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Primary Industry Management

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nzipim NZ Institute of Primary Industry Management

From the Chief Executive

Growth, collaboration and strategic leadership

If I were to reflect on 2014, growth, collaboration and strategic leadership would stand out as key themes for the NZIPIM last year. The NZIPIM has had a successful year and has achieved some significant milestones during the period. I am delighted to share with readers of *Primary Industry Management* some of main highlights achieved during 2014. These include –

- Membership numbers increasing by 16 per cent to 815 for the year, added to which we have 150 student members
- A total of 40 activities and events were held by our regional branches, representing a 100 per cent increase on the previous year
- Launching the People Management Accreditation Scheme in August 2014 with the Dairy Farm System Accreditation Scheme expected to be launched early this year
- Launching the Online Ethics Module in the middle of last year with the purpose of assisting members develop a deeper understanding of their professional and ethical obligations to their clients, the public and other members
- Running two Leadership Development Forums with the aim of building the leadership capability of members so that they can become more influential on important issues affecting primary industry at a high level
- Developing strategic partnership arrangements with companies which share common values and aspirations of the NZIPIM
- Expanding the influence and profile of the NZIPIM across New Zealand primary industry.

The support we have received from members and our strategic partners during the year has been outstanding, and it has allowed the NZIPIM to promote and cement its place as the peak industry body for the rural profession. With this support also come increased expectations. In my view this has been instrumental in providing the board and management greater clarity of purpose of the NZIPIM's role within primary industry and how we can add value to our membership base.

Developing a culture of professionalism and building the capability and knowledge base of the rural profession will become an important platform in the future. With this shift in emphasis, the board recently approved the NZIPIM's 2015 business plan. Key objectives of the plan include –

- Building the capability and capacity of the rural profession, including the facilitation and coordination of professional development programmes which are relevant and valued by members
- Implementing and promoting the accreditation schemes, including the successful launch of the Dairy Farm Systems Accreditation Scheme in early 2015
- Growing and developing the NZIPIM's membership base
- Building on the momentum within regional branches and connecting rural professionals through business and referral networks
- Stimulating discussion on important issues within the primary industry and providing thought leadership on behalf of the rural profession
- Continue to develop collaborative strategic partnerships with like-minded organisations
- Supporting the career development of young rural professionals and those considering a career within the profession.

The year ahead represents an exciting time for the NZIPIM and the rural profession. How we build the capability and knowledge base of rural professionals which service the farming community will be an important function of the NZIPIM in the future. While volatility in our international markets and the climatic conditions has put pressure on the farming community in recent times, the future of the primary industry is very bright particularly for talented and skilled rural professionals who reside within our membership.

I would like to thank members and our strategic partners for supporting the NZIPIM in 2014 and I look forward to your continued support in 2015.

Stephen Macaulay

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Julian Bateson

What is the future for primary industry?

The first two articles in this issue of *Primary Industry Management* look to the future. What should we expect in 20 years or 25 years' time with regard to primary industry? Hindsight will give the perfect result but in the meantime we should be planning to avoid surprises for when the future becomes the reality.

William Bailey, looking just 20 years ahead, concerned about the challenge of meeting the demands for more food, initially looks back 20 years to see how things have changed over a similar period. He concludes that the future looks promising as long as farmers continue to learn and adapt. However, food safety and how food is bought are the two factors which he sees as most important.

Warren Parker, in his article, looks a little further into the future. He sees global demand rising but with demographic changes making a difference. Countries with ageing populations will tend to have static demand, but India and China with increasing younger populations will have growing demand. The extra two billion people expected to be around in 2040 will need to be fed from less land and poorer quality water than today. It will also be an environmentally and socially challenging future. Climate change means we can expect an average temperature rise of over one degree along with much more extreme weather patterns. The article concludes with a series of challenges to be faced and responses needed.

Biosecurity is not raised as a significant concern by either of the above authors. However, as this journal goes to print the media is reporting the discovery of a small colony of Queensland fruit fly in Auckland. No doubt there will be significantly more information on this topic by the time you read this issue of *Primary Industry Management*. As all those in horticulture know, Queensland fruit fly is a very serious threat to their industry with respect to exports. The future needs to include some stronger biosecurity measures so that serious incursions such as this do not happen.

Jill Greenhalgh et al in their article look at farmer resilience to natural disaster using, as an example, the storm in Canterbury in 2013 which blew 800 irrigators over. In the study sample, most farmers affected had expected that their biggest problem from weather would be heavy snow resulting in a loss of electrical power. Many therefore had back-up generators but only 20 per cent of them had sufficient power to run all the farm infrastructure. Only one farmer in the study had a management plan written down. Such a plan cannot cover all eventualities but it can make life easier for farmers and employees when disaster strikes.

Chris Lewis in his article 'Missing parts to modelling irrigation' considers the preparation and modelling of irrigation for dairy farmers on the east coast of the North Island. He asks if there is a flaw in the modelling process and looks at the answers from an agronomic and strategic perspective.

Kevin Old and Peter Nuthall were interested in the ownership systems on New Zealand farms. They used the results a survey of over 700 responses from full-time farmers to study farmer objectives, ownership and the decisions made. It may be a surprise to some readers to find that the study showed most farms are still run by just one or two people, despite the increase in farm size over recent years.

Nic Lees in his article looks at the potential for red meat which currently accounts for 11 per cent of total exports. He suggests that there is limited scope for increasing the volume of meat exported and adding value is the only alternative. However, this will require a coordinated effort from the government, exporters and producers.

Looking again to the future, in his article Tony Wilding asks what the ownership structure is likely to be for the average dairy farm. Sharemilking has underpinned the way in which nearly half of dairy farms operate, with the percentage of farms employing sharemilkers remaining virtually the same over the past 20 years. However, the number of farmers employing herd-owning sharemilkers has decreased significantly. He concludes that there will be a greater focus on better use of sharemilkers who own their own herd.

In other articles in this issue, Blake Holgate outlines how the changing environmental regulations are putting more controls on farmers, Gavin Ussher gives his impressions of the cattle industry in Brazil and Brennon Wood considers the benefits of networking for innovation in farming. Finally, the profile is of Jenny Jago currently working for DairyNZ in their strategy and investment team.

William C Bailey

Peering into the future What does 2035 hold for New Zealand agriculture?

It is tough to make predictions, especially about the future. It is not clear who first used that phrase, but I am going to attribute it to the American baseball legend Yogi Berra. It is difficult to make predictions about the future – I always had difficulty predicting which horse would perform best at the Manawatu Boxing Day races when I was at Massey University. But the future will eventually be here and more quickly than we expect. It is therefore best to give some thought about how things are evolving in order to prepare for, and hopefully avoid, serious surprises when the future becomes today's reality.

A fundamental assumption of these thoughts on the future is that world agricultural productivity will rise to meet growing world demand. There is a constant theme in the popular media about feeding three billion more people in 2050, but those in agriculture are much more confident of meeting the food needs for these additional billions than are many journalists. My ideas about the future see the challenge of agriculture to meet the increased food needs of the future as evolving. In addition, it is assumed there will be significant technological strides forward for some New Zealand agricultural sectors, while others will not see as many changes.

Robotic milking is one technology which is gaining popularity in the United States. Even if that technology does obtain a foothold in New Zealand, the structure of the dairy sector will not significantly change. This article therefore discusses the future 20 years from now in those areas that might provide significant and broad changes to the structure of New Zealand agriculture. It also discusses and evaluates the broad area of government policies in New Zealand and abroad which will affect domestic agriculture over the next 20 years. The emphasis will be on trade and foreign ownership of farms.

Looking back

The best place to take stock of where New Zealand agriculture will be in 20 years is to look back 20 years – to 1995. That does not seem too long ago, but there have been some significant changes to agriculture, particularly in the dairy, beef and sheep sectors. Recall single desk sellers such as the New Zealand Dairy Board. The dairy industry then had a number of dairy companies including Tui, Anchor Bay, Southland and Kiwi. Things have changed. We knew they were changing back in 1995, but not necessarily where they would end up. You may recall the drama associated with the unveiling of the name Fonterra.

In the sheep and beef industry, the changes have not been as dramatic as in the dairy sector. AFFCO and Alliance remain important industry leaders and grass-fed meat is increasingly an important point of difference for domestic and export customers. However, there have been external changes the industry has had to face, including increased consumer interest in how meat is produced, more detailed tracking through the chain of meat cuts, and more awareness of healthy eating with an eye towards how protein may best be consumed.

Since 1995 in the United States the importance of government price support programmes has slowly but steadily declined. The New Zealand government then had a hands-off attitude toward agricultural subsidies and that has not changed. In addition, to reduce direct producer support, the United States government has also stopped subsidising exports of grains and dairy products. A consequence of that move is that the dairy industry today pays a lot closer attention to international demand than it did, or needed to, in 1995.

Some changes anticipated

A vital change for all three sectors over the past 20 years is the decline in the importance of the United Kingdom market and the dramatic growth in the Chinese market. As the importance of the latter has grown, Fonterra has become directly involved with dairy farms there. Fifty years ago the United Kingdom took 88 per cent of New Zealand's dairy exports, today it takes 0.3 per cent. Similarly China takes more than 20 per cent of those exports, whereas 50 years ago the volume was negligible.

By looking back 20 years, I intend to emphasise that change clearly has taken place, and some of the changes



were anticipated while others were not. Many of the industry changes over the past 20 years have been positive, some less so. The general business environment faced by all of New Zealand agriculture today is also significantly different from 20 years ago. Some in the industry have adjusted well, while others are still adjusting.

Looking forward

I am very positive about the future of New Zealand agriculture. It has been, and remains, an incredibly efficient, well-managed and customer-focused segment of the domestic economy. There are some changes coming over the next 20 years, which should provide some interesting opportunities for the sector. I will place these changes into two broad categories – consumers and trade. Within each, I will discuss trends which will shape New Zealand agriculture during its journey to 2035.

This broad category of consumers contains two sub-categories – what consumers buy and how they make purchases. Significant changes are taking place today in both areas which will affect New Zealand agriculture. Because consumer demand provides direction to agricultural production, the shape of that demand needs to be understood so that agriculture may respond to these changes. If agriculture does not respond to changes in consumer preferences, either in the food they buy or how it is purchased, it will suffer and perhaps significantly.

What consumers buy

It is obvious that consumers want to buy food which they trust is safe. In the past, branded products provided assurance about quality – Watties Beans and Mainland Cheese are two iconic New Zealand brands. A brand provides a lot of information, but most importantly the consumer sees it and trusts the product as safe. Today, the role of branded products has declined as consumers look to generic or store-specific brands. Consumers have moved away from expensive and well-known brands because of price. Prices will remain the main factor for most consumer purchase decisions until safety concerns arise.

Consumers will lose trust and stop buying one brand and move to another which they believe is safer – then price becomes secondary to trust and safety. An excellent example is the recent problems which McDonald's experienced in China when questions arose over the safety of several food items in their restaurants. It has been reported that sales were down almost 10 per cent as consumers moved to fast food alternatives to McDonald's. Brands which are strong when things are going right can drag the ship down when things go bad – the entire brand is affected.

New Zealand agriculture has benefitted for a long time from its 'clean and green' image. Fundamentally, consumers looked at what is produced in New Zealand as safe. Food contamination problems which emerge today are given a lot more public attention than 20 years ago, including by social media. I will not buy food products from certain countries because I have read about sanitary, quality and safety problems that are recurring and are widely publicised in social media. I will purchase New Zealand food products because I trust the brand that is New Zealand agriculture.

Over the next 20 years, I expect New Zealand agriculture to take significant steps to monitor the entire food chain to assure the sale of safe food products. From such monitoring, as problems arise they may be quickly identified, located and rectified. Recent challenges with certain Fonterra products underscore the importance of tracking products carefully through the supply chain. The concept of tracking New Zealand beef and lamb through the supply chain and eventually back to the farm has been discussed by some exporters, but I expect it to be common in 2035. Consumers will reject food which they do not believe is safe.

In response, New Zealand agriculture will eventually structure its on-farm operations to accommodate the changes required for tracking. This means the term commodity could become obsolete because each farm, and each animal, will have their own unique identity. The challenge will be producing sufficient volume to meet what I expect will be a significant increase in the demand for New Zealand agricultural products by 2035. Consumers will value and seek out products which have a secure and transparent system that monitors and tracks its path from the farm to their home.

A result of increased tracking costs will be higher



prices. Not all consumers will be able to buy products at the higher prices, but that will be more than offset by increased demand for safe and trusted products. The challenge for New Zealand agriculture will be how to balance the strong demand, which will encourage increased production, with the need to maintain the integrity of the New Zealand brand. The higher prices and increased demand will provide an incentive to some to put products on the market which are not tracked or even from New Zealand. There will need to be an aggressive programme to prevent others from counterfeiting the New Zealand brand for agricultural products.

How consumers buy

In 2013 Christmas online food sales amounted to 15 per cent of all food sales in the United Kingdom. Major retailers such as Tesco and Waitrose are said to be closing stores and opening new food warehouses to accommodate what is expected to be a doubling of online foods sales to more than 10 per cent of all grocery sales over the next 10 years. Giant retailer Walmart in the United States is expecting online sales to become more than 10 per cent of their sales, with fewer sales through their big box stores.

As online sales climb and big box sales decline – the exception is The Warehouse where sales are reported to be growing – the opportunity for New Zealand farmers and firms to sell directly to their customers throughout the world, rather than going through a retail grocery store, is evolving. This means that as online sales grow, more farmers will be able to interact directly with their customers wherever they are in the world. It also means that traditional supply chains for sheep and beef farmers will change, putting more opportunities and risks directly on to the farmers' shoulders if they choose.

A major result of increased online sales and the decline of big-box retailers outside New Zealand is that its isolation from the rest of the world, once viewed as a handicap, will become an even more positive attribute in the future. As the middle class around the world grows they will have the financial ability to look outside their country for safe and high quality food rather than depending on their local grocery store. China is expected to have a middle class of one billion by 2030 with India's reaching 300 million at the same time.

The combination of a growing global middle class, increased use of online shopping and consumers' desire to interact directly with the farmer will blend together to create a whole new supply chain over the next 20 years for New Zealand farmers. This is a unique opportunity to modify the whole 'know your farmer' paradigm to include these farmers, regardless of where the consumer lives.

Trade

As with the consumer discussion above the effect of trade on New Zealand agriculture over the next 20 years is divided into two broad areas – government intervention in trade and foreign ownership of New Zealand farmland. The changes previously noted about what consumers buy and how they buy things will directly affect New Zealand agriculture. However, it is not clear when during the march to 2035 the effect of these trade concerns might be felt in New Zealand agriculture. They are, and will remain, dark shadows on the horizon which could harm agriculture, but it is not clear when.

Government intervention in trade

Government intervention in agriculture around the world is a reality that is with us every day –

- Very low commodity prices at home results in attempts to raise prices by expanding demand
- Too high domestic commodity prices leads to efforts to limit exports, putting downward pressure on domestic prices
- Most recently, political unrest somewhere in the world puts agriculture at the top of the list of actions taken.

The banning of certain food products by Russia is a clear indication of the latter. Argentina's tax on commodity exports is an example of trying to keep domestic prices down by limiting export demand.

However, there are other ways for governments to intervene which may become more prevalent by 2035 as international trade continues to surge. In that surge, there will be winners and losers. For example, manufacturing in the United States has declined as businesses have moved their production to cheaper offshore locations. Twenty years ago, 30 per cent of the workforce in the United States was involved in the manufacturing sector



but today it is less than 15 per cent. The movement of production offshore has benefitted consumers in the form of lower priced imported products and consumers respond to lower prices. Consumers have benefitted from international trade, but that trade has also created significant hardships and chronic unemployment in areas across the United States, mostly in The Rust Belt and the south.

The United States has been very supportive of growth in international trade for agricultural products. The North American Free Trade Agreement signed 20 years ago opened up trade between the United States, Canada and Mexico and has benefitted all three countries. As international trade has grown, many things have changed with more countries taking advantage of trading opportunities which did not previously exist. Twenty years ago, the United States produced almost 50 per cent of the world's corn and more than 50 per cent of its soybeans.

Today, the importance of United States production to world markets has declined – it now produces only 35 per cent of the world's corn and 30 per cent of its soybeans. Although the United States is producing record amounts of those commodities, others around the world with lower costs of production have caught up with its production. Today, corn exporters outside the United States, who compete for the same markets as its exporters, have tripled their production and now have more than half of the world's corn exports. While still important, the United States has lost its dominance in world corn and soybean trading.

The decline in importance of the United States in the world of commodity trading is acceptable when commodity prices are high. However, history has shown that prices will eventually decline. When that happens exporters who have lost market share will start to pressure politicians to do something to help them, specifically for them to compete against lower priced competitors. As a result of that pressure, governments could take steps to support domestic producers by –

- Restricting production, thereby reducing supplies and lifting prices
- Limiting imports of certain products through tariffs or duties to protect domestic producers
- Subsidising exports.

