2022

Baseline of Digital Adoption in Primary Industries

Acknowledgements

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A word from the Chair

It is easy to fall back to stereotypes, generalisations and the general consensus about a narrative. Easy, but not helpful, when we want to support positive change. This report unpacks some of what underlies the stereotypes and current narrative about the adoption of digital technologies by New Zealand growers and farmers.

The agritech sector has two important roles as a contributor to growing the New Zealand economy. Growing and globalising in its own right, and, by having stronger and more innovative companies, supporting New Zealand's pastoral, arable and horticultural sectors to grow by taking on the amazing technologies being developed. But here is the rub - for the agritech sector to support the primary sector and gather the benefits from new technologies; new products and services must be presented in a way, at a time, through a channel and with the support that the customers need to be ready and able to adopt them. So how do we do this? We start by understanding how farmers and growers currently are approaching adopting digital technologies.

The research summarised in this report has opened up many insights, much more nuanced than those easy stereotypes about the adoption of technology. There are many reasons why a farmer or grower will seek out a technology to solve a problem they have identified, or why a farmer or grower will actively not adopt a technology that could make a task "easier". Each response to their situation is 'right for them'. If we believe our technologies are part of solving problems – for individual farmers or for the greater NZ Inc benefit - we owe it to our farmers and growers to understand their reasons and start the conversation there.

AgriTechNZ is proud to have built a resource, based on research, that enables us to start to understand those reasons. Please take the time to read this report and think about what it means from your perspective. We want to support our members, and the wider agritech sector, take action to accelerate the rate of technology adoption that supports growers and farmers meet the challenges ahead.

Bridgit Hawkins
Chair, AgriTechNZ

A word from the Chief Executive

The adoption of technology on farms and orchards is just one dynamic in an overall scheme of extensive changes in agricultural practice. These widespread changes are occurring at a critical point in the evolution of agriculture with increasing food demand, economic and environmental sustainability, and our response to the climate crisis. These issues are inextricably linked and technology solutions are the vital answer for improved food and fibre production.

The utilisation of tech by New Zealand growers and producers is strong compared to many other farming regions. This is largely due to the close affinity, developed over many decades, between innovators and their farming customers in New Zealand. However, the general observation that adoption of technologies in agriculture occurs at a slower rate than in other industries is also true in New Zealand.

At AgriTech New Zealand our premise is that technology innovation is the enabler of profitable, sustainable, and inclusive production systems. It is also a much-needed source of high value jobs and global impact, beyond food and fibre exports.

The adoption of technologies in agriculture also needs to be considered in the context of practice change and not just the acquisition of new tools. For example, a change in practice from 'a response to farming conditions based on a management prescription of learned experience' to 'a system of digital data capture, granular management prescriptions and tight operational control'.

This represents a paradigm shift in the approach to farm operations and is a key factor in the adoption of technology.

Farming practices are continually evolving. One of New Zealand agriculture's distinctive features is its ability to adapt. Farmers build on their experience to refine their livestock and crop management. They are also responding to continual changes in natural conditions and resource availability. Market development also presents challenges and opportunities which require astute farmer response. Inherently, New Zealand producers and growers are pragmatic and capable of change where the right value and conditions exist.

This report was born from the belief that the best progress can be made when progress is measured. The result is what you will read here, a quantified and qualified analysis into the drivers, barriers and realities of digital adoption across primary industries. However, this baseline is also only the start! In time, we will complete an economic impact study on future change. We know there will be significant economic uplift when farming and growing operations have unconstrained access to the best technologies and support. The baseline will then form the basis of longitudinal studies as we track progress over time.

Our increased knowledge exposes the breadth of our misconceptions. Please read this report and consider your perspective and how you can positively contribute to the ongoing discussion. We aim to support the discussions, decisions and interventions that will enable growers and farmers thrive as they face the challenges and opportunities in the seasons ahead.

Brendan O'Connell
Chief Executive, AgriTech New Zealand

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Executive summary

Digital agriculture represents a significant opportunity to enhance New Zealand's primary industries, including economic, environmental, and social outcomes. This report creates a baseline of digital adoption across the primary sector to better understand the motivations, pressures and barriers faced by farmers and growers in adopting new tools. The research is designed to provide actionable insight for agritech businesses, industry groups and public agencies who seek to unleash the potential of digital agriculture and develop strategies to support farmers and growers.

This report is but a summary of the data collected. There is a deep richness in the findings and we strongly suggest you take the time to read the report and think about what it means from your perspective. Key insights:

Attitudes to digital adoption

- 59% of the surveyed population lean towards the adoption of digital technologies but for very different reasons and with different pathways to participation depending on the mix of motivations, pressures, and barriers.

- 41% sided with not seeing much value in using digital technology to run their business. This is a high proportion, though not unexpected considering knowledge levels are low, and the value of data sharing is still to be unlocked.

- Whilst there is a healthy population of trailblazers across all sub-sectors and age groups, on the whole, the willingness to adopt early is lower than outside the primary sector.

- Proudly traditionalist farmers and growers are reluctant to change what has worked for their land for many years. They may accept technology in the office or will tap into the expertise of contractors for specific jobs, the key though is that someone else is doing it.

Attitudes to data sharing

- 64% of farmers and growers have confidence in the custodians of their data.

- 77% are happy to share data where the data provides direct benefits to them. This is a seemingly positive result but is balanced by data that shows only half of farmers and growers are data sharing.

- The biggest barriers to data sharing revealed by the survey included that farmers and growers did not believe their data would have value to anyone else. There is a low recognition of the value in the data held on farm and a difficulty in unlocking the value of shared data. There is also a lack of clarity around who would want the information and why. This is what can lead to confusion, mistrust and fear. Confidence comes from knowing who is using it and for what.

Current use of digital technology

- Adoption is highest in business management (e.g., accounts, payroll and health & safety solutions). This may be the entry point for digital technology on farms, with many tools having been around for a long time and de-risked. It is also the case that these tools are supported by and advisor or accountant and that not all their functionality is realised.

- Across the primary sector, the lower adoption areas are water/irrigation management, plant/crop management and effluent management. However, those with a higher need for precision in these areas are showing higher adoption rates.

- Operational areas with lower current adoption levels are also the areas with lower intended investment levels over the next two years. Tracking this data over future survey points will provide valuable insights into how technology spend plans change with land use changes, policy changes and as the agritech market develops.

About the survey

This report was created as part of a study by AgriTechNZ and insights partner Research First. It was co-designed with our industry partners Zespri, The Foundation of Arable Research, The Fertiliser Association of New Zealand and DairyNZ. It was also supported by the New Zealand Ministry for Primary Industries as part of the Sustainable Food and Fibre Futures initiative (SFFF).

The goal of the research was to gain insight into digital adoption within the agriculture industry by:

- Using a multi-method approach combining a large scale survey, indepth interviews and focus groups

- Engaging 1000+ farmers and growers

- Utilising a pan-sector approach, representative of agriculture production.

For this report 'digital technology' is defined as electronic or computerised tools, automatic systems or devices that generate, store or process data. Some examples on the farm include software to monitor fertiliser use, automation, GPS, moisture or temperature sensors and NAIT RFID tags.

Digital confidence

- There is space to increase levels of confidence amongst farmers and growers. However, the number of farmers/growers who expressed attraction to technology was higher than the number who expressed low confidence.
- Knowledge levels of what technology is available are low with only 24% of farmers/growers rating their knowledge as good/excellent.
- Analysis by primary activity type shows confidence levels are higher in Arable, Horticulture and Dairy, and lowest amongst Beef farmers.

Connectivity

- How growers and farmers perceive their local connectivity is important as it can influence decision making when it comes to digital adoption.
- However, it insufficient to say connectivity alone explains the digital adoption journey.
- The survey showed that ratings of internet connectivity on farm alone was not a significant differentiator to adoption in any of the population segments.
- It is important to note that for the full potential of digital agriculture to be realised, the connectivity discussion needs to shift from % of population connected to % of land connected.

Key drivers and barriers of technology

- When asked to rate the significance of a number of drivers (reasons) in relation to adoption the top three across the sectors were:
    - Efficiency
    - Ease of use
    - Compliance and regulation
- There was a relative lack of significance placed on evidence from other farms or opportunities to 'try before you buy'. The research highlights that placing emphasis on proving efficiency gains and integration with existing systems would have better adoption impact.

The key barriers to technology uptake are:

- Cost
- Reluctance to move from a manual/written system that works
- Proof of ROI

Population segments

An important part of this report is the analysis of farmer and grower population segments based on a combination of: intent to adopt, external pressures and barriers to adoption. We identify six population segments that will need different types and levels of support to realise the benefits of digital agriculture. Segmenting the data in this way enables us to to better understand the pathways for digital participation for farms/orchards.

- Trailblazers: this segment are more likely to be early adopters across operational areas and respond proactively to external pressures.
- Persuadable: this group are reasonably motivated to adopt and perceive less barriers than others. They would respond to effective communication.
- Pragmatists: this group are somewhat open to adoption but require clarity on both the benefits and regulatory expectations.
- Pressured: this group are reluctant but recognise the need to change or use appropriate tools. For them, systems need to be easy to integrate and easy to use.
- Conservatives: perceive higher barriers to adopt and that technology may be for larger businesses. Easy access support during set up and early-stage usage may also increase confidence.
- Traditionalists: more disengaged, low appetite for change, tend to be happy with the way they have always done things or are committed to traditional farming methods.

Segment make-up by sector

	Dairy	Sheep	Beef	Sheep & beef	Arable	Horticulture	Other
Traditionalist	16%	12%	34%	12%	3%	14%	9%
Conservative	20%	11%	32%	14%	3%	14%	7%
Pressured	34%	12%	21%	13%	4%	11%	5%
Pragmatist	23%	16%	26%	12%	3%	14%	7%
Persuadable	28%	10%	20%	14%	11%	13%	5%
Trailblazer	34%	6%	10%	12%	24%	10%	4%
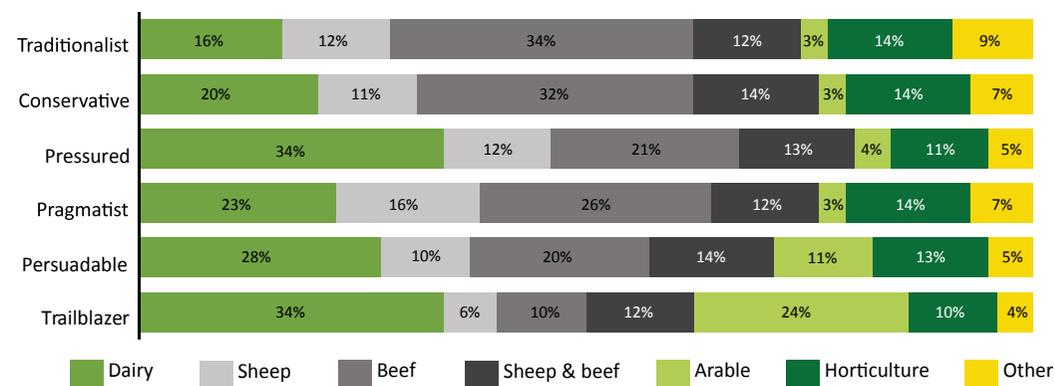
Busted myths

The survey brings new insight to a few viewpoints that are often accepted as true in current times but are misconceptions.

▍ *Not a normal distribution*

- Thinking of technology adoption in the sector as a normal distribution or 'bell curve' does a disservice to the individuals in different population segments. There is a fat tail to the population distribution. In this report, we identify population segments that will need different types and levels of support to realise the benefits of digital agriculture.

▍ *It's about farm stage not farmer age*

- A farm's stage in its lifecycle has more relevance to adoption than farmer age. Farmers and growers of all ages are adopting technology and, whilst there is a drop off in older age groups, the stage of a farm's lifecycle (expanding/growth, stable/mature, declining/exiting) has more influence on adoption decisions.

▍ *Bad experience not a deal breaker*

- 'Previous bad experiences with technology' was identified as the least significant of the barriers to adoption tested. Feedback from farmers and growers showed that solutions are often perceived to be poorly designed and difficult to implement. The fact that this may not put people off in the future indicates a willingness to adopt that is often mischaracterised.

▍ *Farmers are not only looking over the fence for proof*

- There was a relative lack of significance placed on evidence from other farms or opportunities to 'try before you buy'. The research highlights that placing emphasis on proving efficiency gains and integration with existing systems would have better adoption impact.

▍ *Connectivity is not a release pin*

- The survey showed that ratings of internet connectivity on farm alone was not a significant differentiator to adoption in any of the population segments. Connectivity remains an issue and to realise the full potential of digital agriculture the focus should shift from % population connected to % land (productive /catchment areas). However, it insufficient to say connectivity alone explains the digital adoption journey.

About AgriTechNZ

AgriTechNZ is a membership funded organisation with some of the most innovative New Zealand businesses as Members, all sharing a passion for the opportunities that agricultural technologies can generate — for their businesses, the country and the wider global market.

As well as the Members, AgriTechNZ also connects, promotes and advances the agritech ecosystem for innovators, investors, regulators, researchers and other interested stakeholders in New Zealand.

The opportunities for New Zealand created technology domestically and internationally are vast, and supporting that activity is a key focus.

If you are a business in the agriculture sector and interested in becoming a Member of AgriTechNZ please get in touch — **https://agritechnz.org.nz/join/**

Digital Adoption Today

Attitudes to digital technology and data sharing

Farmers and growers were asked to review pairs of statements and pick the one that best described their approach to managing their business.

The majority of farmers and growers prefer others to try new forms of digital technology before they invest. On the whole, willingness to be the forerunner is lower than outside the primary sector; 18% stated they were generally one of the first in their area to use new digital technologies, whereas 35% of business owners/managers surveyed said they would be one of the first amongst their colleagues. However, Arable farmers do show a higher propensity for fast uptake, aligning with the 35% outside of farming.

Two-fifths (41%) sided with not seeing much value in using digital technology to run their business. This is a high proportion, though not unexpected considering knowledge levels are low, and the value of data sharing is still to be unlocked. Over half of farmers and growers (55%) picked that it is difficult to work out what may or may not be beneficial for their business.

Looking across the sectors, Beef farmers were less likely to see value in digital technology, and Dairy and Arable more likely to see significant value for their operations. The contrast between the cattle farms is likely due to Dairy's needs for more routine digital data and therefore a heavier reliance on technology. The data also showed that a farm's stage in its lifecycle has an impact on perceptions; those in the expanding/growth stage are more likely to see value.

All farmers and growers

Statement (left)	Left %	Right %	Statement (right)
I prefer to let others try new forms of digital technology before I invest in it	82%	18%	I am generally one of the first farmers/growers in my area to use new digital technologies
I don't see much value in using digital technology to run my business	41%	59%	I believe the digital technology currently available adds significant value to my operations
I know where to get reliable and impartial information about digital technologies	45%	55%	It is difficult to work out what may or may not be beneficial for my business
I only share my on-farm data with others when I am legislated or otherwise required to do so	50%	50%	I share a range of my on-farm data with others
The risks of data sharing out-weigh the benefits	24%	77%	I am happy to share my data when it provides direct benefits to me
I worry about who has access to my on-farm data	36%	64%	I believe who holds my on-farm data and how it is shared is closely controlled

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
I prefer to let others try new forms of digital technology before I invest in it	82%	83%	79%	87%	87%	65%	79%
I am generally one of the first farmers/growers in my area to use new digital technologies	18%	17%	21%	13%	13%	35%	21%

Across the sector there is a wide range of attitudes. Those that are the forerunners describe themselves as technology savvy and innovative and are happy to trial and lead the way for others. Others see themselves as rationalists and will cite operations they believe have gone under due to overinvestment in technology. Another segment is interested but need the forerunners to de-risk the decision, they have a heightened awareness of issues with a lack of local suppliers and/or poor connectivity and need a clear business case for what anything new will bring to the business in terms of practical gains. Proudly traditionalist farmers and growers are reluctant to change what has worked for their land for many years. They may accept technology in the office or will tap into the expertise of contractors for specific jobs, the key though is that someone else is doing it.

Age has some bearing, but it does not define attitudes to digital technology or data sharing. With the average age on family farms trending up and succession planning becoming less certain, understanding the decision-making process of this group is important. Older farmers and growers tend to have a strong connection to their land, embedded experience and an established pattern of working. Where digital technology is seen as a lever to push more intensive production it is viewed negatively. For these farmers and growers, it is not about mass production for pure profit but rather it is their lifestyle as well as their business and they are proud to be guardians of the land, of their history and experience. Decision making is pragmatic, and they tend to be clear about the benefits they expect to see from anything new on farm:

- Saving time and costs, particularly with labour shortages;
- Preventing excessive use of water, sprays, fertilisers etc;
- Saving effort, especially as farmers/growers grow older;
- Improving the bottom line.

