Wimmera Southern Mallee

Remote Data Use In Agriculture

Final Report, March 2013

WDA Wimmera Development Association Inc

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Acknowledgements
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Contact details

ORM Pty Ltd
PO Box 189, Bendigo Vic 3552
03 5441 6176
admin@orm.com.au
www.orm.com.au

Wimmera Development Association
62 Darlot St Horsham Vic 3400
03 5381 1744
info@wda.org.au
www.wda.org.au

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Executive Summary

"Agriculture is fast becoming one of the most technologically advanced industries in Australia, with some of the lowest levels of phone and data reception. Farmers need up to the minute reliable information, to make informed decisions, and to get the most from efficiency improving technology. The National Broadband Network (NBN) stands to unlock a huge potential for technology development in this industry" (anonymous survey participant).

The Wimmera Development Association (WDA) identifies agriculture as the largest industry sector in the region in terms of employment, expenditure, gross revenue and regional exports. Given its significance in the local economy, agriculture in the Wimmera Southern Mallee needs to stay attuned to the exciting opportunities existing and emerging in the digital economy.

This project undertook extensive regional survey work to benchmark the current use of information and communications technology (ICT) in the agricultural sector of the Wimmera Southern Mallee region.

Approximately 50 % of survey respondents in this project rated the potential benefit of all ICT applications surveyed as above average, even where they did not use the technology. This indicates that many respondents are aware of current and emerging ICT in agriculture.

Primary producer ownership of smartphones in the region is above the national average. However, there is a large variation as to how and where they are used. There is reasonably high uptake of advanced internet use and cloud computing applications in some business sectors. The uptake of more recently emerged technologies such as high definition (HD) cameras, remote machinery control and aerial observation, is less advanced.

Throughout the project, the need for training was commonly identified, with the highest priorities in the following areas.

1. Improving efficiency with the use of smart technology such as smartphones, tablet PCs, and apps.
2. Advanced use of the internet.
3. Remote ICT applications; including using ICT to remotely manage data capture, storage and manipulation, or remote monitoring and control of machines.

Cloud computing platforms will have a role in the development of ICT in the Wimmera Southern Mallee region, and ranked in the top five training priorities. A lack of training was also identified for factory fitted ICT in new machinery, and precision agriculture (PA) products.

The two most common barriers to adopting ICT were poor mobile phone reception and low internet speed. Both are critical to harnessing the full ICT benefits that the digital world continues to offer. This is particularly so with respect to services from a mobile device.

A large percentage of survey respondents in each business sector are unaware, or find it difficult to quantify, what the benefits will be of introducing a high speed broadband service, i.e. the National Broadband Network (NBN), to their community. This reinforces that regular awareness and training will be important to continue to engage the agricultural sector and ensure ICT efficiencies are adopted. Improving connectivity will assist in enhancing business profitability and sustaining communities disadvantaged by remoteness. "Quality mobile service is restricting my profitability by around 4 % to 5 %" (Anonymous survey respondent, Nov 2012).

There are a number of key strategic initiatives that WDA can employ to ensure that agriculture in the Wimmera Southern Mallee region stands ready to embrace ICT in the digital economy. These initiatives are focused around awareness, engagement, training and adoption.

1. Introduction

The aim of information technology (IT) is to efficiently and effectively convert inputs into meaningful output (Uphoff, 2012). IT continues to evolve at a rapid rate with many technology cycles lasting for as little as five years. Higher data capacity and speeds improves our 'connectiveness' to the rest of the world, and opens new opportunities that haven't yet been conceived.

In the Wimmera Southern Mallee region, Agriculture, Forestry and Fishing accounts for 20% (4,376) of regional jobs and generates 17 % ($935.7M) of gross revenue and 37 % ($753.2M) of regional exports (WDA, 2012). This makes agriculture the largest business sector in the region. The ability for this key sector to embrace ICT efficiencies will be determined by various factors including awareness of current and future applications, robust infrastructure to support the technology, a vision for the future and a strategic approach to overcome barriers to adoption.