Given the fluctuation of commodity prices it is not impossible to see a return of export subsidies to help domestic producers as they compete against their lower priced offshore competitors. Budget problems will remain for the United States and Europe, but there are ways to show that export subsidies reduce government spending rather than add to the budget deficit. The probability is low against a return of export subsidies, but they remain an effective and easily used way for governments attempting to support the domestic agricultural industry.

Foreign ownership of farmland

When looking for an offshore agricultural opportunity investment money usually seeks a reasonable return and a safe investment. There has been and probably always will be investment in farmland for personal use such as high country stations or coastal beef and sheep farms, but offshore funds have increasingly flowed into New Zealand specifically for business purposes. Building on the discussion of a secure supply chain, the investors' desire is to own the initial source to assure that the quality of the commodity meets specific standards.

These initial standards may be monitored as the product moves its way through the supply chain. In some countries, offshore buyers of farmland are welcomed because they are looked at as investors helping to develop farmland. Such a view looks at offshore money as new investment entering the country's economy, regardless of what those funds are buying.

An important question faced by many countries, going back to the 1800s in the United States, is 'Should an offshore investor be permitted to buy farmland?' The initial response was to ban the ownership of farmland by foreigners. That position moderated as the benefits of additional capital flowing into the country to develop farmland was recognised. A few states, such as Iowa, still prohibit foreign ownership but most permit it. The only United States government statute relating to offshore purchases of farmland is that the buyer must file certain documents with the local United States Department of Agriculture office. Essentially, the main difference between foreign buyers of farmland in the United States and local buyers is that foreign buyers need to report to the government the details of their purchase.

Some states may have a state-wide ownership threshold, perhaps one per cent of all farmland in the state. When exceeded, this requires a governmental review of offshore farmland purchases. The United States government requires only reporting of certain details when foreign investors buy farmland, but it is another story for offshore investors who wish to buy agricultural businesses.

Recently, a Chinese company purchased the largest pork producer in the country. After some study the Committee on Foreign Investment in the United States approved the transaction. According to its website the committee reviews 'transactions that could result in control of a US business by a foreign person, in order to determine the effect of such transactions on the national security of the United States.' Farmland purchased by overseas investors is not covered by the agency, and apparently foreign ownership does not have an effect on national security in the United States.

As commodity prices have soared, and concerns about reliable supplies have risen, countries as well as corporations have accelerated their interest to control offshore farmland. Several countries have purchased or signed long-term leases for the control of farmland in a variety of different countries. It has been reported that China agreed to a 50-year lease to farm three million hectares in the Ukraine. As a result of aggressive international buying of farmland in its neighbouring states, Uruguay has moved to limit offshore purchases of its farmland whereas traditionally they welcomed offshore investments. The current move to limit access to those investment funds has been a difficult decision. The proposed change in foreign ownership laws, currently in progress as this is written, has been met with considerable opposition, particularly from current investors.

Placing restrictions on who may invest in a country, whether in an industry or in farmland, is clearly a two-edged sword. Foreign investors put nearly US$2.7 trillion into the United States economy in 2012. That is a lot of money which can enhance industries but the result can also move jobs offshore, leaving workers in the United States unemployed. With the importance of the availability of food and the assurance of safe food, foreign investors will continue to buy farmland in a variety of countries including New Zealand. How the New Zealand government responds to this situation is unknown, but it is a factor that will continue to have a significant effect on New Zealand agriculture at least until 2035.

A summary

The future of agriculture looks very positive, but the challenge will be how to adapt and adopt new methods of producing, tracking, marketing and selling New Zealand products to the consumer. Just as new technology may be incorporated into farming operations, it is the farmer who makes the choice about whether or not to participate in new off-farm relationships. As new opportunities arise over the next 20 years, it will be farmers who determine how successful businesses are in seizing these opportunities. There will most probably be government-initiated hurdles to meeting world demand, either through limiting exports or controlling the flow of investment funds into New Zealand, but these are hurdles which will be transitory rather than permanent.

The two factors which will become vital to a prosperous New Zealand agriculture are consumer concerns about food safety and changes in how consumers buy food. New Zealand is uniquely located and its agricultural sector structured to solve consumer food safety concerns with an aggressive national branding programme and a comprehensive process to track and preserve the identity of food from the pasture to the plate. This an old phrase but one that could take on new meaning as food safety means tracking a product from the paddock to the plate – wherever in the world that plate is located.

The second factor of how consumers buy food provides an opportunity for New Zealand agriculture to directly reach customers around the world. There will be challenges to establish and maintain the reality that safe and high quality New Zealand food products are as close as your computer, but they will be fully rewarded. The future of New Zealand agriculture is today positive and it is more in the hands of its farmers than ever before. I wish you well.

Professor William C Bailey is based at the School of Agriculture, Western Illinois University in the United States.

Warren Parker

Preparing New Zealand primary industry for the year 2040

Peter Drucker, the acclaimed management writer, established the truism 'You cannot establish a future that you first do not imagine' and the corollary to this is that today's decisions shape the future. The importance of clarity of vision and purpose for organisations and nations has not diminished through the centuries. What has changed for agribusiness, and business generally, in recent years is –

- Speed of change
- Degree and ease of international connectedness
- Intensity of competition
- Importance of knowledge-based assets such as brands, reputation and other forms of intellectual property
- Economic significance of mega-cities of more than 20 million people
- Mobility and ethnicity of top talent
- Diminishing abundance of natural resources
- Weather and climate change.

Multi-national companies, many bigger than the New Zealand economy, are a particular competitive challenge for primary producers. This is because they operate in many countries, operate at large scale and lobby public policy. They also have the resources to recruit the best people, privatise research, and minimise interest, tax and other costs.

In this article I contemplate the future and the factors which are shaping it. I then look at how New Zealand primary industry, and leaders within, can respond to these factors so that they continue to prosper as the years unfold. Undoubtedly the future is going to throw up some wild cards, whether it is from technological disruption, cyber-attacks, disease pandemic or political unrest. Prudent firms will regularly review and test their aims and strategies to ensure they remain fit for obtaining their objectives.

Factors shaping global change

First and foremost our primary industries compete globally. Because of our small domestic market, the main factors at play in shaping future markets, consumer preferences and demand must be understood. These factors have been widely explained elsewhere.

On one hand, primary industry faces a future buoyed by rising global demand for food and fibre due to population growth, increasing wealth in developing economies, changes in diets and fashion, and demographic change, particularly the growth of the large cities. There are currently around 7.5 billion people in the world. Countries that belong to the Organisation for Economic Co-operation and Development (OECD) generally have ageing populations and static demand.

In contrast to the 1.3 billion people within the OECD, the 1.2 billion people in China and the 1.1 billion in India are part of emerging economies which are on growth trajectories that will significantly further increase their economic and geo-political influence. The rise of China in particular has markedly changed the destination of New Zealand's primary exports. While Europe should not be ignored, much more of our economic and social future by 2040 will relate to the Pacific Rim countries.

A challenging future

Countering this, primary industry faces an environmentally and socially challenging future. First, biophysical limits are being reached for the essential natural resources, ecosystems and climate system which underpin food and fibre production. Second, there is a need to maintain their legitimacy with the public, or social licence to operate, with respect to the effects of intensive agriculture on the environment and methods of production such as animal welfare or forest harvesting. By 2040 another two billion people will need to be fed, clothed, housed and serviced. However, these needs will have to be met using less productive land and poorer quality water than we use today.

With wealth effects added, food production will need to increase by 50 to 70 per cent compared with today, even if waste reduction is considered. Comparable measurements for wood and other natural fibres are talked about less often, but their cultivated production will also need to increase as the availability of indigenous tropical and other forests decline. Global food and fibre supply and demand are therefore increasingly tightly matched. Lack of supply surpluses are reflected by more natural resource insecurity and sharper commodity price

volatility compared with the past. In addition, resource prices over the past 100 years bottomed out of a long-term downward trend around 1999 and they have since been increasing as their scarcity increases.

Ownership of assets

One response to this elevation of business and sovereign risk has been the strategic purchase of natural assets such as land, water and nutrients in other countries. This has precipitated debate in Africa, Australia and New Zealand on what is appropriate public policy for the ownership of these assets, and for the level of foreign investment and the capacity to control supply chains.

For example New Zealand, compared to Australia, has a small land area of 26.9 million hectares. Unlike most other countries, about a third is within the conservation estate with constraints on its use for economic purposes. Almost 40 per cent, or 10.5 million hectares, is in grassland and around 1.7 million hectares in exotic plantation forests. Urban areas, including parks, cover 200,000 hectares and are expanding most rapidly in Auckland, Hamilton and Tauranga. Maori, who generally do not sell their land, own about 1.5 million hectares.

A great deal of our current and future economic performance depends on our understanding of how New Zealand's land is managed and of its physical attributes with respect to productive potential, such as steepness, quality of soils and accessibility to water. Once accurate data is obtained, it is relatively straightforward to estimate potential production volumes of milk, meat, crops and logs, and therefore contemplate ways to optimise economic value while reducing environmental effects.

Steady decline

Another response, the imposition of more rigorous requirements for environmental policy, has increased compliance costs for the users of natural assets, notably land and water. Productivity gains from technological and farm enterprise systems have also slowed from the green revolution days of the 1970s. Recent gains from using fertiliser, conventional genetics, mechanisation and automation are all lower than historic highs.

These reductions reflect the steady decline in agricultural research and development investment by OECD countries and greater global privatisation of research by multi-national companies, particularly in genetics, plant and animal health, and precision technologies. The problem is compounded by a contracting and ageing public sector agricultural research and development workforce. This has insufficient capacity and resources to solve important problems, such as those raised earlier, as well as inadequate succession management.

The urbanisation of societies and growth of mega-cities present opportunities to agriculture regarding food, livestock feed and fibre demand. However, there are also challenges in terms of retaining and attracting labour, reduced political power and influence, and less empathy with the role of farming in society. About 40 per cent of the world's future growth is expected to originate from the 100 largest cities, and exporters will increasingly focus on these markets rather than entire countries.

Climate change and business resilience

Andrew Winston, writing in the April 2014 *Harvard Business Review*, observed that, 'extreme weather caused by climate change and increasing limits resources are both having an unprecedented impact, threatening corporate profits and global prosperity.' For a bio-dependent economy, the response of New Zealand primary business to climate change has been surprisingly mute.

In 2013, The New Zealand Climate Change Centre indicated that we can expect a 1.5°C rise in average temperatures by 2050. This will be associated with more extreme and different weather patterns as well as greater numbers of pathogenic diseases. These effects can be ameliorated to some extent by local action, but multilateral agreements such as the successor to the Kyoto Protocol are necessary for enduring solutions. It is heartening that some global agreements, such as those for acid rain and the removal of ozone-depleting substances have succeeded, but negotiating such settlements is arduous and slow.

This tardiness elevates the risk of ecosystems being irreparably harmed and could make some areas and forms of production uninsurable. In addition, effective abatement options are often expensive for individual producers without some form of public help because they contribute more to public good than short-term private benefit. This can be seen, for example, with respect to nitrogen discharge to waterways where public expenditure since 2004 has grown towards $500 million.

The *Harvard Business Review* summation of how businesses can attain resilience in a hotter world is also wise advice for New Zealand primary industry. As shown, increased collaboration among businesses, communities and government will be necessary for sustainable environmental solutions. Such collaboration could occur by –

- Comparing and sharing standardised best practice environmental performance information
- Paying for ecosystem services, including at a community level for conservation and environmental protection
- Reducing emissions or eliminating waste with industry-wide initiatives.

Responding to the challenges primary industries face

Challenges faced
Challenge More for less – Increase resource use efficiency to intensify within limits. Value over volume – increase product profit margins faster than the volume of output. Competitors innovate faster – concentrate on differentiation and maximise use of new productivity improving technology.
Response Increase investment in research and development, with industry leading by example, and demonstrate the case for parallel increases in Crown funding. Undertake regular competitor benchmarking to identify ways to increase sustainable competitive advantage for New Zealand firms. Collaborate to compete and adopt market-shaping strategies with partners to expand market demand.
Challenge Climate change disruption and economic loss – generate business resilience to extreme weather events and generally warmer temperatures.
Response Shift leadership from denial and defiance to embrace mitigation and adaption options, increase collaboration and involve communities.
Challenge Erosion of social licence to operate – reduce pollution by the recycling and reusing of waste, and change the practices and enterprise mix to exploit complementary ecosystem services such as forestry and pastoral livestock.
Response Promote policy instruments that encourage and reward good environmental stewardship and improve natural capital stocks and flows. Counter anti-science lobbies by promoting science and society, and support rigorous benefit-risk evaluation of new game changing technology.
Challenge Coping with data deluge and information overload – real-time monitoring by sensors and business information networks require smart decision support to avoid farmer's and land manager's time being overwhelmed by planning and reflection.
Response Accept big data concepts together with intuitive decision support aids to demystify complexity and provide simple and ready-to-use decision advice.
Challenge Farming for capital gain rather than for operating profit and free cash flow – solve impending problem of rising age of farm owners and loss of export competitiveness due to over-valuation of assets relative to operating earnings.
Response Encourage farm business model innovation to support ownership succession and new entrants. Support policy instruments such as broad-based taxation of capital gain to reprioritise capital allocation to productivity improving technology and practices, and to broaden the tax base and increase fairness of taxation.

The strategic response to climate change and resource limits

The challenge
Global climate change and resource limits require companies to rethink their strategies, operations and business philosophy in order to create new value and thrive.
The strategy
Firms must embrace a new vision by fighting short-term solutions, basing aims on science and pursuing radical innovation. They must place a value on natural capital and redefine how they measure return on investment. They must also be involved in a new form of collaboration.
The result
The strategy will create more resilient companies which can manage and profit from extreme volatility. It will also help companies address the biggest challenges and create a more prosperous world.

Practical steps for primary industry

Primary industry can do a lot to face the future outlined above. In particular, they can step-up their response to the challenges posed by natural resource limits, climate change and social acceptability for new productivity improving technology such as new genetic technology. In doing so, they will also be better prepared to meet consumer and public expectations. Some responses to the challenges faced by farmers, foresters and orchardists are summarised on the left.

The biggest opportunity is for sector leaders and managers to learn new skills, improve change management capabilities and nurture a new generation of primary industry leadership. The transition under way to resource efficient, low carbon systems and supply chains provides an exceptional opportunity for innovation in a natural resource rich New Zealand. Therefore it is vital that industry leaders move away from the current thinking that research is expensive and best if short-term, applied in orientation and able to be tightly held.

Instead a new world view is required which actively supports bold, and obviously higher risk, options to be pursued with a high degree of cross-sector and international collaboration. We are part of the 21st century global village where information communication technology is disrupting traditional business models, communities and governments with increasing frequency. In this setting incremental short-term thinking is not going to be sufficient to tackle the innovation challenges posed by a hotter, resource-constrained world. Neither will it be attractive to the very best science and business talent we need in New Zealand to make the changes required.

Warren Parker is Chief Executive of Scion based in Rotorua.

Jill Greenhalgh, Philippa Rawlinson and Marvin Pangborn

Improving farmer resilience during natural disasters
The Canterbury 2013 wind

All businesses can face difficult times at some stage, whether they are caused by extreme natural events or adverse market or economic conditions. For example, because dairy farmers know that the milk price goes up and down they have strategies in place for dealing with this. In the past, Canterbury farmers knew that drought was always a possibility and would have a plan of how to cope in one. Irrigation in Canterbury has generally removed the threat of drought as adverse weather.

In the past few years, major problems such as a severe snowstorm in 2006 and the earthquakes in 2010 and 2011, have caused difficulties for some farmers. The wind storm of September 2013 provided the most extreme weather problem which Canterbury farmers have faced this century.

Farmer resilience

Resilience is about the ability of a system to cope with disturbance and to reorganise while undergoing change so that it still has the same function, structure and identity. Farmers who have greater resilience will survive hard times by having a strategy in place to deal with these problems. The literature suggests that two important components of resilience are a farmer's perceptions of possible risk and their ability and desire to respond to a perceived risk.

In 2008, AgResearch carried out a study in Northland looking at how farmers coped with two successive extreme weather problems in the previous year. The first storm hit in March, with over 400 millimetres of rain in less than 10 hours causing flooding and erosion. Farmers set about repairing the damage, only to face a second deluge in May of over 200 millimetres of rain and wind gusting at over 180 kilometres an hour.

AgResearch looked at whether local knowledge, previous experience, information and networks helped build resilience as suggested by the literature. They found that farmers evaluated the perceived threat before assessing actions to mitigate the risk they faced. The



experience they had in farming, and on a specific farm or in a particular region, were important in deciding on the appropriate action. All participants found difficulty in predicting and planning for all possible adverse weather.

Farmer perception of weather-related risk

The extreme wind of September 2013, which unexpectedly blew over 800 irrigators and put them out of action, provided an opportunity to see how Canterbury farmers coped and to add to the knowledge developed by AgResearch. To determine this, 10 farmers from the Ashburton-Selwyn district, where the damage was widespread and substantial, were interviewed. They included a farm manager, two lower order sharemilkers, two farm owners, an equity manager on a corporate farm and two managers of large corporates, along with a dairy support farmer and an arable farmer.