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
I don't see much value in using digital technology to run my business	41%	30%	45%	58%	52%	25%	33%
I believe the digital technology currently available adds significant value to my operations	59%	70%	55%	43%	48%	75%	67%

"I've been farming for a long time now and don't need a computer to tell me if a cow is overweight or underweight."

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
I worry about who has access to my on-farm data	36%	38%	38%	41%	36%	32%	25%
I believe who holds my on-farm data and how it is shared is closely controlled	64%	62%	62%	59%	64%	68%	75%

"It's all good unti it's not good"

AgriTech
NEW ZEALAND

There was a 50:50 split in relation to perceptions of data sharing. Beef farmers were more likely to require legislation to data share but there were no real other differences by primary activity type. This split is interesting when aligned with the fact that only 24% thought that the risks of data sharing outweighed the benefits; 77% were happy to share where the data provides direct benefits to them. This is a seemingly positive result but contradicts the data that shows only half of farmers and growers are data sharing.

The biggest barriers to data sharing revealed by the survey included privacy concerns but also identified that people felt they did not need to, just did not want to, or that they did not believe that their data would have value to anyone else. There is a low recognition of the value in the data held on farm and a difficulty in unlocking the value of shared data.

There is also a lack of clarity around who would want the information and why. This is what can lead to confusion, mistrust and fear. Confidence comes from knowing who is using it and for what.

Farmers' understanding of, experience with, and attitudes towards data sharing, data security, and data privacy varies widely. Compared with business perceptions, the results are interesting: 36% of farmers and growers indicated they worried about who has access to on-farm data, compared with 64% believing access is closely controlled. Business owners/managers outside the primary sector were more likely to be concerned: 48% of business owner/managers surveyed were worried about who has access to their business data, compared with 52% who felt it was closely controlled.

Farmers and growers who are very concerned for data security include both those who have high-tech capacity and understanding, and those who have limited understanding but fear the unknown risk.

Those more comfortable with sharing their data include incorporated farms where data is generally in the public domain through reports to shareholders. These farmers and growers feel they have nothing to hide and if sharing their data helps them achieve their goals then they are comfortable with doing that – so long as it is easy to do. The key to their positive attitude is that the data sharing is "helping me achieve my goals" and is for the greater good of the whole sector. They do not fear competition, they are motivated to share their data because it helps their businesses and everyone else.

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
I know where to get reliable and impartial information about digital technologies	45%	46%	49%	46%	37%	46%	43%
It is difficult to work out what may or may not be beneficial for my business	55%	54%	51%	54%	63%	54%	57%

> "Our biggest problem is that data is being used to try and beat the land user up".

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
I only share my on-farm data with others when I am legislated or otherwise required to do so	50%	45%	52%	62%	48%	53%	41%
I share a range of my on-farm data with others	50%	55%	48%	38%	52%	47%	59%

> "If the freezing works know lamb weights are up around the region, we will get lower prices for them".

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
The risks of data sharing out-weigh the benefits	24%	23%	30%	26%	19%	23%	24%
I am happy to share my data when it provides direct benefits to me	77%	77%	70%	74%	81%	77%	76%

Current digital technology use by operational area

Our ongoing research in this sector shows that terminology is a problem area - what is defined as agritech and what constitutes data sharing differs between farmers and growers so measures of adoption can be complicated.

Survey participants were therefore read a statement defining digital technology to help minimise the risks of different interpretations in the data:

> **By digital technology we mean electronic or computerised tools, automatic systems or devices that generate, store or process data. Some examples on the farm include software to monitor fertiliser use, automation, GPS, moisture or temperature sensors and NAIT RFID tags.**

Across the primary sector as a whole, the lower adoption areas are water/irrigation management, plant/crop management and effluent management. However, those with a higher need for precision in these areas are showing higher adoption rates.

Arable farmers have significantly higher adoption levels for fertiliser/nutrient management, water/irrigation management and plant/crop management. Dairy farmers have significantly higher adoption rates for fertiliser/nutrient management, plant/crop management, effluent management and for animal management (and milking).

Looking across operational areas, adoption is highest in business management (e.g., HR, accounts and health and safety) with computers and cellphones requiring a relatively low level of investment and providing access to tools such as Xero, Farm Focus, Cash Manager and internet banking. Rates of adoption are significantly lower in the Beef sector when comparing across primary activity types. Business management may be the entry point for digital technology on farms, with many tools having been around for a long time and de-risked. It is also the case that these tools are supported by an advisor or accountant and that not all their functionality is realised.

In which areas are you currently making use of digital technologies?
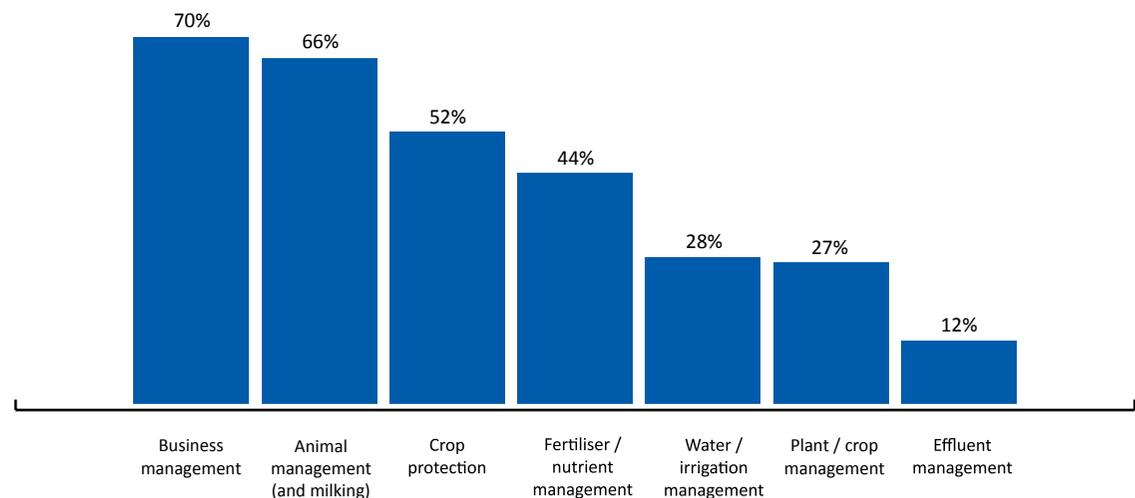
	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
Business management	70%	74%	69%	60%	68%	72%	79%
Animal management (and milking)	66%	80%	62%	71%	72%	48%	25%
Crop protection	52%	*	*	*	*	58%	49%
Fertiliser / nutrient management	44%	54%	47%	28%	43%	75%	41%
Water / irrigation management	28%	29%	26%	8%	15%	61%	49%
Plant / crop management	27%	40%	17%	9%	18%	72%	*
Effluent management	12%	27%	0%	1%	2%	*	*

Excludes 'not applicable' responses. Not all operational areas asked of all farm types.

Intention to adopt new technology

Operational areas with lower current adoption levels are also the areas with lower intended investment levels over the next two years.

Tracking this data over future survey points will provide valuable insights into how technology spend plans change with land use changes, policy changes and as the agritech market develops.

Firm plans to invest in digital technologies or invest in further digital technologies in the next two years.

	36%	35%	34%	34%	21%	22%	13%
	Business management	Animal management (and milking)	Crop protection	Fertiliser / nutrient management	Water / irrigation management	Plant / crop management	Effluent management

Firm plans to invest in digital technologies or invest in further digital technologies in the next two years — by sector

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
Business management	36%	30%	36%	34%	48%	45%	41%
Animal management (and milking)	35%	43%	35%	36%	47%	30%	13%
Crop protection	34%	*	*	*	*	47%	27%
Fertiliser / nutrient management	34%	36%	33%	28%	43%	59%	29%
Water / irrigation management	21%	21%	18%	11%	19%	43%	37%
Plant / crop management	22%	22%	21%	13%	21%	60%	*
Effluent management	13%	28%	1%	5%	7%	*	*

Excludes 'don't know' responses. Not all operational areas asked of all farm types.

Digital confidence

Along with perception, confidence levels in digital technologies also need to be considered. As the report shows, 36% of growers and farmers feel confident using new digital technology tools and 59% saw significant value in digital technology. Confidence and understanding the value are two separate issues and can be connected to knowledge and previous experiences with other digital technologies. Comparisons with the results from a survey of business owner/managers outside the primary sector also show a significant gap between confidence levels[3]:

- 36% of farmers and growers said they feel confident using new digital technology tools; 77% of business owner/managers outside the primary sector said they felt confident.
- 24% of farmers and growers think they can problem solve digital devices; 78% of business owner/managers outside the primary sector said they can problem solve.
- 46% of farmers and growers like using digital technology in their business; 78% of business owner/managers outside the primary sector are positive about use.

Analysis by primary activity type shows confidence levels are higher in Arable, Horticulture and Dairy, and lowest amongst Beef farmers.

The data around knowledge levels of what digital technologies are available for use in the primary sector, highlight another area for improvement. Only a quarter of farmers and growers (24%) rated their knowledge as 'good' or 'excellent'. However, a large proportion giving an 'average' (43%) rather than 'poor' or 'very poor' rating (33%) is promising. Analysis by primary activity type shows knowledge levels are higher in Arable and Dairy, and, lowest amongst Beef farmers.

[3] The business survey is based on a random sample of 132 respondents who own or manage a business in New Zealand. This sample has a maximum error margin of +/-8.5% at the 95% confidence level. Z-tests performed on the data confirm the statistical significance of differences.

How far do you agree or disagree with the following statements? — overall

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I feel confident using new digital technology tools	16%	23%	25%	26%	10%
When I come across problems with digital devices, I think I can solve them	25%	30%	20%	19%	5%
I like using digital technology in my business	13%	13%	28%	27%	19%
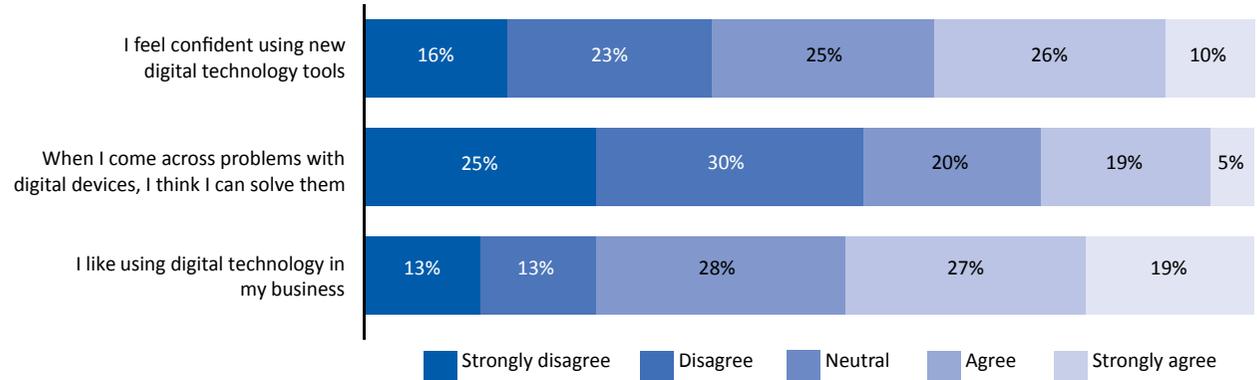
Total that agree with the following statements — by sector

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
I feel confident using new digital technology tools	36%	37%	34%	28%	29%	56%	41%
When I come across problems with digital devices, I think I can solve them	24%	22%	23%	22%	18%	36%	32%
I like using digital technology in my business	46%	51%	36%	34%	43%	64%	56%

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How would you rate your level of knowledge of what digital technologies are available
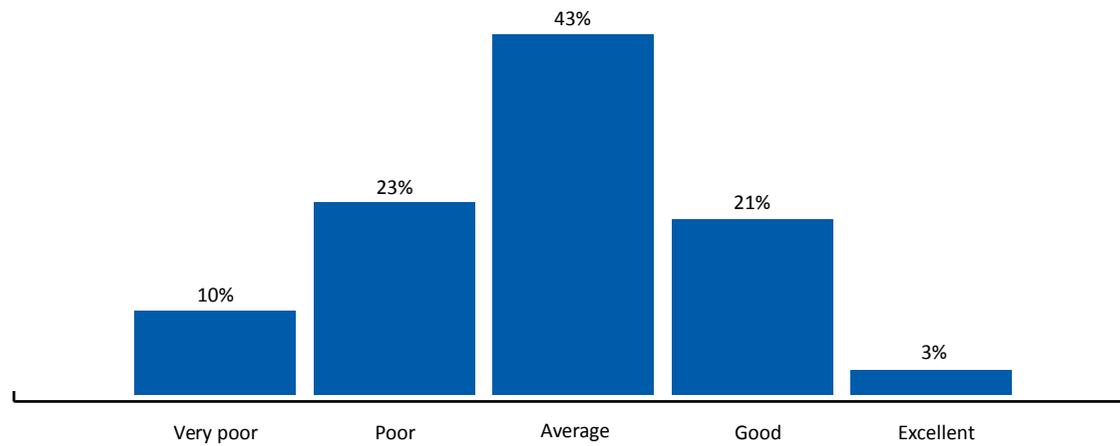
Bar chart values: Very poor 10%, Poor 23%, Average 43%, Good 21%, Excellent 3%

Overall grower and farmer perceptions of the internet service /mobile coverage on farm/orchard — by connection type

	All farmers & growers	Dairy	Sheep	Beef	Sheep & beef	Arable	Horticulture
Very poor	10%	9%	9%	17%	8%	3%	7%
Poor	23%	16%	29%	28%	27%	14%	22%
Average	43%	45%	39%	40%	44%	42%	48%
Good	21%	28%	22%	12%	19%	36%	18%
Excellent	3%	3%	2%	4%	2%	5%	5%
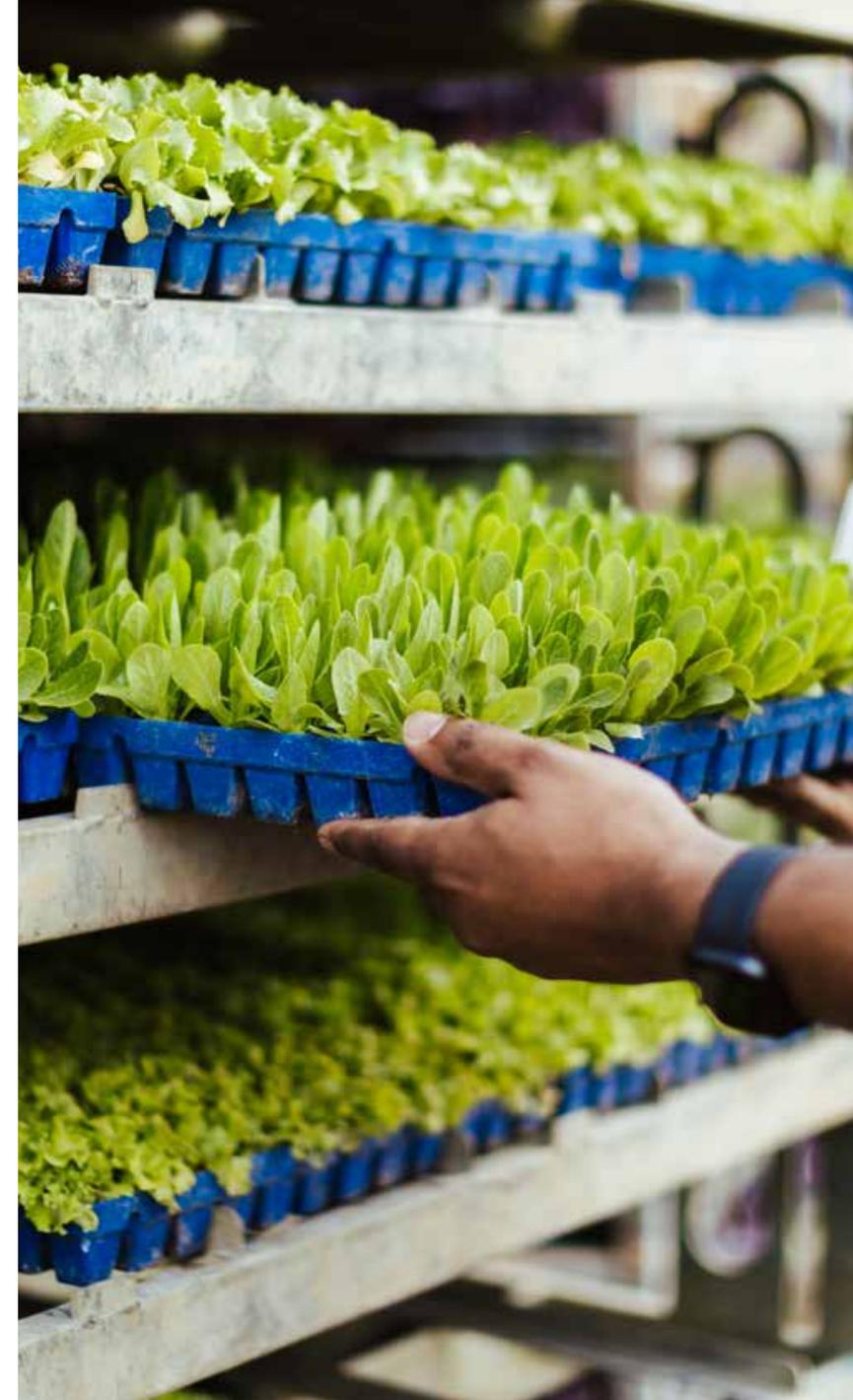
Internet connectivity

The majority of new agricultural technologies come with a digital component that generates, stores or processes data. That data is then sent to a cloud-based service or shared with other IoT technologies. All of this is reliant on having internet connectivity.

