	55.8	53.1	53.6	53.6
	$/kg milk solids	7.14	7.89	7.57	7.26	7.33	7.33
SA	cents/litre	48.6	44.6	34.6	38.0	41.0	38.3
	$/kg milk solids	6.75	6.19	4.73	5.36	5.76	5.42
WA	cents/litre	41.4	49.0	42.4	43.4	41.9	45.0
	$/kg milk solids	5.80	6.77	5.96	6.03	5.97	6.37
TAS	cents/litre	50.2	41.3	34.6	43.2	39.9	40.2
	$/kg milk solids	6.63	5.40	4.46	5.59	5.19	5.16
AUST	cents/litre	49.6	42.4	37.3	43.2	42.0	40.2
	$/kg milk solids	6.68	5.66	4.98	5.80	5.69	5.41

Farm Business Risk Management is a broad topic. This study focused only on understanding and managing the production system, and the price of inputs and outputs. Central to this was the acceptance that there are price cycles in commodities and that the businesses that manage these cycles to minimise loss and maximise income will be more successful over the long term. So, the scope of this Nuffield topic is to understand the tools and approaches dairy businesses can use to maintain consistent operating returns over multiple years, and ideally increase overall operating returns.

Chapter 2 Animal and Farm Management Systems

2.1 Literature review

The literature is relatively sparse with papers that give both a summary and comparison of farm management software available to dairy farmers. It is easy to find promotional material for many and varied programs from around the world. However, Allen and Wolfert (2012) completed a comprehensive stocktake of farm management tools used by farmers and rural professionals in New Zealand. They found that the tools available and used were mostly for stock, feed and financial, and were underrepresented in the areas of nutrient and labour management. They found that the general feeling was that the availability of farm management tools was not the limiting factor to farm productivity.

Their study found that the interconnectivity of different tools and the speed and availability of Internet connections were both considerable issues. These two issues lead to poor time efficiency due to data being entered into multiple tools and waiting for uploads and downloads. Of particular interest, Allen and Wolfert (2012) identified that good information systems should operate at the operational, tactical and strategic levels. They linked these to planning horizon, and defined the periods as: strategic (planning/ monitoring between years); tactical (planning and monitoring within a year); and operational (daily/ weekly use). This observation is particularly relevant for a multi-site business and a corporate model where different layers in an organisation are accountable for different information and decisions, but need to be reviewing the same data set.

2.2 New Zealand

New Zealand was visited in February 2015, at a time when milk prices had almost halved: from $8.40 for the 2013-14 season (a record high) to $4.70 for the 2014-15 season. By the end of the season, it had dropped further to $4.40. This coupled with a “drought” (the definition and criteria for a drought in New Zealand is different to Australia), meant New Zealand dairy farmers were seriously reviewing input costs and income.

New Zealand produced 20.7 billion litres of milk in 2013/14, an increase of 10.1% over the previous year and was at a record production level (Dairy NZ, 2014). There were approximately 12,000 dairy farms, with a national herd of 4.92 million cows. Seventy four percent of herds and 60% of cows are on the North Island, with 24% of cows in the Waikato and 13% in Canterbury.

New Zealand exports around 90 to 95% of production. The cooperative, Fonterra, purchases around 75% of all milk. This approach seems to be working, but does expose New Zealand farmers (and Fonterra) to massive swings in commodity prices (such as those being experienced between 2013-14 and 2014-15). The one advantage of Fonterra is that the farmers do have a factory to send their milk. This may seem a simple statement but is very important when milk price drops and global purchasers cancel supply agreements.

2.2.1 Livestock Improvement Corporation

Livestock Improvement Corporation (LIC) is one of the oldest farming co-operatives in New Zealand. The key objective of LIC has been to improve the productivity and profitability of the New Zealand Dairy herd. Today, they provide herd recording services (milk testing), liquid (fresh) and frozen semen, DNA technology to genomically identify and select elite sires, and a short gestation bull team bred to deliver offspring an average ten days early. To manage and collate all this information, they have a comprehensive cow database that the majority (85% or more) of New Zealand dairy farmers use. This program is called Minda.

Minda collates all the cow information from across New Zealand into one central database. Each individual farmer has their own set of Minda records, which they access to manage their herd. This is usually done with a desktop computer in the dairy or house. All information then synchronises back to the LIC database. There are also hand held devices, which run Minda Mobile. LIC run a herd testing service and this information is entered into Minda. Together, this information is used to create breeding worth (BW) for a cow. There are 46 core fields set by the herd testing standards, which included mating dates, calving

dates, milk quality, pedigree and an additional 140 fields for animal evaluation of traits other than production (TOP). To implement this system in Australia or any other country, there would need to be an alignment of the definitions of the traits. Farmers can add individual cow information (health treatments and events). Farmers then use this data for management of their herd, in particular culling decisions.

The farmer is encouraged to keep all pedigree information for all calves. Minda also connects to the New Zealand Animal Evaluation Unit Database where all Breeding Worth and Production Worth figures are stored and where an animal's profitability indexes are calculated. Minda also has an interface with the New Zealand National Animal Identification and Tracing (NAIT) database. This allows farmers to easily record sales and transfers in Minda that then link directly to the New Zealand National database. Under the NAIT program, cattle are traced using radio frequency identification device (RFID) ear tags. Once tagged, these animals are registered in a national database, and the details of the animal's location, its movement and the person in charge of the animal.

All the LIC AI technicians use handheld devices when inseminating cows. There are a few types of units used, including Psion, Datamate and Trimble. They enter the cow's ear tag number (most of the time manually) prior to inseminating with a particular bull. They check to ensure that the bull being used is not a (close) relative of the cow. This is done by calculating the inbreeding coefficient. The technician, who synchronises their handheld device, then uploads all the information daily. When pregnancy testing is done, the information is either collected manually or entered into Minda or can be entered into a hand held device. The hand held device can be connected to a RFID reader.

2.3.1.1 LIC Dairy Shed automation

LIC also sell an automation system, Protrack, which links to Minda. Protrack does not have the ability to have individual milk metres, although it does allow for individual cow feeding. However, based on the average low level of in-shed supplementary feeding (of grain or palm kernel extract (PKE)), it was a surprise that it was regularly presented as a key feature. The

key features for management is the identification of cows under treatment, auto-drafting of cows and walk over scales. Protrack is only sold in New Zealand.

LIC have recently purchased another company Dairy Automation Limited (DAL), which has in-shed, in-line milk meters. The acquisition of DAL milk meters and cell sense talks directly to Protrack and this does allow the farmer to feed cows to demand. The DAL meters gives fat, protein and yield, and also the cell sense gives an actual somatic cell count (SCC) score. They cost around $400 NZD per unit.

2.3.1.2 Heat detection camera

LIC have developed their own technology for heat detection using devices on cows and a camera. It is called Protrack EZ Heat- assisted detection. The Eziheat camera used for heat detection has now been used for about four years; it communicates data directly to Protrack and drafts all activated or missing heat detectors.

At an advertised price of $20,000 NZD, this is very practical tool to reduce labour on the farm. This system works with an automatic drafting gate. The Protrack drafting systems start at $25,000 NZD and increase to $80,000 NZD for full automation.

2.3.1.3 Minda Land and Feed

This is a pasture management and feed budgeting program provided by LIC. It is generally quite basic, but user friendly. It also has a feed wedge forecaster which is a useful tool. It is very similar to Pasture Plus, which is used by VDL.

2.3.1.4 Agrimetrics

Agrimetrics is a database and dashboard that sits over Minda. It incorporates climate information, stock numbers, production, benchmarking and reproduction. It has been developed by LIC for key accounts (large and corporate customers). The benchmarking is regional and maintains confidentiality. This system is very useful as it consolidates lots of key farm information into one web portal.

2.3.2 Landcorp

Landcorp Farming is a New Zealand government-owned Enterprise, owning or leasing 376,942 hectares (Ha) of land. With 137 properties and 1.6 million stock units, they are one of New Zealand's largest farming organisations. They have sheep, beef, deer and dairy operations. They have their own farms, plus manage farms for others.

Landcorp operates 59 dairy farms, with peak milking cows of 55,000 from the top of the North Island to the bottom of the South island. They have 20,000 Ha allocated to dairy and 300 staff. In the 2013-14 year, they produced 18.6 million kilograms of milk solids. The dairy business contributed $129 million NZD of the $141 million NZD operational income in 2013-14 (Landcorp Farming Limited, 2014). Time was spent on Wairakei Estate, near Taupo on the North Island where they have 10 farms, with about 12,500 cows. Their long-term goal for the area is to have 32,000 cows. The land on Wairakei Estate is coming out of forestry. It is pumice soils, has an Olsen P of 12 with a pH of 5.3 and rainfall is 1000mm per annum. They run a pasture based system, with some farms having irrigation. Their stocking rate is 2.6 cows per hectare on non-irrigated land.

2.3.2.1 Management reporting

Landcorp has a detailed web portal that allows all levels of management to look at different sections of the business. It is called the Gateway and is an Internet site. This portal has been developed in-house, and incorporates data from milk companies (Fonterra, Westland and Synlait). Generally, the reporting is broken into complexes and type of farm. Each Farm Operator reports to a Farm Business Manager who oversees about 7,000 cows.

The Gateway incorporates the Dairy Production Reporting (DPR), the Farm Management System (FMS), all hours worked by staff and the budgeting tool (TM1, from IBM). Each farm operator (Manager, Sharemilker, Sharefarmer) completes a weekly report, which includes feeding, available hectares and cow numbers (in milk, hospital, deaths). This information is collated with milk data to produce the DPR. There is a dashboard report for each farm each week. The FMS is used for two key parts: the company stock reconciliation and all land

activities. FMS is a product from Farm IQ, and is used by Landcorp on all its farms (dairy, beef, sheep, and deer). It has a series of drop down maps that can be used to plan cropping, fertiliser, effluent, chemical applications, pasture covers and record paddock history. This information is collated by the Landcorp agronomy team in Wellington to order fertiliser and seed, and develop nutrient budgets.