Six were Cantabrians so they would have been familiar with the environment. Two were from the North Island, but one had been in Canterbury for 15 years and the other had arrived just before the 2006 snowstorm. The final two were Irish. One was the arable farmer and had been in Canterbury for five years, while the second had arrived a few years earlier and was in his second season as a lower order sharemilker.

Before the storm, these farmers believed the biggest weather-related risk to be the loss of power as a result of heavy snow, based on the 2006 experience. Most considered they had risk management plans, but only in their heads. One farmer noted that they had a snow plan in place, which was that they had to milk and make sure the effluent was safe, ensure the cows were fed, and then they would worry about the rest later. In the days leading up to the wind storm there were forecasts for strong winds, but this is not uncommon in Canterbury so most did not think the wind would pose much of a problem.

Tactical decision-making

When preparing for the wind, the farmers were aware of a Roto-Rainer's susceptibility to wind but they did not expect that pivots would be blown over as well. However, those with centre pivots attempted to position them in a way which would minimise any wind damage, by facing them into or away from the wind. One farmer was too late and while he was getting it into position the power went off. Another positioned his irrigator against a tree line to provide it with some shelter.

Within 30 minutes of the wind arriving, the farmers realised that it was going to be serious. As wind speeds increased, the responses of participants were dictated by continued power supply or access to a generator, and the potential risk to the health and safety of employees and cows.

Only one of the 10 participants did not have a generator, but some farmers were sharing one over several sheds or had generators which were not powerful enough to run all the farm infrastructure such as the milking machines, the vat and their water systems. Only two farmers were able to use their generators to carry on as normal. Some farmers had cows stuck on their stationary rotary platforms, while one had to cope with the cowshed roof about to lift off. They could not get up on the roof so they put the tractor forklift on it and just left it. They expected to come back the next morning to find the roof gone, but the tractor had held it down.

Another farmer could see the damage mounting across his farm as the wind continued. During the afternoon a pivot irrigating 90 per cent of one of his dairy farms toppled over. In addition a 30,000 litre tank created havoc. That tank blew over and knocked down a couple of fences. Then it travelled across the road and just missed a power pole and got on to the dairy track leading to the shed. It was blown all the way down the track and wrecked one side, hitting some posts knocking down another six. It reached a shed and went up a bit of a ramp, bent the rails and then crashed down on to the backing gate.

Safety concerns forced farmers to consider their employees' safety, their own safety and that of their cows. Most sent their employees home and some worked through the night themselves to try to minimise damage and ensure that their cows could be milked in the morning. One farmer had his house struck by lightning during the night and lost half of it in the resulting fire. He also lost two-thirds of his lateral irrigators as they could not be positioned away from the wind. He estimated this cost him 11 per cent of his crop production.

Coping immediately after the wind

Once the wind had eased, the biggest uncertainty was when the power would return. This uncertainty was heightened by ineffective communication between electricity supply companies, the network companies and the farmers. The electricity supplier could not tell them when it was going to be back on and they did not know how long they were going to be in this situation.

As one farmer noted, that was the hardest part for them. There was a storm and they could deal with that,

but they did not know how long it was going to take to get power back. Did they have to worry about next week or just the next four to five hours? Should they sit and wait patiently or take action?

More problems

Some farmers were without electricity for four days. This meant that those relying on pumps for stock water had to have access to other sources such as stock water races or irrigation ponds. In one case the cows went thirsty, resulting in a considerable loss of milk production. Those who had to share generators across farms found there was no time to cool the milk, which then had to be discarded as its temperature was too high. The extended milking intervals resulted in elevated levels of somatic cells as well as decreased milk production.

Further problems were found in the disposal of effluent for those with effluent systems attached to pivot irrigators which had been damaged. One farmer managed to get a contractor to empty his storage pond which was filled to near capacity.

Fallen trees created access problems. On one farm where the cows could be milked, the tanker could not get in to collect it. One farmer estimated he had two kilometres of road with fallen trees which cost him around $40,000 to clean up, re-grass the areas and re-fence. Another farmer estimated he had 56 hectares damaged by fallen trees.

A corporate farmer was able to start cleaning up farms almost immediately due to having access to a shared contracting team. This quick response helped provide employees with the appearance that the farm was recovering as quickly as possible and normality was returning. Another farmer took a week before contacting a contractor, by which time half the district had called him and so was not able to do any work until late January. One farmer committed to replanting shelter and chose Leyland cypress because they are relatively quick growing and have and reasonably secure rooting. They will be kept topped.

Employees

Remarkably, while one farmer lost several cows, none reported harm to their employees or themselves during the wind. One sensibly instructed his employees not to worry about going out at night and doing the springer check as it was too dangerous. Trees were coming down and debris was blowing around. Some of the employees were obviously frightened by the storm, but all the farmers felt they had performed outstandingly.

To add to their stress, many employees had houses with no electricity and had no heating, no way of cooking and no water. Employee welfare was a priority for the farmers during and after the storm subsided. One farmer took his employees' families into town for hot showers. Another employed a catering company to serve hot meals, while a third provided barbeques at the dairy shed. Communal eating meant employers were able to keep an eye on the mental health and wellbeing of workers. If there were problems, or if people were depressed, the office staff were circulating and able to monitor them.

Support for the farmers themselves varied. One heard nothing from his farm's shareholders while another went to his shareholders asking for help. His chairman was helpful by asking what he could do to support him. Those working for the large corporate farms knew they had a number of people rallying to support them, whereas individual dairy farmers were unlikely to have the same level of support.

Longer term consequences

The biggest long-term problem for the farmers across Canterbury was the loss of irrigators. There were reportedly over 800 irrigators which were broken, bent or buckled as a result of the wind storm. Falling trees possibly inflicted as much damage to pivots and Roto-Rainers as would have occurred if they had been left in an exposed paddock. One farmer lost 22 of 220 spans on his pivots and another had 13 out of 35 of his pivots damaged. Others had Roto-Rainers tip over or buckle when trees fell on them.

With parts needing to be imported and a shortage of people capable of fixing the irrigators, the time until pastures could be watered varied. One farmer had water back on within a month, while another did not have his corner unit going for eight months. Farmers coped with the loss of irrigation in differing ways. Some had sufficient scale to incorporate dairy support land into the milking platform, while others faced large outlays on supplementary feed.

Financial losses for these farmers varied from small claims for dumped milk to large sums for infrastructure repair. Two farmers estimated their losses were in the six figure bracket. Most participants were able to file insurance claims to cover some of the losses due to the wind, and Fonterra wiped the grades resulting from high somatic cell counts. The high dairy payout for the 2013/14 season was also viewed as important for easing the financial costs from the storm. One farmer noted that mercifully it came in the right season, as it otherwise could have been a killer blow.

Strategic changes

As a result of the storm most of the farmers were making changes. Several had already purchased generators and one was having his farm assessed to determine a suitable generator system to meet all of the farm's requirements. These generators provide farmers with the security of knowing they can generate their own power and the opportunity to have a level of control.

A cost-benefit analysis comes out in favour of having generators, but they still have to be paid for. One farmer noted that every time he drove past the shed and

saw four generators at $20,000 each, there was a total of $80,000 sitting doing absolutely nothing. In addition to the farm generators, several farmers were buying smaller generators or wiring their houses so that generators could be used to ensure that staff have electricity during any future extended power cuts.

Shelter was being examined carefully on several farms, with either the removal of any trees which threatened farm infrastructure or planting shelter belts which could withstand high winds. Farmers are much more aware of the danger of high winds to their irrigation systems and in the short term at least, intend to react more quickly to high wind forecasts. One farm was making it company policy to leave pivots facing away from the prevailing wind when they were not in operation. All those whose irrigators were damaged are reflecting on how they can be better protected. Lateral irrigators pose a problem and one farmer was looking at a system to tie them down. However, there does not appear to be a simple solution to ensuring an irrigator is not damaged by very high winds.

Like the Northland farmers, these farmers felt it was difficult to plan for every event. Most found it difficult to prepare for something that might never occur. One said that it had not snowed since 2006 and this wind was a one-in-50-year occurrence. However, this was the third serious natural disaster in less than 10 years. It would suggest that it is well worthwhile for farmers to consider producing their risk management plans for natural disasters.

Improving farmer resilience

Farmers face extreme challenges during such events. These problems are stressful for all involved, but particularly for the main decision-makers. They are responsible for the health and safety of their own families, employees and their families, as well as dairy herds. Good decisions are not always made under stress and high pressure. The results for some of these farmers may have been much worse if any of them had suffered an injury. A risk management plan cannot cover every eventuality, but it can make life easier for the farmer and employees. Given the 2006 snowstorm and the 2010 earthquake where electricity was out for some time, it was surprising that there were still so many farmers ill-prepared for this particular problem.

A risk management plan allows a farmer to be proactive rather than reactive, as was the case for most of the farmers in this study. The plan should include the safety of people as a priority. So it would, for example, identify what effect a power cut would have on employees. It would also identify factors around the health and safety of livestock and repairing farm infrastructure. The risk management plan needs to be shared with senior staff so they know exactly what to do in case the farmer is unable to continue to make decisions. They need to know how the electricity and water systems work and what can be done if they fail. Such a plan would also ensure that actions are taken in a timely manner.

Be prepared

A risk management plan needs to be revised and refined after any event. The only farmer in this study with a written risk management plan learned from the event and identified that he probably did not get the stock water problem sorted out quickly enough on two farms, nor the security of food for workers on farms. For example, getting freezers to power points so people could bring their meat was probably two days later than it should have been. This farmer now knows how to deal with these problems in the future.

AgResearch's assertion that local knowledge, previous experiences, information and networks all help build a farmer's resilience is also borne out by this study. Local knowledge tells farmers what will happen on their farm in the physical sense and also how the infrastructure will cope. It is important to know which trees are likely to fall over, how the water system works and what part of the farm is prone to flooding. Two of the farmers found that their experience with the September 2010 earthquake, where they were both farming near the epicentre, taught them to be prepared to operate independently and be self-sufficient.

Another farmer credited the Canterbury snow storms with his success in dealing with the wind. A previous employer had taught him what to do in the snow and how to do it. One farmer had the information at hand to locate extra generators quickly and those with strong networks were able to start the repairs the day after the storm. Such networks include family and friends, as well as colleagues for those on larger farms. They also include the contractors who can be called on for help. Farmers who work to build these networks and relationships will therefore also be building the resilience to better cope with what may recur within the next few years.

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Chris Lewis

Missing parts to modelling irrigation

When modelling for a change from dryland to irrigated dairy there are three components to be considered – the change in pasture yield, in pasture quality and in management or system. There are two irrigation schemes of note proposed for the North Island – the Ruataniwha scheme in Hawke's Bay and in the Wairarapa. One of the proposed land uses for both schemes is dairy farming.

This land use would be in two forms – intensification of existing dairy farms and conversion from dry stock and arable farms to dairy. As a part of the on-farm investigation into these schemes, farm modelling work was carried out and I have been involved in this process using both Udder and Farmax Dairy Pro software. This article discusses the preparation and subsequent modelling of irrigation for dairy farms on the east coast of the North Island.

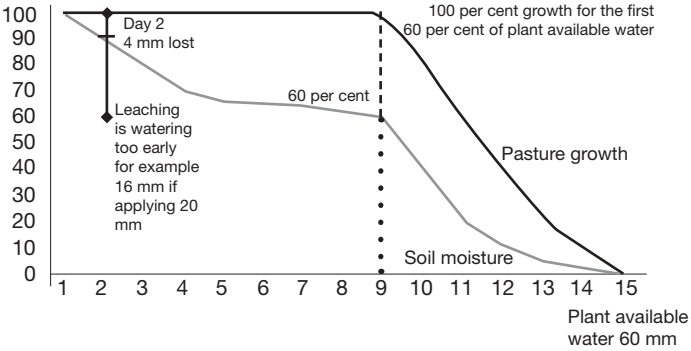
Following various reports and cost-benefit studies there has been one consistent question raised – How can the sum be greater than the parts? This question is derived from the observation that the milk solids produced from irrigated pasture exceeds that expected from applying common feed conversion efficiencies to the extra pasture grown. That is, modelled productivity is greater than extra grass grown multiplied by normal feed conversion efficiency. Why is this?

Is there a flaw in the modelling process or is there a missing part to the equation? It is helpful to start by looking at the first question in the modelling process about what changes when you irrigate pasture? This question has to be looked at from an agronomic and a strategic perspective.

Available water and plant growth

The effect on plants of a moisture deficit is not always visual. Before a pasture plant shows stress, moisture deficits will influence pasture yield. By having irrigation at times when pasture would otherwise be entering into and leaving an observable stress period, its growth will be higher. This means that well-managed irrigation systems will grow more grass over an extended period.

The relationship between plant available water and plant growth is demonstrated in the following graph. This shows that with between 60 and 100 per cent plant available water in the soil, plant growth is at maximum. As available water drops below 60 per cent, plant growth rate drops at a faster rate. In the example shown, pasture growth is reduced after nine days and stops after 15 days at an evapo-transpiration rate of four millimetres a day.



Effect of plant available water on pasture growth rate

With irrigation, farmers have an opportunity to change the pasture composition. It is reasonable to invest in higher yielding cultivars and those which require moisture to be sustained, such as tetraploids that might otherwise be lost from the sward from over-grazing.

With superior cultivars and a slower rate of reversion it is feasible to sustain dominant ryegrass pastures. These can be selected to match the specifics of the farm system and climate. The result of sustained superior cultivars is that higher dry matter yields and higher metabolisable energy can be expected.

Change in pasture yield

There is a distinct lack of up-to-date verified data for pasture growth under irrigation in the east coast of the North Island. However, data does exist on closely monitored commercial dairy farms. These farms are achieving pasture harvest, consumed or cut, in the range of 12 to 14.9 tonnes of dry matter per hectare. The range in yield is explained partly by irrigation type whether it is a light or heavy soil. Because this is feed consumed, it leaves the question of utilisation to determine total pasture grown. At very efficient levels of utilisation around 85 per cent, this data suggests irrigated east coast North Island land could grow 14 to 17.5 tonnes of dry matter per hectare.

The highest rates of pasture yield were on free-draining pivot irrigated properties usually using in excess

of 200 kilograms of nitrogen per hectare. For an east coast North Island non-irrigated comparison we would expect a yield under dry land dairy farm management of eight to nine tonnes of dry matter per hectare eaten, or at 85 per cent utilisation 9.5 to 10.5 tonnes grown.

This range of 3.5 tonnes of dry matter per hectare in irrigated yields is from different farms and was generated from three successive years of data. The variability across seasons for all farms was in the order 2.5 tonnes of dry matter per hectare, from the poorest to the best growing year. South Island pasture yield data under irrigation suggests a significantly smaller variation of plus or minus 0.2 tonnes of dry matter per hectare, this lack of variability an important facet of irrigation.

Change in metabolisable energy

In addition to the lack of pasture yield data there is also a lack of pasture quality data when under irrigation. With respect to this, the Lincoln University dairy farm data was reviewed and showed that in the calendar years of 2002 to 2004 with irrigation beginning in 2001, the average pasture metabolisable energy was 11.7.

For the period 2011 to 2013 it was 12.2, which demonstrated that pasture metabolisable energy can and will improve under irrigation, acknowledging the combined effect of irrigation, changes in grazing management and a proactive pasture renewal programme. In this case there was a gain of 0.5 megajoules of metabolisable energy per kilogram of dry matter. However, this gain was not on the marginal change in pasture yield, but is for the entire pasture.

Summary of pasture metabolisable energy data from Lincoln University dairy farm

	2002 to 2004	2011 to 2013
January	10.9	12.0
February	11.3	12.0
March	11.1	12.0
April	11.6	12.3
May	10.9	12.2
June	11.7	-
July	12.4	12.7
August	12.2	12.6
September	12.5	12.4
October	12.4	12.2
November	11.7	12.1
December	11.9	12.1
Average	11.7	12.2

Total metabolisable energy yield change

Consider the combined effect of higher pasture yields and higher pasture metabolisable energy provided under best practice irrigation and compare this to a system which is not irrigated. To keep this simple we take the mid-points for pasture harvested, un-irrigated 8.5 tonnes of dry matter per hectare and 13.4 tonnes of dry matter per hectare irrigated. Then use average pasture energy of 11.5 and 12 megajoules of metabolisable energy per kilogram of dry matter, respectively.

This generates a total energy yield of 97,750 megajoules of metabolisable energy per hectare un-irrigated and 160,800 irrigated. This is a 57.5 per cent gain in pasture harvest and an energy gain of 64 per cent.

Change in management or strategy

With irrigation, famers invariably design and develop a different farm system and they do not repeat the pattern of management developed under dry land farming. With a reliable and more square-shaped pasture growth curve, the stocking rate is usually raised to fit the pasture growth supply curve.