In New Zealand there are approximately 4.5 million internet users with internet penetration standing at 94% in January 2021.[1] This may not be reflected in the availability and quality of connectivity in rural farming regions around New Zealand or how that internet connectivity is perceived by farmers and growers themselves.

It is important to note that for the full potential of digital agriculture to be realised, the connectivity discussion needs to shift from % of population connected to % of land connected. This dimension was beyond the scope of this report and will be included in future surveys.

The top three internet connection types found on New Zealand farms and orchards are wireless broadband, copper line broadband and satellite broadband. Fibre represents just 3% of connections. The last available data from StatsNZ (June 2018[2]) put fibre at 32% of all broadband connections in NZ, a number that will have risen steeply in the subsequent years and provides a sharp contrast to availability on farm.

There are some variations by primary activity type. Beef farms are more likely to have no internet service while sheep farms have a lower reliance on copper broadband and higher reliance on wireless broadband.

[1] Statistics from datareportal.com
[2] https://www.stats.govt.nz/information-releases/internet-service-provider-survey-2018

Type of internet connection on your farm/orchard, overall
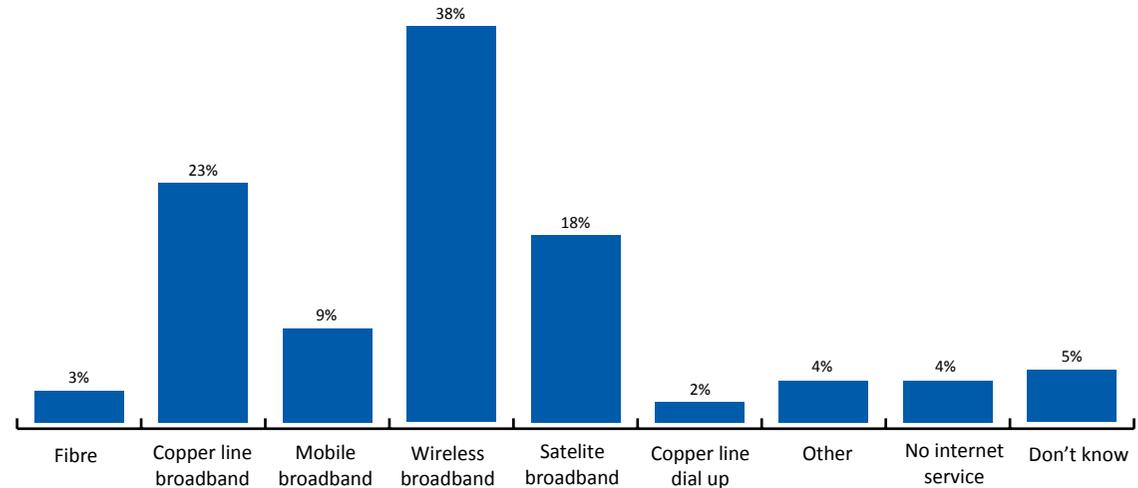
Type of internet connection, by sector

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
Fibre	3%	4%	3%	3%	6%	2%	3%
Copper line broadband	23%	25%	11%	21%	17%	24%	33%
Mobile broadband	9%	11%	5%	7%	7%	15%	10%
Wireless broadband	38%	42%	53%	33%	36%	45%	32%
Satellite broadband	18%	19%	21%	14%	30%	17%	10%
Copper line dial up	2%	2%	1%	3%	1%	3%	5%
Other	4%	4%	3%	5%	4%	3%	3%
No internet service	4%	3%	4%	9%	1%	0%	2%
Don't know	5%	2%	4%	9%	4%	5%	8%

While the proportions with no internet service are small, the services connecting farmers and growers do present some difficulties for digital adoption.

Wireless broadband works on radio frequencies so obstacles typically found on farms and orchards (trees, hills, large buildings) can distort connection.

Copper line broadband is fast but service is limited in some rural areas, so a barrier to access for some farmers and growers.

Satellite services do connect remote locations, but service levels have been characterised as patchy and slow.

Grower and farmer perceptions of internet service / mobile coverage on farm / orchard — overall
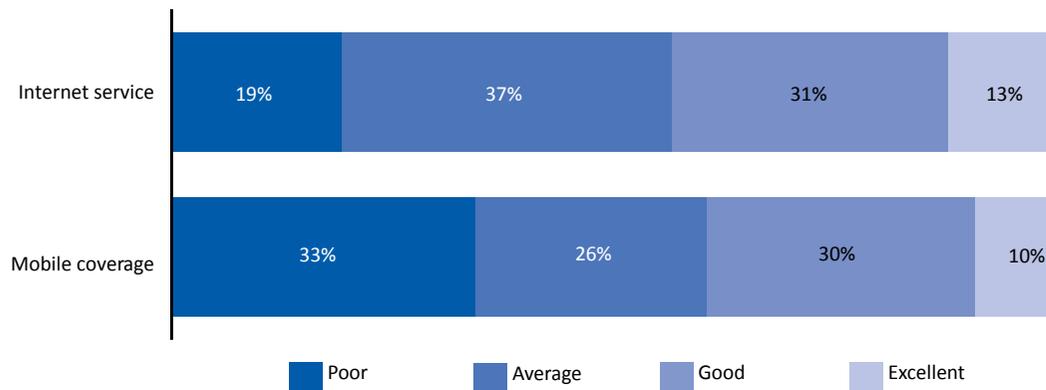
	Poor	Average	Good	Excellent
Internet service	19%	37%	31%	13%
Mobile coverage	33%	26%	30%	10%

Overall grower and farmer perceptions of the internet service / mobile coverage on farm / orchard — by connection type

	Fibre	Copper line broadband	Mobile broadband	Wireless broadband	Satellite broadband	Copper line dial up	Other	Total
Poor	3%	31%	21%	15%	14%	32%	26%	19%
Average	29%	42%	49%	34%	35%	36%	23%	37%
Good	44%	23%	23%	37%	34%	23%	23%	31%
Excellent	24%	4%	7%	14%	17%	9%	28%	13%
Sample size	34	226	90	383	176	22	39	896

Overall grower and farmer (negative) perceptions of internet service/mobile coverage on farm/orchard — by region

Results showed that over half of farmers and growers (56%) rated their internet service as poor or average (ranging from 41% in Gisborne to 70% in Southland) and 60% rated their mobile coverage as poor or average (ranging from 48% in Auckland and the Bay of Plenty to 68% in Manawatu-Wanganui and the West Coast).

How growers and farmers perceive their local connectivity is important as it can influence decision making when it comes to digital adoption – particularly those utilising cloud-based solutions. For this reason, improving internet coverage is critical to ensuring accessibility for everyone. It is also of value for technology suppliers to recognise a potential roadblock and consider technology design that features offline services or other solutions that can work within the limitations of unreliable internet connectivity.

NORTHLAND 56% 62%

AUCKLAND 55% 48%

BAY OF PLENTY 61% 48%

WAIKATO 51% 57%

GISBORNE 41% 41%

TARANAKI 52% 57%

HAWKE'S BAY 58% 54%

MANAWATU-WANGANUI 58% 68%

NELSON TASMAN 57% 60%

WELLINGTON-WAIRARAPA 56% 60%

MARLBOROUGH 67% 67%

WEST COAST 53% 68%

CANTERBURY 64% 64%

SOUTHLAND 70% 54%

OTAGO 43% 65%

Internet Mobile
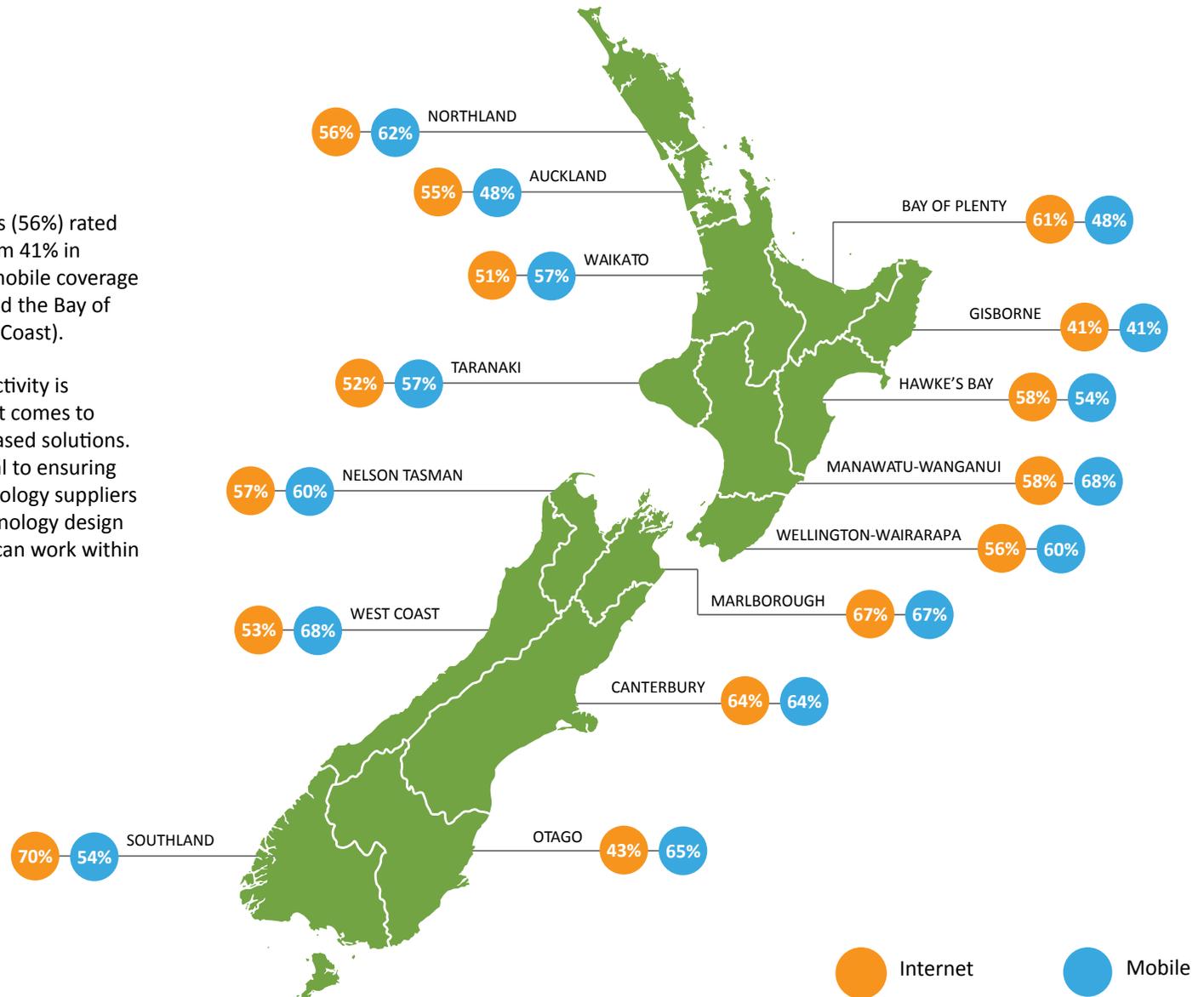
Key Drivers and Barriers to Adopting Technology

Ranking the significance of drivers in relation to most recent adoption

When asked to rate the significance of a number of drivers (reasons) in relation to adoption of the last piece of digital technology on farm, the top three across the sectors were:

- Efficiency
- Ease of use
- Compliance and regulation

How significant were the following drivers in prompting you to get your last piece of digital technology?

Driver	Not significant	Neutral	Significant
Potential to improve efficiency	14%	13%	73%
Ease of use	10%	17%	72%
Compliance and regulation requirements	26%	13%	61%
Potential to improve profit margins	30%	18%	52%
Ability to connect up with devices and systems you already have	28%	21%	51%
Availability of training and support	31%	21%	48%
Recommendation from someone you know	37%	19%	44%
Environmental sustainability outcomes	43%	20%	37%
Evidence of results from other farms	47%	19%	34%
Opportunity to try before committing	51%	17%	32%

■ Not significant   ■ Neutral   ■ Significant

Analysis by sub-sector shows Arable farmers were more likely than other activity types to note profit margins, interoperability, the availability of training and support and environmental sustainability as drivers that were significant in their decision making. There were few other differences between sub-sectors identified.

The lack of significance placed on evidence from other farms and opportunities for trials is valuable information for product sales and marketing strategies. Emphasis would best be placed on proving efficiency gains and showing that design meets needs.

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
Potential to improve efficiency	73%	78%	70%	67%	73%	72%	75%
Ease of use	72%	75%	67%	71%	65%	76%	78%
Compliance and regulation requirements	61%	62%	59%	63%	60%	60%	64%
Potential to improve profit margins	52%	54%	47%	44%	48%	76%	58%
Ability to connect up with devices & systems you already have	51%	54%	43%	47%	46%	67%	52%
Availability of training and support	48%	56%	35%	41%	48%	63%	57%
Recommendation from someone you know	44%	42%	55%	40%	36%	46%	51%
Environmental sustainability outcomes	37%	45%	30%	30%	28%	50%	40%
Evidence of results from other farms	34%	39%	43%	25%	34%	30%	32%
Opportunity to try before committing	32%	30%	34%	33%	28%	39%	35%

Proactive versus reactive adoption

There are many positive reasons to look at in proactive adoption of technology. These need to be promoted because practical and attitudinal hurdles can be high.

- Saves time and effort/makes jobs easier
- Reduces the number of people in the business – cowshed, orchard etc. - saving money
- Ambitions to grow and succeed – optimise production
- Curiosity – may adopt small measures as a "toe in the water"
- Want to make life simple/easier – more joined up processes
- Scope for reducing stress for livestock – animal welfare
- Scope for reducing stress around compliance – much easier to compile and send regulatory data
- Comfort – technology can keep you warm and dry when you can monitor systems at home on a wet night
- Legacy – investing in and improving the business for the next generation

Some farmers and growers are adopting technology ahead of their true inclination to do so. Increased compliance and reporting requirements have meant manual systems have become too time consuming. In cases where the farmer or grower have been 'talked into it by a consultant', levels of apprehension can be high and there is an increased risk that they do not understand the capacity of the solution or how to get the best use from it. While not necessarily creating a bad experience, this does not encourage further technology adoption.

"I can draft my cows from anywhere in the world, with just one worker in the shed".

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Ranking the barriers to technology

The key barriers to technology uptake are:

- Cost
- Reluctance to move from a manual/written system that works
- Proof of ROI
- Poor internet connectivity

'Previous bad experiences with technology' was the least significant of the barriers tested. Feedback from farmers and growers shows that solutions are often perceived to be poorly designed and difficult to implement. The fact that this may not put people off in the future indicates a willingness to adopt that is often mischaracterised.

Analysis by sub-sector identifies that cost is a more significant barrier for Dairy farmers, Sheep and Beef farmers are more likely to identify internet connectivity as a barrier (though they were no more likely to rate their internet service poorly when compared with the other subsectors), Arable farmers are less likely to be reluctant to move from manual/written systems and more likely to focus on the suitability of what is available and a lack of integration with existing tools. The main barrier for Horticulturists was the reluctance to move from manual/written systems that work on orchard.

How significant are the following barriers to technology uptake on your farm/orchard?

