TECHNOLOGY USE BY TOP SHEEP AND BEEF FARMERS

HOW DO TOP WAIRARAPA SHEEP AND BEEF FARMERS USE TECHNOLOGY TO ACHIEVE BUSINESS EXCELLENCE?

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Contents

EXECUTIVE SUMMARY

Farming is increasing in complexity, as such technology is becoming more important in businesses to understand impacts on both financial and physical performance. Top farmers typically lead effective technology adoption, however, this is not always the case. Five Wairarapa farmers along with one Central North Island Farmer were interviewed to determine how and why technology is used in farm businesses, to be a top farmer.

Past research in this area has been minimal, particularly in the sheep and beef sector. The majority of the research has been conducted with Dairy industry funding. As such, little is really known about how and why top sheep and beef farmers use technology.

Budgeting technology was a key part of each farm business, and the only technology used by all six farmers. Farmax and Farm IQ were the two other technologies that were utilised in four of these farm businesses that were a key to their success.

Three important findings have emerged from this research. Firstly, top farmers are intrinsically successful. Technology just assists them in knowing their position to make informed decisions. Secondly, ground-truthing the results from technology with the farmers gut-feel and observations in the paddock is critical to effective decision making. Finally, technology provides some level of 'insurance' against events that may render the key decision maker unable to perform their duties for an extended period. Technology use is unique to individuals, but some themes emerge time after time, therefore, a greater understanding of these will lead to a more successful and resilient Sheep and Beef industry.

It is hoped this report will stimulate further discussion and investigation into technology use on farms by farmers and industry professionals alike.

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1 INTRODUCTION

Technology is an ever present buzz word in today's society. The rate of technology development in recent years has been staggering. Take the apple iPhone for example, the first generation was developed a mere 10 years ago, and now this device is a daily part of so many of our lives. We have more information at our fingertips than ever before, and the Agriculture Industry is no different.

In recent years there has been a significant increase in the number of technologies, tools, and applications (apps) appearing on the market, and the Agricultural Industry is no exception (Hammond, 2012). Technology use is well researched, however, this has not always been the case in the primary sector (Dooley, Hammond, Allen, & McLean, 2012), and specifically the sheep and beef industry. While it is apparent there are a number of technologies available, it is less clear which tools are predominantly used, why, and how the information generated supports farmer decision making.

Technology is becoming more important in Agricultural businesses, largely due to their growing complexity (Dooley, Hammond, Allen, & McLean, 2012). Successful farmers typically implement technology into their business and use it effectively to achieve higher financial returns than those who do not use technology (Dooley, Hammond, Allen, & McLean, 2012). However, there are some successful farmers who are able to perform to a high level with little technology integration in their businesses.

The purpose of this research is to understand how top sheep and beef farmers utilise technology to drive business excellence. It is anticipated that understanding this will enable more farmers to adopt these findings to create more resilient farm businesses into the future.

2 AIMS AND OBJECTIVES

This research seeks to answer the question:

> *"How does the use of technology drive excellence in sheep and beef farm businesses?"*

Initially, a multi-pronged approach to gathering data was proposed. This involved a survey of Wairarapa farmers across varying levels of business success, followed by interviews of two high performing farmers. However, given the number of surveys farmers receive, and perceived low response rates, the methodology was altered to exclude the survey and increase the number of interviews. This has improved the quality of the data. It has also allowed technology users and non-users to be interviewed.

One of the key objectives was to understand how top farmers use technologies. The author's initial hypothesis was that top farmers used technology, where lower performing farmers didn't use technology. However because lower performing farmers were not contacted this was re-shaped.

It is thought that technology will change the way we farm in New Zealand, especially looking to the future with more traceability and plant based protein alternatives being developed. Technology is expected to enable farmers to capture opportunities on their farms through knowing their position, and improve operating efficiencies. Understanding how top farmers are using technology will enable the Sheep and Beef industry to develop and implement such technologies and drive business excellence, working towards one of the Primary Growth Partnership's goal of doubling primary sector exports by 2025.

3 LITERATURE REVIEW

Technology is such a broad topic, therefore the scope has been narrowed to three specific agricultural technologies; Farmax, Farm IQ, and Cash Manager Rural for this literature review. Computers and the internet are also briefly covered to add context to the latter discussion.

Most of the literature pertaining to technology use in pastoral farming has been researched by industry groups, primarily funded by the dairy industry. One key group contributing to this research is One Farm, the Centre for Excellence in Farm Business Management. This is a joint venture between Lincoln and Massey Universities targeted at addressing critical knowledge gaps, specifically focused on the dairy industry. Material produced by One Farm is being researched by Massey and Lincoln University staff and students, however, in many cases it has not been peer reviewed and published in well regarded journals. Therefore there is an information gap in the literature on this topic.

3.1 COMPUTERS AND THE INTERNET

A web search of the timeline of computer history (Computer History Museum, 2017) reveals just how rapid the developments in technology have been. The first computer was built in 1941 by Konrad Zuse, it was later destroyed in 1943 during a bombing. The first home computers were released in the 1980s although they were cost prohibitive for most families and had limited functionality. In 1983 the internet was launched. Text messaging and commercial cellphone networks emerged in 1987. Apple released the first portable computer in 1989 for US $6,500. From 1990 onwards the rate of technology development and change has been most rapid, this began with the introduction of the "World Wide Web" in 1990. We now have technology that allows fingerprint security, watches that allow internet access and monitor health and exercise. We even have drones that are commonplace in today's world. The rate of technology development has been impressive with significant developments still to come. It is therefore no surprise that technology is becoming an ever present part of businesses.