This brings a change in the way in which supplements are used. Large amounts of supplements are not inefficiently conserved and inefficiently fed in a possible drought. Instead of feed deficits, forage supplement is moved to the shoulders of the season. Then with a closer match of supply and demand, minimal surplus pasture is harvested as silage which is another source of efficiency gain.

There is a growing trend for energy-dense high dry matter feed to be integrated with an irrigated system. This allows a higher stocked system to buffer smaller fluctuations in pasture yield and therefore sustain even higher per cow performance. Other system changes will occur as a result of irrigation. This might include a move away from winter milking, changes in calving date and different use of support land. The systems and management change list continues to grow.

Modelling

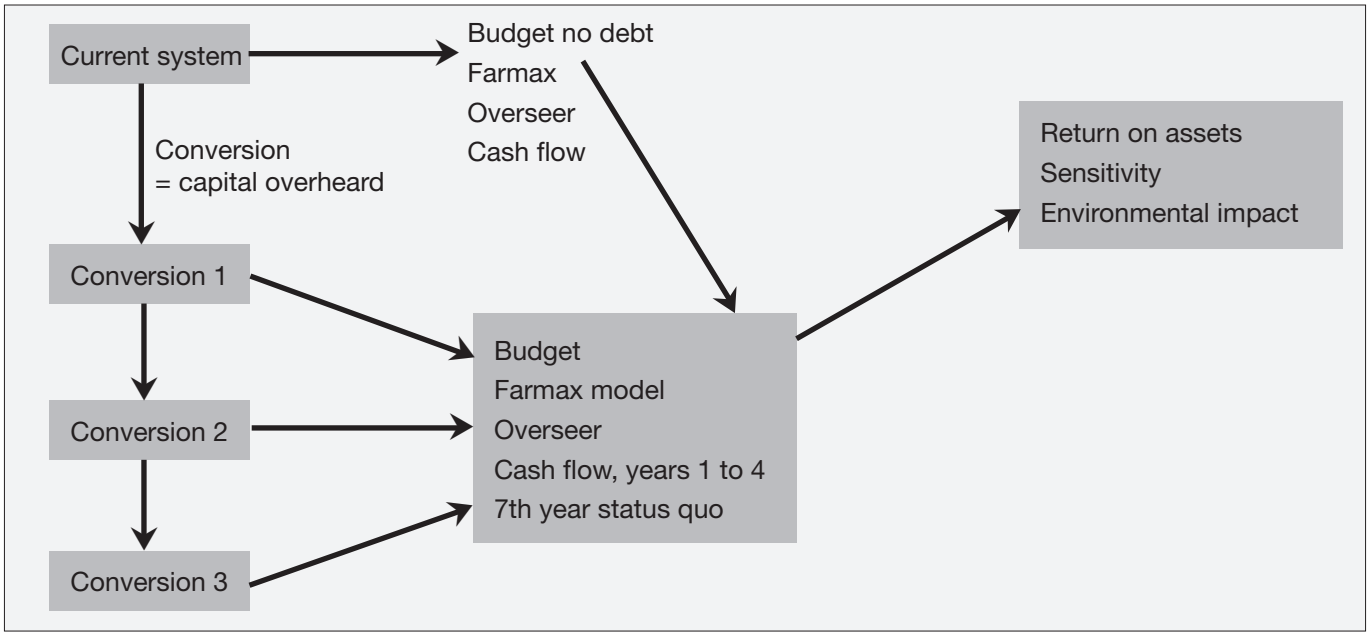
How is this energy and systems change realised in terms of productivity and economic performance? The division of energy between livestock live weight maintenance, changes in cow condition, pregnancy and milk yield is a complicated matrix. This is where energy-based modelling methods such as Farmax and Udder allow the merging of policy, science, data and assumption to form a profile for a new farm system.

On completion of the farm system models the result can spill over into detailed financial cost-benefit analysis, data for environmental modelling, cash flow planning, risk analysis and sensitivity testing. As part of the Ruataniwha irrigation scheme investigation a specific case study farm was modelled with the findings presented at a public field day. The analysis work was completed using Farmax Dairy Pro, Concepts Cashmanager, Excel and Overseer.

The next table shows the results from the case study model. The cash surplus is before any pre-conversion debt

Results from the Ruataniwha Case Study 2013

Farm system	Dryland cropping and dairy support	Dairy 600 cows	Dairy 650 cows	300 hectares of dairy
Milk solids production		240,240	300,000	477,000
Milk solids per hectare		1,144	1,429	1,590
Pasture harvest tonnes of dry matter per hectare	6.65	10.94	11.37	11.97
Gross revenue	$328,780	$1,631,560	$2,024,789	$3,198,325
Operating expenses	$177,900	$1,084,504	$1,331,147	$2,176,148
Depreciation	$20,000	$70,750	$84,250	$144,200
Earnings before interest and taxes	$130,880	$476,306	$609,392	$877,977
Debt servicing interest only		$347,684	$403,409	$591,809
Cash surplus pre-tax and drawings	$130,880	$128,622	$205,983	$286,168
Return on assets	3.54%	5.02%	5.85%	5.80%
Nitrogen loss to water in kilograms per hectare	34	29	28	31



Project process diagram

and with milk revenue based on $6.50 per kilogram of milk solids inclusive of dividends on a fully shared up property. For this property 75 per cent of the farm is being irrigated, but the pasture harvest described is for the entire farm.

Future needs

Looking ahead, there are several important opportunities for lower North Island irrigated dairy farming. We need validated data for pasture metabolisable energy yields under various forms of irrigation. It is anticipated this will confirm what is already identified on the highest performing properties – that there is significant benefit potential for pasture and energy yields. We should be able to exceed 20 tonnes of dry matter per hectare grown as pasture with a metabolisable energy at or exceeding 12 megajoules of metabolisable energy per kilogram of dry matter.

However, this might reveal another limitation already identified in Australia. Is pasture the most efficient target for irrigation water? Could an integrated cropping regime and plants such as lucerne actually show even greater potential? If we could quantify the higher levels of pasture or crop yields, and then model these, we would find the potential for milk production under irrigation is yet to be fully realised.

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Kevin Old and Peter Nuthall

Ownership, labour and objectives on New Zealand farms

To understand and work with New Zealand farmers it is important to appreciate the ownership systems used. This should influence decisions because what is appropriate for one structure may not suit another. Farmer and farm family objectives should also influence the decisions. A consultant working on an individual farm will be aware of the ownership situation, but others working in extension on a wider scale need to understand the current ownership systems more generally.

This article provides information on the current scene. The data presented is based on a nationwide survey conducted over the latter half of 2013. Over 2,000 farmers were mailed a questionnaire achieving a response rate of 36 per cent. It was clear the farmers were interested in the topics covered.

The sample was randomly selected by standard statistical regions, farm type and farm size in hectares. For each combination the sample size was based on the proportion of the total found in each. The table at the top of the next page gives the percentage of the sample in each farm type. As the respondents were not asked to give their region for confidentiality reasons, it is not possible to check the geographic distribution.

However, there is no reason to doubt a full representation as the farm type and area distributions of the sample were a good representation. The second figure in each cell gives the difference between the sample percentage and the Statistics NZ data. In the discussion which follows the use of the term farmer includes all horticultural managers.

Farm sizes cover a wide range related to the farm type. However, dairy farming has a significant number of larger farms than the traditional ones. Their distribution is similar in many respects to specialised, or intensive, sheep farming.

Farm size

The sample was restricted to full-time farmers, and although some part-time units appeared, these were removed. The table at the bottom of the page opposite presents the number of labour units on the farms including the manager. Dairying covers the full range of labour unit categories, with 1.6 per cent of the sample involving more than 10 labour units.

The last row of the table gives the percentage of the total sample for each labour level category. About 25 per cent are one person units, but most are two person farms. After three person farms the number of labour units drops off quite markedly. Given approximately 75 per cent of farms including horticultural units employ labour, decisions on employment relations are important. However, some of the 75 per cent will be partnership arrangements in theory simplifying the labour management concerns.

A surprising number of farmers have an ownership interest in more than one farm and the last column in table three presents this information. The average over the whole sample is 1.75 farms. The full significance of this is not clear because an ownership interest can cover a wide range of levels. Comparative figures for earlier generations are not available, but it is suspected the interest in multiple farms is growing as the number of farmers declines.

Table 1: Distribution of farm types by farm area as sample percentages

Farm type area hectares	Under 79 hectares	Under 99 hectares	Under 199 hectares	Under 399 hectares	Under 599 hectares	Under 799 hectares	Under 999 hectares	Under 1999 hectares	Under 3999 hectares	Over 3998 hectares
Sheep specialised	1.03 -.2	1.03 +.3	3.48 +.8	7.88 +3.0	3.74 +1.5	1.93 +.7	0.77 0.0	1.67 +.3	0.39 -.3	0.0 -.5
Beef cattle	2.58 +1.4	1.16 -.6	3.61 -.8	4.25 +1.3	0.77 -.2	0.77 +.3	0.13 -.1	0.51 +.2	0.13 +.1	0.0 0.0
Sheep and beef	0.26 -.4	0.39 0.0	1.03 -.7	2.06 -.1	2.58 +.5	1.8 +.5	1.42 +.6	3.24 +1.4	1.55 +.9	2.19 +1.7
Cropping	0.51 -.7	0.13 -.3	0.39 -1.0	1.42 0.0	0.51 +.1	0.13 0.0	0.0 -.1	0.0 0.0	0.0 0.0	0.0 0.0
Dairy	3.22 -1.3	3.61 -.4	10.80 -3.3	9.15 -.5	3.09 +.7	1.55 +.7	0.26 -.1	1.42 +1.1	0.26 +.2	0.13 +.1
Deer	0.13 -.3	0.13 -.1	0.26 -.3	0.39 -.1	0.0 -.1	0.0 -.1	0.0 0.0	0.0 -.1	0.0 -.1	0.0 0.0
Other livestock	0.13 -.2	0.0 0.0	0.0 -.1	0.13 +.1	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
Flowers and ornamental	0.39 -.8	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
Vegetables	0.90 -.5	0.0 0.0	0.13 -.1	0.13 0.0	0.0 -.1	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
Fruit and viticulture	3.35 -3.7	0.0 -.3	0.26 -.3	0.0 -.2	0.0 -.1	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
Other	2.32 +2.3	0.13 +.1	1.29 +1.3	0.64 +.6	0.0 0.0	0.13 +.1	0.0 0.0	0.0 0.0	0.13 +.1	0.0 0.0

Table 2: Distribution of farm types by labour unit including the manager – sample percentages

Farm type Number of units	Under 1.01	Under 2.01	Under 3.01	Under 4.01	Under 5.01	Under 6.01	Under 7.01	Under 8.01	Under 9.01	Under 10.01	More than 10.0
Sheep specialised	7.77	11.02	2.12	0.66	0.13	0.40	0.0	0.13	0.0	0.0	0.0
Beef cattle	7.03	5.97	0.66	0.13	0.13	0.0	0.0	0.0	0.0	0.0	0.13
Sheep & beef	3.18	9.02	1.86	0.93	1.19	0.0	0.0	0.26	0.0	0.0	0.13
Cropping	0.66	1.33	0.93	0.13	0.13	0.0	0.13	0.0	0.0	0.0	0.0
Dairy	1.99	10.87	6.51	4.65	2.40	2.13	1.34	0.68	0.81	0.13	1.60
Deer	0.93	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other livestock	0.13	0.0	0.13	0.0	0.0	0.0	0.13	0.0	0.0	0.0	0.0
Flowers and ornamental	0.26	0.0	0.0	0.13	0.13	0.0	0.0	0.0	0.0	0.0	0.0
Vegetables	0.26	0.26	0.53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fruit and viticulture	0.80	1.59	0.53	0.40	0.13	0.13	0.0	0.13	0.0	0.13	0.0
Other	2.39	1.19	0.26	0.13	0.13	0.0	0.0	0.0	0.0	0.0	0.13
Totals	**25.33**	**41.25**	**13.53**	**7.16**	**4.37**	**2.66**	**1.60**	**1.20**	**0.81**	**0.26**	**1.99**

Table 3: Averages for years of farm ownership, proportion of decisions made by the farmer and the number of farms held

Farm type	Average years	Percentage	Number of farms
Sheep specialised	25.80	88.58	1.45
Beef cattle	25.01	90.68	1.57
Sheep and beef	27.26	87.84	1.70
Cropping	30.12	91.72	1.72
Dairy	23.46	78.85	2.11
Deer	24.00	97.14	1.86
Other livestock	17.00	88.33	1.67
Flowers and ornamental	22.00	99.75	1.00
Vegetables	24.56	83.78	1.17
Fruit and viticulture	23.59	91.79	1.65
Other	26.58	89.85	1.33
Total average	**25.15**	**85.85**	**1.75**

Table 4: Percentage of respondents involved in the listed ownership arrangements, and also the average percentage of net assets held in each arrangement

Ownership arrangement	Percentage of respondents	Percentage of assets held
Held personally	56.64	48.60
Held by spouse	37.14	35.22
Held by a trust	47.08	74.38
Held by a partner of some kind	7.70	32.46
Held in private company shares	14.53	60.05
Held in public company shares	1.24	10.10
Other	3.11	29.14

Table three also shows that the current group of managers have spent many years with a direct financial interest in their current farm. They are also responsible, on average, for most of the decisions made relative to relying on decision help from a range of other potential sources. Over all farm types the farmers report they are responsible for 86 per cent of the decisions. Of course many will make 100 per cent of the decisions as other ownership arrangements including share farming, but some partnerships will involve several people bringing the average down to 86 per cent.

In the table, the average years are the years of ownership of at least some assets in the current farm. The percentage is the proportion of decisions made by the respondent. The number of farms are those in which the farmer has an ownership interest.

Details of asset ownership arrangements

Despite media reports often suggesting otherwise, most farms have a relatively simple ownership structure and off-farm owners are quite scarce. Table four shows that trusts dominate, along with farmer and spouse ownership arrangements. Many of the latter will be partnerships. Family trusts are an important avenue in which to hold assets. The total percentages do not add up to 100 per cent because of multiple systems such as a family trust along with some personal ownership.

Public company ownership arrangements are not particularly important overall, although some are probably quite large entities. On the other hand, private companies cover a significant proportion of farms. As recommended by some lawyers, mixed trust and private company arrangements do exist with nearly 15 per cent of farmers reporting a private company. Even with all these various arrangements, farmers still make a significant proportion of the decisions.

The distribution of the years of farm investment, percentage of decisions made by the farmer, and the number of farms held by each respondent are all given in

Table 5: Percent of respondents with the given proportion of their assets in the categories and ranges given

Percentage assets held	Personally	Spouse	Trust	Other partner	Private company	Public company	Other
0 to 10%	13.8	19.7	4.5	37.1	12.8	90.0	28.0
11 to 20%	7.5	8.1	3.7	11.3	11.1	0.0	16.0
21 to 30%	8.7	11.0	4.7	6.4	14.6	0.0	16.0
31 to 40%	7.5	8.4	5.3	11.3	1.7	0.0	12.0
41 to 50%	38.6	51.8	9.5	17.8	7.7	0.0	16.0
51 to 60%	2.0	0.0	4.0	1.6	4.2	0.0	16.0
61 to 70%	1.7	0.0	5.0	1.6	0.9	0.0	8.0
71 to 80%	1.3	0.7	12.9	3.2	4.3	0.0	4.0
81 to 90%	0.9	0.0	7.7	1.6	1.7	0.0	0.0
91 to 100%	18.0	0.3	57.3	8.1	41.0	10.0	0.0

Table 6: Distribution for farmers' length of investment in current farm, proportion of decisions made by the manager and number of farms held.

Year ranges	Years dollar investment per cent	Range per cent	Decision per cent	Range	Number of farms
Less than 5	3.10	Less than 10	0.88	Equal to or less than 1	57.60
5 to 10	6.59	10-20	1.13	1-2	27.81
10 to 15	11.76	20-30	1.76	2-3	7.14
15 to 20	8.40	30-40	1.51	3-4	3.95
20 to 25	19.51	40-50	0.50	4-5	1.67
25 to 30	10.21	50-60	12.09	5-6	0.46
30 to 35	15.76	60-70	1.51	6-7	0.30
35 to 40	7.88	70-80	4.53	7-8	0.46
40 to 45	7.88	80-90	4.66	Greater than 8	0.61
Over 45	8.91	Greater than 90	71.4		

table six above. This extends the basic information which provides 'farm type' category information.

The bulk of farmers have been involved in their current farm for a significant number of years, and over 90 per cent of the decisions are made by over 70 per cent of the farmers. The other categories have small numbers other than the 50 per cent to 60 per cent category which will relate to many share farmers. The average number of farms the respondents are involved in is much more than one, but nearly 60 per cent work with only one farm, with another 28 per cent up to two farms. The small number with an interest in a larger number of farms, over eight in some cases, brings up the average.

Managers' status relative to ownership

Most managers have a financial interest in the farm. Table seven below shows that nearly two per cent of farmers are paid managers with up to another 5.3 per cent falling into this category. Overall, the data would suggest the remaining 93 per cent have a direct financial interest in the farm and are in various forms of the 'owner-operator' classification.