	Not significant	Neutral	Significant
Cost of implementation	27%	21%	52%
Already have a manual/written system that works	28%	23%	49%
Proof of return on investment	27%	26%	47%
Poor internet connectivity	37%	15%	47%
Suitability of what is available	32%	30%	38%
Staff understanding of how to use digital technology	42%	21%	37%
Knowledge and awareness of what is available	31%	32%	37%
Lack of integration with existing solutions	41%	23%	34%
Lack of support options	42%	23%	32%
Previous bad experience	53%	22%	25%

	All farmers & growers	Dairy	Sheep	Beef	Sheep & Beef	Arable	Horticulture
Cost of implementation	52%	63%	43%	47%	50%	48%	50%
Already have a manual/written system that works	49%	49%	51%	51%	44%	37%	60%
Proof of return on investment	47%	51%	42%	44%	42%	52%	48%
Poor internet connectivity	47%	48%	46%	46%	56%	49%	47%
Suitability of what is available	38%	41%	29%	35%	36%	56%	38%
Knowledge and awareness of what is available	37%	41%	35%	35%	35%	40%	41%
Staff understanding of how to use digital technology	37%	45%	33%	32%	33%	42%	34%
Lack of integration with existing solutions	34%	41%	31%	30%	29%	43%	33%
Lack of support options	32%	36%	24%	34%	32%	39%	26%
Previous bad experience	25%	29%	24%	21%	27%	30%	20%

The qualitative work allowed these barriers to be grouped further into:

Attitudinal challenges: life stage and mindset
- Exiting farming and not willing to invest.
- Older age groups that are typically less technology savvy and less willing to learn new skills.
- Traditionalist connections "To me, farming is archaic but that's because it works."

Situational challenges
- High debt loads.
- Small businesses with low capital.
- Need to upskill without time and resources to achieve this.

Technology challenges
- Most technology is perceived to be still in the development phase. It requires an expensive outlay and likely additional upgrade costs. The hope is that if they wait, prices may drop, and quality improves.
- Lack of local manufacturers means support is perceived to be slow and expensive.
- Generating a volume of data requires work to manage and use it effectively. "Why generate it if we don't get round to using it?"
- Connectivity problems and high costs.
- Reliance on continuous power. Experience of outages and generators not necessarily being sufficient creates risks.

Understanding where the levers are for different segments of the population

The data shows that some farmers and growers report high resistance to adoption, rating the barriers to technology adoption as significant, yet also report high levels of uptake of digital technology. The data also shows that some report that the barriers are less significant to them, yet also have low levels of adoption.

Further analysis of the data reveals that the shift to digital is a product of intent (internal motivation or enthusiasm indicated by current levels of adoption), external pressures (drivers of adoption) and the third dimension, resistance (barriers to adoption).

Segmenting the data provides six useful segments to better understand the levers and how to move the farm/orchard along the digital adoption journey.

High External Pressure

Low Resistance

Strong Demotivation

Strong Motivation

High Resistance

Low External Pressure
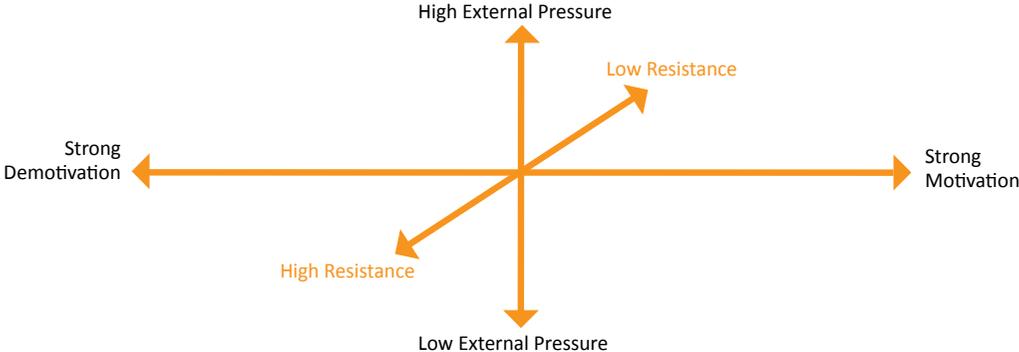
Primary sector segmentation for digital adoption

Traditionalist	Conservative	Pressured	Pragmatist	Persuadable	Trailblazer
25%	17%	16%	20%	10%	12%

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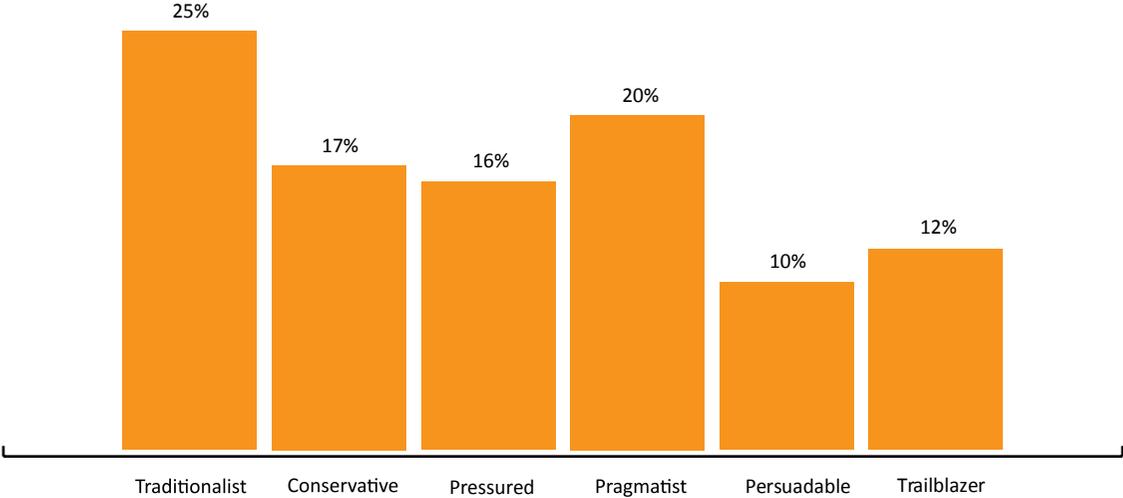
Traditionalist and Conservative farmers and growers are more disengaged, with Conservative perceiving higher barriers to adopt.

Pressured and Pragmatist farmers and growers appear closely related on the quadrant plot. The difference lies in the fact that Pressured farmers perceive higher, more significant barriers to adoption and appear less open to implementation.

Persuadable farmers and growers are reasonably motivated to adopt and perceive less barriers than others. They would respond to effective communication, maybe from those in the Trailblazer segment.

Trailblazers are hungrier for information and will be more open to innovation. This segment are more likely to be early adopters across operational areas and are responsive to pressure.

The statistical analysis put no farmers and growers in the low intent, high pressure quadrant of the grid.

The following grid provides typical characteristics of each segment's members. The important factors to note are that all sub-sectors are represented in each segment and that ratings of internet connectivity on farm were not a significant differentiator in any segment. These two factors do not explain the story and are no longer useful on their own to explain the digital adoption journey.

Segment make-up by sector

	Dairy	Sheep	Beef	Sheep & beef	Arable	Horticulture	Other
Traditionalist	16%	12%	34%	12%	3%	14%	9%
Conservative	20%	11%	32%	14%	3%	14%	7%
Pressured	34%	12%	21%	13%	4%	11%	5%
Pragmatist	23%	16%	26%	12%	3%	14%	7%
Persuadable	28%	10%	20%	14%	11%	13%	5%
Trailblazer	34%	6%	10%	12%	24%	10%	4%
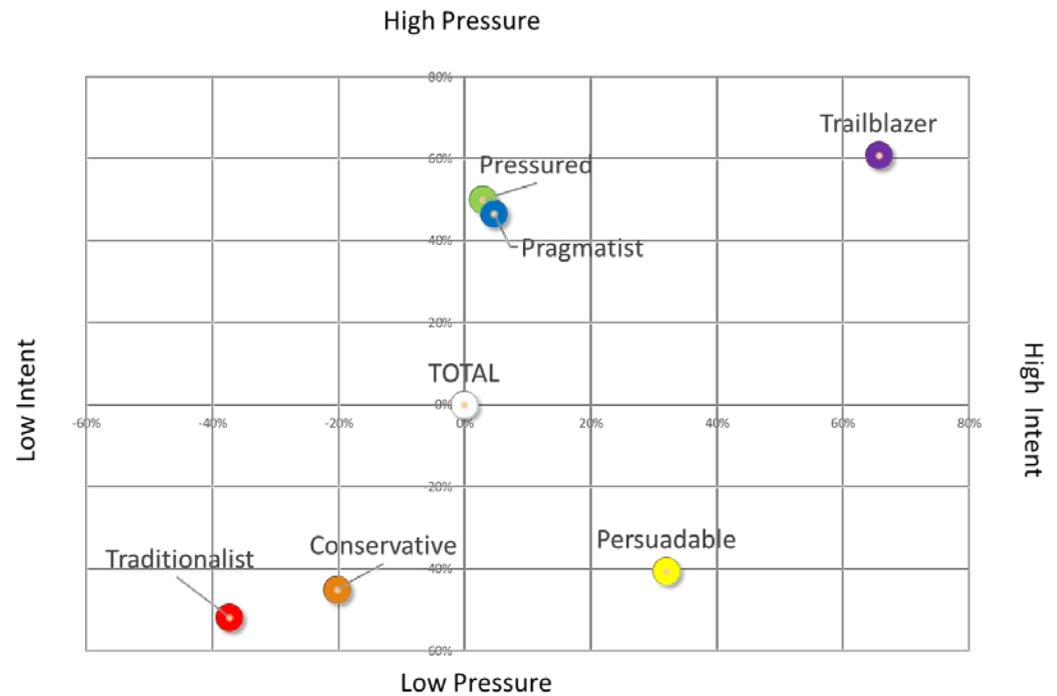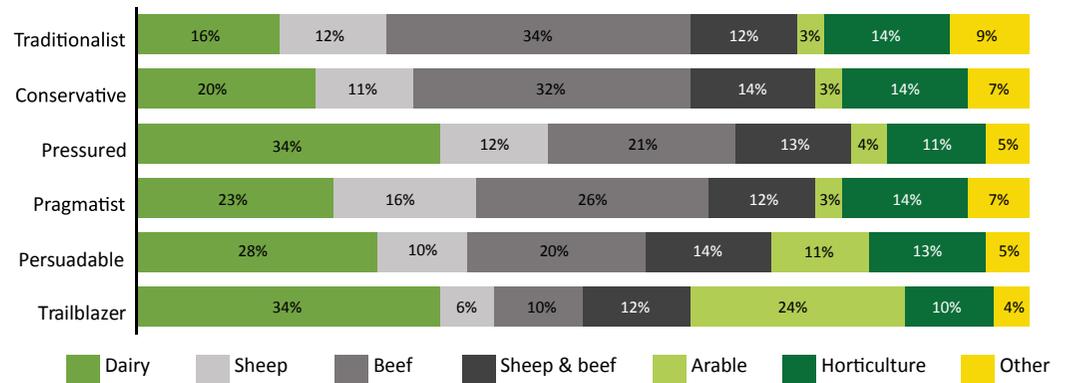
Traditionalist (25%): very low intent, low pressure and low barriers

- Conservative and confident that their methods work
- Smaller farms/orchards (up to 80ha)
- Age: older (65+)
- Ownership: single owner
- Sub-sector: High presence of Beef
- Better ratings of cellphone and internet coverage
- Very low levels of digital confidence and very unlikely to see the value of digital technology for their business
- Low thirst for information. Disengaged from digital technology.
- Need to be required to data share, high perception of risk.
- Poor perceptions of digital technology that they have adopted.

ADOPTION POTENTIAL

- At a personal level adoption will be low. Low appetite for change, tend to be happy with the way they have always done things or are committed to traditional farming methods.
- Not averse to contractors on farm using digital technology for set tasks e.g., spraying, but do not see the value for themselves.
- May respond to pain more than incentives; adverse conditions that require something different.
- Likely to be planning to retire so there may be an incentive around a simple technology "pack" if it means a better price on retirement.

Conservative (17%): low intent, low pressure, medium/high barriers

- Conservative but potentially open to consider
- Lifecycle: Declining/exiting
- Age: older (65+)
- Ownership: single owner
- Region: Higher presence in Northland (lower regional pressures)
- Sub-sector: Higher presence of Beef
- Copper line broadband
- Worst ratings for internet service and cellphone coverage
- Low levels of digital confidence
- Do not see the value of digital technology
- Worry about who has access to their on-farm data
- Compliance and regulation driven
- What they have got is less likely to their meet expectations.

ADOPTION POTENTIAL

- Restricted by operation size, cash flow and profit challenges in the business. Perceive digital technology to be something for larger businesses.
- Adoption will focus on compliance or labour saving.
- Where they lack strong links to other farmers/growers or industry bodies, they may not see much practical information or case studies that might help smaller family operations.
- Small business modelling or starter technology offers and support may raise some interest. They agree that some degree of technology has a use in all sizes of business.
- Easy access support during set up and early stage usage may also increase confidence.
- Proof of ROI is important e.g., financial modelling to show how investment can reap rewards later if they sell up or pass on to family.

Pressured (16%): strong pressure, high resistance

- Pressured
- Age: older (55-64)
- Sub-sector: Higher presence of Dairy
- Fairly positive around using digital technology and levels of confidence with use but are not necessarily problem solvers.
- Ease of use is important in decision making
- Actively seek information on what is available.

ADOPTION POTENTIAL

- Resistant to "being sold to", but are very open to case studies and examples of real-life applications and success stories.
- Only wants "as much as I need".
- Will need to see robust ROI analysis and will make an informed decision. Gains must be achievable rather than speculative.
- Have some successful systems in place now and will promote the benefits.
- Are less interested in a range of technologies independently. They want to see the how technology can be combined to create an overall farm benefit.
- No interest in becoming an agritech expert. Systems need to be easy to integrate and easy to use or they will disengage and delegate to others.

Pragmatist (20%): moderate intent, medium/high pressure, low barriers

- Pragmatist
- Medium scale (80-400ha+)
- Region: Higher presence in Manawatu-Wanganui
- Better ratings of cellphone and internet coverage
- Fairly positive around using digital technology and levels of confidence with use but are not necessarily problem solvers.
- Most interested in data sharing; low perception of risk
- Ease of use is important in choices
- Actively seeking information, advice and support and know where to look.

ADOPTION POTENTIAL

- Higher potential to adopt. They have a relatively high knowledge and recognise the advancement in their industry.
- Need to see clear benefits and also the "big picture" of how it fits the operation - more likely to adopt technology if they see clear benefits for themselves and the industry.
- Customised solutions have potential. As business moves into new areas, more specific solutions may be needed for different activity types.
- Financial support at set-up stage can make a difference and encourage further adoption.

Persuadable (10%): strong intent, no pressure, low barriers

- Pragmatist but seeking more
- Age: younger (35-44)
- Fairly positive around using digital technology and levels of confidence with use but are not necessarily problem solvers
- See the value of digital technology
- Unlikely to be forerunners; likely to others try new technology first.

ADOPTION POTENTIAL

- Has potential but need approaches that are catered to medium sized, stable operations that are not focussed on fast expansion.
- Stability is key so clear risk/reward assessments will help, alongside a focus on addressing regional issues/tensions.
- Successful implementation of early technology systems encourages uptake of further systems.
- Focus on practical benefits so will require relevant and local case studies and the ability to make a clear business case for adoption.
- Industry recommendations and support are influential.
- Funding support may also be an incentive.

Trailblazers (12%): very strong intent, strong pressure, medium barriers

- Forerunners
- Big farms (400ha+)
- Age: younger (35-54)
- Ownership: equity partnerships / company shareholdings
- Region: Higher presence in Canterbury (higher regional pressures)
- Sub-sector: Higher presence of Dairy and Arable
- Satellite broadband
- Driven by profit margins, efficiency and environmental sustainability
- High levels of digital confidence but ease of use is important in decision making
- Most likely to be the first in the area to adopt
- Actively seeking information, advice and support
- Evidence from other farms is more important to this segment than any other
- Interested in technology in general including outside of farming e.g., education, gaming etc.
- Tend to keep to the same groups/discussion groups with similar interests.

ADOPTION POTENTIAL

- Tend to have been exposed to technology for a long time, have grown up with it or have first hand experience of value and impact.
- Likely to have already integrated significant amounts of technology into the business and will be seeking innovations.
- Looking for very practical technology that is reliable and does not require frequent support.
- Time is money. If problems occur, they require quick resolution.
- Seek interoperability. Prefer systems that are easy to integrate rather than running a series of parallel systems.
- Labour and skills focus in the bigger operations mean there is a high interest in technology that helps less experienced workers get up to speed and operate effectively.
- Technology that helps with environmental compliance and long-term protection of the land is also of interest.