3.2 SHEEP AND BEEF APPLICATIONS OF TECHNOLOGY

According to census data, internet usage in the Agriculture, Forestry and Fishing industry has increased by 14% between 2010 and 2016. (Statistics New Zealand, 2012,2016).

Adoption of technology follows a lifecycle (see Figure 1) with only a small portion of farmers falling into the innovators (2.5%) and early adopters (13.5%) categories. Tool use has increased for sheep and beef farmers between 2012 and 2014. Significant increases have been seen in the use of feed budgeting and financial budgeting technologies over this time (Corner-Thomas, et al., 2016). This may be partially due to an increase in the number of tools available in the industry. In a report published in 2011 there were 127 tools available for use by farmers and rural professionals (Allen & Wolfert, 2011). It is expected that the number of tools has grown significantly since 2011, however, there has not been a more recent stocktake of tools.

Figure 1: Technology adoption lifecycle (Russell, 2014)

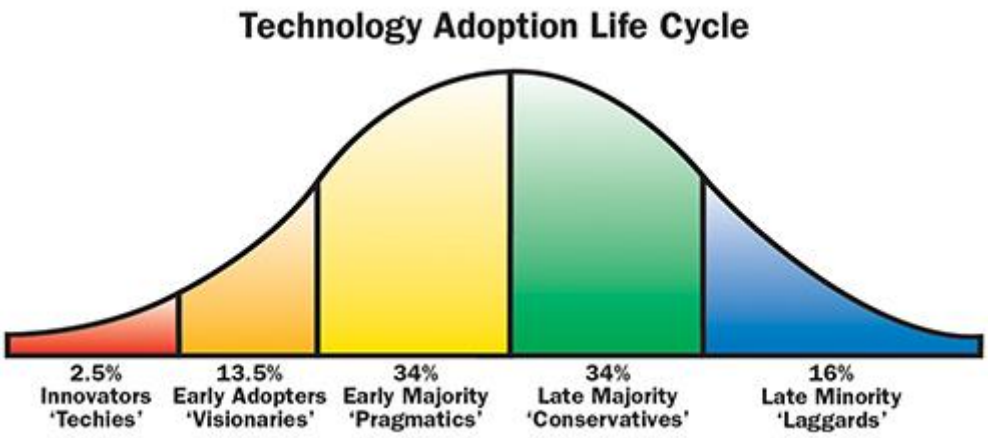
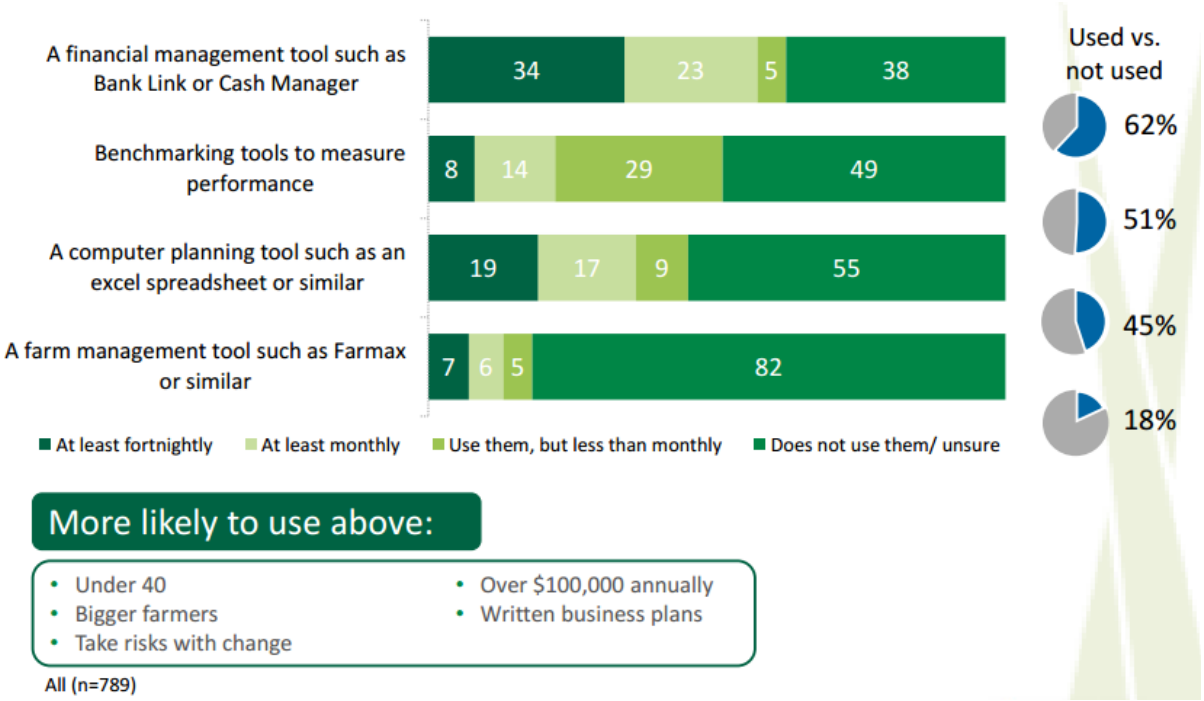


Figure 2 overleaf shows the use of digital and benchmark tools by 789 farmers who were involved in Red Meat Profit Partnership research. 57% of farmers used a financial budgeting tool such as Cash Manager at least monthly, while only 13% of farmers used Farmax over the same period (Red Meat Profit Partnership, 2015). Furthermore, 38% and 82% of farmers didn't use programmes such as Cash Manager or Farmax respectively at all. Therefore, technology is not widely used in the Sheep and Beef industry with a higher proportion of farmers not using more complex

technology to aid on-farm decision making. This is likely due to the aging population of sheep and beef farmers (Red Meat Profit Partnership, 2015).