In many owner operator cases the predominance of partnerships is clear, but so is the sole proprietor situation. With the importance of partnerships it is useful to further explain their details. Table eight on the next page relates the various forms of partnerships across the different farm types, and table nine shows the differences according to farm size as reflected in the farm's nett assets.

For most farm types spouse partnerships predominate, although in cropping and extensive sheep, partnerships involving additional family members are significant. On the other hand, mixed partnerships involving non-family members are relatively rare except in dairying. It is also noticeable that as the size of business increases, using nett assets as a measure, the spouse partnerships tend to decline in importance with the opposite occurring for mixed family partnerships. In this case it is likely the larger-sized operation allows for taking other family members into the partnership.

Table 7: Percentage of the sample falling into a range of financial interest categories

	Per cent
A paid manager with no financial interest in the farm	1.70
A paid manager with some financial interest in the farm	5.70
In a partnership and receive a share of the profits, but no salary	44.1
In a partnership and receive a share of the profits and a fixed salary	12.8
Receive profits but no salary and not in a partnership	28.6
Sharemilker with some ownership of assets and receive profit share	1.50
Sharemilker with little ownership of assets but receive a share of profits	0.20
Other or missing	5.30

Table seven gives a fuller description of the columns. Note that column seven of table 10 – sharemilkers with little or no financial investment – is blank as the farmers in this category chose not to enter this data. For purely salaried managers, the numbers tend to drop off as the investment level increases. However, this also tends to be the case for all other managerial arrangements except for the very large farms where there is a significant number of purely salaried managers.

Farmer objectives

The objectives of the farm owner influences whether a farmer operates for maximum profit, or some combination of profit and other objectives. The objectives may also influence ownership arrangements, particularly on the larger farms where multi-family member operations are possible. To assess some of these questions the farmers were asked to rate a range of objectives using a five-point scale. The alternative objectives offered for ranking are listed in the table on the right.

The average rankings of each objective is provided in table 11 for a range of farm profit levels. For example, farmers with a nett profit less than $50,000 ranked objective one, the importance of passing the farm to family, at 2.85 which is about the middle of the five-point scoring range. On average, these farmers were ambivalent over this objective. Farmers with a profit within the $150,000 to $200,000 range were a little keener on this idea.

Table 8: Partnership arrangements across farm type

Farm type	Spouse partnership	Partnership with one or more family members	Partnership with non-family members	Partnership with both non-family and family members
Intensive sheep	72.56	22.76	1.62	3.25
Sheep and cattle	60.92	37.93	0.0	1.12
Deer	83.33	16.67	0.0	0.0
Cattle	80.77	16.67	0.0	2.56
Dairy	70.53	19.47	4.74	5.26
Other animal	100.00	0.0	0.0	0.0
Fruit and viticulture	75.00	25.00	0.0	0.0
Cash crop	62.50	37.50	0.0	0.0
Flowers and ornamental	100.00	0.0	0.0	0.0
Vegetable	83.33	16.67	0.0	0.0
Other	91.67	8.33	0.0	0.0

Table 9: Partnership arrangements across nett asset range in row-based percentages

Asset range in dollars	Spouse partnership	Partnership with one or more family members	Partnership with Non-family members	Partnership with both non-family and family members
Under $5 million	77.53	18.82	1.40	2.25
$5 to $10 million	65.88	27.06	3.53	3.53
$10 to $15 million	55.17	34.48	0.0	10.34
$15 to $20 million	57.14	28.57	14.29	0.0
$20 to $25 million	16.67	83.33	0.0	0.0
Over $25 million	60.00	0.0	0.0	40.00

Table 10: Financial interest in the farm relative to nett asset ranges in percentage

Asset range	Manager, no financial interest	Manager with financial interest	Partnership, profits, no salary	Partnership, profits and salary	Profits, no salary, no partnership	Sharemilker, assets and profits	Sharemilker, profits	Other
Over $5 million	50.00	65.91	74.92	57.83	80.00	71.43	0.0	55.55
$5 to $10 million	16.67	20.45	16.72	25.30	16.50	14.29	0.0	0.0
$10 to $15 million	8.33	6.82	6.19	8.43	0.50	14.29	0.0	11.11
$15 to $20 million	8.33	0.0	1.24	1.20	2.50	0.0	0.0	11.11
$20 to $25 million	0.0	4.54	0.62	2.41	0.0	0.0	0.0	0.0
Over $25 million	16.67	2.27	0.31	4.82	0.50	0.0	0.0	22.22

Farmers in the lowest profit range were keen on minimising pollution, but so were most farmers. However, these farmers were less keen than the high profit farmers in ranking the importance of objective 16. There is a pattern here.

If the scores for the objectives are correlated with a number of ownership factors it is clear that objectives and factors such as the number of farms held by a farmer are related. Which comes first is another matter. For example, the objective 'it is very important to pass on the property to family members' is positively correlated with the length of time a farmer has had a financial ownership interest in the current farm. However, has the farmer held the farm longer so they can meet this objective? Or has the objective followed from ending up holding the farm many years?

In contrast to this positive relationship a negative correlation exists between the importance of passing the property to the family and the proportion of decisions made by the farmer. People who do not think it is important to pass to the family tend to make a higher proportion of the farm decisions themselves. This may reflect their personality or possibly a traumatic event in the past. Other interesting correlations include –

- A negative correlation between the number of farms held and the importance of making a comfortable living, which you would expect
- A positive relationship between the number of years

Alternative objectives precis statement
1. Important to pass property to family
2. Important to earn respect of colleagues
3. Making a comfortable living is important
4. Keep debt as low as possible
5. Need reasonable holidays and leisure
6. Attending field days is vital
7. Important to reduce risk
8. Developing good working conditions is crucial
9. Ensure employees enjoy their job
10. Doing jobs I enjoy is very important
11. Minimising pollution is important
12. Enjoy new products and production systems
13. Retirement planning is a major consideration
14. Strive to increase total value of assets
15. Expand size of business is very important
16. Maximum sustainable nett cash is important
17. Involved in community activities is important
18. Important to improve condition of property
19. Giving to children for education/business is important
20. Farm even though do not enjoy it as cannot move

Table 11: Farmer objectives relative to profit levels with the average importance score on a 1 true to 5 not true scale

Number of objectives	Under $50,000	$50,000 to $100,000	$100,000 to $150,000	$150,000 to $200,000	$200,000 to $250,000	Over $250,000
1	2.85	2.61	3.00	2.51	2.52	2.66
2	2.50	2.52	2.56	2.45	2.22	2.47
3	1.59	1.48	1.30	1.33	1.35	1.40
4	1.95	2.11	2.03	2.51	2.48	2.92
5	2.54	2.20	2.22	1.98	2.09	2.20
6	3.10	2.94	2.93	2.63	2.61	2.42
7	2.29	2.22	2.07	2.14	2.48	2.64
8	1.74	1.68	1.69	1.61	1.61	1.48
9	1.59	1.56	1.65	1.46	1.61	1.40
10	1.68	1.95	1.80	1.90	1.83	1.99
11	1.51	1.56	1.66	1.61	1.43	1.52
12	2.44	2.44	2.62	2.35	2.87	2.08
13	2.28	2.26	2.60	2.06	2.65	2.20
14	2.27	2.18	2.39	2.14	2.13	2.07
15	3.75	3.61	3.86	3.39	3.09	3.08
16	2.16	1.83	1.90	1.84	1.70	1.57
17	2.58	2.48	2.71	2.47	2.26	2.29
18	1.54	1.42	1.40	1.55	1.26	1.37
19	2.51	2.44	2.66	2.20	2.48	2.33
20	4.44	4.69	4.45	4.59	4.77	4.74

with an ownership interest in the current farm with the desire to keep debt as low as possible, the reason for staying so long on the same farm
- A negative relationship between the number of farms held and the desire to keep debt low
- A positive relationship between the desire to keep risk low and the years on the current farm with an ownership interest
- A positive correlation between the belief that constantly expanding the size of the business is important and the number of farms held
- A positive correlation between the desire to provide children with assets for education and a business and the number of years on the current farm with an ownership interest
- A negative relationship between non-enjoyment of farming with the number of farms held.

Most of these examples from the relationship between ownership factors and objectives follow logic and point out how the objectives of a farmer and a farm family influence their actions, as they should. The objectives also, of course, influence most factors on a farm and not just ownership questions.

Concluding comments

Farmer objectives, ownership arrangements and decision responsibilities will always be important factors in appropriate consultancy activities with both specific farmer work as well as group extension work. This article provides the current situation for ownership and decision factors. These partly relate to farm size as expressed in the number of employees. Despite farm size growth, most farms are still one or two person operations.

It is interesting to note that the highest ranked objective was making a comfortable living closely followed by improving the condition of the property and ensuring employees enjoy their jobs. It is reassuring that farmers state they are husbanding their properties and employees in contrast to simply maximising their return. In addition, the next highest ranking objective is minimising pollution, further emphasising that a responsible national approach is being expressed.

Then follows the objective of creating good working conditions with doing jobs they enjoy next. The objective of aiming for maximum sustainable net cash returns being very important only comes seventh in the list. It is also clear that the ownership systems used allow these objectives to be expressed. For example, public companies are far in the minority. This happens for a range of reasons, but where the farmer has ownership and managerial control their objectives can more easily be met. It is also interesting that the percentage of decisions made by the farmer is surprisingly high and this is across a range of ownership systems. You can understand why.

The other striking situation is the number of farms the average farmer has an ownership interest in which is 1.75 farms. However, looking deeper shows the majority still work with only one farm. On the other hand, it is also noteworthy that an appreciable number of farmers are controlling large multi-farm operations and probably spend a large proportion of their time in the farm office.

Finally, it is very clear that ownership still mainly resides with the farmers and their spouses as 83 per cent of the assets are held this way. Ownership systems remain relatively simple with partnerships being very important. Corporate farming is minimal but trusts, mainly farmer and spouse arrangements, along with private companies are important avenues for holding the assets.

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Nic Lees

The potential for red meat value chains

The New Zealand government has an ambitious aim by 2025 to raise total exports to 40 per cent of gross domestic product and double the value of primary exports. They have stated that this will involve developing stronger relationships with New Zealand exporters and supporting them to add value from existing markets by supply chain integration, brand promotion and protection. New Zealand red meat exports play an important role in this as they represent 11 per cent of total exports.

There is limited scope for increasing the volume of red meat production in New Zealand due to land and environmental constraints, which means that adding value to these exports is the only alternative. A significant proportion of this country's red meat is still exported as a commodity and fails to achieve a premium for the attributes of its New Zealand origin. Changing this will require a coordinated effort from government, exporters and producers.

Market access and promotion of the New Zealand brand story can create opportunities for exporters, but capitalising on these initiatives requires companies to develop capability and a strategy to market and deliver these products to demanding international consumers. These consumers are demanding greater variety and quality in the food they eat. They need a consistent year-round supply of high quality safe food. They also want food which aligns with their own personal values, including attributes such as environmental sustainability, animal welfare and fair trade, as well as local and organic production.

To provide this it is necessary to have farmer suppliers who can produce the right quality of product when the market requires and who are committed to long-term supply relationships. Without this type of integrated value chain this country will fail to break out

Producing the right quality for the market

of its reliance on agricultural commodities. Research has focused on several New Zealand exporters and their suppliers who have developed relationships with high-end retail customers and have a strategy in place to add value to their products. Consistently meeting consumer demand is difficult within the constraints of New Zealand's pasture-based agricultural production systems, as volume and specifications are dependent on the climate.

Overcoming constraints

It is also difficult when the relationships between suppliers and their processing and marketing companies are dominated by short-term spot market relationships. Research therefore needs to focus on how to help more New Zealand firms and their suppliers to overcome these constraints and participate in integrated value chains.

This research project involved semi-structured interviews with suppliers from three New Zealand agri-food exporting companies between May 2012 and October 2013. The companies selected all have a focused differentiation strategy. The products exported included beef, lamb and venison and their main markets were in the European Union, North America, Asia and the Middle East. The suppliers were required to meet high product specifications in terms of timing of delivery, food safety, traceability, environmental sustainability, animal welfare and product quality.

The producers were asked what they valued in their supply relationships and the benefits they had received. They were also questioned about the disadvantages of belonging to the supply relationship. The research aimed to identify –

- The characteristics of long-term successful supplier, processor and retailer partnerships in agri-food supply
- The characteristics of the participants and how long-term partnerships created value from cooperation
- What allowed long-term cooperation to occur as opposed to short-term opportunistic behaviour.

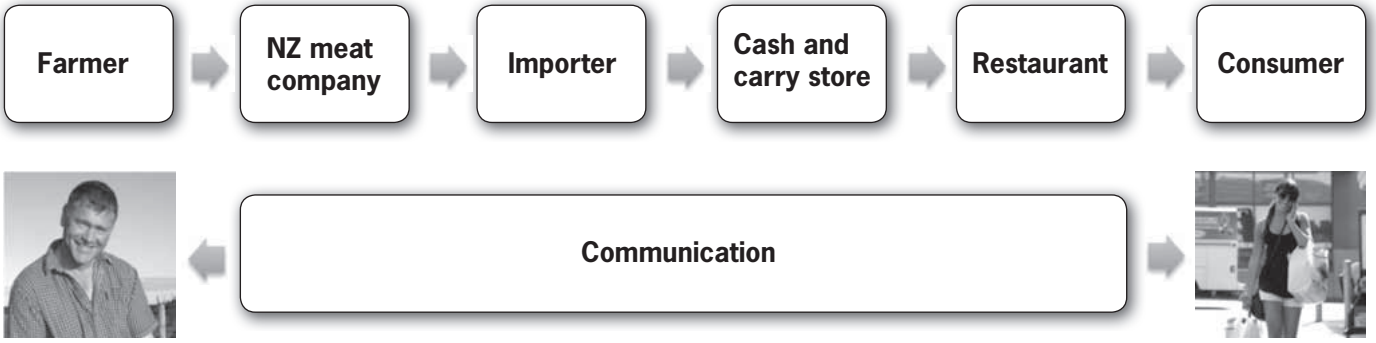
An important characteristic of these supply chains was the significant amount of trust between all the participants, from the farmers through to the retail customers. Related to this was a high level of openness and transparency which allowed customer requirements to be communicated along the supply chain to producers. The product attributes were communicated down the supply chain to consumers.

This meant a better match of supply and demand as farmers could adapt the timing of their supply and product specifications to consumer demand. Conversely, the New Zealand story and product attributes, such as animal welfare, food safety and environmental sustainability could also be communicated to consumers.

Exporter characteristics

The New Zealand exporters established trust partnerships by investing in human resources to develop these relationships. These companies all had marketing staff who worked with customers to understand their requirements and communicated this to their producers. They also had staff who worked closely with suppliers to help them understand the market requirements and supported them in adapting their production systems to meet these customers' needs. These integrated value chains need high quality relationships for the customer and supplier.

Another characteristic of these companies was that they were often more recently established and tended to be smaller than some other exporters. Larger companies tended to rely on scale as a competitive advantage and therefore found it difficult to customise their products to



Long-term relationships with high levels of trust allow information to flow both ways

Spot market transactions

meet specific market requirements. Selling large quantities meant they often needed to sacrifice value for volume. They also have sales and distribution relationships which encouraged volume rather than value.

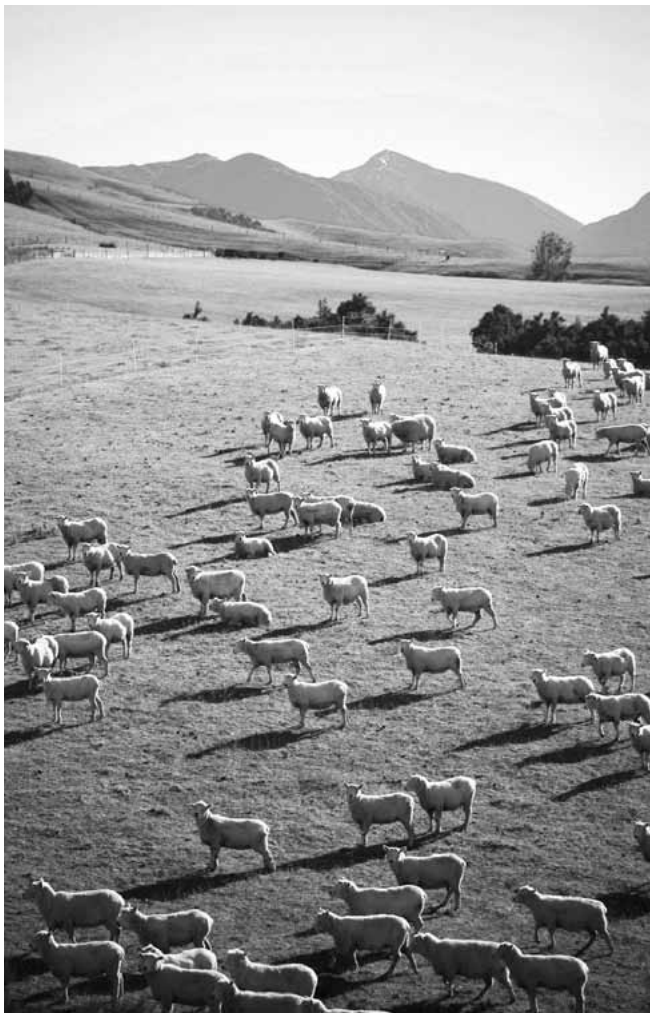
Smaller companies were able to exploit narrower market niches and were more adaptable to customers' requirements. They could not compete on scale so needed to focus on value creation to be profitable. Newer companies have often adopted innovative strategies and have less cultural baggage, allowing them to take advantage of emerging opportunities. However, their lack of scale can be a significant disadvantage as they have few resources to invest in marketing programmes and research and development.