Digital confidence within the segments

I feel confident using new digital techology tools
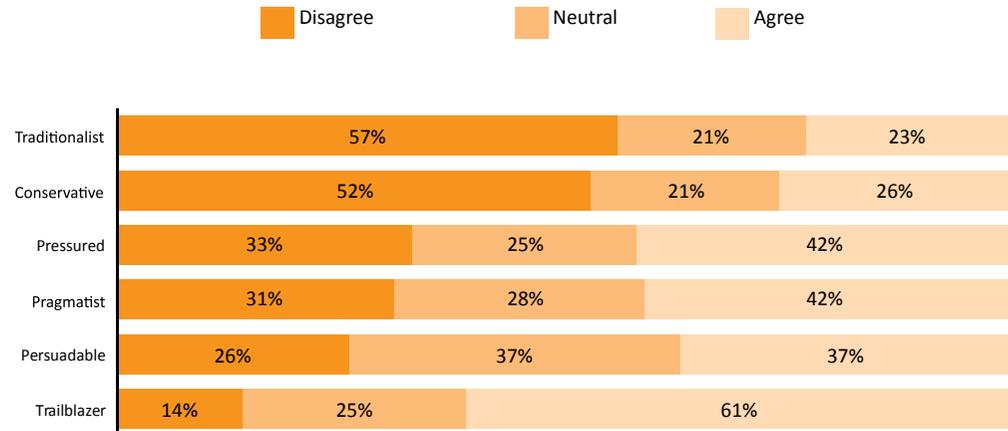
Segment	Disagree	Neutral	Agree
Traditionalist	57%	21%	23%
Conservative	52%	21%	26%
Pressured	33%	25%	42%
Pragmatist	31%	28%	42%
Persuadable	26%	37%	37%
Trailblazer	14%	25%	61%

When I come across problems with digital devices, I think I can solve them

Segment	Disagree	Neutral	Agree
Traditionalist	67%	18%	15%
Conservative	64%	15%	21%
Pressured	51%	23%	26%
Pragmatist	53%	22%	25%
Persuadable	53%	22%	25%
Trailblazer	32%	26%	42%

I like using digital technology in my business

Segment	Disagree	Neutral	Agree
Traditionalist	44%	32%	24%
Conservative	36%	34%	30%
Pressured	18%	26%	56%
Pragmatist	19%	29%	52%
Persuadable	18%	31%	51%
Trailblazer	6%	12%	82%
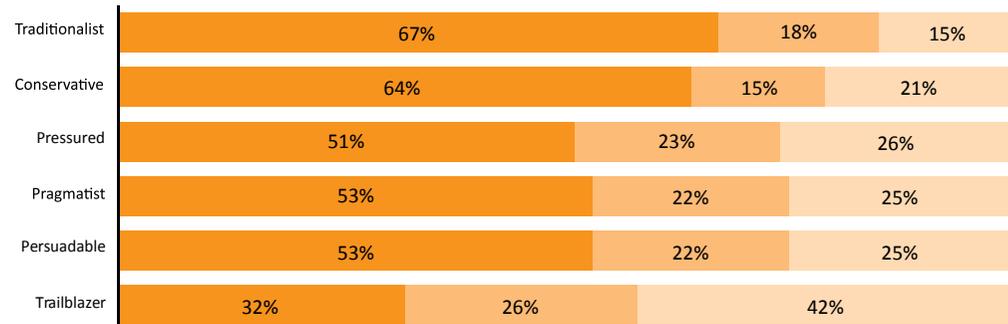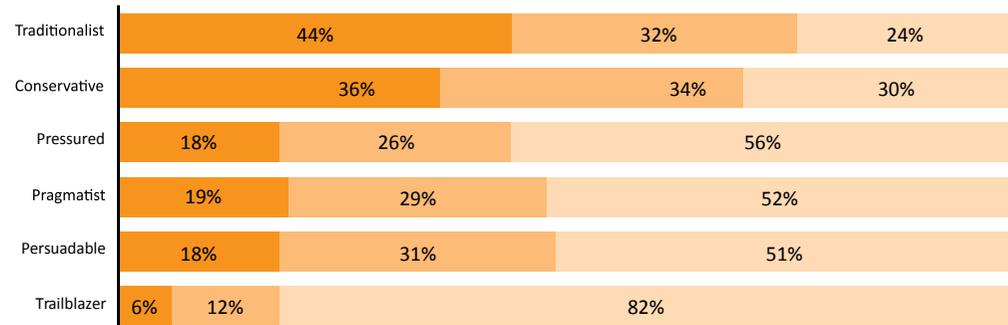
Knowledge of what digital technologies are available for use in the primary sector within the segments

Segment	Very poor	Poor	Average	Good	Excellent
Traditionalist	23%	33%	36%	7%	1%
Conservative	17%	29%	39%	14%	1%
Pressured	3%	18%	51%	26%	2%
Pragmatist	2%	21%	45%	28%	5%
Persuadable	3%	17%	50%	27%	3%
Trailblazer	2%	21%	45%	28%	5%

Legend: Very poor · Poor · Average · Good · Excellent
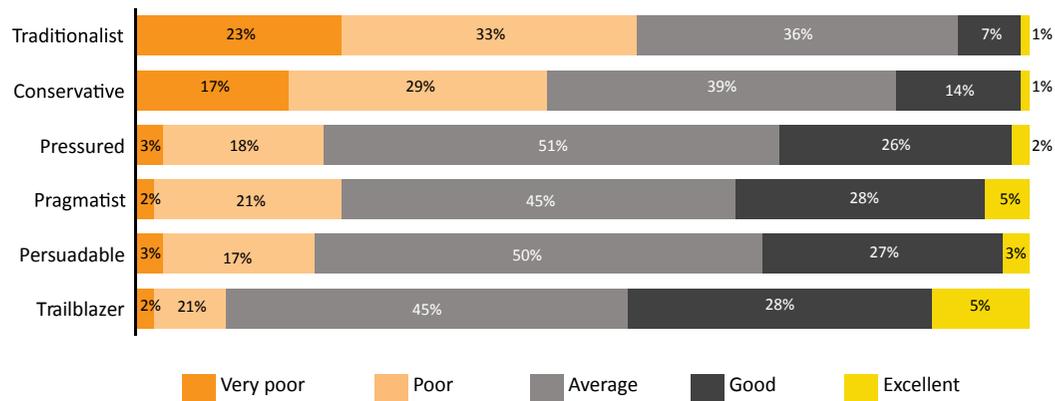
Current rates of adoption by operational area and segment — Business Management

Segment	Adoption
Traditionalist	37%
Conservative	61%
Pressured	85%
Pragmatist	80%
Persuadable	91%
Trailblazer	93%
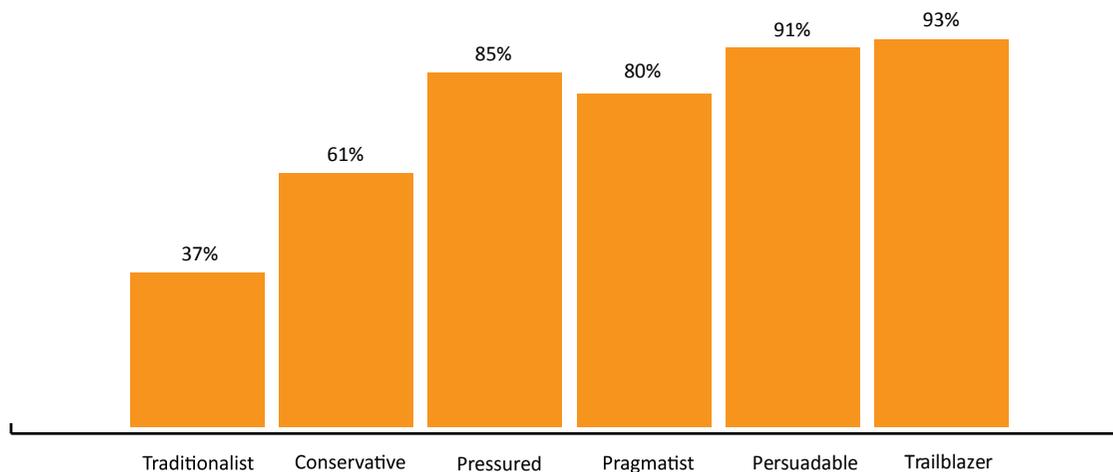
Current rates of adoption by operational area and segment — Animal Management and Milking

Traditionalist	Conservative	Pressured	Pragmatist	Persuadable	Trailblazer
41%	51%	80%	76%	76%	88%
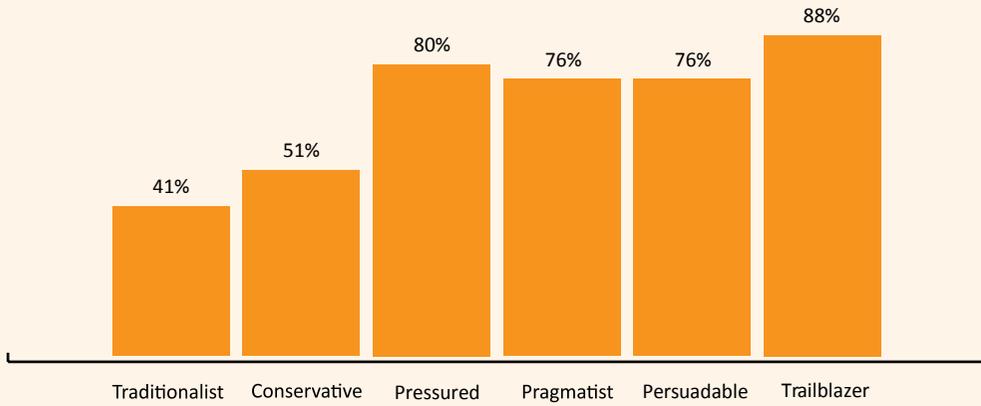
Current rates of adoption by operational area and segment — Crop Protection

Traditionalist	Conservative	Pressured	Pragmatist	Persuadable	Trailblazer
18%	41%	47%	67%	64%	77%
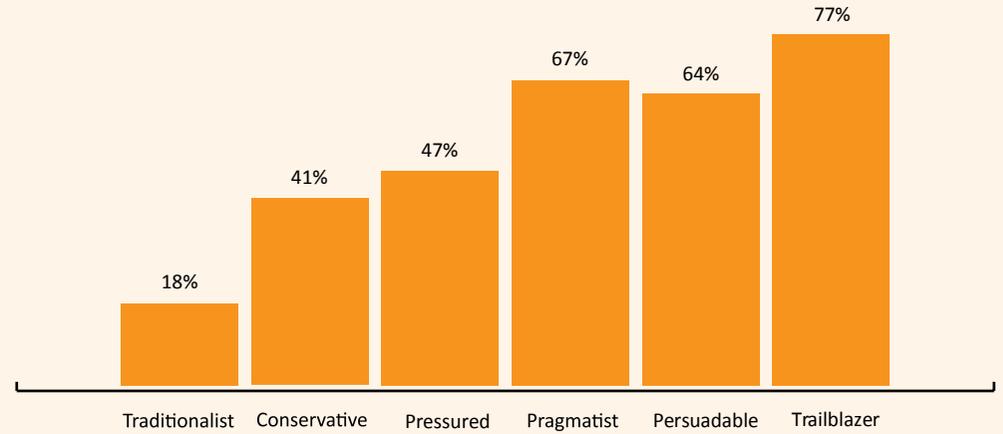
Current rates of adoption by operational area and segment — Plant and Crop Management

Traditionalist	Conservative	Pressured	Pragmatist	Persuadable	Trailblazer
4%	9%	27%	28%	46%	72%
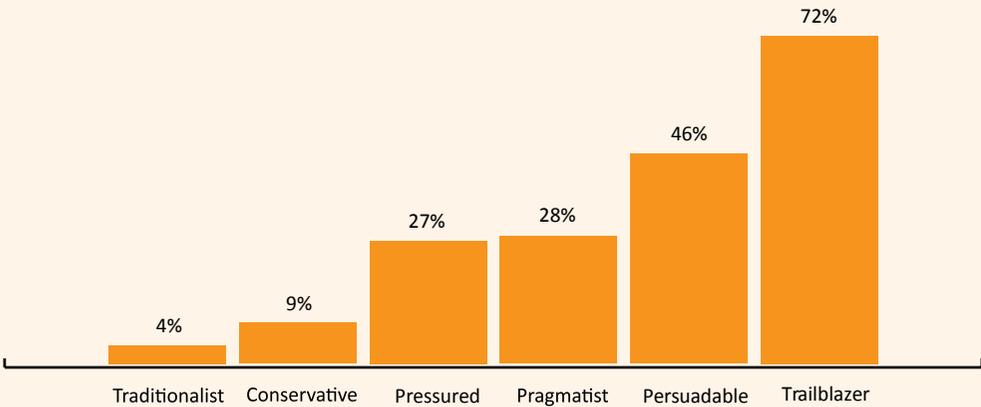
Current rates of adoption by operational area and segment — Fertiliser / Nutrient Management

Traditionalist	Conservative	Pressured	Pragmatist	Persuadable	Trailblazer
9%	25%	54%	54%	66%	85%
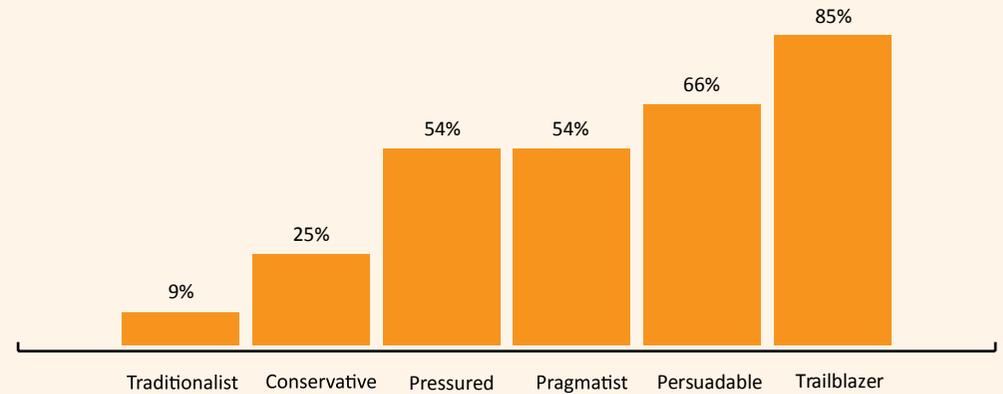
Current rates of adoption by operational area and segment — Effluent Management

Traditionalist	Conservative	Pressured	Pragmatist	Persuadable	Trailblazer
0%	5%	9%	8%	28%	45%
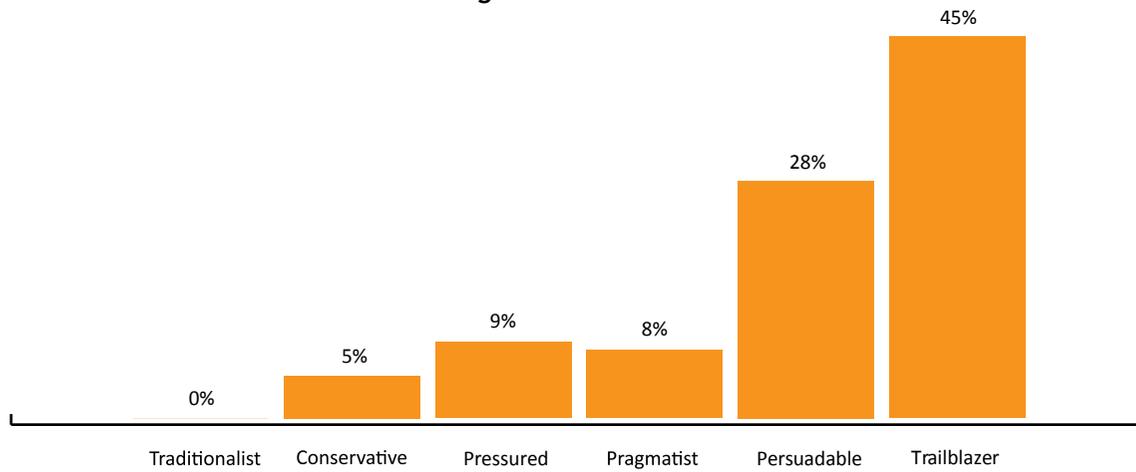
Current rates of adoption by operational area and segment — Water/Irrigation Management

Traditionalist	Conservative	Pressured	Pragmatist	Persuadable	Trailblazer
7%	15%	34%	32%	40%	60%
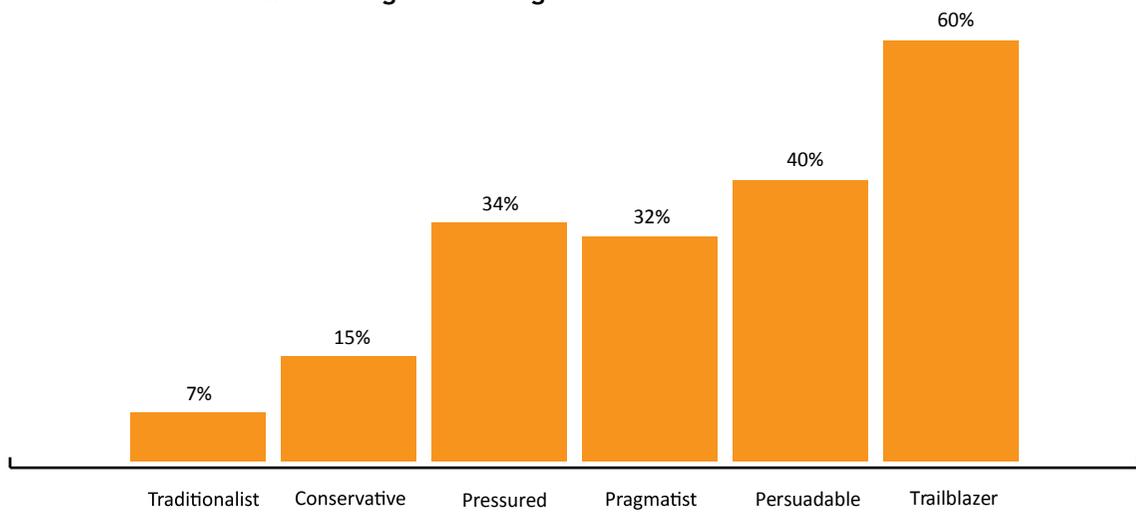
Sector Summaries

Dairy Sector Insights

'More and more dairy farmers are leveraging advancements in digital technology to enhance efficiencies, sustainability, animal care and to create great workplaces. It's important we understand what technology challenges farmers are facing to enable user-centred design and effective use of technology. We have observed issues around lack of awareness of the options available, integrating technology into existing systems, skills and education, understanding the value proposition and support available for smooth implementation. The Baseline of Digital Adoption Report allows us to determine the extent of these challenges so we can help farmers to unlock the potential of digital technologies and optimise efficiencies across their operations.'