Figure 2: Use of varying technologies in farm businesses (Red Meat Profit Partnership, 2015)



3.3 FARMAX

Farmax is a decision support tool for farmers. It was developed through intellectual property from AgResearch and was commercialised in 1993 (Farmax, 2017). It is a computer programme that is built around a number of algorithms that allows farmers and rural professionals to: create models of farming systems, make informed decisions around land use, and constantly re-forecast as actual data is entered (Farmax, 2017). No information could be found regarding the use of Farmax sheep and beef, however, Dooley *et al.* (2012) described the use by a Dairy Consultant. From the author's experience the use in sheep and beef and dairy systems is not significantly different.

Inputs into Farmax include feed production and feeding (pasture, nitrogen and supplements), stock numbers and production (liveweights) and stock movements and their timing (Dooley, Hammond, Allen, & McLean, 2012). Sheep and beef inputs also include mating, and shearing timing. Outputs of Farmax include production performance (pasture and feed production and animal production) and financial performance (gross margins and profit and loss) (Dooley, Hammond, Allen, &

McLean, 2012). A sound understanding of the farm system and their drivers is essential when setting up a Farmax model (Dooley, Hammond, Allen, & McLean, 2012).

Farmax can be used for operational, tactical or strategic planning decisions. Operationally a feed budget can be used for day-to day decisions, tactically, the application of Nitrogen, or sale and purchase of stock can be modelled, or strategic decisions can be made after modelling a range of management scenarios (Dooley, Hammond, Allen, & McLean, 2012). Accuracy of Farmax models improves over time as understanding and actual data increases. Key benefits of using Farmax are: better understanding of the farm system, monitoring and planning tool, neutral decision making, and a reporting tool (Dooley, Hammond, Allen, & McLean, 2012).

Over the past 10 years Farmax has helped improve on farm performance, with sheep and beef farmers utilising Farmax, performing 78% better than the industry average (Farmax, 2017).

3.4 FARM IQ

Farm IQ is a relatively new Agricultural technology. It was established in 2010 following funding from the Ministry for Primary Industry's Primary Growth Partnership. Farm IQ is an information hub and a secure record of on-farm activities (Farm IQ, 2017). A review of the literature found no instances where the use of the programme has been researched. Farm IQ is a hub of information based around actual data. This includes stock, paddock and forage information that allows you to compare and benchmark. Planning tools are integrated into the software, and recently health and safety and environment planning modules have also been added (Farm IQ, 2017).

3.5 CASH MANAGER

Cash Manager Rural is a financial budgeting tool used by farmers and rural professionals to support operational decision making. It is classified as a compliance/monitoring tool by Allen & Wolfert (2011). The programme was founded by three farmers in the Wairarapa in 1981 (Cash Manager, 2017). It was developed for the Agricultural industry. Like Farm IQ, no literature could be obtained that focused on the use of Cash Manager Rural.

4 METHODOLOGY

The purpose of this study is to determine how top farmers use technology to drive business excellence. A case study approach was selected to answer this question. This allows an in-depth understanding of what technologies the selected farmers used, why they selected those technologies, and how they were used. Multiple case studies were investigated, six in total. This meant that a wider understanding of the domain could be achieved, with comparisons and contrasts drawn (O'Leary, 2005).

4.1 CASE SELECTION

Case selection is the specification of criteria by which the case will be selected (see (O'Leary, 2005). In this instance Wairarapa farmers were selected because they are typically regarded in the industry to be forward thinking and engaged in new technologies. The Wairarapa also appealed as Baker Ag, an esteemed Agricultural consulting firm which operates in the area. A Baker Ag representative was contacted and the project was discussed. They then selected four farmers, two users of technology and two non-users of technology. The two non-users were selected because they are top farmers and both past Wairarapa Farmer of the Year winners. The two users were selected because they are 20+ years younger than the two non-users, equally competent farmers and high users of technology in their businesses. Further to this, the author selected another past Wairarapa Farmer of the Year winner who is of a similar age to the two non-technology users. This was done to reduce the age bias in the sample. Furthermore the author also interviewed a top Landcorp farm manager. This gave a corporate perspective to technology use, and further reduced the age bias as he is a similar age to the two non-users. Key attributes of the interviewees are summarised in Table 1 below.

Table 1: Summary of farmers and their businesses

	Farmer 1	Farmer 2	Farmer 3	Farmer 4	Farmer 5	Farmer 6
Approx. Age	50s	30s	50s	30s	50s	50s
Time on Farm/in industry	30+ years	10 years	30+ years	11 years	30 + years	30+ years
Status	Farm Owner	Farm Owner	Farm Owner	Farm Owner	Farm Owner	Farm Manager
Business Size	400ha plus shares in Dairy Operations	430ha	620ha	650ha	800ha plus	2,000ha
Technology user	Light user, non-user of Farmax and Farm IQ	Proficient user and regular user of Farmax and Farm IQ	Light user and non-user of Farmax and Farm IQ	Proficient user and regular user of Farmax and more recently Farm IQ	Moderate user, used both Farmax and Farm IQ with support from rural professionals	Proficient User. Uses both Farmax and Farm IQ well
Uses a Farm Consultant	Irregularly	Yes	Irregularly	For strategic decisions	Yes	Irregularly
Attends Industry Discussion Groups	Yes	Yes	Yes	Yes	Yes	Irregularly

4.2 DATA COLLECTION

Data was collected during semi-structured in depth interviews. Each participant was interviewed once with interviews lasting between 45 and 70 minutes. Some key questions were asked to each of the interviewees (see appendix A) with other questions used to probe for further detail, or to ensure there was no ambiguity between what the farmers said and the author understood. Given time constraints and conflicting schedules four participants were interviewed face-to-face. Farmer 3 and Farmer 4 were interviewed over the phone.