Supplier characteristics

The suppliers identified in this research looked for added-value supply chains as they recognised that they created greater value from their existing farm resources. These suppliers had specific human resources in terms of high levels of farm management capability and quality physical farm resources. This meant they had a greater ability to produce higher-specification products which had less flexible requirements.

This was evident when interviewing less committed suppliers, as the most common problem they mentioned was the reduced flexibility in delivery timing and quality that these supply chains required. This was most significant for suppliers who had farms where summer rainfall was unreliable and soils had little water storage without irrigation.

Combined with these resources was a high level of motivation and ability to innovate. They described themselves as progressive farmers, and had a strong desire to develop and grow their farm business. This did not always mean physical expansion, but was often about positioning their business to adapt to future changes. As a result, they were hungry for information and



High quality farm resources

knowledge which would allow them to improve their farm performance. They had a long-term perspective and wanted to ensure their business was able to adapt to future challenges and changes in the industry.

They were also motivated by setting both short and long-term aims. The suppliers obtained a great deal of satisfaction from achieving them and improving performance. They also had a strong focus on producing high-quality products and also got satisfaction from this. Many expressed that they were committed to producing high-quality products and would do this regardless of the premium received.

The suppliers had good relationship skills, which allowed them to work cooperatively with other suppliers and the companies they supplied. They were committed to working with other suppliers and other parts of the supply chain. They had learned the benefits of working together to create value. They were also customer and market-focused. Knowing who the customer was gave them a sense of satisfaction and also the assurance that they were adapting their farm system to customer demand, reducing their perceived risk. Customer connection provided them with the personal satisfaction of knowing their efforts to produce a high-quality product were appreciated and valued.




Conclusions and discussion

The research showed that it is possible for New Zealand to develop differentiated value chains with committed long-term relationships. However, this requires a specific set of resources and capabilities not common in the red meat sector. There is currently significantly more investment in staff resources at the procurement end of the supply chain than offshore in marketing and customer relationships.

New Zealand's geographic distance from European markets and cultural distance from Asian markets creates barriers for exporting firms in getting close to customers and building long-term relationships. It has been difficult for agri-food exporters to access support and funding for market research, market testing, market development or sales promotion activities. The Ministry for Primary Industries' Primary Growth Partnership has taken on some market development responsibility, but there is a need for a coordinated government agency method which looks at the whole value chain and the constraints to increasing the value of our existing commodity exports.

The New Zealand red meat industry needs a diversity of strategies for suppliers and exporters. However, the current industry model is heavily weighted towards commodity supply chains. There is therefore a need to specifically support those companies and their suppliers as they are developing higher-value strategies. There are significant barriers for companies attempting to build long-term relationships and higher value differentiated supply chains.

There is a role for government to help these businesses, as there are significant spill-over benefits to the industry and New Zealand economy. It is often smaller innovative companies who have value-added strategies. The government can help overcome their lack of resources and scale by co-funding research and development investments and market development programmes. They can also provide expertise and training to these companies in specific areas where they lack knowledge and resources. Encouraging networking and collaboration between like-minded businesses can also help maximise the resources of these companies.

The government should support diversity in the structure of export industries to encourage innovation and entrepreneurship. The New Zealand red meat industry needs a balance between larger companies with scale and resources, and smaller businesses which are more adaptable and able to exploit smaller high value market niches. Individual producers and exporters will choose different models within the continuum between spot markets and integrated supply chains. This will be based on their perception of the way they can maximise the value of their existing resources and capabilities.

Recommendations

Companies should be encouraged to see their suppliers as partners and move beyond procurement relationships to supply management and technical support roles. Helping processing companies understand supplier needs and how to improve supplier relationships is just as important as helping suppliers' understanding and meeting customer needs.

The government should support the programmes which improve farmer management capability, as this will improve the performance of these supply chains and provide a greater pool of suppliers capable of supplying these more demanding specifications. A good example of this is the Red Meat Profit Partnership. New Zealand farm management research has traditionally focused on maximising farm efficiency and reducing costs rather than improving the quality of the product to meet specific customer requirements. More research should be focused on producing animals to particular market specifications within the constraints of our pasture-based production systems.

The government can encourage motivation by supporting and promoting companies and farmers who are successfully getting high value products to discerning international customers. Many farmers have little awareness of customer demands or opportunities in the market, therefore promoting knowledge and awareness of market needs and supply chain opportunities is important.

The capability can be developed by providing resources to improve the physical resources of farms by investment in irrigation systems, improved pasture species and alternative forage crops. Providing investment in research and development, along with developing farmer knowledge specifically targeted at the specifications of these value chains, will allow more farmers to be able to to commit to supplying these high value customers.

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Tony Wilding

The sharemilking sector
Its value today and future sustainability

For many years the sharemilking sector has underpinned the way in which around 40 per cent of dairy farms have operated. Equally as important it has acted as a stepping stone to farm ownership for many of today's farm owners. Along with these two historic pillars, it has also allowed farm owners to step back from their day-to-day operations and give a sharemilker with ideas an opportunity to take the business to a new level. These factors are a part of the reason for the success we enjoy today.

One of the biggest reasons for productivity in the sector is the rejuvenation of ideas from change as people progress through the industry. The percentage of farms employing sharemilkers has not changed much in the last 20 years, but the percentage of farms employing herd-owning sharemilkers has decreased to now only making up about half the mix. This has put pressure on the numbers progressing, but it has also opened up opportunities which were not there 20 years ago.

As farms have become larger the ownership structures have changed, with multiple ownership and equity operating partners. In addition, good business owners who wish to retain top operators are offering equity shares in cows on large herd properties. This allows talent not to be retained and moving through to acquire and grow a substantial stake without being sharemilkers in their own right.

For herd-owning sharemilking to be sustainable in the long term, the type of discussion in negotiating an agreement has changed. The term 50:50 is no longer on the Federated Farmers agreement due to the flexibility which is being sought by farm owners. Features such as farm production systems are changing and are more diverse than 20 years ago, with more technology such as cow-activated drafting, cup removers and in-shed feed creating labour-saving benefits. Sharemilkers being able to increase their business by rearing more than the traditional 25 per cent replacement rate is being considered, with grazing young stock no longer 50:50 in all agreements. Bought-in feed on most farms exceeds the amount of on-farm supplement and crops grown.



The 2013 review

With all this happening it was important for the Federated Farmers review team which looked at the herd-owning agreement to take these realities into account and make some important changes to reflect today's environment. The review took place in 2013 and was completed with good initial input from the two negotiating bodies – the sharemilkers' sub-section of Federated Farmers and the Sharemilker Employers group.

The agreement was put out for wider review from the sector, including the New Zealand Institute of Primary Industry Management. The area which also needed a good review was the dispute resolution and arbitration clauses. We had expert legal advice and two arbitrators from the Abitrators' and Mediators' Institute who contributed experience in dairy sector arbitration. Also part of the review team was an experienced sharemilker advocate. I believe we now have a modern document which is better aligned with common law and reflects the changes made in the variable order agreement in 2012.

Withholding payment

One of the changes which has been well received is the removal of the right for the owner to withhold milk payment – the right of set-off. This clause has been contentious and in a number of cases has been abused by farm owners. There is a clearly defined pathway to resolving disputes and this has been further strengthened in the new agreement. The review team believes that withholding payments was a draconian practice and should no longer have a place in the Federated Farmers agreement.

For herd-owning sharemilking to be the business model which will encourage any successful farm business, it must start with open minds and a flexible approach. Federated Farmers believe that herd-owning sharemilkers bring more skills and experience to the table than farm managers or variable order or contract milkers. Having a larger investment, and in particular owning the stock, will see a greater attention to detail and a stronger affinity with the animals under their care. The new agreement also brings greater focus on making decisions which are best for the total business, rather than on how those involved in the agreement will be affected by decisions such as conserved feed or cropping.

Fluctuating returns

It has been always recognised that the return on cows needs to be higher than the return on land. This is mainly to do with the risk a sharemilker has in usually only having a three-year contract, as well as the fluctuations in cow values which could leave the owner of stock having to sell on a considerably reduced market. The herd-owning agreement should continue to reflect that differential.

The fluctuating payout has been another factor which has led to farm owners switching back to herd ownership when a traditional 50:50 agreement did not seem to be a fair divide when the payout was seven dollars or more per kilogram of milk solids. The agreement is as it stands and always has been is a negotiable agreement. Too many have thrown out a very successful business model because, for example, the traditional share did not make sense at eight dollars.

It would be much more sensible for both parties to renegotiate the percentage rather than change the business model if that is what is required to return some equity. The result is that the farm would retain the more experienced and stable management, and the cows would remain owned by an inspirational sharemilker who has real experience. Most important, another herd-owning position remains for future progression.

New and different business models

Fortunately, some of the demise in herd-owning agreements is being replaced with other opportunities for capital growth. Equity partnerships in larger farms are common, with the operating partner often starting with around 15 per cent of the equity or shares. In taking this opportunity it is important for the operating partner to understand the investment model and the shareholders' agreement.

Opportunities for growth need to be more than just a verbal undertaking. This type of venture is not always straightforward when dealing with multiple investors. We hear of some success stories, but equally many unhappy relationships and stifled business models for the growth



of the operating partner. The arrangement requires more business skill and relationship management to negotiate and to operate.

Being professional

It is just as important for those wishing to adopt the herd-owning agreement, or the variable order agreement, that a professional and considered approach is required. That does not necessarily mean a lawyer and big expense. There are very capable and experienced people in the sector who can go through the agreement to ensure that the individual clauses and obligations are fully understood. In the herd-owning agreement there is much more room for negotiation, and that is where a third party can make sure the different options on cost sharing where negotiation is required are kept within the balance of fairness. Time and money spent in this area is well worth it.

Time spent on the annex in the back of the agreement costing the viability of the contract which the sharemilker is entering into is vital. Stories of variable order jobs giving a nett reward to the sharemilker of less than a farm manager on a similar job are not uncommon In addition, in the event of a lack of clarity or potential disagreement this third party could be your first point of call.

Although it might be stating the obvious, the most critical ingredient to a successful business relationship is good communication, no surprises with a joint and agreed plan to handle adverse conditions. It is in this area where most agreements go wrong and they are all linked. Arguments about feed shortages and the blame for them is quickly followed by who pays the cost and owners asking why they were not told.

Use a farm advisor

Where there is an absentee owner I have always given the advice to bring in a farm advisor to carry out a monthly report, with both parties present when the visit takes place. The fees that I see for a good competent service do not make this a barrier, even at a lower milk price. If that is not your choice, a formal monthly meeting or report is a good record of an agreed plan. Note the word formal. It is not an unannounced visit to the dairy shed by the owner at the end of morning milking for a bit of a chat. This can sometimes not be constructive if matters are not quite right.

Family contracts or those who know each other well should not side-step this advice. Many friendships have been destroyed by a lack of business formality. The warranties and obligations must be considered and understood by everyone involved.

There is an awareness by some that the decision to employ a herd-owning sharemilker is not just about a short-term financial return, but the medium to longer-term return from a more productive and better maintained asset. Quite often the operating model for a farm is being led by investors and financial advisers who have very few skills and knowledge about practical farm operations and the motivators for productivity. Herd-owning sharemilkers, who have the ability to motivate and lead people, are an important component in achieving high performance, lower maintenance costs, reducing the risk of poor performance and high staff turnover.

The future

Many ask the question about what our future average farm will look like and what sort of ownership structure is developing. Will it be sustainable if we are to continue as we have in the past, getting a four per cent productivity improvement inside the farm gate? The technology is there to continue the improvement, but there will be greater focus on refinement and better use rather than more of the same. The environmental footprint of dairying is now being measured, and more noticed, particularly by those less directly involved outside the farm gate.

To continue to improve our financial performance, while reducing or mitigating against the effect on our environment, will require highly skilled operators with real experience. They will see that today's decisions will determine the licence that we have to farm in the future. Those long-term decision-makers are today's herd-owning sharemilkers.

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Blake Holgate

Competitive challenges Environmental regulations are changing the rules of the game

The competitiveness of an agricultural exporting country such as New Zealand is mainly determined by production costs and potential for industry growth, both of which are influenced by the regulatory regime under which its exporters operate. Regional authorities throughout the country continue to place increased environmental controls on New Zealand farmers.

It is important to examine the role which central and local government regulation plays in determining the relative competitiveness of agricultural production and export supply. This can be illustrated by highlighting the effect that different regulatory methods are having on production costs and the growth of dairy exports in New Zealand, California and The Netherlands.

Concern over the effect of intensive farming on the environment has been growing worldwide. What were once considered normal and acceptable practices are now coming under increasing public and political scrutiny as farming is becoming progressively more intensive. The effect of this intensification on the environment's natural values, character and ecosystem health is now more apparent. This growing concern has translated into increased pressure for improved environmental performance, not only from society, but within the supply chain including consumers, food processors and retailers.

Some industry groups have responded with self-imposed regulations, establishing minimum environmental requirements and standards which producers and suppliers must achieve. In addition to this self-imposed regulation, farmers are facing increasingly strict controls put in place by regulators to mitigate the environmental effects of farming practices and incentivise the uptake of more sustainable practices. Compliance with these tougher regulations requires investment. This is likely to increase production costs and could limit industry growth, as some resources will be diverted away from production and into ensuring that new environmental standards are met.

At the same time, governments around the world are promoting policies designed to increase agricultural production and provide economic growth from surging global food demand. For example, the New Zealand government has suggested a doubling in the value of this country's agricultural exports from $32 billion in 2013 to $64 billion by 2025. The challenge for New Zealand, and other exporting countries, is how to increase output and improve environmental performance while still remaining commercially competitive in a global marketplace.

Defining the problem

Environmental regulation has been in place to differing degrees in various countries for decades. However, the extent to which society now expects agriculture to be held responsible and accountable for its full effect on the environment is greater than ever before. Policy makers are coming under increasing pressure to implement a greater range of regulations based on the principle that the polluter pays.

As farmers are increasingly expected to pay for a greater proportion of the environmental effect, production growth is being constrained as they face upward pressure on production costs. In addition, increased spending on mitigation measures, changes to land use practices, and reductions in land use intensity are all potential consequences of heightened environmental regulation. The extent to which these changes affect the relative competitiveness of each region's agricultural exports will depend on the particular regulatory regime they operate under.

Each agricultural producing country faces its own unique environmental challenges, in terms of the industry's effect on the environment and the degree to which the public and the government expects the cost burden to be shared between the farmers and the wider community. As a result, different countries have developed different regulatory approaches to deal with these challenges.

Generally, farmers operating in countries with tighter environmental regulations will incur higher costs than those who are subject to weaker or non-existent regulations. If two exporting countries are identical in all aspects, apart from the robustness of their environmental regulations, farmers operating in the country with the weaker regulations will be at a cost advantage over their competitors. The size of this cost advantage will depend on the range of pollutants that competitors regulate, such as air quality, water quality and greenhouse gases, how they are regulated, along with the willingness and ability of farmers to adapt to these challenges.

The Netherlands – change still required

In The Netherlands during the early 1980s, large herd sizes, inefficient use of nutrients and over use of fertilisers was causing leaching, resulting in diminishing soil and water quality. Regulators responded by implementing a prescriptive regulatory regime based on controlling inputs to the farming system. In the decades since these original reforms, further restrictive revisions to environmental policies have taken place. Measures include –

- Prohibiting effluent placement during winter, requiring it to be stored from September until February in some regions
- Placing limits on the annual use levels for phosphorous and nitrogen
- Prohibiting effluent spreaders and mandating the use of low emission effluent injection for grassland
- Environmental permits limiting herd numbers.

For over two decades rigid rules controlling herd size, and tough conditions around the storage, placement and processing of effluent, have had a significant effect on the cost structure and production levels of the dairy industry in The Netherlands. The approach taken there provides relative certainty, but it does limit potential innovation as there are only so many variables over which individual farmers have control. In spite of this there has been environmental innovation within The Netherlands and some which has been implemented is the most advanced in the world. However, the industry has been forced to innovate within the confines of the highly controlled system under which it is regulated.

One advantage The Netherlands has is that its dairy industry has been operating under a highly regulated regime for a long time. Most of the industry's compliance costs are already incorporated into the cost structure, unlike countries such as New Zealand where impending regulatory reform will impose new costs on the industry.