2.3.2.2 Farm IQ

Farm IQ is a business established as a Primary Growth Partnership between the New Zealand Government and industry. It is producing integrated solutions for the red meat industry. Farm IQ is a farm system management tool to collate Geographic information system (GIS) data with land and animal management at its core. The system was launched in August 2014. The program brings in data from many sources. It incorporates data from Trackmap; a global positioning system (GPS) based spreading system for fertilizer. It also communicates with NAIT. The aim is to link Farm IQ to Farmax.

Landcorp have embraced Farm IQ as a business-wide solution. Over time, the objective for the dairy farms is to introduce Farmax Dairy as a business planning tool, link it into the company finance models and then link the nutrient management into Overseer. This will meet both on farm needs and regulatory and reporting requirements.

Minda is used on approximately half the farms. LIC prepare and send through weekly breeding reports, which are visible in the Gateway. On the other half of the farms, MilkHub is used. MilkHub is used on many farms in the Taupo area. MilkHub is used for all animal health information, does individual milk production on a daily basis, can do individual feeding, is used for pregnancy testing results and is linked to auto-drafting. On these farms, herd testing is not conducted. MilkHub is not linked to Minda currently. The end goal is to link MilkHub into Minda and/or the national database so they build BW and production worth (PW) for all their cows.

Farm financials are broken down by farm to compare running costs (excluding rent) with the budget on a monthly basis. Budgets are reviewed quarterly.

2.3.2.3 On Farm

Landcorp does move cows between farms to manage feed availability and demand. The transfer in cow data is managed through Minda. On farms that don't have MilkHub, the farm operator is accountable for keeping all cow records. The Farm Business Manager can log onto Minda remotely and look at cow information. This would be mostly for developing lists of cows to cull.

On one Landcorp Farm (without MilkHub), the manager had developed a simple system for the recording of all cow events. It was very user friendly so all staff on the farm could see and record cow events. This is shown in Figures 1 and 2.

Figure 1. Landcorp Farm Business Managers Louise Cook and Matthew Johnson in the office at the dairy with the wall chart of every cow on an 800-cow farm (Niven Collection, 2015)

Figure 2. Individual cow information and records completed by staff and available for all staff (Niven Collection, 2015).

2.3.3 Craigmore Sustainables

Craigmore is a relatively new corporate dairy farming business established by Forbes Elworthy and Mark Cox. Craigmore Sustainables is a diversified farming business with dairy, beef, kiwi fruit, blackcurrants, sheep meat, sheep milk and squash. They started with two farms in north Canterbury, two in south Canterbury and one near Otago. They are experiencing fast growth in the dairy business, and now have 15,000 cows. They are growing through conversion, consolidation and acquisition. The business philosophy is to engage "family farmers", inject third party capital, and assist the manager develop their wealth within the business.

The north Canterbury Pod around Culverden has three farms with 1080, 1060 and 800 cows respectively. General Manager- Dairy, Peter McLeod, Pod Manager Josh, and his wife, Bec were fantastic hosts and were very open with information about their business and where it was in the bigger company journey.

In the Culverden Pod, the three farm managers complete a daily report (on a smart phone). These daily feed details from the phone app go to a central place and are collated and sent back to Pod Manager and senior staff. The information includes supplement consumed, grass consumed, area grazed and cows milked. The farm managers and pod manager meet together weekly. Minda's Land and Feed is used on all farms to provide average pasture cover (APC), growth rates and a pasture wedge. The key metric to monitor is supplementary feed. The objective of this pod is that farm managers don't have any office work. They want the farm managers working on things "where they move the needle the most".

The farming system is set up to have 17% of the lactating cow diet as brought in feed. This is composed of 200kg of grain, 150kg of silage and topped up with PKE. Based on last season, 12.6T of pasture was eaten per hectare. Much of the farm area is irrigated, with 4mm of water applied per day per hectare from 1st November to 31st March (a total of 600mm). This is in addition to the 650mm rainfall. Urea is applied at a rate of 300kg per Ha per year.

Financial reporting is done through monthly accrual accounting for a profit and loss. The business is developing new systems to prepare management reports. They have just commenced comparing farm physical and financial performance on a monthly basis.

2.3.4 Pye Group

The Pye Group is a family company with dairy farms, large scale cropping (potatoes, carrots and arable), a transport business and a carrot washing facility. The Company is owned and run by husband and wife team of Michelle and Leighton Pye. Michelle had spent time working with Alan Hubbard, and Leighton's father Alan Pye was involved with Dairy Holdings. They started in 2002 with one dairy unit and started building another. They have grown this business to nine dairy farms, milking over 7,000 cows and producing 3 million kilograms from 1,689 Ha.

They run a simple business model where they have contract milkers and sharefarmers. These Farm Operators provide their own utes, quad bikes, employ staff and pay all shed

costs. All farm operators report to Leighton, who is on farm regularly. Each farm is responsible for keeping all their cow records in Minda up to date. There is no movement of cows between farms. All heifers are reared centrally, but each farm receives back the heifers they sent. Most cows are wintered on fodder beet on a Pye Group run-off block that is walking distance from the farms. Each farm is allocated paddocks for the wintering period. They raise invoices between the different parts of the business so that everything is costed.

Reporting from the farm is monthly, and is focused on stock numbers, sales, farm physicals, health and safety, environmental consents (irrigation and effluent) and employment. This is a simple two-page report that would take only 15 minutes to complete. On a monthly basis, all Farm Operators come to the company office to review and approve invoices for their farm. Information from Fonterra for production and farm financials is then fed back to each farm. Each farm only sees its own data. However, all information is collated for management reporting for the comparison between farms. The key metric is the cost per kilogram of milk solids per month.

2.3.5 Dairy Holdings

Dairy Holdings was started in September 2000 by Alan Pye and Allan Hubbard who purchased seven farms, mostly from corporate farmers Tasman Farms and Dairy Brands. By 2001/2, they had 30 farms and produced 7.95 million kilograms of milk solids and received $5.30 per kilogram. In 2002/3, the milk price dropped to $3.63, and the business commenced a “return to basics” program. Their aim was to have repeatable and simple systems that lead to profitability. In 2014/15, they now have 56 dairy farms plus support land, with 44,500 cows on 13,500 Ha producing 15.8m kilograms of solids.

They are based in four hubs and are self-contained for wintering and heifer rearing. Their governance structure is a board of five, including two independent directors (including the chair) and one representative from each of the three owners. The board meet four times per year, and by phone when required. The Chief Executive is supported by a Chief Financial Officer (CFO), Financial Controller, Contracts Manager and three Operations Managers and five Farm Supervisors. Each of the three Operations Managers has about 13 farms reporting

to them, of which half are herd owning. The Farm Supervisors typically operate one farm themselves and oversee six to eight farms which are mostly lower order share farmers or contract milkers. The business has 50:50 Sharefarmers, lower order sharefarmers with and without cows, contract milkers and managers. The trends between 2009-10 and 2014-15 include a reduction in managers (24 to 2), an increase in lower order share milkers with cows (1 to 15) and contract milkers have increased from 8 to 25. This has coincided with Dairy Holdings becoming an *Investors in People* company that has included a strong focus on career progression and the ability to build equity and wealth. Chief Executive, Colin Glass (2015) [2], says that moving to becoming *Investors in People* was a watershed moment. Within Dairy Holdings now, Glass explains, "progression is constant and dynamic … and there will always be opportunities for top performers", Glass further states, "one structure is there to facilitate the other, and a mixed model works the best".

The Dairy Holdings business uses many tools to measure the performance of each farm, farms in regions, farm soil types, the farms of different operations manager and the business as a whole.

2.3.5.1 Internal approach

The key measure that is used in the business is earnings before interest and tax (EBIT). They also use simple key performance indicators (KPIs) such as- milk solids production, cell count, nitrogen applied, average farm cover and pasture harvested per hectare. As a business, they plan in physicals and report in financials.

Where possible, they use supplier's data. They have found monitoring the 10-day average bulk somatic cell count; the year to date average and the variance is a good lead indicator if things aren't under control on a farm. They use the monitor and review approach that gives focus and insight to the people who work on the farms. The information is presented in easy to understand graphs.

They also present a weekly dashboard of pasture walks which includes information such as when last completed, average pasture cover, pre- grazing cover, greatest cover, post grazing target and lowest cover and growth rates. This is great way to create peer pressure for those who have not completed their pasture walks.

The business runs its own Internet site as a central portal to everything the managers, sharefarmers and staff need. This includes a link to Fonterra, internal reports (mostly financial) and the LIC site. It also includes irrigation information, such as water takes, and soil information on time below refill points and time above saturation collected through telemetry. There are three layers of access, Board and senior management, Operations Managers and Farm Operators. They also have a portal for their bankers.

Dairy Holdings use LIC to generate customised reports at key times throughout the year. This provides them with Herd Test, mating and reproduction, Minda and other information in one place. Minda is reconciled to the monthly stock reconciliation. Prior to using Land & Feed, they used Pasture Coach for monitoring pasture.

A GIS system for proof of placement for fertiliser has been in place for the past three seasons and helps to ensure fertiliser plans are effectively carried out. Assessing management is the next part of the business where they are looking to use a system to measure and monitor business performance.

2.3.5.2 Externally

Dairy Holdings also benchmarks itself with external sources. New Zealand has a detailed industry-benchmarking tool called DairyBase, which consolidates physical and financial performance. Dairy Holdings prides itself on being as good as owner operator dairy farms. Analysis conducted by Baker and Associates for the 2009/10-year showed Dairy Holdings farms were around or better than owner operator farms for the operating profit per hectare for all the regions where they farmed (coastal Canterbury, inland Canterbury, Otago/ Southland, Waitaki and West Coast). For example, a 50:50 sharefarmer in coastal

Canterbury had $2,400 (NZD) profit per hectare compared with an owner operator at $2,000 (NZD) (Glass, 2015 [2]).

2.3.6 MyFarm

Myfarm Investments was established in 1990, and today has $550 million (NZD) of farm assets under management. They have 300 syndicated investors in a mix of dairy, sheep and beef farms in New Zealand's key farming regions. They have 47 Dairy farms under management.

For their dairy syndicates, Myfarm aims to attract experienced contract milkers and farm managers to manage the investment and achieve performance targets. Some MyFarm syndicates also offer farmers the opportunity to invest in the farm syndicate as an equity manager. The syndicate managers work with the MyFarm Agribusiness Manager to manage and operate the farm using the MyFarm processes and systems (MyFarm, 2014). Each syndicate has a board with a Chairman and is run as an individual entity. MyFarm provides management services, which range from hourly consulting to an annual management fee.