Interviews were taped with the permission of the participants. The author also took notes throughout the interviews. Once the interviews were completed the author reviewed the tapes against the notes taken and highlighted important quotes and themes using qualitative data analysis techniques as advocated by Dey (1993). Comparisons and contrasts were then drawn between the different participants and the existing literature.

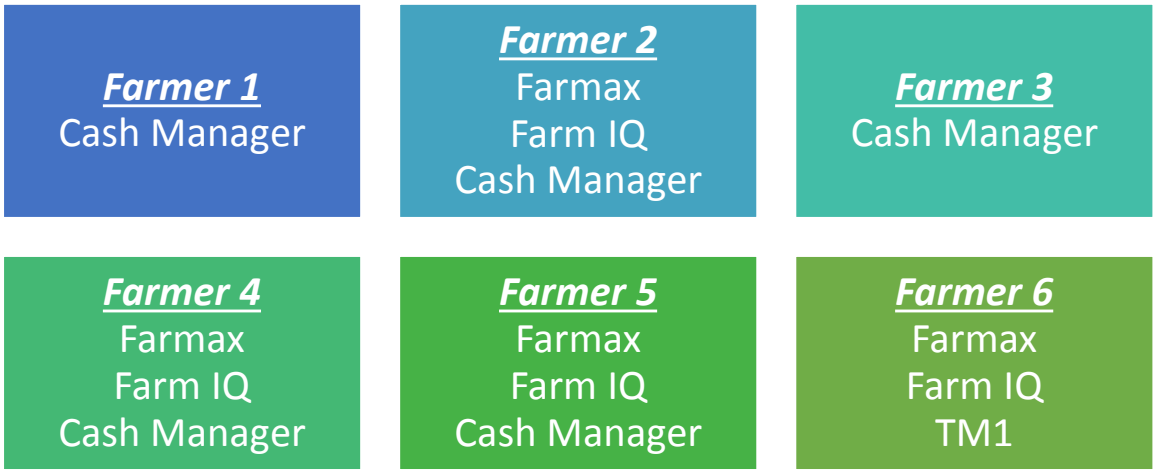
5 RESULTS

This section summarises the results of the six interviews. Key technologies used in each business are discussed, as well as how these are used, benefits and limitations in each case. Following this, the link between the technology and on-farm decision making is discussed. Finally the value of technology use in the farm business is highlighted.

5.1 SUMMARY OF TECHNOLOGIES USED

Technology use varies across farm businesses. For the purposes of this research farmers were selected because they were either high or light users of technology in their business. This section details the key technologies used in each business. Figure 3 below summarises the key technology used by each farmer. It should be noted there are a number of technologies used in each business such as Microsoft Excel, the internet, cell phones, Stock Care and others that have not been covered in depth. This is due to the scope of the project becoming too broad. Further research could be conducted to understand the use and benefits of these technologies.

Figure 3: Summary of key technologies used by each farmer



Farmer 1

Farmer 1 is a light technology user, and a non-user of Farmax and Farm IQ. He is a past Wairarapa Farmer Of The Year winner and a successful businessman with investments in Dairy Equity Partnerships. The key technology used in this farm business is Cash Manager. He also uses Microsoft Excel, the internet, rural professionals and past records of animal numbers and pasture covers. Technology use in this farming business can be summarised by the quote from Farmer 1 below.

"I use technology where I see value, I just have a simple system and know my farm well."

Farmer 2

Farmer 2 is a regular user of technology, and a regular user of both Farmax and Farm IQ. He is relatively new to farming but is extremely competent. As well as Farmax and Farm IQ, Farmer 2 uses Cash Manager, Stock Care, Track Map amongst other technologies. Technology is a big part of this farming business as outlined by the quotes from farmer 2 below.

"Technology is a way of leap-frogging time"

"The seasons have been so different, it's helped us plan and get through where we might have otherwise struggled"

Farmer 3

Farmer 3 is also a light user of technology and a non-user of Farmax and Farm IQ. Similarly, he is a past Wairarapa Farmer Of The Year winner. Cash Manager is used in his business but not by the farmer personally. Record keeping, weighing stock, and referring back to past records is a key part of this farmer's business. Farmer 3 runs a simple system and his thoughts around technology use are reflected in the quote below.

"I think farming is pretty simple, we complicate it, we get too technical"

Farmer 4

Farmer 4 is a proficient user of technology and a user of Farmax and Farm IQ. Farmax was used more regularly in his previous business as it was more complicated. It is still used but to a lesser extent in his current business. Farmer 4 regularly uses Cash Manager, Track Map and Ag Hub as well as other technologies.

Farmer 4 is developing his farm business through the use of technology demonstrated by the quotes below.