Tim Mackle
Chief Executive Officer, DairyNZ

The dairy sector plays a significant role in the New Zealand economy with approximately 34% contributed to the total value that New Zealand earned from its merchandise exports (in 2019-20) of $NZ19.7 billion.[4] Given its influence on the agriculture industry, understanding farmers perceptions and use of technology is of immense value. Here are the findings for this sector based on dairy farmer respondents.

There are no significant differences between the digital confidence levels of dairy farmers when compared with other farmers and growers[5]. Across the sector there is space for strategies to build confidence as a lever for adoption. Farmers and growers like technology but need tailored support.

Dairy farmers are significantly more likely to believe current digital technology adds value to their operation. Attitudes in all other tested areas align with the sector as a whole.

[4] Quickstats about dairying New Zealand 2020 - DairyNZ
[5] Sample by primary activity type: Dairy n=245, all other farmers and growers n=756. Data tested at the 95% confidence level for statistical significance.

% agreeing or strongly agreeing with each statement

	I like using digital technology in my business	When I come across problems with digital devices, I think I can solve them	I feel confident using new digital technology tools
Dairy farmers	51%	22%	37%
All other farmers and growers	44%	25%	36%
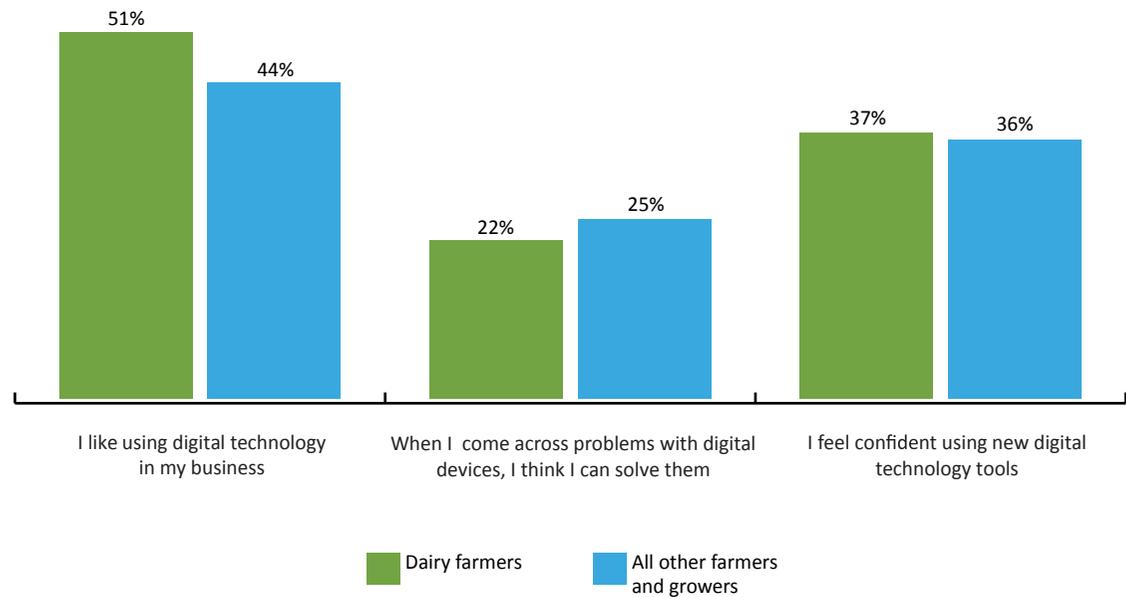
	Dairy	All others	All others	Dairy	
I prefer to let others try new forms of digital technology before I invest in it	83%	82%	18%	17%	I am generally one of the first farmers/growers in my area to use new digital technologies
I don't see much value in using digital technology to run my business	30%	45%	55%	70%	I believe the digital technology currently available adds significant value to my operations
I know where to get reliable and impartial information about digital technologies	46%	45%	55%	54%	It is difficult to work out what may or may not be beneficial for my business
I only share my on-farm data with others when I am legislated or otherwise required to do so	45%	52%	48%	55%	I share a range of my on-farm data with others
The risks of data sharing out-weigh the benefits	23%	24%	76%	77%	I am happy to share my data when it provides direct benefits to me
I worry about who has access to my on-farm data	38%	35%	65%	62%	I believe who holds my on-farm data and how it is shared is closely controlled

Current adoption of tools in the dairy sector is unsurprisingly higher in the animal management and milking and effluent management operational areas. However, dairy farmers also have significantly higher adoption rates for technology around plant/crop management and fertiliser/nutrient management. Intention to invest in the next couple of years follows a similar pattern to current adoption.

% currently making use of digital tech, by operational area

	Dairy farmers	All other farmers and growers
Business management	74%	69%
Animal management (and milking)	80%	61%
Plant / crop management	40%	22%
Fertiliser / nutrient management	54%	40%
Effluent management	27%	1%
Water / irrigation management	29%	28%

Legend: ■ Dairy farmers ■ All other farmers and growers

% intending to invest in the next 2 years

	Dairy farmers	All other farmers and growers
Business management	30%	38%
Animal management (and milking)	43%	33%
Plant / crop management	22%	22%
Fertiliser / nutrient management	36%	34%
Effluent management	28%	4%
Water / irrigation management	21%	21%

Cost, staff understanding of how to use digital technology and a lack of integration with existing solutions are all significantly higher barriers to adoption on dairy farms when compared to the primary industry as a whole.

The top three barriers across the dairy sector though are the same as the wider primary sectors: cost, proof of ROI and a reluctance to move from manual/written systems that are proven to work.

The shift to digital is a product of intent (internal motivation or enthusiasm indicated by current levels of adoption), external pressures (drivers of adoption) and the third dimension, resistance (barriers to adoption).

'Trailblazer' farmers are hungrier for information and more open to new ideas and methods. They tend to be earlier adopters and are responsive to pressure. They seek interoperability, systems that are easy to use and easy to integrate with what they already have.

'Pressured' farmers are under some pressure e.g. regulation to adopt new technology, but they experience more barriers. They need to see robust ROI analysis, real-life applications and success stories before they adopt. They have no interest in becoming the technology expert, but they are fairly positive about using digital technology on farm. They resist being sold to and only want as much as they believe they need.

'Pragmatist' farmers behave similarly to Pressured but are less affected by barriers. They have a high potential to adopt but do need to see evidence of clear benefits for themselves and the industry. This group are more interested in data sharing.

All sub-sectors are represented in each segment and an individual's relationship to a segment can vary according to the type of technology adopted or as situations change in the business. However, there is a higher likelihood that dairy farmers are represented by the 'Trailblazer', 'Pressured' and 'Persuadable' segments.

% rating the barrier as significant or very significant
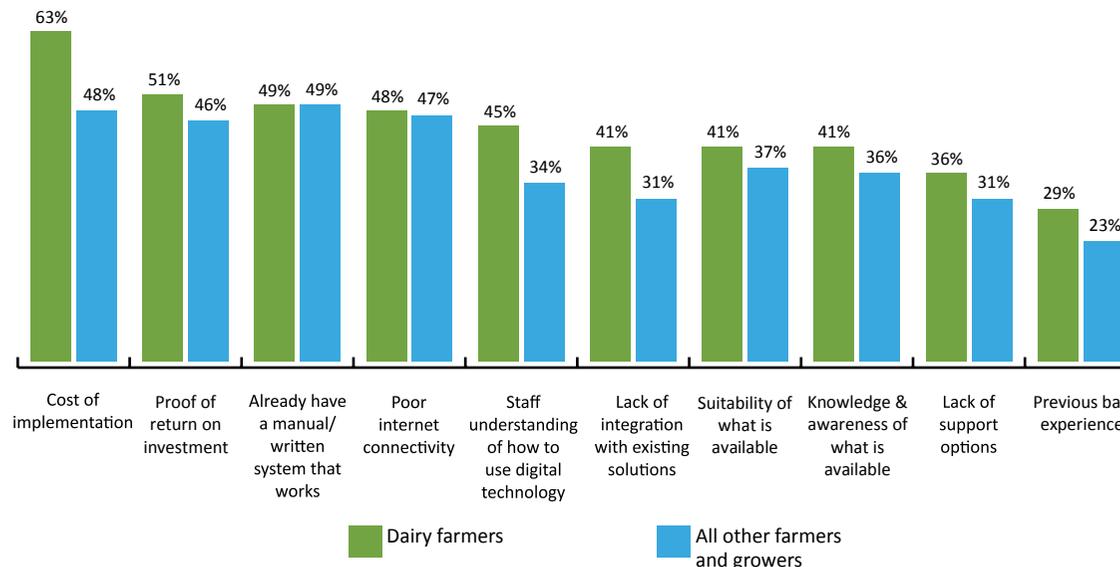
Segment make-up by sector
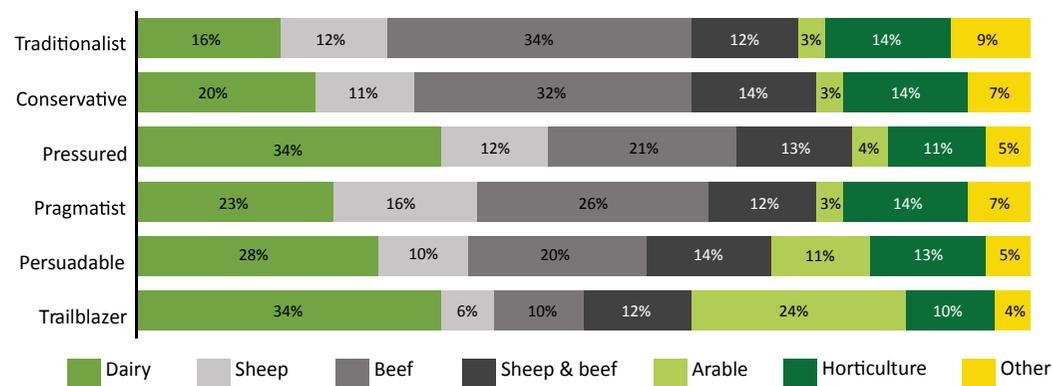
Horticulture Sector Insights

'At Zespri we know that to achieve the growth we have planned, in a way that respects and sustains our land for future generations- we will need technology. We embarked on this collaborative project with AgriTechNZ and Research First to understand first where we are at today as an industry. As we build our investment in technology for precision horticulture, we want to find out what the big problems are that growers want us to help solve, and in particular we wanted to uncover any barriers to adoption. A couple of clear insights that jumped out to me were the clear need for any technology to make sense from a value perspective (ROI), and I was also encouraged at the current use of technology in horticulture relative to the wider primary sector. We look forwards to tracking progress over time through this survey. '

Dr Juliet Ansell
Head of Core & Resilience Innovation, Zespri International Ltd

> *The horticulture sector is responsible for more than 11% of New Zealand's merchandise exports worth $NZ6.6 billion (year ending June 2020). Kiwifruit is the biggest horticultural export worth approximately $NZ2.5 billion[6]. Here are the findings for this sector based on horticulture respondents.*

Digital confidence in the horticulture sector[7] is high in comparison to the rest of the primary sector . Significantly more growers like using digital technology and believe they can solve problems. Focusing in on kiwifruit, shows these growers are more likely to be confident problem solvers.

Horticulturalists are also more likely to see the value of digital technology in their operations, when compared to the rest of the primary sector. They are likely to be interested in data sharing, with significantly higher proportions already sharing a range of on-farm data with others and three-quarters being confident that who holds their farm data is closely controlled.

[6] Statistics from FreshFacts 2020
[7] Sample by primary activity type: Horticulture (including kiwifruit) n=130, Kiwifruit n=56, all other farmers and growers n=871. Data tested at the 95% confidence level for statistical significance.

% agreeing or strongly agreeing with each statement

Chart values:

I like using digital technology in my business
- Kiwifruit: 56%
- Horticluture: 56%
- All other farmers and growers: 45%

When I come across problems with digital devices, I think I can solve them
- Kiwifruit: 57%
- Horticluture: 32%
- All other farmers and growers: 23%

I feel confident using new digital technology tools
- Kiwifruit: 38%
- Horticluture: 41%
- All other farmers and growers: 36%

Legend: Kiwifruit | Horticluture | All other farmers and growers
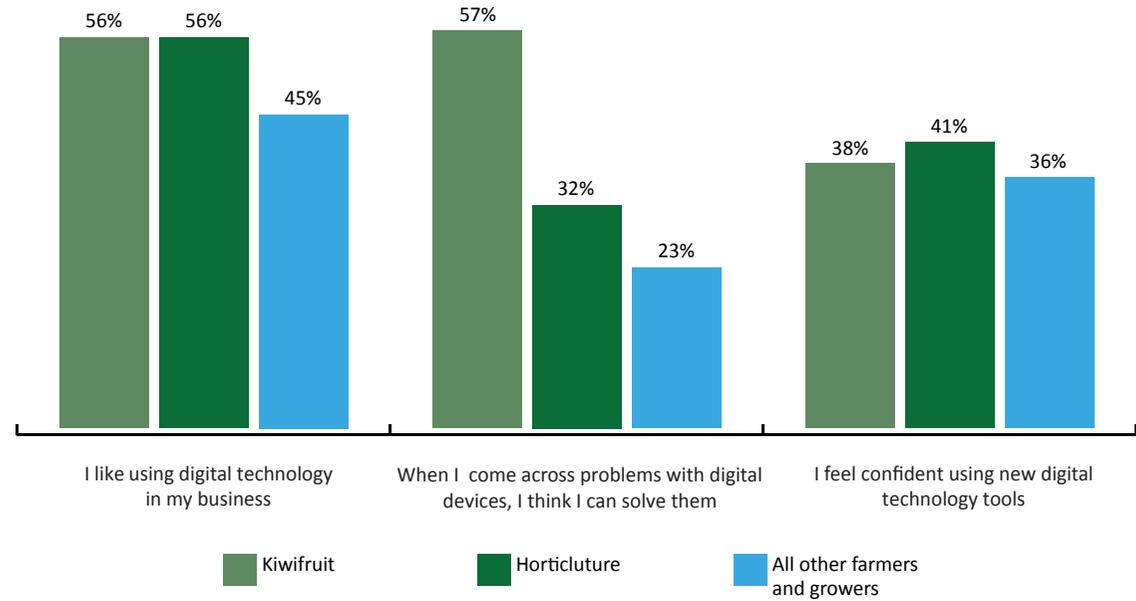
	Kiwifruit	Horticluture	All other	Kiwifruit	Horticluture	All other	
I prefer to let others try new forms of digital technology before I invest in it	83%	79%	83%	17%	21%	17%	I am generally one of the first farmers/growers in my area to use new digital technologies
I don't see much value in using digital technology to run my business	27%	33%	43%	57%	67%	73%	I believe the digital technology currently available adds significant value to my operations
I know where to get reliable and impartial information about digital technologies	38%	43%	46%	54%	57%	62%	It is difficult to work out what may or may not be beneficial for my business
I only share my on-farm data with others when I am legislated or otherwise required to do so	41%	41%	52%	48%	59%	59%	I share a range of my on-farm data with others
The risks of data sharing out-weigh the benefits	24%	24%	23%	77%	76%	76%	I am happy to share my data when it provides direct benefits to me
I worry about who has access to my on-farm data	27%	25%	38%	62%	75%	73%	I believe who holds my on-farm data and how it is shared is closely controlled

Digital tools already on the farm / orchard show a focus on business management that aligns with the primary sector as a whole, crop protection and fertiliser/nutrient management tool uptake also aligns with trends in the overall sector. However, the horticulure sector has a significantly higher level of adoption of agritech for water/irrigation management.