Felix McGirr is the Agribusiness Manager based in Christchurch. He manages seven farms that range from 160 to 500 Ha, carrying between 700 and 1600 cows. All are pivot irrigated and all have Protrack. Felix was very generous with his time and how the MyFarm management service works.

The management service provided by MyFarm includes a formal monthly visit, and an additional one or two visits per month. Farmax is used on all farms and is synchronised so the Agribusiness Manager can see all farms. All physicals are budgeted and then the Farm Manager enters actuals every ten days. They fill in their pasture walk information, nitrogen application, cropping details on a ten-day cycle. Milk reports are generated every 10 days. The Farm Manager completes a monthly report by the 5th of the month which includes the stock reconciliation, cow numbers and class (dry, milking frequency) feeding, supplements on hand plus a commentary. These reports are reviewed and edited by MyFarm

Management and sent to all shareholders. MyFarm produce a monthly profit and loss report (comparing actual with the approved budget) and a quarterly comprehensive report including production, stock reconciliation, profit and loss (accrual basis), cash flows, capex and industry update.

All accounts for the farm are received centrally, scanned and collated into a form for approval by the Farm Operator, Agribusiness Manager and the Chairman. This happens within two days.

For the management of physicals on the farm, MyFarm have a number of Internet enabled tools. All herds are on Minda. All sheds have Protrack Vantage, the premium offering from LIC. This allows for individual cow feeding. It also has the functionality for weight drafting cows based on weight change. MyFarm have the Agrimetrics tool from LIC and this is of considerable benefit to Agribusiness Managers who can see a dashboard of the reproductive performance of their farms.

MyFarm also utilise an excellent web based tool called Aghub from fertiliser supplier Ballance. It is linked to all aspects of land and water use for all the farms. It shows the monitoring of all irrigation pump sheds (litres per second), the outputs from on-farm weather stations (irradiance, evapotranspiration) and soil conditions (re-fill, wilting and soil temperature). It is also used for all fertiliser planning and application. The Agribusiness Manager loads the fertiliser plan and the Farm Operator places the order. The program has different permissions as to who can adjust orders. The program then records proof of placement, including who applied it and when. It is all GPS tracked and you can see on the screen exactly where the truck went.

It was noted that with such good real-time systems, there is also the need to have a point in time observation. For businesses focused on financial values, particularly for balance sheet reporting, programs need to be able to not only show real-time information, but also be able to hold a history at a set point in time. The challenge for such systems that are based on-

farm, where power supply and Internet connectivity are not always available, is to fill in the gaps, rather than report no data. This is particularly important for livestock and feed monitoring.

Of all the businesses I visited in New Zealand, MyFarm had the best systems, which collated animals (through Protrack, Minda with the Agrimetrics web portal), business planning and feed management (in Farmax) and water and fertilizer management (in AgHub). This made it easy for the Agribusiness Manager to have all the information at his fingertips to monitor what was really happening on farm.

2.4 China

China has a growing thirst for dairy products. Between 2000 and 2011, average per capita milk consumption tripled from 9 litre equivalents per person per year to 30 litre equivalents of dairy products. By comparison, Australia's average consumption is around 300 litre equivalents per person per year (IFCN, 2012). In 2011, China produced around 32 billion litres of milk, and consumed 42 billion litre equivalents of product.

The domestic Chinese dairy industry is growing. Based on visits, there seems to be two growth engines. Firstly, large Chinese corporations are utilising foreign investment and knowledge to build and operate large (over 1000 cow) housed dairy farms. Fonterra are an example of a business that is operating in this space. Secondly, there are numerous smaller farms (between 200 and 1000 cows) that are being set up by local business people. I was very fortunate to see ten of these types of businesses in Shandong providence.

The Fonterra farms used DairyComp 305 (DC305) and Feedwatch to manage their farms. Valley Ag Software (VAS) have invested and put a support office in China to support their offerings there.

2.5 USA

The USA was visited twice during 2014, visiting California, New York State, Illinois, Wisconsin and Minnesota. The people met with had farms in these states plus operations in Texas, New Mexico, Michigan, North Dakota and South Dakota. People trading in commodities linked to the dairy industry were in Chicago and New York.

The USA produces about 85 billion litres of milk (IFCN, 2012) and exports about 15% of production. The three largest processors are co-operatives: Dairy Farmers of America (all states) 20%, California Dairies 9%, and Land O'Lakes 7% (North West states).

2.5.1 Fernandes Brothers

The five Fernandes brothers run two dairy farms (3600 and 3000 cows) and a cropping business with 3000 acres (1214 Ha) for forage for cows. A meeting with Jared Fernandes was held at Fern Oak Dairy.

Dairy Comp 305 is used for all cows. Jared also uses a program called PenBot, from VAS. It scans every cow's electronic identification (EID) tag when they walk onto the platform. This is very similar to the EasyDairy program or Protrack systems used in Australia and New Zealand. Generally, in the US, cows on the rotary are only milked. This is because the cows are housed and are checked mostly for reproduction performance whilst in stanchions. In Australia and New Zealand, most reproductive assessment and many treatments are done on the rotary. Also, cows are fed on the rotary in Australia and New Zealand, whereas almost no cows are fed in the parlour in the USA.

PenBot (a VAS product) was installed so cows could be injected with Bovine somatotropin (BST) whilst on the platform. This was to save time. It is also used to identify cows that are in the wrong pen.

The dairy office is the control centre for the farm. There are a number of computers and screens where CCTV footage is shown. There is also cow information displayed (shown in Figure 3). Jared has enhanced the performance of some devices for scanning cows. He has permanently attached a longer RFID reader to a handheld device and added a speaker (Figure 4). This is to streamline the collection of data when cows are in stanchions.

Figure 3. Jerod Fernandes in the office with real-time data on cows being milked (screen on left) and CCTV screen (Niven Collection, 2014).

Figure 4. Jerod Fernandes with his hybrid hand held device, with extension scanning wand and microphone (Niven Collection, 2014).

2.5.2 Observations from other dairy farms in the USA

Of the 30 plus dairy farms visited in the USA, all used DC 305. All farmers liked the program and said it met their requirements. Very few producers were challenging the management system, and therefore challenging how DC 305 worked on a farm. Those that were challenging the system were looking at options to use DC 305 in the milking shed, and therefore conduct some activities (such as injections) on the platform. DC 305 was not able to meet this requirement.

The 200-cow farm, Tayl-Wind Farm with Lely automatic milking boxes, used Lely T4C (Time for Cows) and DC 305 Scout. Lely T4C was an excellent program and allowed the owners to spend more time analysing their cow data. The dashboard is shown in Figure 5. The farmers also used CCTV to monitor milking, calving pens and feeding.

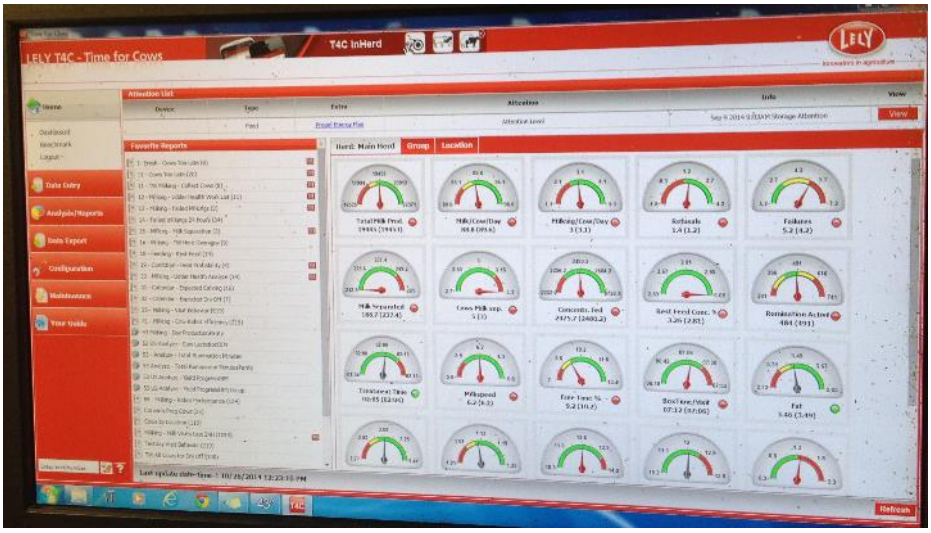

Figure 5. Lely Time for Cows management screen (Niven Collection, 2014)

The majority of farms visited used FeedWatch (from VAS) for their feed formulation and management of rations. TMR Tracker was also used, but the manager said he thought FeedWatch was probably better but would cost them $25,000 USD for four dairy farms. These types of programs are not suitable for pasture-based dairying but are ideal for TMR systems. The key metric in these programs is *shrink*- the reduction in dry matter (DM) content of feed in a silage stack between ensiling and feeding. Different businesses account for this in different ways. It seemed to run at about 10%, and seemed to be accounted for when used, rather than ensiled.

VAS had a number of other tools, including Parlourwatch (for measuring production from a pen of cows) and a new and exciting tool called Chemwatch for measuring DM of silage in the stack.

2.6 Limitations of the study

This study looked at systems used in China, The Netherlands, USA and New Zealand. It did not look at systems used in the UK, Ireland or South America.

The focus was mostly on the management of the cows and the use of nutrients (fertiliser). It did not focus on the systems used in broad acre cropping.

This study was focused on dairy farms. One meeting was held with egg producers who ran multiple site operations in different parts of New York State. This was with Brett D Kreher and Vaughan Gingerich, from Kreher's Farm Fresh Eggs. This was an extremely valuable discussion. However, they were really running each facility as a stand-alone operation. They did centrally manage procurement and sales of inputs and outputs.

Chapter 3 Managing risk and changing input and output prices

3.1 Context: VDL

Since 2011, VDL has started using tools to manage price variation in inputs. These take contracts for key inputs for fixed volumes for defined periods. These tools have been used for urea, fertilizer, grain and electricity. On the sales side, VDL considered a fixed sales price for certain amounts of milk in the 2013-14 and 2014-15 years.