The Wimmera Development Association (WDA) project 'Remote Data Use in Agriculture' is aimed to benchmark the current use of ICT, specifically remote data access and application, in the agricultural sector of the Wimmera Southern Mallee region. Further, it will identify strategic activities to support the increased use of ICT in the region.

2. Methodology

ORM, in conjunction with the WDA, ran an ICT information session in Horsham on the 15th October 2012, and met with five regional focus groups spread across the Wimmera Southern Mallee region in the same week. A cross-section of regional stakeholders, including representatives from existing regional networks, were invited to participate in the information session to increase their awareness and collect feedback. That information was then used to develop a survey (Appendix A) to measure the current use of ICT and advance capabilities in the region.

The Horsham ICT session was conducted over approximately four hours and included a combination of information delivery and breakout discussion groups. Presentations included:

- Conducting business online, Pru Cook, Department of Primary Industries;
- Broadband technology, Andrew Skewes, LaTrobe University; and
- University of New England's (UNE) 'Smart Farm' adoption of ICT in conjunction with the NBN roll-out, Professor David Lamb, University of New England.

Thereafter, the audience broke into smaller breakout groups to discuss and answer four key questions.

1. Who is using what where?

   i.e. What are the current ICT applications you use personally and in your business, specifically remote data access and application?

2. What do you want to do?

   i.e. In an ideal world, with no constraints, what ICT opportunities would benefit you or your business and how will they help you economically?

3. Why can't you do it now?

   i.e. What barriers are stopping you using this technology right now?

4. Strategic Activities

   i.e. What does our region need to do to support emerging ICT and its increased use?

The regional focus groups were conducted at Birchip, St Arnaud, Warracknabeal, Nhill and Edenhope. ORM and the WDA met with key stakeholders for two to three hours to discuss specific regional issues, and then participants were asked to respond to the four key questions outlined above.

3. ICT applications used in agriculture in the Wimmera Southern Mallee region

The survey ran for the month of November, 2012. A total of 123 participants completed the survey which was considered a very good response rate by Roberts Evaluation (Appendix B) who assisted with development and layout. Response to the survey included a good cross-section of regional stakeholders and districts in the region (Figure 1 & 2).

Key points about the respondents include:

- Primary producers made up the highest number of participants (45 %)
- Most respondents were aged between 31 and 60 years
- 76 % of respondents were male
- Figure 2 shows the geographic spread of respondents.

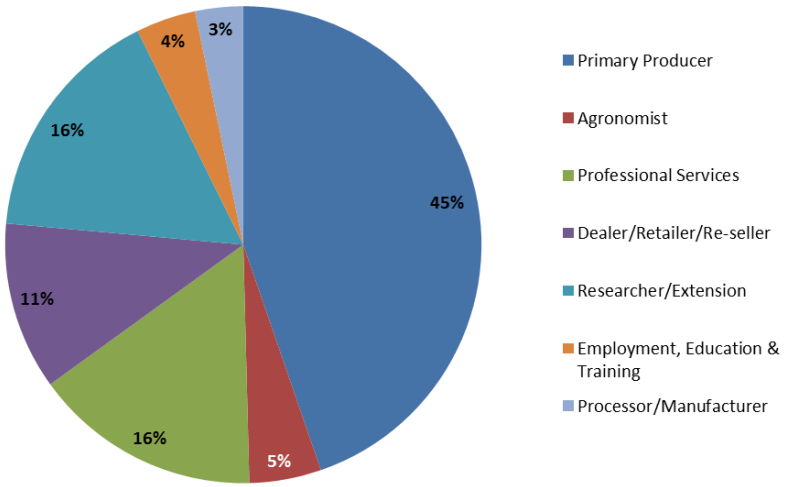

Figure 1. Primary business role (n=123)