California – regulation diverting expansion elsewhere

Environmental compliance costs have become an increasing concern for California dairies for more than 10 years. The increase in environmental regulations has been due to a combination of air pollution which is amplified by the geographic location of the state, large dairies located on relatively small land bases affecting water quality, and the state's political climate being sensitive to environmental factors. Other states, such as Texas, Idaho and several in the mid-west, have sought to attract California's high capital and labour intensive dairies. The major selling point is lower environmental regulation costs to maintain, expand or build new dairy facilities.

Although water and air quality regulations are

pertinent to dairy facilities, water quality regulations in particular have gained the most attention since the adoption of the General Order in 2007. Before its adoption, the federal government's Clean Water Act regulated waste discharge for existing dairies but was only for surface water. The General Order, however, regulates factors affecting surface and groundwater at the dairy facility itself, as well as on any associated crop land. To comply with the requirements of the General Order, among other factors, dairies are required to –

- Submit annual reports
- Develop and implement a nutrient management plan with an annual update, as well as a waste water management plan
- Monitor waste water daily and sample waste water, irrigation water, plant tissues and soils
- Supply wells for laboratory analysis.

The overall purpose of these measures is to prevent excess application of manure on crop land and to monitor water quality to assess the effectiveness of waste management techniques.

Central Valley dairies are also subject to the federal government's Clean Air Act. The Central Valley in California is surrounded by mountain ranges and tends to trap air pollutants. As a result this area has been designated as 'extreme non-attainment' for ozone. Most current regulations relating to air quality have been in effect since the mid-2000s. Construction involving new dairies, infrastructure updates to existing dairies or other changes which increase emissions on any unit of the farms, means an 'authority to construct' application must be submitted.

Environmental regulation costs are not a make or break factor for most existing dairies operating in the Central Valley. Instead, the biggest environmental cost hurdles will come from starting new dairies or substantially expanding them, which is likely to limit industry growth. For example, new or expanding dairies must undergo an environmental impact report, which adds additional expense and opens construction activity to litigation from environmental interests. Most future production growth will therefore come from stretching the capacity of existing facilities and higher production per cow.

New Zealand – regulatory momentum gathers pace

Since 1991 the discharge of contaminants to air, water and land within the New Zealand environment has been regulated by the Resource Management Act. Under this Act, regional authorities are responsible for managing natural resources within their region of which there are 16. To date, regional regulations have mainly focused on dairy shed effluent management, with rules in place for storage and application of effluent to prevent raw effluent from directly entering the waterways.

To protect the quality of New Zealand's waterways, the National Policy Statement for Freshwater Management was introduced under the Resource Management Act in 2011. The statement directs regional authorities to establish water quality targets and set enforceable limits to maintain or improve water quality in water bodies within their region. Regional authorities have differing timetables but must have the required changes implemented by 2025.

To meet future water quality targets and limits, regional authorities are in the process of introducing a raft of new environmental regulations. Traditional regulation dealt with point source discharges where it is possible to identify the point at which a pollutant is entering a water body such as a drainage pipe. New regulations are mainly focused on solving the problem of non-point discharges where nutrients leach into surface waters and groundwater as a result of rainfall, soil infiltration and surface run-off.

Controls are being placed on the amount of nitrogen, phosphorous and sediment which can leave a farm's boundary. As phosphorous and sediment loss occurs mainly via run-off across the surface it can mainly be controlled by riparian planting, fencing waterways and grazing management systems. These are practices which New Zealand dairy farmers largely understand and many have already implemented.

Based on effects

Regulation of nitrogen leaching poses a much greater challenge. Because nitrogen leaches down through the soil and into the groundwater system, it is a difficult pollutant to measure and control. However, due to the potential negative effect nitrogen can have on New Zealand's waterways, regional authorities are now setting enforceable nitrogen leaching limits for farmers. Accurate measurement and monitoring leaching levels will be critical to attaining the targeted change in environmental results. Confidence and understanding of the chosen tools and basis for measurement is required to ensure enforcement is achievable.



New Zealand is generally adopting an effects-based regulatory regime based on regulators setting standards or limits that must be met. But it is mainly left to the individual business owner to determine the most efficient or effective way of getting there. For example, most regional authorities are setting nitrogen limits, but not enforcing how farmers have to farm to get there, which is the more prescriptive approach they have taken in countries like The Netherlands. Controlling effects rather than inputs creates greater incentives for innovation.

As a result, business owners are approaching the problems by trying to determine the most efficient and cost-effective means of meeting or exceeding requirements. The most competitive and successful producers will be those who can best adapt. The effects-based model has a disadvantage in that it can create uncertainty and fear for the producers, as many are unsure exactly what changes need to be made to meet standards. Under an inputs-based model, it is simply a case of doing what the rules say you are allowed to do.

To take advantage of the flexibility New Zealand's regulatory approach provides, and to reduce some of the uncertainty faced by farmers, it is important that investment is made into building knowledge, science and new technology to encourage innovation. Environmental management needs to become a core function of farming, similar to livestock management or pasture management. It is in the interests of all producers to adapt quickly to minimise environmental effects and avoid the risk that regulators eventually pursue the inputs model approach to achieve the desired results.

The way forward

International competitiveness in milk production will be controlled by the extent and pace of regulations affecting production costs, willingness and ability of producers to expand. Comparing the relative position of the three milk production regions, given the current environmental regulatory framework and expected effect, shows how this can vary as shown in the table.

For New Zealand, where regional authorities are just embarking on the process of determining and implementing regulations relating to water quality, the full effect on agricultural productivity is yet to be seen. However, achieving a balance between complying with increasing environmental protection regulation while maintaining productivity growth is a critical challenge to the future competitiveness of its agricultural sector.

Relative competitive position based on future environment regulations showing magnitude of effect

	The Netherlands	California	New Zealand
Regulatory stage and progress	High	High	Low
Speed of regulatory change	Medium	Low	Medium
Government assistance provided	Medium	Medium	Very low
Production cost effect for existing producers	High	Low	High
Production growth prospects	Low	Medium	Medium
Effect on relative competitiveness	High	Medium	High

Investment in science and new technology to minimise agriculture's effect on the environment while maximising potential production will be the most important impetus behind our competitive advantage. Regions which have the regulations that encourage innovation, and are willing to spend the time and resources developing their farming systems, will be in the best position to bridge the gap between competing environmental protection and economic development.

The New Zealand agricultural industry is already putting significant resources into dealing with environmental requirements. However, given the scale of the challenge, it is going to take a lot more investment in research and technology around farming systems, soils, nutrients and fertilisers to maximise efficiency around how nutrients are used and retained within the system. It is important that this investment is recognised as an essential long-term investment for all of New Zealand, not just the industry. The reason for that is, if it is all done in right way, investment will enable our country's biggest industry to grow in a sustainable way while still meeting community expectations about water quality and the environment.

This article is condensed from the Rabobank report 'Competitive Challenges – Environmental Regulations are Changing the Rules of the Game' published in July 2014.

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Gavin Ussher

Brazil the land of cattle

Brazilians are rightfully proud of their beef cattle industry and the potential it has to help in feeding the world. Their dairy industry flies under the radar, but is one worth watching closely.

Brazil is immense – it is number five in land mass in the world, 10 per cent larger than Australia. It has recently become the largest exporter of beef in the world. This beef exporting has grown since 2000 in comparison to Australia and New Zealand. The cattle population of beef and dairy is large, with one cattle beast for every head of population, around 210 million.

The comments below are based on what I observed over 10 days in Sao Paulo in September 2014 during visits to a large commercial dairy farm, research farms and university farms. Our hosts did emphasise that what we were looking at was far superior to the typical dairy enterprise in their country.

For a person not acquainted with Brazil before this visit, it is surprising to discover that it is number five in the world for milk production. At 30 million tonnes, its production is almost double that of New Zealand's. However, milk production on a per cow basis is very low at 1,370 litres per lactation or 4.5 litres per cow per day. The two main reasons for this are –

- Of the estimated 25 million dairy herds, only five million are Holstein, or Holstein type, the balance being made up of various zebu breeds with their associated very low production
- A large number of small and very small producers, with 80 per cent of the dairy farms classified as small accounting for 27 per cent of Brazil's production and with an average of 14 litres of milk per farm each day.

The university and research farms I saw had their dairy cows producing between 25 and 35 litres per cow each day, all Holstein type. The major factor influencing this production, apart from the breed, was the amount of supplements the cows were given. Cows producing 25 litres a day were being fed 15 to 18 kilograms of dry



matter of maize silage a day along with other supplements while feeding on very dry and brown pastures. Sao Paulo state was still suffering from its worst drought in 80 years. Cows producing 35 litres a day were being fed 25 to 30 kilograms of dry matter maize silage.

These university and research farms either supplied fresh milk to a processing cooperative at a price equivalent to NZ58 cents a litre of milk, or to their students at subsidised prices. Some students specialising in dairy had a major role to play in the day-to-day running of the farm apart from the milking. On one farm a barn was currently housing 20 cows, with a potential for 60. There was no spare money to buy additional cows. Part of the research being undertaken here concerned additives to supplementary feed on behalf of a United States feed company.

Forage production

Typical maize silage crops achieved 35 tonnes of dry matter per hectare, with other species planted for the winter. However, the winter growth was not successful this year because of the drought. A nearby commercial farm was getting two crops of maize silage each year at 30 tonnes of dry matter per hectare. Our host had it on good authority that a farm close to the equator was achieving 50 tonnes of dry matter per hectare per crop, three times a year.

One university farm was limiting their nitrogen input to 150 kilograms of nitrogen per hectare each year, the other farms were using 400 kilograms. Pastures were based on panicum, with some elephant grass. This is used for grazing by milking cows over the summer months. The panicum grass was 40 years old and they do not believe they will achieve production increases from the new cultivars.

Grass growth in the summer months can be up to 35 tonnes of dry matter per hectare with no irrigation but generally good rain and using 400 kilograms of nitrogen per hectare. There are no legumes in these pastures. They have stopped trying to keep a legume base with these very fast summer-growing species which require high nitrogen inputs.

Grazing rotation of the panicum grass is 30 days, even with daily summer growth rates over 150 kilograms of dry matter per hectare per day. In their view, the quality of this forage does not drop away until the rotation hits 35 to 40 days. There were no metabolisable energy results to see to back up or counter this view. There was better persistence of plants using the 30-day rotation.

Commercial farms

The commercial farm we visited was milking 1,200 to 1,500 cows. It was also producing beef as well as juice from citrus fruit on land that had been in the family for over 60 years. The average milk production was 35 litres per cow each day, with milking three times a day, and cows being fed 30 to 40 kilograms of dry matter each day of maize silage, along with other meal supplements. Milking cows do not have access to any pasture during their lactation. The farm grows 300 hectares of maize silage.

Production was quoted at 3,000 kilograms of milk solids per hectare per year, but I was unable to clarify exactly what hectares were involved. Somatic cell count averages were 380,000. Cows only last three to four lactations, which means that 350 to 450 heifers come into the herd each year. The calving interval is 14 months. Cows are large in size and semen is obtained from the United States and Europe. Cows are culled for not getting into calf or if their udder or feet 'collapse'. All heifer calves are retained, with surplus two-year heifers sold currently for NZ$4,000 each. Bull calves are virtually given away to anyone who will take them for veal production.

Heifer calf rearing is on an individual basis to begin with, compared to mobs of 30 to 60 or more as in New Zealand. Our host was understandably proud of the results for one of his areas of responsibility which was calf rearing. Calf losses of fewer than 10 a year when rearing up to 800 heifers was a very good result. These heifers are inseminated at 14 to 15 months of age and continue to be well fed to calve in good body condition, and in excess of 500 kilograms live weight.

Milk price

There are two current milk prices for this commercial farm. One price is NZ58 cents a litre for contract fresh milk to Nestlé or another company, with the contract decided on a weekly basis. The other price is NZ$1.10 a litre for milk they process themselves and sell in Sao Paulo 350 kilometres away. This is a ready market of 12 million people in the city itself and 18 million when you add in the surrounding area. About 35 per cent of daily production is in the high-priced category.

The movement in price has been significant. The October 2002 typical milk price in Brazil was NZ10 cents a litre which was a significant improvement on the 2001 price and which had seen many farmers leave dairying and some processors close down.



The environment

Water is becoming more of a problem, even before the current drought occurred. The storage and use of effluent was of a high standard on the commercial farm and had been for many years. This was due to commercial and personal reasons as opposed to any industry or regional government policies. Legally, all landowners throughout Brazil need to have areas of their farm in trees. The actual area depends on the state. For example, Sao Paulo requires 20 per cent of the farm area to be growing trees compared to 80 per cent for the Amazon state. This is referred to as legal reserves or planted forest.

In addition to this, if there is a lake, spring or river which cuts through the farm then trees have to be planted on the river banks. These are called permanent preservation areas. The depth or distance away from the river which needs to be planted has recently been reduced in size by central government. The monitoring and policing of these legal reserve requirements is by the environmental agency of each state. The theory is that if farmers are not abiding by these laws they will be fined.

Our impression from our short visit to Sao Paulo state was that the laws are being adopted very well. One statistic I saw is that the areas occupied by woods and forests grew by 5.6 million hectares between the agricultural censuses of 1996 and 2006.

Beef cattle

Brazil is a beef cattle land and it has seen considerable growth in its cattle population and exports. It is now number one in the world for tonnage of beef exported.

Exports of beef

Country	Year 2000	Year 2011	Per cent increase
Brazil	410,779 tonnes	1,402,280 tonnes	241
Australia	1,208,058 tonnes	1,254,699 tonnes	4
New Zealand	457,153 tonnes	500,468 tonnes	9

The small increases in beef exports by New Zealand and Australia pale into insignificance compared to what Brazil achieved over a ten-year period. These exports are mainly led by their beef cattle population as shown in the table below.

Cattle numbers in millions

Country	2000	2011	Per cent change
India	191.9 million	210.2 million	Plus 9
Brazil	169.9 million	212.8 million	Plus 25
Australia	27.6 million	26.7 million	Minus 3

South Americans eat a lot of beef. Brazil's neighbours, Uruguay and Argentina, have the highest beef consumption in the world, averaging 59 kilograms per person each year. Consumption in Brazil is 38 kilograms a person, which is 30 per cent higher than consumption in New Zealand. One of the two Brazilian barbecues I attended had extremely tasty and tender beef and lamb. This is in comparison to neighbouring Bolivia, which has very tasty meat but is a workout on teeth and gums for the toughest beef I have eaten for 30 years.

High prices

Of all the meat eaten in Brazil, 47 per cent is beef and for Argentina it is 63 per cent. In New Zealand we consume more pork and lamb than Brazil, with beef consumption 28 per cent of total meat intake.

Beef prices have hit an all-time high in Brazil which is not directly due to the shortage of beef in the United States where Brazil does not export due to foot-and-mouth disease. Drought, a low supply of finishing cattle and a never-ending demand for beef has pushed the current price to R$134 for 15 kilograms, or the equivalent of NZ$4.65 a kilogram which is considerably lower than in New Zealand. The current price in Brazil for 190 kilogram weaner cattle is NZ$555 a head at NZ$2.92 per kilogram – very similar to New Zealand. The increase in beef prices is similar to their dairy, from low prices in 2000 to 2006.

Feed efficiency trials are being undertaken with funding by breed societies. Computerised and individually identified steers are fed reasonably high quality diets based on maize silage for set periods. With daily intake electronically, daily growth rates and feed conversion efficiencies can be calculated. Sire bulls, which show up well in these feed efficiency trials, can then command a premium for their semen.

Of the 12.3 million doses, or straws, of semen sold in Brazil in 2012, 60 per cent were used in the beef cattle industry, leaving the remainder for the dairy industry. In contrast to the dairy industry, where 70 per cent of the semen is imported, in the beef cattle industry only 30 per cent is imported.

Brazil has often been described as having significant cattle production potential, but questions are always asked about if and when that potential will be achieved. If the current prices, the movement in prices over the last 10 to 12 years, and the increasing beef and dairy production are a good indication for the future, then this potential will be steadily achieved.

Gavin Ussher is an Agricultural Consultant with Clover Consultancy based in Kaitaia.

Brennon Wood

Networking for innovation in New Zealand's primary industry

Quite quickly, networking has become the order of the day with a lot of it happening in New Zealand's primary industry. All over the country network-building initiatives are under way to lift the prosperity of land-based businesses. The number and variety of these initiatives is striking. Large strategic alliances are radiating out from industry headquarters and the Wellington ministries. More humble schemes are also in progress, including the small-scale Massey experiment discussed in this article.

As you would expect investment in networking is not unique to New Zealand's primary industry – it is a global trend in business, government and science. But what does it really mean? Is it new wine in old bottles? Or is the turn to networking more significant? Does it promise a quite different way of managing our primary resources?

We all know that the game is about adding value as resources change hands. Does it matter if you think about these exchanges as network flows? Adding value requires innovation, because a mix of business acumen and scientific research has shown that innovation in networks differ significantly from those used for business as usual. The sort of network power you have makes a difference.