Within the world context, VDL did not have a detailed price risk management strategy and was only using a few of the tools available.

3.2 Literature review

Within Australia and New Zealand, there is often debate on the relative efficiency and therefore profitability of the *farm system*. For the purpose of this work, the dairy *farm system* is defined as the quantity and type of feed that is used to feed milking cows. Often, the farm system is linked to the risk profile of the business. Changing or adjusting the farming system is seen as a way to change, and ideally reduce business risk. Recent studies from Australia and New Zealand have explored this premise.

3.2.1 TasMilk 60 Study

The most relevant Australian work was conducted as part of Dairy Australia's Grains2Milk Program (2011). The project was to analyse physical and financial data from 69 Tasmanian dairy farms for between one and three consecutive financial years 2006/07to 2008/09. Fifty-six farms were studied for all three years. Farms were grouped into three systems on the amount of grain/concentrates fed to cows: low (< 1T), medium (1T – 2T) and high (>2T) per cow per year.

The findings from the study were analysed in relation to either performance (physical) or profitability (financial). The study found no simple relationship between the amounts of

concentrate fed per cow and the pasture utilisation per hectare. Good and poor pasture management occurred at all levels of concentrate feeding. Total feed intakes per cow are not always higher on farms where more concentrate was fed. There was also found to be a significant variation in the protein to fat ratio in milk from farm to farm.

The profitability study found that there was no best concentrate feeding level for production/feeding system. Any concentrate feeding level of a production/ feeding system can be profitable in any year given the appropriate mix of management, milk price and input costs. The difference in average or median profits between farms using the low/ moderate/ high concentrate feeding levels are small compared with the variability in profit within each concentrate feeding level.

The findings concluded that for all feeding systems there is a mix of risk, performance, and management principles. The farmer can successfully balance risk and reward by understanding and managing these principles. Pasture utilisation, pasture quality and core costs per cow are key profit drivers in all pasture-based feeding systems, regardless of the level of concentrate fed, and can be used by all farmers.

3.2.2 New Zealand

DairyBase is the New Zealand national database used by dairy farmers and professional advisors in New Zealand to analyse farm results and benchmark them with their peers. It is run by DairyNZ, and provides a standardised methodology to analyse and review KPIs for an individual farm business. There is no licence fee for a farmer, but the farmer has to use an accredited DairyBase rural professional to enter data, which is done at commercial consulting rates.

Shadbolt (2012) used the DairyBase data from 2006/07, 2007/08 and 2008/09 to examine the financial performance of the five New Zealand dairy farming systems to determine any differences in the drivers of financial success between systems. The five systems are shown in Table 2. This test examined the premise that if a farm system had a comparative

advantage, it would exhibit above average performance. The Du Pont model was used for the analysis to evaluate the drivers of return on assets (ROA) and return on equity (ROE).

Table 2 New Zealand Feeding Systems Source: Shadbolt, 2012

Feeding System	Description
1	Self-contained- no imported feed
2	4 to 14% of total feed imported- for milking cows of off-farm grazing or brought in feed for dry cows
3	10 to 20% of total feed imported – for extending the lactation of milking cows and off-farm grazing or brought in feed for dry cows
4	20 to 30% 10 to 20% of total feed imported – for milking cows at both ends of lactation and off-farm grazing or brought in feed for dry cows
5	More than 30% of total feed imported- all year round for milking and dry cows

The study found there were low-input farms which achieve low cost production through cost control (the numerator effect) and high-input farms, which achieve it through improved outputs (the denominator effect). Despite differences in production and operating profit per hectare, there is very little difference between ROA and ROE between the systems. Shadbolt (2012) made particular mention of the consistency in operating profit margin between different systems, indicating no loss in operating efficiency as the system intensifies (from System 1 to System 5).

3.2.3 Global warming

No review of risk management would be complete without considering the changing climate. Of particular relevance to this study, Phelan *et al* (2014) have reviewed the impact of the changing climate on north-west Tasmania. The research was undertaken to quantify and provide information for pasture based dairy systems in north-west Tasmania. Their study modelled pasture yields in the period 2010 to 2050 and then 2050 to 2085. The modelling showed additional growth from late winter to spring, reflecting warmer winters and spring temperatures with adequate soil moisture. However, during summer a decrease is projected in pasture production due to the moisture deficit. They also modelled the physical and financial outcomes of different stocking rates to consume this additional pasture. However, the variability in gross margins increased under higher stocking rates.

This study supports a long-term view that Tasmania will remain a good place to grow grass for consumption by dairy cows. Ultimately, this supports dairy businesses in the area to plan for the future.

3.3 New Zealand

3.3.1 Landcorp

3.3.1.1 On the ground- Farm Operator and Farm Business Manager

The farm operator's work with the Farm Business Managers to set annual budgets and three-year plans. Within season, and as part of reviews with milk and feed pricing, the Farm Business Managers do lots of scenario planning. Most of this work is done in an Excel-based program, built by Landcorp called *Feedplanner*. It was described as a model that was similar to Udder, but easier for multiple scenario planning.

At Farm Business Manager level, there was a very good understanding of supplementary feeding costs and milk income. The scenario tool, shown in Table 3, was developed in a working session where the author was shown the economics of feeding palm kernel. At the time of the visit, there were drying conditions through most of the dairy regions. Milk price was at $4.70, coming off a record of $8.40 for the previous year. Businesses were making the decision to dry cows off rather than to bring in feed (such as PKE) and continue milking them.

Table 3. The economics of feeding palm kernel (Cook and Johnson, 2015)

Price of PKE landed on Farm	$ 265
Dry matter	90%
Wastage	15%
Cost per tonne consumed	$ 346
Feeding cost (per tonne)	$ 50
Total cost per kg DM consumed	$ 0.40
Conversion of 1kg of DM to milk solids	82
Cost to produce 1kg milk solid	$ 4.83
Milk price ($/kg milk solid)	$ 5.00
Discount/ premium of feed price on fat: protein *	87%
Real milk price	$ 4.35
Net benefit of feeding	-$0.48

* *Different feeds will cause different responses in the fat and protein composition in milk. PKE leads to a higher fat percentage, and therefore a lower value of each kilogram of milk solid*.

3.3.3.2 Head Office and corporate approach

The Landcorp approach is to develop farm systems that are most profitable and resilient for the different regions. This is achieved through the business planning system. The *Feedplanner* is seen as a tool that is very rigorous and has served the business well. A screen shot of *Feedplanner* is shown in Figure 6. It is accepted by senior management that systems will be different in different regions.

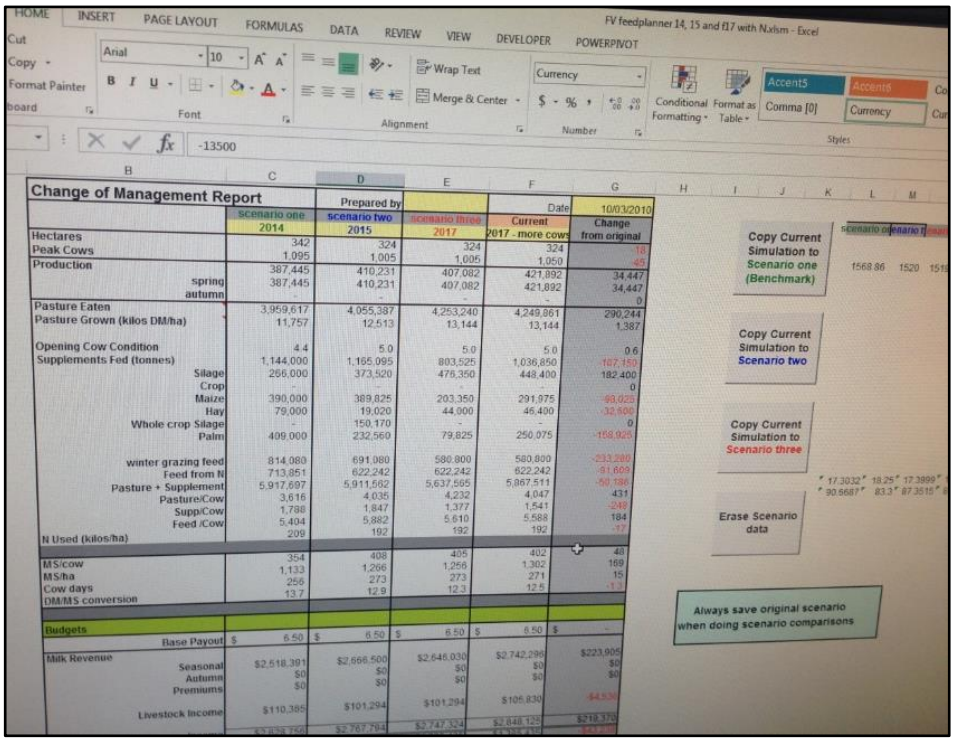

Figure 6. Landcorp's *Feedplanner* business support tool is seen a cornerstone of rigour in the farm modelling process (Niven Collection, 2015).

For example, in Northland, the farms have split calving (60% spring and 40% autumn), use maize at 10% of the ration to swing production and then use PKE as the marginal feed. However, in the 2013-14 year, it was agreed that across the business more money would be spent on feed to give an increase in income over and above the cost (roughly a 3:5 ratio). Landcorp is still evolving how it can *turn-on production* when the price signals indicate. This requires the facilities to feed either PKE or maize silage.

3.3.2 Pye Group

The aim of the Pye Group is to be a low cost dairy producer year-on-year. They do not attempt to change their farming system between years.

They have a number of significant price risk mitigating strategies. They grow all grain within the Pye Group, and sell it to the dairies at market prices. All winter grazing and heifer rearing is done within the group. Their aim is to be self-sufficient. They do utilise group-buying power for farm inputs. They also have a business policy of locking in a certain percentage of milk each year. This is a relatively new approach, as Fonterra has only had this

option for the last two seasons. Across the other parts of the business, they have contracted prices for all potatoes, carrots and grain.

This is a simple and repeatable business model that provides focus on cost management on-farm. The centrally managed procurement and risk mitigation approaches have made it appear a very sustainable and resilient business.