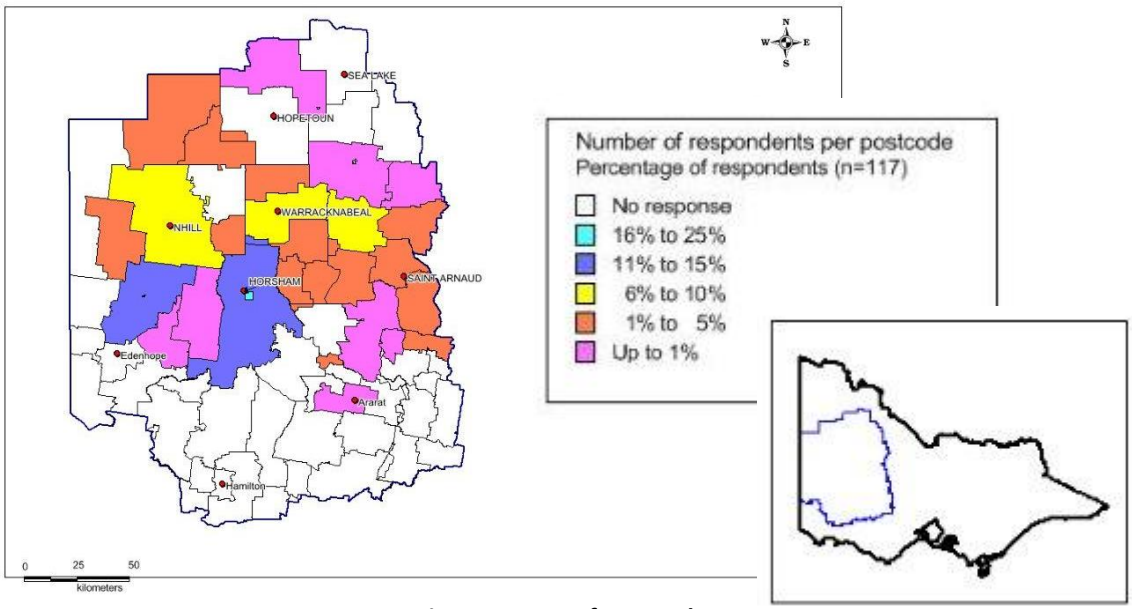

Figure 2. Map of respondents

3.1. Internet advanced

At least 77 % of respondents in each business sector were using the internet for more than just general internet searching or email (Figures 3). Advanced internet use extended to banking, webinars, video-conferencing, web-conferencing, online shopping and online tuition e.g. YouTube. Despite the high use, training on the advanced use of the internet was still identified as a high priority in the survey.