% currently making use of digital technology, by operational area
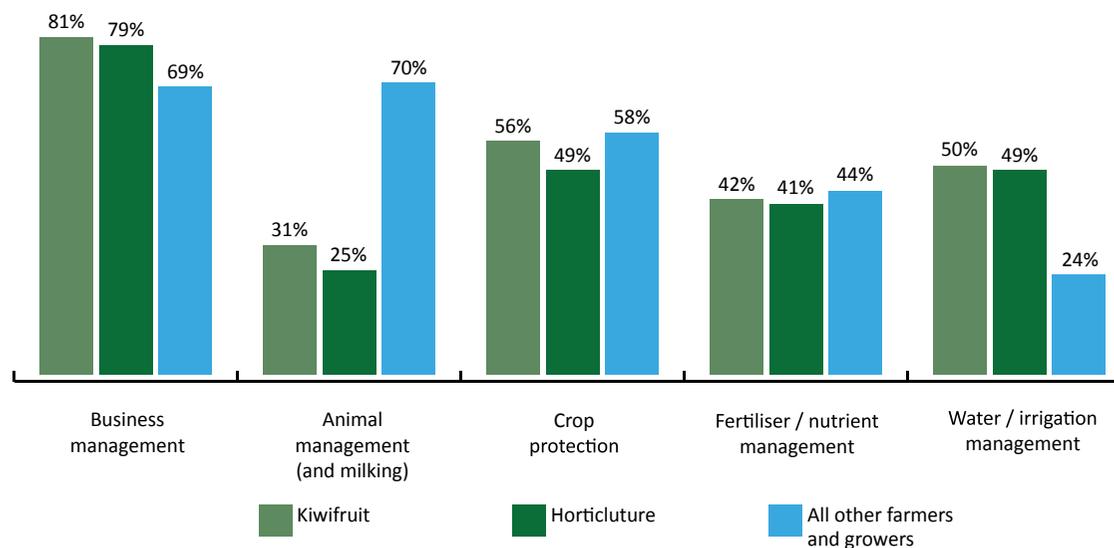
Legend:
- Kiwifruit
- Horticluture
- All other farmers and growers

Business management: 81% / 79% / 69%
Animal management (and milking): 31% / 25% / 70%
Crop protection: 56% / 49% / 58%
Fertiliser / nutrient management: 42% / 41% / 44%
Water / irrigation management: 50% / 49% / 24%

% intending to invest in the next 2 years

Business management: 38% / 41% / 36%
Animal management (and milking): 17% / 13% / 38%
Crop protection: 31% / 27% / 47%
Fertiliser / nutrient management: 33% / 29% / 35%
Water / irrigation management: 38% / 37% / 19%
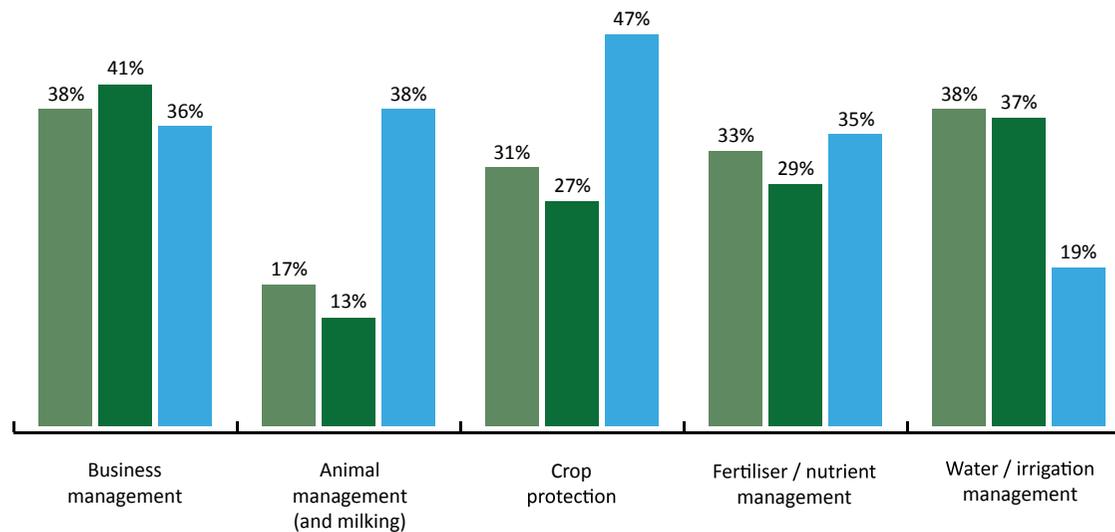
Across the primary sector as a whole, cost, proof of ROI and reluctance to move from manual/written systems that work are the key barriers to adoption. Within the horticulture sector though, that barrier relating to manual systems is much more significant.

The shift to digital is a product of intent (internal motivation or enthusiasm indicated by current levels of adoption), external pressures (drivers of adoption) and the third dimension, resistance (barriers to adoption).

All sub-sectors are represented in each segment and an individual's relationship to a segment can vary according to the type of technology adopted or as situations change in the business. The horticulture sector is fairly evenly spread across the segments, though slightly less represented in the Trailblazer segment and Persuadable segment. Intention to adopt is relatively lower with the barriers tending to be seen as significant.

% rating the barrier as significant or very significant

Barrier	Kiwifruit	Horticulture	All other farmers and growers
Already have a manual/written system that works	61%	60%	47%
Cost of implementation	46%	50%	52%
Proof of return on investment	44%	48%	47%
Poor internet connectivity	55%	47%	48%
Knowledge & awareness of what is available	42%	41%	37%
Suitability of what is available	42%	38%	38%
Staff understanding of how to use digital technology	38%	34%	37%
Lack of integration with existing solutions	37%	33%	34%
Lack of support options	31%	26%	33%
Previous bad experience	22%	20%	25%

Segment make-up by sector

Segment	Dairy	Sheep	Beef	Sheep & beef	Arable	Horticulture	Other
Traditionalist	16%	12%	34%	12%	3%	14%	9%
Conservative	20%	11%	32%	14%	3%	14%	7%
Pressured	34%	12%	21%	13%	4%	11%	5%
Pragmatist	23%	16%	26%	12%	3%	14%	7%
Persuadable	28%	10%	20%	14%	11%	13%	5%
Trailblazer	34%	6%	10%	12%	24%	10%	4%

Arable Sector Insights

'Arable growers run highly diverse and integrated farm businesses with sophisticated multi-year rotations. This requires the ability to plan, action, manage and monitor multiple facets in the most efficient way. Digital technology has been a key enabler for this decision making with arable growers recognised as having much higher digital confidence than other farmers or growers. The scope for further technological improvements is high and FAR will support on-going grower adoption via its extensive agronomy and technology extension platforms.'

Alison Stewart,
Chief Executive Officer, Foundation for Arable Research

The arable sector is worth $NZ2.1 billion to the New Zealand economy and includes the production of grain, seed and other crops as well as the source of seed for animal pastures, and grain silage for animal feed for the 20 billion livestock industry.[8] Here are the findings for this sector based on arable farmer respondents.

Digital confidence is significantly higher amongst arable farmers when compared to other farmers and growers.[9] The scope for increasing adoption is high.

Arable farmers are also significantly more likely to be the forerunners in their area and are more likely to see the value of digital technology in their operations. These farmers have the potential to be promoters of digital technology, influencing uptake within arable farming and across the primary sector.

Focus has so far been on plant/crop management and fertiliser/nutrient management, with three quarters of arable farmers currently using digital technology in their operations in these areas. Plans to invest in the next two years show these areas remain a priority.

% agreeing or strongly agreeing with each statement

	Arable farmers				
I like using digital technology in my business	64%				
					45%

Legend: Arable farmers | All other farmers and growers

I like using digital technology in my business	When I come across problems with digital devices, I think I can solve them	I feel confident using new digital technology tools
64% / 45%	36% / 24%	56% / 35%
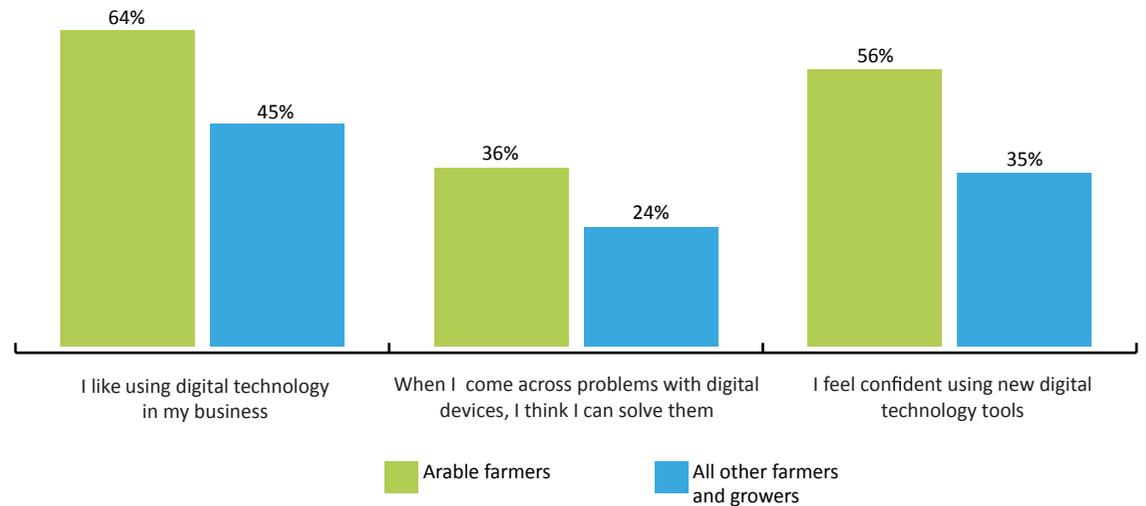
I prefer to let others try new forms of digital technology before I invest in it	65%	83%	17%	35%	I am generally one of the first farmers/growers in my area to use new digital technologies
I don't see much value in using digital technology to run my business	25%	43%	57%	75%	I believe the digital technology currently available adds significant value to my operations
I know where to get reliable and impartial information about digital technologies	46%	45%	55%	54%	It is difficult to work out what may or may not be beneficial for my business
I only share my on-farm data with others when I am legislated or otherwise required to do so	53%	50%	50%	47%	I share a range of my on-farm data with others
The risks of data sharing out-weigh the benefits	23%	24%	76%	77%	I am happy to share my data when it provides direct benefits to me
I worry about who has access to my on-farm data	32%	36%	64%	68%	I believe who holds my on-farm data and how it is shared is closely controlled

% currently making use of digital technology, by operational area

	Arable farmers	All other farmers and growers
Business management	72%	70%
Animal management (and milking)	48%	67%
Plant / crop management	72%	23%
Crop protection	58%	49%
Fertiliser / nutrient management	75%	41%
Water / irrigation management	61%	26%

Legend: ■ Arable farmers ■ All other farmers and growers

% intending to invest in the next 2 years

	Arable farmers	All other farmers and growers
Business management	45%	36%
Animal management (and milking)	30%	36%
Plant / crop management	60%	19%
Crop protection	47%	27%
Fertiliser / nutrient management	59%	32%
Water / irrigation management	43%	20%
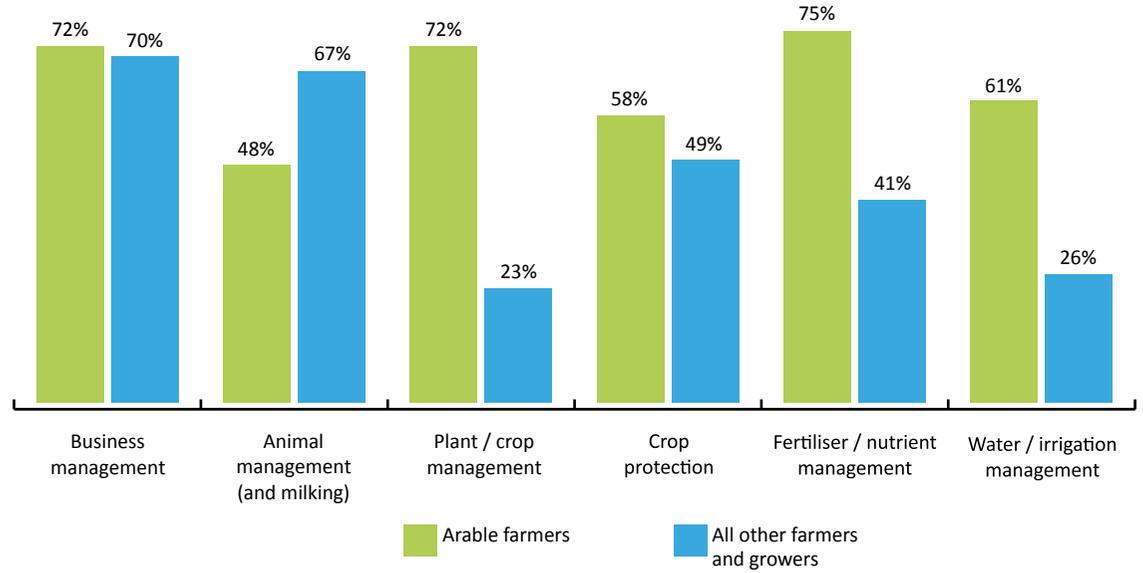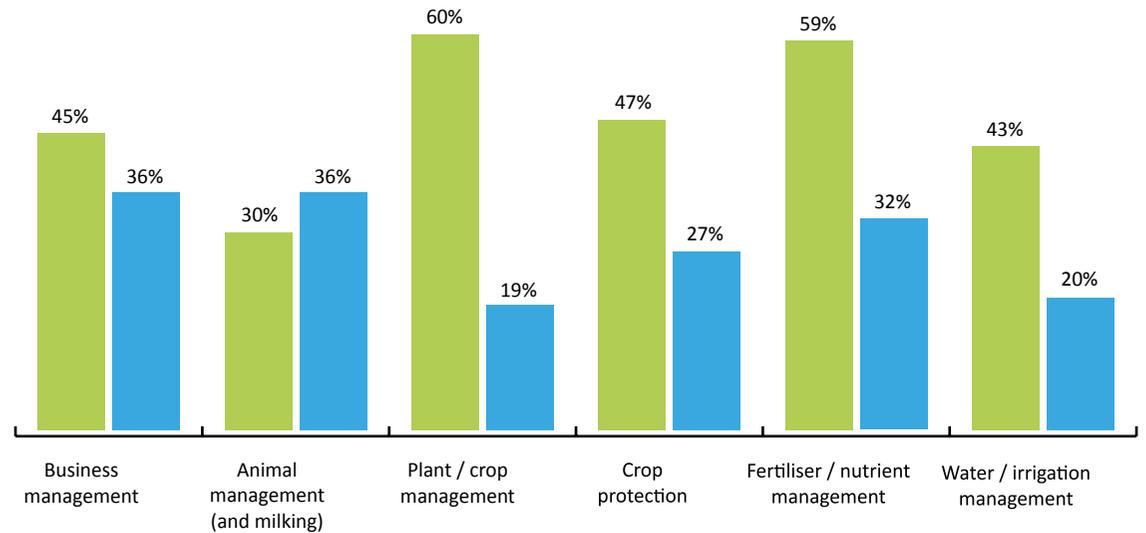
Across the primary sector as a whole, cost, proof of ROI and reluctance to move from manual/written systems that work are the key barriers to adoption. With the arable sector however, perceptions of the suitability of what is available play a much bigger role and that reluctance to move from paper-based alternatives is less significant. There is a willingness to adopt if the technology available can catch up and meet needs.

The shift to digital is a product of intent (internal motivation or enthusiasm indicated by current levels of adoption), external pressures (drivers of adoption) and the third dimension, resistance (barriers to adoption).

All sub-sectors are represented in each segment and an individual's relationship to a segment can vary according to the type of technology adopted or as situations change in the business. However, there is a higher likelihood that arable farmers are represented by the Trailblazer segment.