3.3.3 Dairy Holdings

This business has a very sound and thorough understanding of costs and profit. They are very clear there is no link between the amount of feed purchased and profit in their New Zealand setting. Where more feed is brought in, the margin is reduced by feed wastage. There is a linear relationship between pasture harvested and profit in New Zealand. In their research, supplementary feed costs in New Zealand, compared to milk price are the highest in the world, whereas feed price, relative to milk price is the least in the USA. Their approach is to use PKE when grass is not available, such as during drought.

They focus on leaving a grazing residual of 1500 kg DM/ Ha, and only put feed in to hold the rotation length. If residuals fall below 1300, grass growth is compromised. They aim to calve down with a cover of 2200 to 2300 kg DM/ Ha, drop to 1900 on breakeven day and manage this period with a spring rotation planner. This way they can make early decisions. Their objective is to minimise any silage, and will only cut a genuine surplus.

CEO, Colin Glass (2015)[1] says the business is not shy of debt, and this has led to the business being able to expand and seize opportunities. Glass states, “If a balance sheet gets too strong, management get lazy”.

After the 2008 global financial crisis, Dairy Holdings reviewed its risk profile. The key costs that were the most variable part of farm expenditure were feed, grazing and fertiliser. In the period financial year (FY) 2008 to FY 2011, the business strategically reduced cow numbers to more closely match pasture growth rates and therefore reduced the brought in feed per

cow. This lead to the business reducing its external grazing and exposure to purchased feed risk.

The business is also not afraid to build internal capacity to give the total business cost savings. They are now self-sufficient for heifer grazing, after poorly grown heifers, grazed externally, were the number one complaint and excuse for poor performance. In addition to the young stock operations, they now have 11 farms that winter graze 27,000 mixed aged dairy cows over the non-lactating months of June and July. This next year they will have 1000 Ha of fodder beet for wintering of dry cows. Table 4, below, outlines the disproportionate increase in heifer rearing and dry cow wintering over recent years.

Table 4. Relative milk price and wintering costs in the South Island of New Zealand. Source: Glass (2015)[1]

	Milk price ($/ kg MS)	Wintering cost per week
2001	$5.00	$10
2014	$8.40	$30

After the 2013 wind events, where numerous pivot irrigators were blown over in the south island of New Zealand, Dairy Holdings internalised this business. In the process, they found that spare parts for the pivots were approximately 2.5 times the value of new irrigators. This lead to change in the way the business operated.

The business has also mitigated risk of availability of water for irrigation. They have internalised a contracting business and developed on-farm storage of dairy shed effluent on approximately 30 farms.

There is some centralised purchasing. However, they only take contracts if there is a lift in the market. The business philosophy is to buy on spot prices. This is so the money stays in their business's bank account and the feed isn't on -farm, which would tempt people to feed it (and reduce pasture utilisation).

The business has not hedged milk. The philosophy is that the business should be agile and respond to market signals. Taking a fixed price would mean that the business doesn't feel the pain and therefore slower to respond to market signals. The approach is to have a strong balance sheet to beat spot pricing. The view is that if a business was to fix or commit, it should take a similar view every year, and take the same proportions of feed and milk. Glass (2015)[2] said "over time, no-one is good enough to beat the market".

They have focused on further developing their irrigated land and types of irrigation. They have found that irrigation gives the Farm Operator (and the overall business) the confidence to push the farm hard. They do not want to use irrigation conservatively. Changing the type of irrigation increases pasture growth, as shown in Table 5. Furthermore, as the ease of application increases, the lower the skill of the Farm Operator needed.

Table 5. Relative pasture growth rates from the same volume of water used through different application methods. Source: Glass (2015)[1]

	Pasture grown	Incremental cost
Border Dyke (flood)	10T	
Rotarainer	12T	$2,000
Pivot	16T	$4,000

Dairy Holdings benefit from a simple business model that has low levels of brought-in feed. This means the business is a permanent low-cost producer. This business also shows how businesses evolve and grow, with a constant CEO and relatively consistent owners. The business measures the key performance indicators of each farm and these are communicated to everyone in the business. This business has a critical focus on costs, and is happy to manage spot pricing. They see their stable, variable-order sharefarmers achieve improved performance year-after-year. Data drives their decisions and gains come in small steps.

3.3.4 MyFarm

MyFarm goes through the process of establishing a management system and then syndicates the investment. The Farm Manager and Agribusiness Manager then operate the farm to this plan. For example, in the Information memorandum for the Te Pahau Limited Partnership

(May, 2014), there is a detailed property overview and business plan for the asset. In this memorandum, they also detail the "procurement power" of the MyFarm Management group, and state that gains are between 3% and 15% and therefore cover the cost of approximately one third of the MyFarm management fee. MyFarm also state they "consider feed price trends and recommend the take-up of longer term feed contracts" to the Board of management of the syndicate.

Felix McGirr (2015) says MyFarm generally feeds cows better than most dairy farmers in New Zealand. This is partially to ensure cow condition and also to maintain the MyFarm brand. "One MyFarm Contract Milker can make MyFarm look really good or really bad" (McGirr, 2015). Therefore, Contract Milker selection is critical to the success of the syndicate and to MyFarm. The Agribusiness Manager is accountable for the appointment of the Contract Milker.

They generally base their farming system on bringing in 700kg of supplementary concentrate (grain and/ or PKE) per cow. However, McGirr (2015) says the farm must "never lose sight of the pastures". Interestingly, MyFarm have, in some parts of the business, responded to changes in milk prices. In 2013, they increased supplementary feeding of brought in feed from September on some Southland farms. This was done with Board approval. Overall, they brought in an additional 300kg DM per cow of feed, which lead to an extra 70kg of milk. This was, in part, due to improvement and apparent full utilisation of pasture. In the current year, with a drop of $3 per kilogram of milk solids, they stripped out costs for feed and cows at the first quarterly review in October. MyFarm are also aware of the impact that this decision will have on a Contract Milker

3.4 USA Farm Business Visits

3.4.1 Federal margin protection tools for US Dairy Farmers

Government support for milk pricing was undergoing structural change in 2014. All *price support* had been removed with the introduction of margin protection insurance. The Farm Bill 2014- Dairy, introduced a Margin Protection Program (MPP) (MPP (Dairy) Fact sheet,

June 2015). MPP is a voluntary risk management program looking at margin protection. Producers need to enrol for the program, which will be in place until 2018. Each year, milk producers can take out *insurance* through the United States Department of Agriculture (USDA) to protect a margin. Different premiums buy different levels of insurance. The background for the model was the USDA's crop insurance program.

For the MPP, the USDA calculates a feed cost (soy, corn, alfalfa) and the *All Milk price*. This is used to calculate the margin. There is no link to the individual farm's costs or milk price, and no adjustments for states. There is free *catastrophic* protection for a margin of less than $4 (the maximum is $8). The aim of the program is to prevent dairy producers going out of business when margins drop below $4. For the last 10 years, the average margin is around $8, with peaks of $15 in 2007 and 2014, and lows of $2.50 in 2009 and late 2012. Producers can commit between 25% and 90% of their milk (in 5% increments) for a margin between $4 and $8 in 50c increments (MPP (Dairy) Fact Sheet, 2014). There is a break point for premiums for more than 4 million pounds of milk. This would be the equivalent annual production from a 200-cow herd. This appears to be an incentive to protect small farmers.

This program has the potential to change the landscape of how dairy farmers use hedging tools in their business. For an administration fee of $100 per year, any and every dairy producer can effectively insure 95% of their milk for a margin of $4. (http://www.futurefordairy.com/). Specifically, the MPP was seen to reduce the number of people on forward contracts.

There was a general view from the businesses visited that these types of government programs were not useful to the industry as a whole. This, in part, was reflective of the farms visited; large, family run businesses, which were often integrated with processing. The issue with the programs was that they changed behaviours of farmers to accept and plan for a safety net. The program was also criticised for keeping small producers in the industry.

3.4.2 Bidart Dairies, California

Bidart Dairy Farms is based near Bakersfield in California. They milk 9900 cows through four 35 per side double up parlours on one site. John Bidart, a third generation dairy farmer, runs the business.

John Bidart also sits on the Board of California Dairies. California Dairies, Inc. is the largest member-owned milk marketing and processing cooperative in California, processing 47% of California's milk. Co-owned by more than 410 dairy producers who ship 18 billion pounds (8.165 billion kilograms) of milk annually, California Dairies, Inc. is a manufacturer of quality butter, fluid milk products and milk powders. California Dairies process 10% of the USA's milk, 45% of California's milk and are responsible for 12% of all US exports. (www.californiadairies.com)

Within his business, John manages the procurement of feed. They have 7,000 acres (2832.8 Ha) for growing their own forages. They procure corn gluten, mill run, canola, dry distiller's grain (from ethanol plants) and almond hulls. His approach to procurement has changed over the last five years. They used to have contracts for at least one year out. They then moved to more spot price purchases. Now they have established and buy in price (value) ranges. They will buy more as prices drop, and move from one source of feed to another as prices rise. For example, at the time of my visit in October 2014, there was no soy in the ration due to price and they were using canola.

Bidart Dairy Farms does not take positions on milk price; John Bidart (2014) stated that you "can't beat the guys in the suits".

3.4.3 Fernandes Brothers, California

Jared Fernandes manages the risk profile of the dairy business. He does the buying of feed, and hedges milk. For buying feed, he uses a business called Commodities Plus who work with about 30 dairies. They change a retainer and provide their clients with market information and leverage their combined size for better procurement options. Based on the

pricing of different feed options, Jerrod then speaks with nutritionist and rations are adjusted.

For milk pricing, Fernandes knows his relative costs of production, and generally uses tools to allow him to sell off to the top of a price range to protect the floor milk pricing. As for all producers in California, the basis is different, which does create some challenges for relative pricing. Jerrod believes that very few other Californian dairy farmers are using similar approaches to manage risk. His philosophy is that they won't make a lot of money (from the price spikes) but will stay in business.

Fernandes also uses a web-based tool to manage price risk. The tool uses three years of financials to develop operating costs, including feed costs, rations and cost to feed. The tool then allows for the analysis of what hedging would do for the business. It uses a link to a soy and corn equivalent (which can be traded on the Chicago Mercantile Exchange (CME). It takes the approach that all feed is bought onto the farm. It develops a sensitivity analysis of margin and shows the effect of forward selling milk. Jared was keen to point out the differences between protecting a margin and locking a margin. If a margin was locked, there was no upside potential.