"If you don't embrace it [technology] you're going to miss opportunities"

"Technology is the only way forward, it's all there, stock recs, gross margins, it's easy to run scenarios and look at the profitability"

Farmer 5

Farmer 5 has integrated technology into his farm business. He uses both Farmax and Farm IQ, although he utilises consultants for the former. Farmer 4 also uses Cash Manager and weigh technology amongst others. Technology has been integrated into this farm business for some time now, such technologies enable the farmer to have his finger on the pulse demonstrated by the quotes below.

"I was one of the first guys to get a computer"

"You know exactly where you are with technology. Knowledge is power. It keeps you informed, and you're taking more interest in what you're doing"

"I'm an early adopter but need to be convinced it's worthwhile"

Farmer 6

Farmer 6 is a corporate farm manager and, as a result of Landcorp's commitment to technology, uses numerous programmes in his business. He does however see significant value in the technologies he uses. Farmer 6 uses both Farmax and Farm IQ, as well as TM1 (Landcorp's budgeting system) amongst others. Farmer 6 uses technology to drive business excellence as demonstrated by the quotes below.

"Technology is a big part of our business, it drives our profitability"

"If it wasn't for the programmes that we use we wouldn't be as successful. We just know our position"

5.2 USE OF FARMAX AND FARM IQ

This section describes the benefits and limitations of Farmax and Farm IQ use in the farm businesses. Only the farmers who use Farmax and Farm IQ were questioned in depth about the programmes. The farmers who do not use the programmes were also asked why they chose not to integrate these technologies into their businesses.

Farmax

Farmax has been available in the New Zealand Agricultural sector since 1993. It is widely used by rural professionals and specifically farm consultants. It is regarded as the key piece of technology for modelling and decision making.

BENEFITS

Three key benefits for using Farmax were highlighted by the farmers that were interviewed. Firstly, Farmax enabled the farmers to make decisions on-farm with confidence. Secondly, it enabled the farmers to understand their farm and business faster than would have otherwise been possible. Thirdly, farmers were able to forecast. Each of these benefits is described below.

In some cases Farmax was critical to on-farm decision making. This was made clearer when discussing making significant decisions such as; how to get through a drought, or a change in farm policy. As the farmers interviewed are high performing farmers with a goal to maximise the returns in their business, they used Farmax to reach a decision that would minimise the negative impact to their business. These thoughts are reflected in the quotes from Farmer 5 and Farmer 6 below.

Farmer 5: "I use Farmax to look at options, especially in a drought... [I] prioritise Capital stock and replacements, look at margins on trade stock"

Farmer 6: "When making a decision Farmax is the first tool we go for"

Farmer 6: "Since we changed the farm policy we live and die by what goes into the files. We are regularly looking at margins."

Farmax enabled the farmers to understand their farms faster than what may have otherwise been possible. As Farmax provides a picture of the business, scenarios can be run to see impacts on the farm and growth rates of pasture and stock. These sentiments are demonstrated in the quote below.

Farmer 2: "We got into Farmax because we were new to farming and new to the farm. We wanted to learn lots in a short period and get a handle on what we were growing".

Another key benefit of Farmax is the ability to forecast and identify pasture surpluses or deficits ahead of time. The farmers also recognised it was critical that the Farmax file aligned with their gut feel. The ability to forecast the farm's feed position, make early decisions and the relationship with the farmers gut feel is highlighted by the quotes below.

Farmer 5: "[I] use technology [Farmax] to predict further out than gut feel"

Farmer 4: "I need numbers around things to back up my gut feel" "otherwise you're going blind"

Farmer 4: "I'm a big believer in early decision making"

Farmer 6: "we don't have hard and fast decision rules. Levers are being pulled monthly"

LIMITATIONS

Although the farmers found Farmax a useful tool, and important in decision making, there are limitations to its use. Three key themes were described by the farmers that were interviewed. Firstly, it is only as good as the information you're putting into it. Secondly, it can be difficult to use. Thirdly, Farmax is more useful on finishing rather than breeding farms. These themes are expanded below.

The primary limitation that all farmers described is 'It's only as good as the information you're putting into it.' Farmax is a decision support tool that relies on the information being entered being correct to be effective. This is evident in the quotes from the farmers below.

Farmer 2: "It works well for us but I can see how people get in trouble because they don't think about the information going in"

Farmer 4: "as long as you've got good info going in its pretty accurate"

Farmer 5: "people get in trouble with it [Farmax] because they don't get the info going in right."

Farmer 6: "It's [Farmax] only as good as the information you put into it"

Another limitation to Farmax use is the complexity of the programme. This was described by some of the farmers, one of which used Farmax Lite. This is best demonstrated by the quote below from Farmer 5.

Farmer 5: "I used to do the Farmax file but I found I wasn't getting the best out of it. The consultant does it now, I'm getting much more value out of it."

Farmax was seen as more valuable on finishing farms than breeding farms. This was due to the more complex systems and the ability to predict kill flows. Finishing farms also tended to have more 'levers' that could be pulled to capture opportunities. Often the farmers on the breeding farms noted their systems were simple and Farmax didn't add significant value, thus was not being used as much.

Farmer 4: "When I was on the finishing farm I was using Farmax more, and being more efficient. I knew what was happening, my finger was on the pulse. I knew my growth rates, I knew I needed certain covers at times of the year."

Farmer 6: "When I moved to the breeding farm it wasn't as useful [as on the finishing farm]. We didn't get the same info so used it for 'putting out fires'. We didn't build a history of pasture growth rates and stock numbers"

FARM IQ

Farm IQ is a relatively new technology, becoming commercially available in 2010. It was developed with funding from the Primary Growth Partnership (PGP). The programme is primarily an information hub, with panning tools, health and safety and environment planning recent additions to the programme.