It is too soon to tell what this means because although numerous initiatives are under way there is no real sense of what they might add up to. As yet we know too little about the networks through which primary resources flow.

Working together

Four years ago a multi-disciplinary team of scientists came together at Massey's Manawatu campus made up of five agricultural scientists – four biophysical and one farm management, two educational researchers and myself as a network sociologist. The eight of us wanted to work together and to do this by working with farmers.

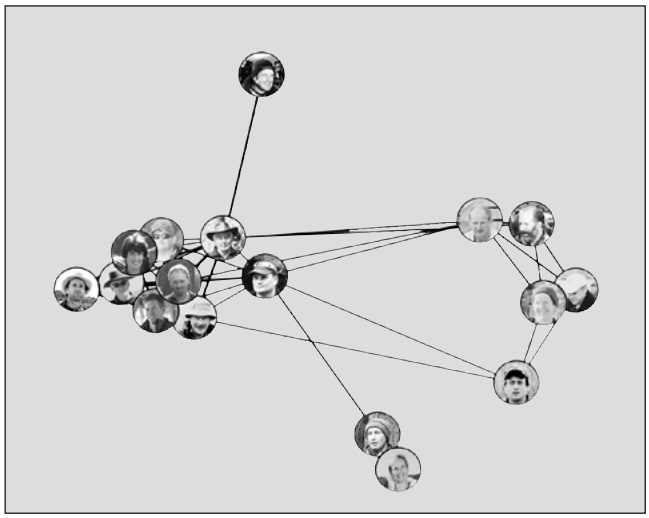
It was decided to run a lamb finishing experiment on chicory and plantain pastures, and three years of funding were obtained to run the experiment with some sheep and beef farmers within relatively easy reach of the university. Preliminary results were regularly discussed, as were the usual practical decisions such as stocking policy, grazing management and finishing dates.

Our general idea was to promote learning by strengthening farmer relationships with agricultural scientists. The science itself had to be done and the results published, but our main interest was to discover more about doing science with farmers. Alison Sewell and Maggie Hartnett, the two educationalists in the team, wrote about the project in this journal in September 2014, highlighting the importance of co-learning. This article focuses on how the farmers networked the scientific experiment by sharing it with other people.

Getting started

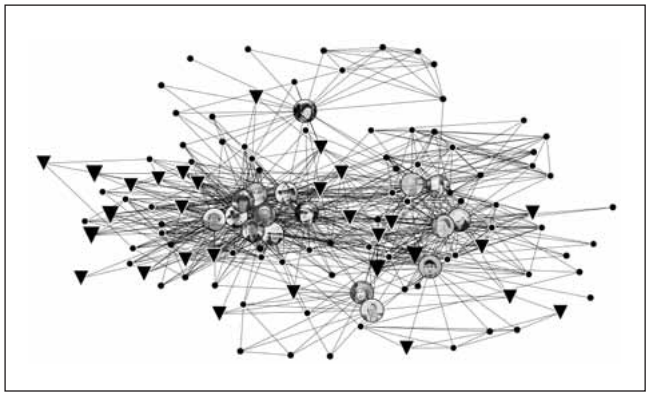
In late 2010 we needed to call together a group of farmers to work with us on the herb pasture experiment. Like anyone in such a situation, we simply went out through our existing networks to find the willing and able. Eventually we came up with 17 farmers, and as the project started we talked to them individually to find out what and who they knew about these pastures. When you use networks, what you find is that the people you contact are often already in communication with each other.

The diagram is a network of the 17 farmers, showing who already knew each other personally before we got in touch with them. The software used to make this diagram positions people closer together when they know more people in common. You can see that the 17 farmers already had a group life before we called them up.



Network of 17 farmers

We contacted the farmers because we wanted their help with the lambs-on-herbs experiment. Forage crops such as chicory and plantain have been around for a while and farmers have already been sharing what they know about these plants. We asked each of the farmers who they had talked to for information and ideas about herb pastures. As the second network diagram shows, a substantial knowledge-sharing network was already in place.

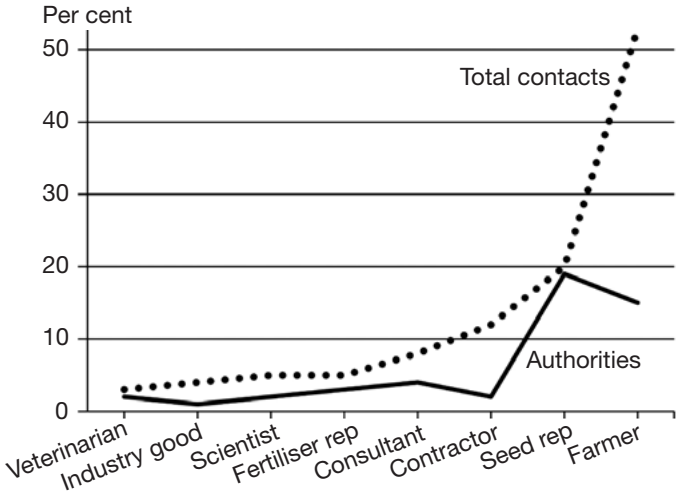


A knowledge sharing network

The 17 farmers identified 110 contacts, an average of about six each, although some had many more than others. The contacts ranged from three to 18, and it is not uncommon for networks to have a few very highly connected members. The diagram also shows that the farmers have numerous contacts in common. The network is a dense thicket of relationships because they share know-how with many of the same people.

Some of these contacts have been singled out as particularly significant. The triangles with the point down are 29 people who the farmers individually identified as their most useful sources for herb knowledge. There are two important things to note about this structure –

- The power to determine what counts as worth knowing about herb pastures is not scarce or concentrated, but is multiple and dispersed
- There is clearly a structure at work with some herb authorities relatively isolated, others are associated with particular clusters of farmers, and some are located between these clusters.



The farmers' know-how contacts

Who are the people the farmers draw on for herb knowledge? As the graph shows they are a mix of professions, but by far the biggest number are fellow farmers at 48 per cent. As is often said, farmers prefer to learn from each other rather than from anyone else. There are three veterinary contacts and two are recognised as authorities. Given that this is a herb pasture network, we might not have expected them to figure quite so prominently.

The leading role played by seed merchants may be more predictable but they convert network presence into authority with their 20 contacts receiving 19 nominations. In comparison, fellow farmers are the most common contact but they are second placed on the authority scale.

The lambs-on-herbs experiment

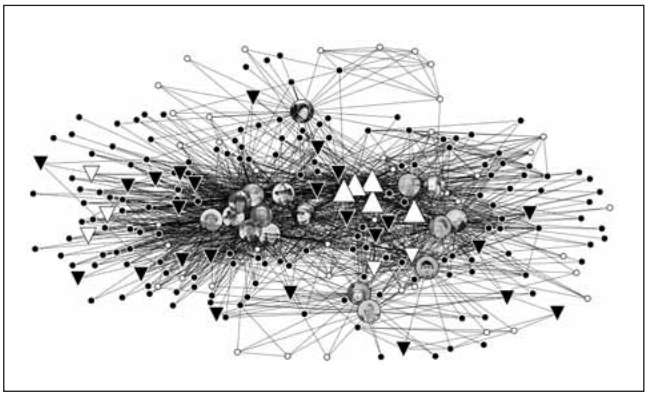
This was the situation as we started on the lambs-on-herbs experiment. The 17 farmers had agreed to participate and each of them brought considerable network resources along to our first meeting in June 2011.

Over the following three years the team's five agricultural scientists and 17 farmers ran the experiment at Massey's Pasture and Crop Research Unit. As a bonus, the farmers were also offered a series of science oriented workshops. A lot of what we did involved standing in fields of herbs talking about what we saw and thought.

Although the project offered many new opportunities, we also frequently used the discussion group formed by farmers coming together in a paddock. These discussions are important because farmers prefer to learn from each other – they learn best with peers. At such meetings, farmers gather the resources with which they stock their knowledge networks. This wider networked discussion is continually mulling over the challenges and possibilities of farming in different ways.

The network at 18 months

After the project had been running for 18 months we interviewed the farmers again to find out who they had talked to about the lambs-on-herbs experiment. This was to determine if they had talked to their previous contacts and if anyone new had been added to their herb networks.



The network after 18 months

The diagram above shows what we found.

- The five agricultural scientists involved with the experiment are the large triangles pointing up
- At 18 months the farmers had talked to 177 people about the experiment and these contacts are all coloured black in the diagram
- Before the Massey project began they had 110 contacts so these had grown by about 60 per cent
- Of the 177 people now in the network a third were previous contacts and two-thirds new
- Over 80 per cent of the recognised authorities, the triangles pointing down, had been spoken to
- An accountant and five bankers were now in the mix
- Initially about half their prior contacts had been fellow farmers but by 18 months this had risen to two-thirds
- Adding them all together, the 17 farmers identified 223 herb contacts.

The project team's 22 scientists and farmers were all asked who of these people they knew personally and met on a fairly regular basis. It turns out that contact sharing is very common, with approximately 90 per cent of the contacts known by more than one team member. On average, each of the 223 contacts is known by one of the project team scientists and by four or five of the farmers. As the lines on the diagram indicate, the project team therefore has many contacts in common. Just as was the case with the farmer networks before the experiment began, this is also a dense thicket of relationships.

Learning some lessons

A farmer discussion network was discovered by working in it. Does any of this matter? We believe so because we are convinced that more lively connections between farmers and scientists will help New Zealand agriculture prosper. The lambs-on-herbs experiment was in a knowledge-sharing network which is extensive. There are three lessons that are hopefully of some value for primary industry managers interested in networking to bring about change.

Networks are numerous and you need to work out those you are interested in. There is no one network through which all resources flow, so pick a few of practical interest. For example, are you interested in meat, money, knowledge or influence? Resources do not all move through networks in the same way, knowledge flows by parallel replication. If you do not understand how things flow, how can you add value to them?

The page is never blank so discover the existing networks you want to be involved with. Do not try to start building from scratch. Networks are all around and it is not about something brand new it is about making more of what you already have. Finding out how your networks operate is the core business.

It is not just about more, it is about the right type. You already have network power and what matters is the sort of power you have and look for. It also pays to know what is on offer. Only theoreticians can afford to invest all their resources in weak powers of little consequence.

To go back to the farmers' network, this has numerous interesting and peculiar features. Imagine if other agricultural relationships were organised in similar ways. The farmers' network is densely tied with its members close together where they can reach each other relatively easily. It moves resources as a decentralised flow. Rather than rely on central materials occasionally shipped in from elsewhere, the network is self-organising and uses resources at hand in the everyday work of farming.

Not all networks are like this as some are much less densely connected. More sparsely tied networks create numerous opportunities for someone to fill in the missing relationships by acting as a go-between. This is what networking is usually taken to mean. It is all about helping relationships between people who would otherwise remain out of touch with each other. However, the farmers' network offers very few opportunities like this because everyone can already reach each other easily.

Consider yourself as a rural professional, venturing into this network and determined to set up shop as a crucial lynchpin connecting people who would otherwise remain oblivious. Unfortunately, you have the wrong job description. Do many of New Zealand's primary industries look like the farmers' network? I suspect so. Can we align the resource flows in all these networks with consistent messaging from some sort of newly facilitated central authority? I doubt it. Something different is called for.

Brennon Wood is a sociologist based at the Institute of Agriculture and Environment at Massey University in Palmerston North.

Profile

Jenny Jago

Jenny Jago was brought up on a dairy farm in Stratford where her great-grandparents had broken in the land. She has always had an interest in animals and farming, enjoying getting up early to help on the farm doing everything except actual milking. Much more interesting was sitting on the cow shed roof doing a behavioural study of how dominance hierarchy affected access of cows to molasses licks in the holding yard before milking.

As a sixth form student she carried out a year-long study on the garden snail. Jenny started with 11 snails and these multiplied until there were over 250. Many experiments ensued, and she recalls that looking back they were well set up with controls. One test was about how strong snails were. She tied a piece of cotton around the snail's shell and attached it to a matchbox filled with coins. She also carried out food preference tests and plotted population curves as the snail population expanded. For her final year of schooling she moved to Hamilton Girls' High where she carried out a study on crickets 'Do crickets have memories?' which won the most innovative project at the Waikato Science Fair.

Study and research

It is not surprising with these early indications that Jenny would end up in a career in science and her studies took her in this direction. At Waikato University she graduated with a Bachelor of Science, a Master of Science and finally a PhD in 1997. At the end of her second year at Waikato she had a summer placement at Ruakura, working with meat scientist Alan Kirton around the time MafTech was changing and the Crown Research Institutes were being formed. To fund her study she also worked as a technician at the Animal Behaviour and Welfare Research Centre run by AgResearch in Hamilton.

Jenny's masters topic was on the transportation of deer, using cameras to film animals as they were transported different distances and over varying terrain. This was later used to train drivers and develop transport stocking density guidelines. Her PhD was on immune-castration in bulls, vaccinating beef cattle to suppress the unwanted behaviour of bulls while aiming to keep growth rates high. During her doctoral study she learnt about the importance of communicating science, and it was at this time that she won the New Zealand Society of Animal Protection Young Scientist award.

Post-doctoral placements followed in the late 1990s at the Danish Institute of Agricultural Science and an OECD Fellowship at the French National Institute for Agricultural Research. During this time Jenny realised how much effort the Europeans were putting into animal welfare research. She also encountered indoor farming systems for the first time, including robotic milking.

Changing the way we milk cows

On returning to New Zealand Jenny worked at AgResearch for 12 months before taking leave to have the first of her three children. Following this she took up a position with Dr Murray Woolford to set up the Greenfield Project, exploring the viability of fully automatic milking technology on New Zealand farms. It was to become the most challenging and rewarding project in her career so far, turning the way we farm on its head. Why not get the cows to do the work, relieving people from so much repetitive manual labour? After working with the cows for a few months it became clear to those in the project that the ability of cows to learn was very high.

During the nine years of the project Jenny also learned about farm systems as she had not come through the traditional route of Massey or Lincoln universities.

Profile

Historically the most influential dairy scientists in New Zealand have been systems scientists. In her view we need more people with these skills if agriculture is to continue to grow and prosper because the problems we face today require systems solutions.

Near the end of the project Jenny became interested in conventional milking methods. She then borrowed an idea from the Australians of shorter milking times or maximum milk out times. Why not take the cups off after a certain time rather than wait for milk flow to drop to a set level? This worked, so the project took it a step further and showed that milk quality was not affected and substantial time could be saved by adopting this practice.

The big challenge was that it was counter-intuitive and went against what farmers had learned over the years. The vital step was to get a small number of farmers to try the new method and then get those farmers to talk about it and how they managed the change backed up by the scientists with the data. The practice is now quite well known and used on farms.

Involving farmers in research

In 2009, Jenny spent a year in Ireland at Moorepark, the government science organisation. This experience confirmed to her the importance of involving farmers in research. The scientists at Moorepark were very in touch with farmers, most being part-time farmers themselves or at least involved in a family farming operation. This meant their research was what was needed and they also built credibility with farmers. When she came back to New Zealand Jenny was determined to make sure farmers were involved in projects. She believes we need researchers to be working alongside top farmers, learning from each other, questioning and testing ideas, then translating the results into a wider industry perspective.

The Irish experience proved valuable for other reasons, including realising the importance of taking some time out to reflect on the industry from a distance. Jenny believes she gained a much wider perspective of the New Zealand dairy industry and began to realise the importance of having a global view. Spending time in Europe and the United Kingdom, as well as Canada, during her sabbatical strengthened the view that the New Zealand dairy industry has all of the major pieces in place –

- A strong co-operative culture
- Flexible farming systems which can remain competitive in a volatile environment
- Farmers who rapidly adopt practical and effective solutions, then willingly share these with other farmers
- A single industry body to support farmers by research, development and extension and strong policy input.

The next generation

Jenny has also gained a lot of satisfaction from encouraging the next generation of scientists. She believes there is some real talent coming through and the dairy industry is putting a lot of effort into attracting the next generation of people.

This is not just in science, but in all parts from on-farm to support such as consultants and rural professionals. Appropriate cows and good management of feed are important components of a successful dairy system, but the value of skilled people is only just being fully understood and quantified.

Current work

A few months ago Jenny joined the strategy and investment team at DairyNZ. She considers it a privilege to be working and interacting with some of the most respected and critical thinkers in the industry. Until this role she had not fully appreciated the significant role of DairyNZ and the breadth of work the levy was supporting. The industry has set some challenging targets to achieve its vision of dairy farming working for everyone, but it relies on many organisations contributing and working together to achieve this aim.

Overall, she feels the dairy industry is unique and has an opportunity to be more understood and an even greater contributor to New Zealand society and economy. The challenges to achieving success are significant but history shows that New Zealand dairy farmers are adaptable, resilient and able to seize opportunities. She believes we have to look outwards not inwards. Fragmentation is a risk, however, and not being able to see the bigger picture of global opportunities and competitiveness.