3.4.3.1 Other external impacts of price risk management

One of the largest risks to the Fernandes' business is the lack of water. They had never really thought about water, but over the last five years, it is now a considerable issue. They are now moving away from growing corn to growing sorghum, as it is more water efficient.

Fernandes reported that he has experienced input from banks that will reduce interest rates for farmers who lock milk price. This was the first report of banks financially rewarding producers for the active management of price risk.

3.4.4 Redtop Dairy, California

Redtop Dairy is run by Managing Partner, Scott Wickstrom, a fourth generation dairyman. They describe themselves as a large family farm, milking 4,000 jersey cows. In October 2014, average production was 4.8% fat, 3.8% protein and 63 pounds (28.58kg) per day. It is understood to be the last large-scale dairy farm built in California. Building commenced in 1999, but took seven years to complete construction. The delay was to prevent the threat of litigation as during the period, the bulk of changes to environmental management codes took place. At the time, USD$350,000 (up to the beginning of the building process) was spent to get environmental consents and licences. It is now understood that no counties in California are issuing environmental licences for new dairy farms.

At Redtop they have two philosophies: produce and buy feed as cheaply as possible, and make the highest production as possible of the highest value milk. Wickstrom (2014) says "they never want to sacrifice production".

They see California as a great location for purchasing feedstuffs, and use up to 15 ingredients in their rations. These ingredients include corn silage, wheat silage, lucerne, whole cotton seed, dried distillers grain, almond hulls, pomegranate, tomatoes, onion, grape pumice (squished grapes), soy hulls, canola, rolled corn and cereal grains. They grow 95% of their corn and wheat silage, and buy 50% of lucerne hay and silage. They are paying USD$350/ metric tonne for lucerne hay at 22% protein. This compares with corn silage at USD$80 per metric wet tonne (USD $240 T DM) landed on farm.

They use a feed broker to procure feed ingredients. The broker will engage directly with the nutritionist if they see an opportunity with a feed type. The broker also organises delivery. They lock in some feed ingredients that are standard; they do this based on a monthly forward projection of volumes.

They do not currently hedge milk. They had done simple cheese contracts for 3 months or 60 days. They did this over 10 years ago, but now look to other opportunities to protect he bottom line.

They used a number of approaches to *protect after tax dollars*. This included options from the Co-Op to allow for the deferring of milk income. They also have the option with suppliers to pre-pay some expenses. Their focus on protecting *after-tax dollars* was very impressive, and was the only business visited throughout the world that articulated such a focus.

Their approach to milk pricing was to let it ride the market. Wickstrom used 2014 as an example, stating "no-one saw the price increase coming" (2014). He also outlined that having a strong relationship with your bank is key. Depending on debt gearing, many banks require dairy businesses to pre-pay fees and establish an additional line of credit to take a position.

3.4.4.1 Environmental regulation and risk

Wickstrom outlined that the biggest risk, and where he spent bulk of his time, was in environmental management. In 15 years, it has gone from minimal time to a massive management input. This has been as a result of changes to the Californian political environment; underpinned by a large urban population. Wickstrom acknowledges too many things were not environmentally stable, but considers it has now gone to excess. For example, records need to be kept of how many hours a generator runs, the number of tyres covering a silage stack is audited and they have just had to change from six inch to four inch stickers on pressurised vessels. As a business, they have to hire experts to be compliant and to obtain permits. Scott is frustrated that it is not done for the benefit of the environment, "it's done for CMA" (cover my arse).

Twenty years ago, dairy farming in California was perceived to be the best business model with inexpensive land and abundant water. Producers could easily and cheaply buy feed.

This has now changed, with demand from other industries such as nut trees and horticulture, and is compounded by the increasing cost and reduced availability of water.

3.4.5 Noblehurst Farms, New York State

John Noble and his son, Christopher (eighth generation farmer) farm in upper New York State. After their family arrived in the USA from Scotland and Ireland, they spent four generations just feeding their families. In the 1960's, they had 5 sites, milking 40 cows on each site, which was large scale for the time. They have now expanded to have 30 people in the business, including both family and non-family. Of these, 12 work every day on the farms. In 2009, they lost one third of their equity in the business with low milk prices and the global financial crisis; this lead to the business re-evaluating their objectives. Christopher returned to the business in May 2009.

Their aim is to keep a viable business for the next generation. Their business now includes a farm machinery business, dairy farm contract management, five dairy farms milking a total of 5,000 cows and a commodity trading business. Their drivers are to bring clever young people into agriculture, value-add to products and set the business up for subsequent generations. Their objectives are to be good stewards of the land, of the family and of the community.

They have internalised the monitoring, management and procurement of inputs. They established Linwood Commodities as a bookkeeping and trading company. It is owned by 9 businesses and transacts over $20 m per year. Christopher has an agribusiness degree from Cornell and had worked for a small commodity hedge fund, and for Rabobank in New York, for eight years. He works with Dick, the internal commodity trader to monitor and purchase inputs. They use trading ranges for different commodities and have buy-points. They centralise the purchasing of feed through the *central desk*, but each farm buys their own fuel and consumables. They also look at alternative feed options, and Dick works with nutritionists to review options. They have moved from using one nutritionist to multiple to access more innovative thinking.

They understand there can be considerable variation in price for delivered product at different times of the year, so are very active traders. They consider that other states, such as California and Idaho, have more consistent pricing, and therefore need less monitoring.

Within the office, they have a direct feed of live CME and other commodity information (as shown in figure 7). This service is provided by The Progressive Farmer, who provides agricultural information and market intelligence to enable their customers to actively and effectively manage their business.

Figure 7. Christopher Noble of Noblehurst Farms in his farm office with a screen displaying market information (Niven Collection, 2014).

Dick and Chris monitor on a weekly and monthly basis the rolling average feed costs. They review where prices are trending and where they can lock prices. They use historical pricing patterns to establish the parameters they use to manage their business (as shown for Soy in Figure 8). They aim to lock in 25-50% of milled product. For commodities on the CME, they hedge with futures and options, and do not take delivery of physical product. They do take delivery of other items such as blood meal. They aim to match the hedging of milk sales with feed purchases. Overall, they endeavour to have a layering of price risk coverage. Their approach can also be used to manage cash flow, rather than gain or lose on a hedge.

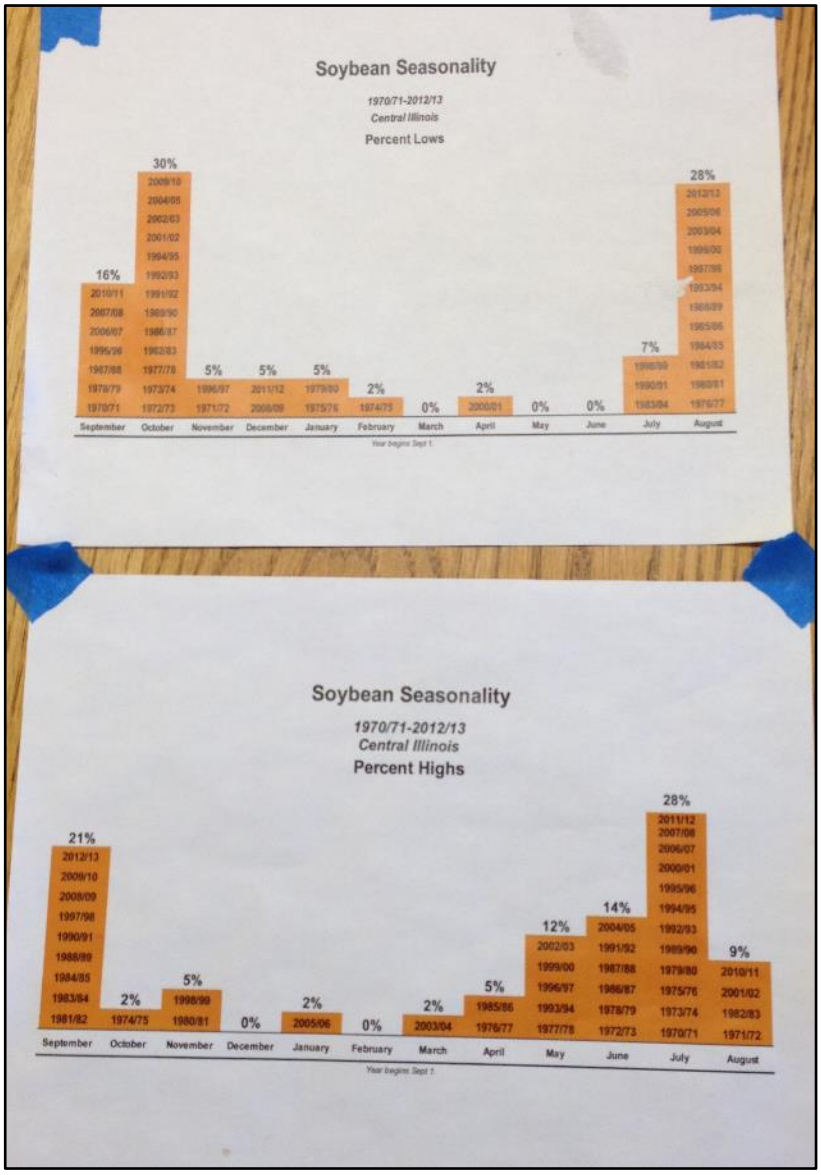

Figure 8. Noblehurst Farms monitoring of seasonality of Soy bean high and low prices for Illinois by Noblehurst Farms (Niven Collection, 2014).

They use MPP as a *cheap way to buy options* and Noble (2014) estimates this tool takes out 15-40% of the risk. It provides them with a floor, and does not limit the upside. This program will stop their business losing as much equity as was lost in 2009.

They have also expanded the *central desk* to cover other farm inputs, such as silage covers, tyres and tractors. This is done more as a collation of orders than taking positions.

In October 2014, Noblehurst Farms were starting to commission a milk plant that made crème and skim milk; the next phase is artisan cheese. Their points of differentiation were that all the milk was BST free, and the plant uses sustainable energy sources, such as solar panels and energy from the bio-digester on a neighbouring dairy farm. The plant is a joint venture with dairy cooperative Dairy Farmers of America (DFA), with DFA the managing partner.