BENEFITS

As Farm IQ is a relatively new technology compared to Farmax the number of users and functionality of the programme are not as well understood. The benefits and limitations of the programme were not as clear, however, one key benefit to the programme was described by all four farmers. This was the mapping functionality. There were other benefits each farmer saw, however, these were individual preferences rather than clear themes.

Farm IQ is based around a map of the farm. Each farmer used this in a slightly different way, but all saw benefits in this function. Mapping was critical when Farmer 6 was undertaking a development programme on his farm by subdividing paddocks. Farmer 2 realised when setting up the map on Farm IQ that some of his paddock sizes were incorrect on his existing maps, and therefore understood why stock didn't last as long as he anticipated. Farmer 4 is relatively new to Farm IQ but is enjoying the mapping function and can see value in this in the future when subdividing the farm.

Farmer 6: "I get value from the mapping, fertiliser and regrassing records. When we were going through the change we mapped the new paddocks on Farm IQ then went out and marked the new fence lines"

Farmer 2: "The farm map is great, we use it lots and realised when we were setting the map up that some of our paddock areas were way out"

Farmer 4: "I'm really green with Farm IQ at this stage. I'm enjoying the map and there's a cool rotation planner"

Two other functions the farmers saw value in are the diary and pasture wedge, although these were not common across all farmers. Farmer 6 was the only farmer who used the pasture wedge. Farmer 2 and Farmer 6 noted the benefits of the calendar for simplifying audits by meat companies to achieve premiums.

Farmer 6: "We use the pasture wedge a lot, more so when we were getting started in the new system. Now the team have a handle on it we don't use it quite the same".

Farmer 2: "It's been handy when doing audits, it's saved a lot of time and paper"

LIMITATIONS

Farm IQ is a relatively new programme, therefore its key features are still being developed. One of the key limitations of the programme described by the farmers was the cost of it for the benefits received. One farmer has stopped using Farm IQ due to the cost of the software and the limited benefit he was getting from it, and

one other stated when their funding ran out they would only continue with the mapping function, supported by the quotes below.

Farmer 2 "We started using Farm IQ because we were funded as part of the RMPP"

Farmer 2: "we'll probably only continue with the mapping function when the funding (RMPP) stops"

Another limitation of the Farm IQ software is the ease of liveweight tracking of groups of animals. Farmers were mostly unaware of how to set up monitoring groups for liveweights, or how to easily access the data. Further training or focus on these areas could improve the benefits farmers see in this software.

5.3 BUDGETING TECHNOLOGIES

Across all of the farmers interviewed budgeting technology was also used. Farmers 1-5 all used Cash Manager, while Farmer 6 used TM1. Cash Manager is a budgeting programme that was founded by Farmers in the Wairarapa in 1981. It is the most widely used rural software programme in New Zealand. TM1 is an enterprise planning software that is typically used in large businesses. The key benefit of this programme is the ability to easily consolidate multiple business units to form complex reports. Landcorp uses this programme, as such Farmer 6 is a user.

Budgeting programmes were a key driver in all of the businesses with only Farmer 4 not completing his own budget. All farmers noted the importance of understanding their financial position to drive business excellence. All farmers adjusted budgets based on the decisions they were facing, such as droughts or opportunities.

Farmer 5: "I'm the only user of technology in the business, I'm too much of a control freak to let [my wife] play with the Cash Manager file"

Farmer 5: "When I first started I got into Cash Manager, I really like the programme."

5.4 WHY NOT USE MORE TECHNOLOGY?

Farmers 1 and 3 are light to non-users of technology, specifically Farmax and Farm IQ. They both run very successful farm businesses, reflected in being Wairarapa Farmer Of The Year winners. Both farmers credited their success to the amount of time spent on their farms, and their experience and intuition. Both farmers have investigated technologies but prefer simple systems and see their value is delivered in the paddock rather than in the office. One key to this success has been having some key decision rules, and sticking to them regardless of seasonal variations.

Farmer 1: "Most of what we do isn't difficult it's about timing"

Farmer 1: "... being ruthless about protecting capital stock...we have some key decision rules, for example Ewes need to be a 3 (Body Condition) on tupping"

Farmer 1: "Once a certain level of performance is reached it's easier to be ruthless with decision making"

Farmer 3: "In our situation with 75% sheep breeding it's [technology] not as much of an advantage. With my experience and the system we run I don't see lots of value in more technology"

Farmer 3: "when you're in front of the computer you're not necessarily getting it right out on-farm. I like to operate out in the paddock"

Farmer 3: "I keep an eye on rainfall compared to past years, if we're running slightly behind I look at covers and see how far behind are they? We use the cattle policy as a lever, it's flexible"

All farmers, but specifically Farmers 1 and 3 highlighted the importance of having good networks, and placed significant value on attending discussion groups.

Farmer 1: "The key to my success is having a good network..."

Farmer 3: "We align with experts to drive the business forward, we have the motivation and passion to bring ideas home and implement them."

5.5 LINK BETWEEN TECHNOLOGY AND WHAT HAPPENS ON FARM

Using technology is an important part of many farm businesses. However, as all of the farmers interviewed indicated, technology does not replace good on-farm

decision making. Each farmer has seen users of technology make mistakes by not 'ground-truthing' what was being reported. They stressed the importance of getting out on farm and see what was happening in the paddocks. If their gut feel matched the picture being displayed by the technology the farmers made decisions with confidence. If however, their gut feel didn't match the technology, they went back and reviewed the technology to ensure it and their gut were aligned. This is demonstrated by the quotes below.