Trailblazer farmers seek agritech information and are open to new ideas and methods. They tend to be earlier adopters and are responsive to pressure. They want interoperability; systems that are easy to use and easy to integrate with what they already have. They seek practical technology that is reliable and does not require frequent support.

% rating the barrier as significant or very significant

Legend: Arable farmers / All other farmers and growers

Categories: Suitability of what is available (56%, 37%); Proof of return on investment (52%, 47%); Poor internet connectivity (49%, 47%); Cost of implementation (48%, 52%); Lack of integration with existing solutions (43%, 33%); Staff understanding of how to use digital technology (42%, 36%); Knowledge & awareness of what is available (40%, 37%); Lack of support options (39%, 31%); Already have a manual / written system that works (37%, 50%); Previous bad experience (30%, 24%)

Segment make-up by sector

Segment	Dairy	Sheep	Beef	Sheep & beef	Arable	Horticulture	Other
Traditionalist	16%	12%	34%	12%	3%	14%	9%
Conservative	20%	11%	32%	14%	3%	14%	7%
Pressured	34%	12%	21%	13%	4%	11%	5%
Pragmatist	23%	16%	26%	12%	3%	14%	7%
Persuadable	28%	10%	20%	14%	11%	13%	5%
Trailblazer	34%	6%	10%	12%	24%	10%	4%

'We are pleased to support the survey on 'Benchmarking the adoption of digital tools and services across the primary sector'. It provides powerful insights into the use of digital tools which can help the primary sector to perform better environmentally and economically. The survey helps us to understand the drivers and also barriers to adoption. It helps us to understand our level of progress over time. This knowledge will also improve our strategies for supporting uptake of new digital tools and services to enable the primary sector to reap the social, economic and environmental benefits these digital technologies can deliver.'

Greg Sneath
Executive Manager, Fertiliser Association

Sheep and Beef Sector Insights

> *The sheep and beef sector exports contribute approximately $NZ10 billion to the New Zealand economy[10] and covers around 45% of our total agriculture area. Here are the findings for this sector based on beef and sheep farmer respondents.*

Results have been analysed by primary activity type on farm (self-selected by the respondents), providing comparisons of results for sheep farms, beef farms and sheep & beef farms[11]. These results are compared with the results of all other farm types (excluding sheep, beef and sheep & beef).

The results show significant differences between the digital confidence levels.

- sheep farms, beef farms and sheep & beef farms are all less likely to like using digital technology in their business
- sheep & beef farmers are less likely to be confident problem solvers for digital devices
- beef and sheep & beef farmers are less likely to feel confident using digital tools.

The overall picture in terms of attitudes towards digital technology is positive, particularly regarding opportunities for data sharing. Farmers and growers want to see their data put to good use and have confidence that their data can be closely controlled.

Significant differences between sheep, beef and sheep & beef are highlighted in the table below.

- beef and sheep & beef farmers are less likely to be early adopters
- all three farm types are less likely to see the current value of digital technology
- beef farmers are less likely to be data sharing and also less likely to be confident in the security of their on-farm data.

[10] Statistics from Beef + Lamb NZ reported on Tupu.nz
[11] Sample by primary activity type: Sheep n=116, Beef n=254, Sheep & Beef n=125, All other farmers and growers n=506. Data tested at the 95% confidence level for statistical significance.

% agreeing or strongly agreeing with each statement

I like using digital technology in my business
- Sheep: 36%
- Beef: 34%
- Sheep & Beef: 43%
- All other farmers and growers: 55%

When I come across problems with digital devices, I think I can solve them
- Sheep: 23%
- Beef: 22%
- Sheep & Beef: 18%
- All other farmers and growers: 28%

I feel confident using new digital technology tools
- Sheep: 34%
- Beef: 28%
- Sheep & Beef: 29%
- All other farmers and growers: 42%

Legend: Sheep | Beef | Sheep & Beef | All other farmers and growers
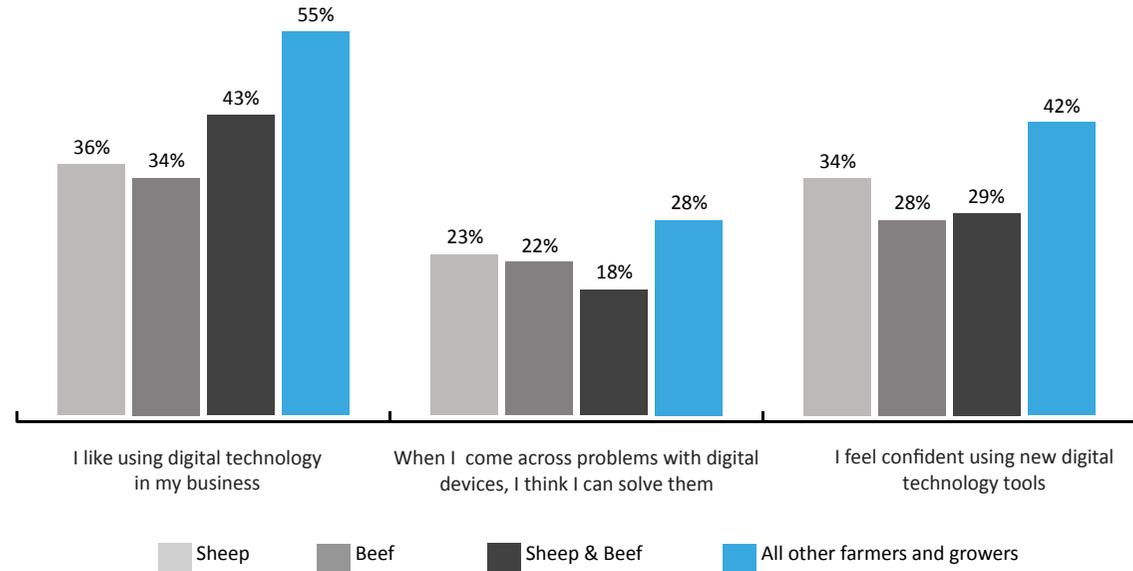
|	Sheep	Beef	Sheep & Beef	All other farmers and growers
I am generally one of the first farmers/growers in my area to use new digital technologies	21%	13%	13%	20%
I believe the digital technology currently available adds significant value to my operations	55%	43%	48%	70%
I know where to get reliable and impartial information about digital technologies	49%	46%	37%	46%
I share a range of my on-farm data with others	48%	38%	52%	55%
I am happy to share my data when it provides direct benefits to me	70%	74%	81%	78%
I believe who holds my on-farm data and how it is shared is closely controlled	62%	59%	64%	67%

Current adoption of tools does vary by farm type and operational needs. Business management is a good indicator to compare across the sector as it is a common need; for sheep, beef and sheep & beef farms, current adoption is lower, reflecting the lower levels of digital confidence and lower perceptions of the value of digital technology.

Intentions to invest amongst sheep & beef farmers are relatively high. The data shows that this group are unlikely to be early adopters of a tool and do not necessarily see the value at this stage. They are not confident users. This group must therefore be a good potential market, they are waiting to be convinced that a tool is right for their farm and that it is easy for them to use.

% currently making use of digital technology, by operational area

Operational area	Sheep	Beef	Sheep & Beef	All other farmers and growers
Business management	69%	60%	68%	76%
Animal management (and milking)	62%	71%	72%	62%
Plant / crop management	17%	9%	18%	44%
Fertiliser / nutrient management	47%	28%	43%	51%
Effluent management	0%	1%	2%	25%
Water / irrigation management	26%	8%	15%	40%

Legend: Sheep | Beef | Sheep & Beef | All other farmers and growers

% intending to invest in the next 2 years

Operational area	Sheep	Beef	Sheep & Beef	All other farmers and growers
Business management	36%	34%	48%	35%
Animal management (and milking)	35%	36%	47%	31%
Plant / crop management	21%	13%	21%	28%
Fertiliser / nutrient management	33%	28%	43%	35%
Effluent management	1%	5%	7%	26%
Water / irrigation management	18%	11%	19%	27%

AgriTech NEW ZEALAND

The top three barriers across the sector as a whole are cost, proof of ROI and a reluctance to move from manual/written systems that are proven to work. For sheep, beef and sheep & beef farmers, poor internet connectivity is slightly more significant.

The shift to digital is a product of intent (internal motivation or enthusiasm indicated by current levels of adoption), external pressures (drivers of adoption) and the third dimension, resistance (barriers to adoption).

All sub-sectors are represented in each segment and an individual's relationship to a segment can vary according to the type of technology adopted or as situations change in the business. However, there is a higher likelihood that beef farmers are represented in the Traditionalist segment and the Conservative segment

Traditionalists tend to be confident that their methods work. They have a low appetite for change, tend to be happy with the way they have always done things and/or are committed to traditional farming methods. They also have low levels of confidence with digital technology, poor perceptions of tools that they have come in contact with, and higher perceptions of risk around data sharing. They may not be averse to contractors on farm using digital technology for set tasks e.g., spraying, but do not see the value for themselves. For this group it will be about moving the farm along the digital journey, rather than the farmer.

Conservatives have similarly low levels of digital confidence and poor perceptions of the value of digital technology, but they are more open to consider. However, this group are more likely to be restricted by poor internet service and cellphone coverage than some of the other segments. As they are typically smaller sized operations, they may face profit and cash flow challenges that become barriers to implementation. They will perceive digital technology to be something for bigger operations, unless it offers labour savings or is required for compliance.

% rating the barrier as significant or very significant

Sheep | Beef | Sheep & Beef | All other farmers and growers

Segment make-up by sector
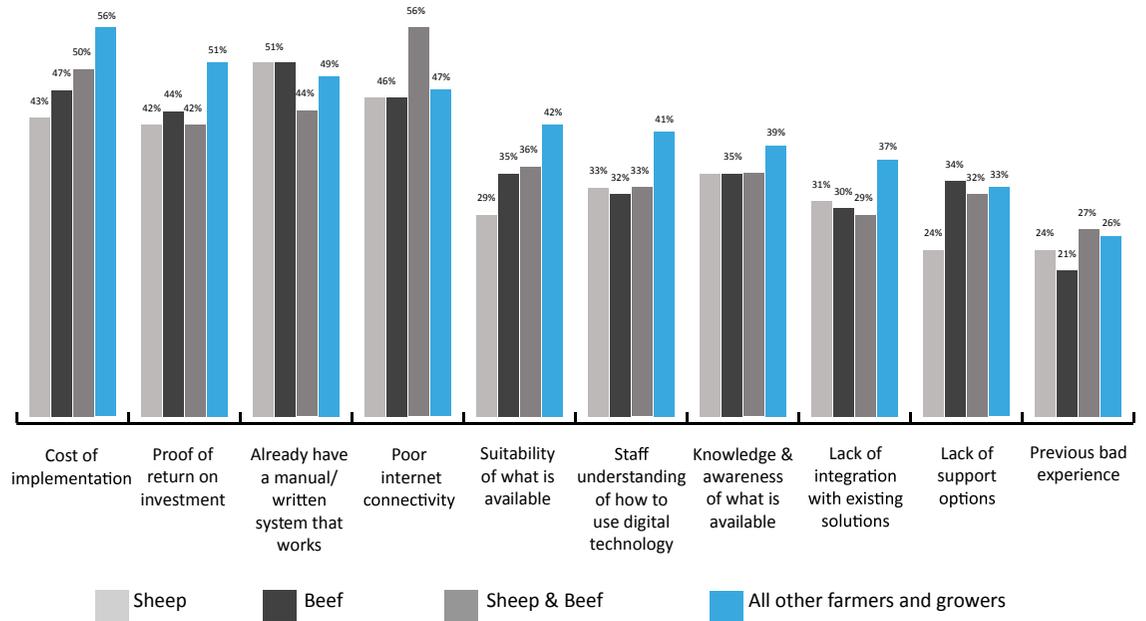
Dairy | Sheep | Beef | Sheep & Beef | Arable | Horticulture | Other
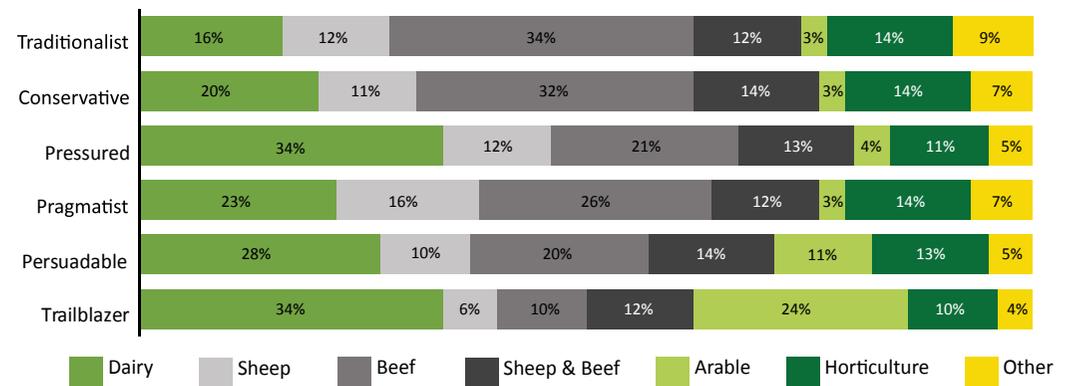
What's next?

Digital agriculture represents a significant opportunity to enhance New Zealand's primary sector, including economic, environmental, and social outcomes. This project has created a baseline for digital adoption across the primary sector providing powerful insights to on-farm use of digital technologies and the strategies to enhance and support them.

There is a wealth of data in the project that has only just been touched on in this summary report. This information will continue to be analysed to support and drive public and private sector priorities on extension and digital support of our agricultural industry.

The project has been designed to provide a repeatable and statistically sound platform for insight delivery. The value of this project will grow as subsequent survey iterations are completed.

If you have any feedback or thoughts you'd like to share regarding this report, please don't hesitate to contact us at **info@agritechnz.org.nz**

Appendix

Research design

AgriTechNZ is an association of organisations that have come together to lead a programme of work to maximise the opportunities enabled by agritech and address any challenges. Research First is an insights agency that specialises in rural sector research.

AgriTechNZ and Research First have developed an insights project that provides visibility of the relative adoption of technology across the primary sector and will inform better digital and outreach strategies that are truly aligned with farmer and grower needs, focusing on the risks as they see them. This project is supported by core industry partners: Zespri, Foundation for Arable Research, Fertiliser Association of NZ and DairyNZ.

Over 1,000 farmers and growers have taken part in the research so far. The project combined a survey element, engaging a robust and representative sample of over 1,000, and a deep-dive qualitative follow up where Research First spoke to groups of farmers and growers in more detail to pinpoint the challenges faced with digital adoption and data sharing. A summary of the research is provided in this report.

The survey component provides a repeatable and statistically sound platform for insight delivery. Data was collected through telephone surveys with a random sample of farmers matching the profile of agricultural production in New Zealand. The sample profile by activity type and associated error margins are shown in the table. Error margins increase as sample sizes decrease so the smaller activity types have relatively high error margins. For this reason, these results have not been reported by sub-sector as part of this report, though it is critical that they were included in the 'all farmers and growers' sample to ensure this is a truly pan-agricultural piece of work. Data in this summary report has been rounded for accessibility so totals will not add to 100% in all cases.

Main Activity	Ag Prod Stats	Achieved Sample (%)	Achieved Sample (n)	Maximum Error Margin[11]
Beef	25.2%	25.4%	254	+/-6.2%
Dairy	23.3%	24.5%	245	+/-6.3%
Hort	12.9%	13.0%	130	+/-8.6%
Sheep & Beef	11.9%	12.5%	125	+/-8.8%
Sheep	11.3%	11.6%	116	+/-9.1%
Arable	6.3%	6.6%	66	+/-12.1%
Viticulture	2.7%	2.7%	27	+/-18.9%
Deer	1.6%	1.7%	17	+/-23.8%
Equine	2.6%	1.0%	10	+/-31.0%
Poultry	0.4%	0.4%	4	+/-49.0%
Pigs	0.2%	0.2%	2	+/-69.3%
Other	1.5%	0.5%	5	+/-43.8%
Total			**1,001**	**+/-3.1%**

NOTE: As part of this agriculture research, respondents were chosen under A01 in the ANZSIC codes so therefore do not include fisheries (A02), fishing, hunting and trapping (A04), forestry and logging (A03).

[11] Maximum error margins are calculated at the 95% confidence level.

Farms surveyed

NORTHLAND 101
AUCKLAND 53
BAY OF PLENTY 82
WAIKATO 85
GISBORNE 48
TARANAKI 63
HAWKE'S BAY 55
NELSON TASMAN 60
MANAWATU-WANGANUI 72
WELLINGTON-WAIRARAPA 54
WEST COAST 41
MARLBOROUGH 45
CANTERBURY 105
SOUTHLAND 70
OTAGO 67

● Farms surveyed