3.4.6 United Dairies, Minnesota

United Dairies (purchased 2003) operate three farms, each with 1500 milking cows, near Litchfield in Minnesota. Nick Ridgeway, a former banker, is the General Manager. They calve all cows on the one dairy (Union Dairy) and then move most first and some second lactation cows to Westland Dairy. Second lactation cows go to Cottonwood dairy. Cows on their third or more lactation, or cows that transitioned poorly, stay at Union. Union Dairy was originally designed as a Land O'Lakes (dairy cooperative) model farm. They also bought a 20,000 head beef feedlot in Kansas (two states away) where they rear their heifers. They have chosen this model, as the cost to build a heifer facility in Minnesota would be ten times the price due to the requirements for all cows to be in barns.

The business is structured as four farms with four managers, and Ridgeway as the General Manager. Another partner manages one of the farms. Each farm has a P & L and review at the budget and costs every month.

Ridgeway's role includes the management of procurement and hedging. They focus on the purchasing of electricity and use a local county cooperative to purchase some of their power needs. The cooperative tenders for the best price from generators and uses the collective buying power to secure lower costs.

The business' aim is to maximise income, not maximise production. This was a different philosophy to most producers in California. Ridgeway says the partners (as investors) like predictability. They aim to make money every year, pay a dividend and increase equity.

They use hedging and forward pricing to give this predictability. Although they see these risk management tools as useful, Ridgeway says the business must start with a low cost of production and the best management practices. Then the business can utilise these tools to support the business, not drive the business.

They have developed detailed models to calculate the price of corn silage. They established a system where they buy the seed (that is, as the purchaser, they chooses the variety to be grown) and then they pay seven times the ethanol price less the basis price for corn silage. This model has worked well, but they now want to work towards a local price. They are in an area with a negative basis price, which ranges from 20c to $1. They contract grow 100% of their corn silage. They manage their lucerne haylage in a similar way, and fix the price for three years, which is considered the lifespan of the stand (at four cuts per year). If silage is produced on a farm, they pay the same price so as to ensure there is an accurate and true price of feed.

As a business, they lock 60% of their inputs and 60% of their outputs. The aim is towards 65%, and partners have changed their view on locking prices. They understand they may lose out on upside prices, but they have protected their floor. Ridgeway (2014) says the key to their business is to lock in a profit, make a margin, and accept that they'll miss the top of the market.

They sell milk using a facility from cooperative Land O Lakes. It costs 12c per hundredweight (45.4kg) of milk. They could do the activity themselves for 8c per hundredweight, but would need an additional line of credit to fund the transaction. They aim to lock class-three milk at the cost of production and then get an extra $2 to $3 based on premiums for components, SCC and quality. In Minnesota, dairy farmers need to be members of a cooperative to sell their milk as there are only a few independent buyers of milk.

Nick plans to enrol the business in the MPP. However, whatever the business does, they key is to ensure transparency of the decision-making. He recommends that all businesses

document the context, document the reasons and keep consistent in their approach to risk management and forward pricing.

3.4.7 Riverview, Minnesota

Paul Fehr started Riverview in the late 1930s (he is grandfather of Brad and Gary Fehr). Gary then started to grow the business in the 1980s. They started with two feedlots of 5000 cows with the plan to buy 500 pound (lb) (227 kg) feeder cattle and finish them by May of the following year. However, by the early 1990s, all the meat packers had closed in Minnesota and the only option was to send the cattle six hours by truck to Nebraska. They explored pigs, turkeys and settled on dairy. They built their first (800 cow) dairy in 1995 and brought in outside investment.

As a business, they have a high comfort level to bring in outside capital and advice. In 2000, with a new group of partners, they built a 2000 cow dairy, followed by a 6000-cow dairy in 2004. Since then, they have rolled these into a limited liability partnership. 85 employees own Seventy percent of the partnership, and neighbours and family own 30%. They now have five dairies in Minnesota and three in South Dakota, milking 60,000 cows. Whilst visiting they were in the process of acquiring a dairy farm in New Mexico and converting it to a heifer rearing facility. They also have three feedlots in Nebraska, and finish 50,000 cattle per year. They farm 27,000 acres (almost 11,000ha). Animals consume 80% of what is grown, and this accounts for 20% of total feed consumed. The business employees 800 people, of which 250 are veterinarians (majority from Mexico).

Gary Fehr is the CEO, and his brother Brad is the CFO. They have a seven-person board that *watch the balance sheet*. Each site has a manager and reports through to the Chief Operating Officer. They have well defined core values and operating model, which are communicated throughout the business. These are shown in Figure 9.

They manage price risk by defining the type of product they are producing. They segment their key products, meat and milk into a number of products. For milk, the segments are

from organic to commodity. For beef, they see ten segments from organic to commodity. Within their beef business, they are all natural and hormone free. All except one of the dairies are antibiotic free. They are BST free. They have changed the mindset from treatment to prevention. They regularly conduct animal welfare audits of the farms.

They are moving to all jersey genetics; they are about to move to sexed semen and are rearing around 40% replacements currently. Their cull rate is currently 35%.

They use ten core ingredients in the cow's diets. These included corn silage, lucerne, distiller's grain, canola meal, soy and a mineral pack. They also use corn syrup by-product and pressed beet pulp. They determine their own corn price, and silage produced by neighbours is priced off this base. They set a price in March for Lucerne baleage. They sell the manure back to the farms as fertiliser and it is injected into the ground. This reduces the loss of nutrients and reduces odour. It also means that there are fewer matters for the people in the community to complain about. They use long term supply contracts with neighbours to provide the feed they need for their operation.

This was the largest dairy business visited. Of all the dairy farms visited during the Nuffield scholarship, the Riverview home farm was the most professional, had the best presentation (equal with farms in California and The Netherlands) and had work health and safety at the centre of how the business was run.

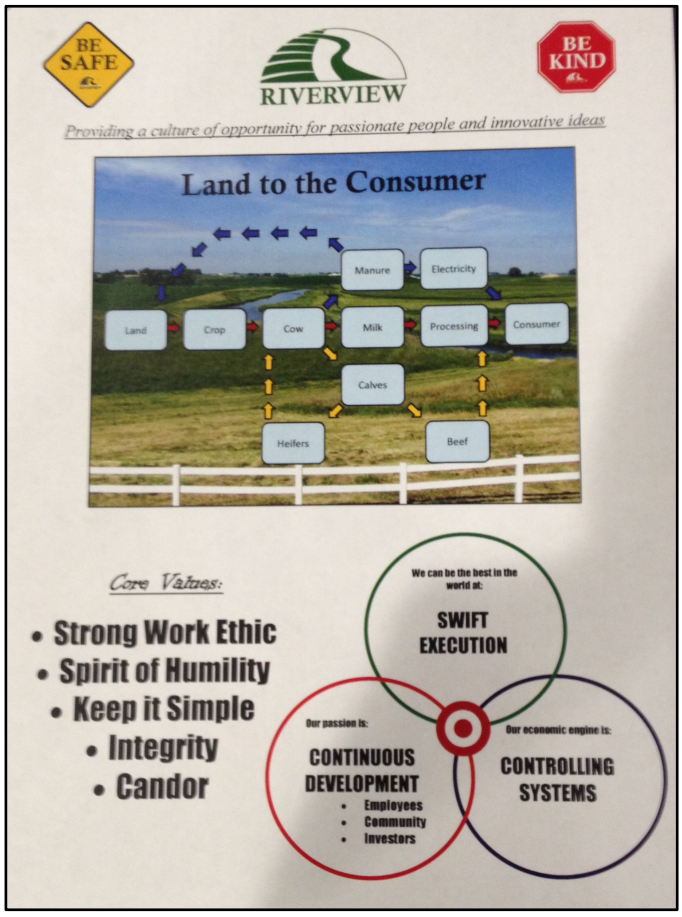

Figure 9. Mission, core values and business model of Riverview Farms (Niven Collection, 2014).

3.5 USA Brokers and Markets

3.5.1 INTL FC Stone

INTL FC Stone is a Fortune 500 company that provides clients, across the globe, with a comprehensive range of customised financial services and tools to help them protect their margins and manage volatility. INTL FC Stone's customers include the producers, processors and end users of virtually every major traded commodity; commercial counter-parties; governmental, non-governmental and charitable organizations; as well as institutional investors, brokers, professional traders, commercial and major investment banks.

They offer these customers a comprehensive range of products and services. Among these services is their proprietary Integrated Risk Management Program (IRMP), as well as exchange, and execution and clearing services designed to limit risk and enhance margins, and bottom-line results. They also support the physical trading in precious metals and grains, a global foreign exchange and currency payment service, asset management, equities market-making, securities execution and trading, and investment banking advisory services.

It was a pleasure to meet with Robert Chesler, Vice President of the Foods Division. Chesler outlined how their business provides services to dairy producers, and provided a tour of the CME. Chesler's team have tools that are used by dairy farmers to understand their costs and manage their risk. It brings in details of the ration, and adds cost per commodity, and cost for key components such as protein. They also have the ability to add in fixed costs. With this, they then focus the farmer to look at their margin over feed costs (MOFC). With these parameters set, it allows the FC Stone advisor to show the producer their exposure to different changes in feed and milk costs. From there, the farmer, depending on their risk profile, may choose to hedge feed inputs or milk.

Like many clever tools designed by industry specialists, the challenge for FC Stone is to have access to producers and engage them in the conversation about risk management. FC Stone

were looking at new and different ways to engage producers in the conversation about price risk management.

3.5.2 Rice Dairy

Rice Dairy is a boutique brokerage firm, offering guidance, analysis, and execution services on futures, options, spot, and forward markets, specializing in dairy and markets at dairy's periphery. They help producers make decisions. They are brokers rather than a partner in the transaction taking a margin only. More recently, they are working with some Australian based companies.

In meetings with Jon Spainhour and Trevor Slegers, and then Slegers and founder Brian Rice (in July and October of 2014, respectively) they shared a deep understanding of the milk and input markets in the US. Since 2007, when the US dairy market became more export aware, they have expanded to look more at global milk markets and pricing. This resulted from trading companies entering the butter market in the US to make money out of spreads between the US market and overseas markets.