Farmer 1: "there's no substitute for time spent on farm".

Farmer 2: "it's no good making a decision if it doesn't feel right. If it feels wrong it probably is so I go back and check the file".

Farmer 3: "when you're in front of the computer you're not necessarily getting it right out on-farm. I like to operate out in the paddock"

Farmer 4: "my gut matches the file by the time it's done."

Farmer 5: "there's a fine line between getting carried away with technology and ignoring the basics"

Farmer 6: "[I spend] time in the paddock to get Farmax and my gut feel aligned"

5.6 VALUE OF TECHNOLOGY IN THE BUSINESS

Unsurprisingly, the value each farmer placed on technology differed, and the value they received from each programme was different. Farmers 1 and 3 placed little value on technology, but saw benefits in budgeting. Farmers 2, 4, 5 & 6 credited some of their success to the effective use of technology. Farmer 4 placed the most value on Cash Manager. Farmax was the preferred technology by the remaining farmers (2, 5 & 6). Value derived from Farmax is described by farmer 5 & 6 in the quotes below.

Farmer 5: "The financial benefit of Farmax is huge, I couldn't put an exact dollar value on it, but knowing where you are allows you to make better decisions".

Farmer 6: "In a system like ours Farmax is at least as valuable as having a labour unit"

Technology also provides some 'insurance' in farm businesses if the key decision maker is unable to perform their role. In the businesses with clear Farmax files and plans the farmers did not see a significant risk to their business. In the other cases, family members had been part of the farm teams for some time, so were also confident their businesses would remain successful in these circumstances. As these farmers are all top operators and forward thinking they had thought about such possibilities. However, in other businesses it is the author's opinion that technology would assist someone coming in to understand the business faster, and therefore minimise the negative impact in such circumstances. Quotes from farmers 3 and 6 below reflect on how their businesses would operate if the key decision maker was unable to perform their role.

Farmer 3: "my son is here, he's been part of the way we operate for the past 11 years so I'd hope he would step up and take over. It wouldn't throw too much of a spanner in the works"

Farmer 6: "we have good support systems, probably the only programme one of my farm team couldn't use is TM1 but there's people in the business to help out with that. The team know what's coming up so it wouldn't impact the business too much."

5.7 TECHNOLOGY SELECTION AND TRAINING

Selecting and implementing technology is one thing in a business, but using it effectively can be quite different. Typically farmers adopt technologies on the advice of rural professionals such as consultants, or bank managers, or by talking to other farmers. When Farmer 2 started out he asked around to see what other top farmers were using, and how they found the programmes. Farmers were part of his local discussion group. He also asked a farm consultant what he would suggest. This sentiment was shared by the other farmers as well, they placed more value on word of mouth than advertising.

Effectively using these technologies has come about through training, both formal and informal, time spent using the programmes, and support from helpdesks. For each farmer they received some form of initial training on the technology, whether it be formally through the provider (Cash Manager, Farmax, Farm IQ or other), or through existing users, such as farm consultants, rural professionals, or farmers. In some instances farmers were self-taught through playing with the programme or

watching tutorials online. Formal training usually consisted of a 1-2 day course covering the basics. After this training was completed by using the programme and calling helpdesks when farmers encountered a problem. All farmers were satisfied with their ability to use the technology to achieve their goals. If they were looking into opportunities outside their normal use, they typically engaged a consultant. An example of this is Farmax modelling for a policy change or farm purchase. In these cases the consultants completed the modelling.

Farmer 1: "I'm pretty much self-taught. I call the help desk from time to time if I get really stuck"

Farmer 6: "I learnt how to use the tools by playing, and some training. Time spent on the tools makes a difference."

6 DISCUSSION

Technology is a key part of many farms in the Sheep and Beef industry. Successful farmers are effective regardless of technology use, however, technology is increasingly important with farming business growing in complexity. This sentiment is reflected in both the research completed by Dooley *et al.* (2012) and Farmer 4 with his quote *"[I] use technology [Farmax] to predict further out than gut feel".* Similarly, throughout this research it became apparent technology would enable another individual to pick up the farm business if the key decision maker on farm was for some reason unable to be on farm for an extended period. Therefore technology is an important part of each farm business investigated, although the importance varied in each farm.

Many farmers do not personally use the technologies as discussed by Dooley *et al.* (2012). This is also reflected by Farmer 5 having his Farmax file completed by his consultant. Similarly, Farmer 3 doesn't complete his Cash Manager. However, for the remaining programmes the farmers completed their own financial budgets, feed budgets, and records, which disputes the findings from Dooley *et al.* (2012). Therefore it is expected that top farmers drive business profitability effectively through having a good understanding of what is happening on-farm and matching that gut-feel with technology. Therefore enabling them to make effective decisions with confidence with the assistance of technology, in many cases Farmax.

Farmers who don't use technology have some key decision rules they stick to which enables them to achieve top performance regardless of seasonal variations. This has not been reflected in past research but is an important finding that probably separates top farmers from average and poor farmers. Understanding these decision rules further may help improve the performance of poorer farmers who do not use technology.

Each of the top farmers stressed the importance of ground-truthing results from technology, in particular Farmax. This corroborates the information presented by Dooley *et al.* (2012) who concluded that a less experienced user and poor data would reduce the effectiveness of Farmax. As such the success of top farmers is often a result of skilled use of technology and effective ground-truthing to ensure

the technology and gut feel are aligned. Without this key step in the decision making process, decisions would not be as effective.