Prior to 2007 and the subsequent introduction of the Global Dairy Trade (GDT), the US was not able to easily access export markets. Since the GDT, it has led the US to focus more into skim milk power and cheese. It was the view of the people at Rice that New Zealand had considerable exposure to China, considering 50% of their dairy product is whole milk powder, and 100% of it is exported to China. New Zealand had left skim milk powder (SMP) and cheese, and the US had entered this market. However, with changes in New Zealand's production profile (back to SMP and cheese), this will lead to a price drop in the US. The real issue for the US dairy industry is the speed with which processors can switch between products. It's not just about making product, it's about having the customers ready, and then the hedge positions that the producer, processor and end user make.

3.6 Limitations of the study

From a US perspective, this study focused on milk as one of the four white commodities (rice, sugar and cotton being the other three). This study did not investigate how commodities in the USA, not associated with dairy cows, were traded. There was general discussion that dairy risk management tools were not as advanced as for corn, but this was not investigated. It was also mentioned that the new Farm Bill with margin protection was modelled on the mechanism in place for corn farmers.

This study did not explore the tools available to European farmers. Through the mechanism of the European Common Agricultural Policy, there may be tools that could be useful for dairy farmers outside Europe.

Chapter 4 Conclusions

4.1 Farm Management Systems

"*The challenge for all businesses is the expertise of people on the ground to implement and senior management's ability to monitor and manage*" Robert Poole (2015).

New Zealand and the USA each have a dominant program used to manage cow data (Minda and DC 305 respectively). Each of these programs also has associated and compatible programs for managing feeding. Neither of these systems, however, is directly transferable to an Australian pasture based dairy farm. In the case of Minda, it is linked to the New Zealand national cow database and this excludes the assimilation of Australian data. DC 305 is designed for cows in sheds, where all animal activities, such as breeding and treatments are done in the pen. This is not currently fully compatible with an Australian or New Zealand system where all animal activities are done in the dairy shed, and usually whilst milking.

In both the USA and New Zealand, more work is required to have better portability and functionality of the database on small handheld devices. In some areas of the USA and many areas of New Zealand, Internet access is not sufficient to operate these systems in real time. There are many solutions in place (Wi-Fi and daily syncing), but these are not yet ideal.

4.2 Price Risk Management

Throughout the US and New Zealand, price fluctuations for inputs and outputs are considered a usual part of the external operating environment for a dairy business. However, there are very different ways that farmers in each country can manage the business risk created by the price fluctuations.

In Australia and New Zealand, dairy farmers often use the *farm system* as a surrogate for risk management. Farmers often change their farm system to manage the price risks associated with brought in feed. In New Zealand, there were views that a business with minimal or

even no brought in feed were less risky (and also more profitable) than a business where some feed had to come in every year. Within an Australian and New Zealand context, this view was based on the issue of drought. During an extended drought, feed prices increase dramatically and in some regions, no feed would be available for purchase at any price. Alternatively, some dairy businesses change their system to include a set amount of brought in feed (usually cereal grain or PKE in New Zealand) to increase stocking rate and increase production.

Analysis of dairy businesses in New Zealand and Australia, however, show that all farming systems, from no supplement through to high supplement can be as profitable as the others. Therefore, it is time that the debate moves from which system is the most profitable to how do I make my system most profitable.

Throughout the US and New Zealand, the businesses that were the most profitable knew their system, knew their costs and how to manage their costs. They had a clear understanding of their feed costs, their feed requirement and the milk income from their farm at different milk prices. The best businesses focused on having the best people managing the key business drivers.

When it came to tools available to dairy farmers to manage the risk associated with changing input and output prices, there were vast differences between the countries. In the US, the tools were well developed, and commonly available; most dairy producers had used some of the tools at least for some inputs, for some time. Many US dairy businesses employed a specific person to monitor input and output prices, and then buy physical product for immediate or delayed delivery, or use futures or options to take a long term position. Most businesses had a risk management philosophy as to the percentage of feed and milk they wanted hedged.

By contrast, tools available for the New Zealand dairy farmer to managing risk are virtually non-existent. Most producers accepted they were price takers for milk in a global market.

Everyone explained that they committed their business to produce milk without even knowing the price they would receive. Against this backdrop, the overwhelming approach was to be a low input and therefore low cost producer. In the last two years, Fonterra New Zealand had been offering fixed milk pricing for a proportion of a farm or business's milk. The uptake of this tool was greatest amongst corporate businesses.

Chapter 5 Recommendations

5.1 Recommendations for Farm Management Systems

The following recommendations are made to the manufacturers of software programs:

- Those companies operating in the USA, and other places where cows are housed, should consider the improvements to their offerings by looking at pasture-based dairy farming where all activities are done in the dairy shed. This should lead to improved labour efficiency and faster collection of data. (p 15)
- The hand held devices available for Minda and DC 305 are robust, but are not as user-friendly as they could be. Improving the hand held devices will improve usability. This applies to the US market as much as the Australian market. (pp 23,24)
- It is essential for large herds with multiple staff that the hand held devices have the ability to electronically scan EID tags into the device to bring up cow information, rather than rely on manual data entry. (p23)
- There is opportunity for a software provider to develop and sell the overarching architecture to link and consolidate animal, feed, and financial information to all farmers, irrespective of size. Such a system will improve the alignment of physical and financial information to assist dairy farmers manage their business. (pp 20, 21, 22)

Recommendations for dairy farm management systems

- For both software developers and dairy businesses looking to install a new farm management system, separate the requirement of the software with the functionality of the hardware. (p 14)
- For businesses considering installing and implementing farm management software (and hardware) consider both the initial set-up cost and the on-going resource (people and money) to support and maintain the system. (pp16, 22)
- Internet coverage remains a considerable limitation to implementing a real-time system in Australia, New Zealand and parts of the USA. Governments and service providers need to continue working on providing phone and Internet access to rural and regional areas.

- All businesses that are embarking on implementing a farm management system should look to have the least number of data entry points as possible for the same information to maximise efficiencies. (p 18)
- The best system is one that is used throughout the organisation: from the person putting the cups on cows through to the CEO (pp 13, 16, 20, 31)
- Businesses need to know the levers they can pull on business costs and milk production- how fast, how much, and the impact of changes over many years.
- Ensure there is transparency in how records of physical parameters are converted into financial data. This allows all levels of management to link action on the ground with improved financial performance of the business.

5.2 Recommendations for Price Risk Management

The following approach has been designed for any dairy business in the world- irrespective of size, ownership or system, to manage price risk.

1. Choose and define your farming system; it is necessary to understand it in order to manage it.
2. Understand cost structures; understand the ranges for fixed and variable costs between years and seasons.
3. Use benchmarks for your farming system and cost structure to look for improvements in the business.
4. Understand the price cycles of finance costs, inputs and your outputs (milk). It may be necessary to seek advice from an adviser or expert.
5. Set price trigger points for inputs and outputs, and understand the financial impact on the total profitability of changes
6. Decide on a price risk management strategy. This can vary from no risk management through to 100% of inputs and outputs bought at pre-determined prices.
7. Get advice on the tools available to implement a price risk management strategy.
8. Commence measuring, monitoring and managing price risk.
9. Re-assess the price risk management strategy every six months, and prior to making any farm system changes.

General recommendations

- Every dairy business must understand, measure, monitor and manage their top three physical and financial KPIs (pp20, 21, 31, 32, 35, 36)
- Consider the lead indicators for the future success of the business. Retrospective KPIs are not useful for managing future business risk. (p. 37)
- Within Australia and New Zealand, it is time to move the debate from *which system is the most profitable* to *how do I make my chosen system most profitable*. (p. 29)
- With rare exception, dairy farmers must accept that they are in a commodity market and prices will fluctuate for inputs and outputs. It is therefore necessary to have a system to access and monitor commodity prices. (p. 12, 35, 38)
- Dairy businesses need to access professional advice and information. This can be through external support or, for a large business, bringing this service in-house. (pp 38, 40, 42)
- When making business decisions to mitigate price risk, the context for the decision should be documented. This is important when others in the organisation review these decisions at a later time.
- The development of DairyBase Australia, the Australian national database of dairy farm performance, needs to be a priority. This will assist farmers to benchmark their businesses and optimise performance.

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Plain English Compendium Summary

Project Title:	Management systems and price risk management for multi-site dairy operations
Nuffield Australia Project No.:	1420
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Objectives	To understand how farming businesses manage multiple site animal operations. To understand how businesses manage input and output price volatility, and the tools and approaches to optimise income in the medium to long term. To further investigate how businesses adapt their operations to capitalise on certain price point opportunities in commodity price cycles.
Background	The author undertook a Nuffield Scholarship whilst in the role of Business Manager- Dairy for the Van Diemen's Land Company, Australia's largest dairy farming business. As the business matured and stabilised, it sought ways to use its purchasing power of commodities and proven farming system to capitalise on commodity cycles and make more money from the business whilst reducing risk. This study was aimed at determining what systems exist around the world to aid this process.
Research	The research consisted of visits to farms, financial markets, brokers, manufacturers and suppliers in continental Europe, USA, New Zealand and China. The scope of the study was limited almost exclusively to the dairy industry.
Outcomes	There are many and varied software tools to manage multiple site animal businesses. However, in the USA, Dairycomp 305 has very high market share (90%+). The complexity added in grazing dairy systems (ie cows and land) has not yet been adequately consolidated into a system for multiple site operations, but Landcorp in New Zealand, currently, have the most developed framework to consolidate multiple systems. Around the world, businesses display the full spectrum of price risk management- from pure price takers through to hedging all farm inputs. There are fundamental differences in the tools and opportunities in different countries available to dairy business. The key, however, for all dairy enterprises, whatever their system, is to comprehensively understand their cost of production, and understand where all their inputs and outputs are on the commodity price cycle.
Implications	Dairy businesses must understand the flexibility of costs to their system and monitor the key external commodity price triggers. Many businesses around the world have unrealised opportunities to *turn on* and *turn off* parts of their production system in order to increase profit at certain times. There is a void (and therefore an opportunity) for software that can consolidate both the animal and farm data for multiple-site pasture-based animal operations so all levels of management can monitor and manage their businesses, and be able to quickly respond to changes in commodity prices.