7 CONCLUSION AND RECOMMENDATION

Successful farmers are motivated and at the forefront of the industry regardless of technology use. However, top farmers who do use technology are poised to lead the industry in an increasingly volatile global environment. Regulations around environment, water use and opportunities in marketing, eating quality of meat and niche markets globally, will place more importance on understanding farm businesses.

Farmer 2: "Technology is a way of leap-frogging time"

Farmer 5: "[I] use technology [Farmax] to predict further out than gut feel"

Farmers who use technology run more agile and dynamic businesses. They are able to capture opportunities that would otherwise be difficult. These businesses are also less dependent on the skill of the individual making the decisions. Farmers who don't use technology have some key hard and fast decision rules they stick to without fail. The success of these businesses is largely dependent on the individual decision maker and their skill. Technology is an increasingly important part of the Agriculture industry moving forward and implementation of key technologies such as Farmax, Farm IQ and Cash Manager will ensure a resilient Sheep and Beef industry into the future.

This research set out to understand what sets top farmers apart from average farmers, and how technology plays a part in this. To a certain degree this has been achieved, however, as with all research a number of questions have arisen along the way. One of the key pieces of missing information is peer reviewed literature on technology use in the Sheep and Beef industry. Farmer 4 eloquently sums up his thoughts around technology use with the quote below.

Farmer 4: "you've got to keep up with the times, if you don't embrace it [technology] you're going to miss opportunities. It just makes life simpler"

8 LIMITATIONS

There are a number of limitations to this research that should be kept in mind when assessing it. These relate to the sample size and selection, and the availability of literature in this area.

A sample size of six is not representative of the Wairarapa region, or the whole industry. Furthermore, concentrating the research to one geographical area (Wairarapa) also introduces some bias, reflected in the use of Cash Manager in all businesses. Initially four interviews were proposed, however, two more were added. The primary reason for this was to reduce age bias between users and non-users of technology. Farmer 6 was also selected to give a corporate farmers view of technology.

Finally, one of the biggest limitations to this research is the limited availability of published and peer reviewed articles. There is undoubtedly a wealth of literature pertaining to technology that was not reviewed. Exploring some more of this and looking into international research would have added value, and may have resulted in slightly different conclusions being drawn.

9 REFERENCES

Allen, J., & Wolfert, S. (2011). *Farming for the future: towards better information-based decision-making and communication.* Centre of Excellence in Farm Business Management.

Beef and Lamb NZ. (2017). *On Farm Data and Industry Production.*

Cash Manager. (2017, May 21). *About Cash Manager*. Retrieved from Cash Manager: http://www.crssoftware.co.nz/about/

Computer History Museum. (2017, April 29). *Timeline of Computer History*. Retrieved from Computer History Museum: http://www.computerhistory.org/timeline/

Corner-Thomas, R. A., Kenyon, P. R., Morris, S. T., Ridler, A. L., Hickson, R. E., Greer, A. W., Blair, H. T. (2016). THe use of farm-management tools by New Zealand sheeo farmers: changes with time. *New Zealand Society for Animal Production*, Vol 76:78-80.

Dey, I. (1993). *Qualitative Data Analysis.* London: Routledge.

Dooley, L., Hammond, H., Allen, J., & McLean, N. (2012). *The Use of Farm Tools by Rural Professionals and Farmers.* Centre of Excellence in Farm Business Management.

Farm IQ. (2017, April 29). *About the Farm IQ Programme*. Retrieved from Farm IQ: http://www.farmiq.co.nz/content/about-farmiq-programme

Farmax. (2017, April 29). *About Farmax*. Retrieved from Farmax: http://farmax.co.nz/news-and-resources/media-room/farmax-profiles/about-farmax/

Gray, D. I., Parker, W. J., Kemp, E. A., Kemp, P. D., Brookes, I. M., Horne, D., . . . Valentine, I. (2003). Feed Planning - alternative approaches used by farmers. *New Zealand Grassland Association*, Vol 65: 211-217.

Gray, D. I., Reid, J. I., Kemp, P. D., Kenyon, P. R., Morris, S. T., Brookes, I. M., . . . Horne, D. (2006). High sheep performance on hill country: Critical winter management decisions. *Agronomy NZ*, Vol 36: 12-23.

Hammond, H. (2012). *Stocktake of Farm Management Apps used by Farmers and Rural Professionals. Client Report for Dairy NZ.* Centre of Excellence in Farm Business Management, Massey University.

O'Leary, Z. (2005). *Researching Real-World Problems A Guide to Methods of Inquiry.* London: Sage Publications.

Red Meat Profit Partnership. (2015, December). *RMPP Research Summary Overview.* Retrieved from http://www.rmpp.co.nz/site_files/13089/upload_files/RMPPSegmentationResearchSummaryDec2015.pdf?dl=1

Russell, G. (2014, June 1). *Technology for Profit: How Farmers, Dealers Adopt New Technology*. Retrieved from Farm Equipment: https://www.farm-equipment.com/blogs/6/post/11481-technology-for-profit-how-farmers-dealers-adopt-new-technology

Statistics New Zealand. (2012,2016). *Business Operations Survey.* Statistics New Zealand.

10 APPENDICIES

10.1 INTERVIEW QUESTIONS

What is your background that has led you to you current farm business?	
What does your role on the farm look like on a daily, weekly, monthly basis?	
What technology do you use in your farming business?	
Why did you select those technologies?	
Who is the main user of technology in your business and why?	
Why don't you use *more/any* technology?	
How did you learn how to use these programmes?	
What benefits are there in using technology?	
How has technology driven your business' profitability?	