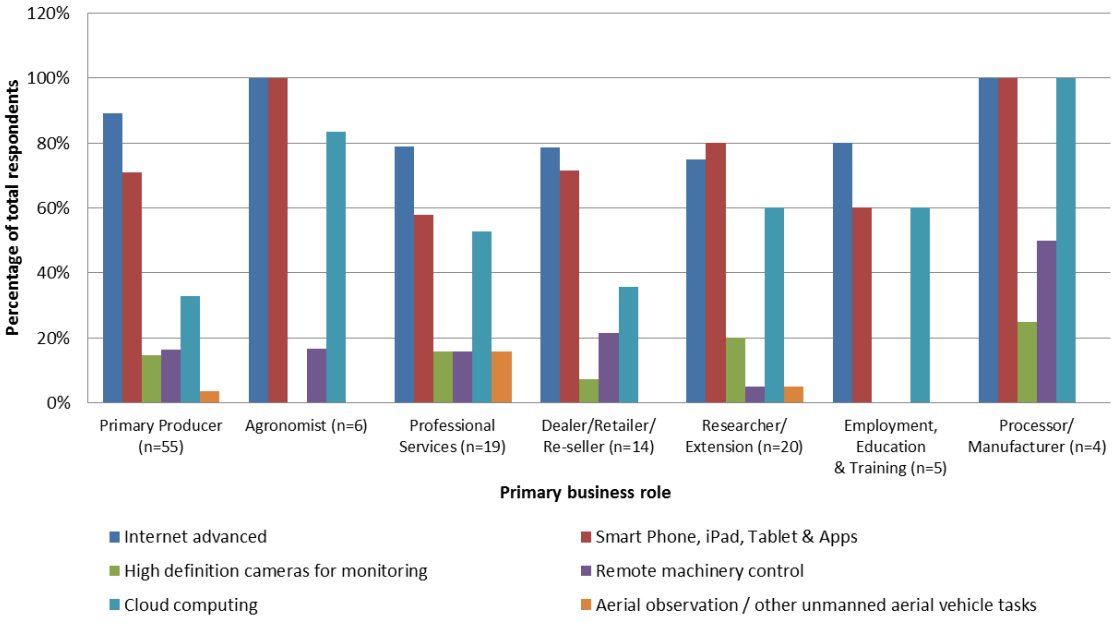

Figure 3. ICT applications used in respondents' businesses (n=123)

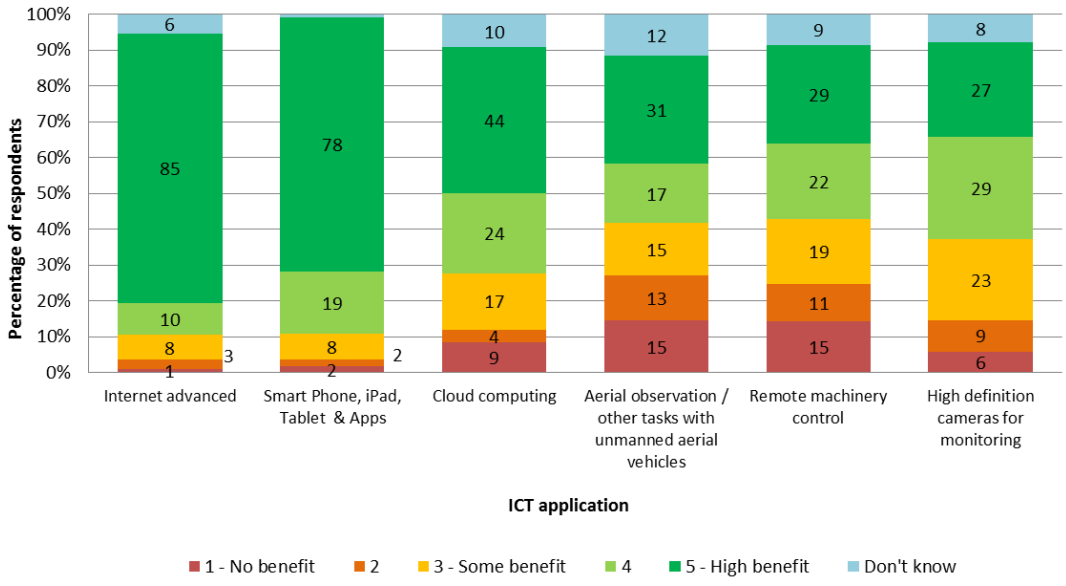

Figure 4. Potential benefit of ICT applications to business (n=117)

3.2. Smart phones, iPad's, tablet PCs and apps

The introduction of smartphones has reshaped mobile computing given their ability to store data, access to the internet, ease of use, range of general functions and apps. Apps running on mobile devices, such as smartphones and tablet PCs, enable some business functions to be performed remotely i.e. out of the office. A list of apps currently being used in the region was collated in the focus groups and is attached as Appendix C.

Just over 70 % of all respondents were using smartphones, ranging from 58 % for professional services to 100 % for agronomists and processors or manufacturers (Figure 3). Primary producer adoption of smartphones and tablet PCs was 70 %, which is above the estimated national adoption level of around 56 % according to recent nationwide survey (Roberts 2012).

General internet browsing, email, calendar and to-do list functions, and weather forecasts were the main use for smartphones. However with the number of new apps expanding rapidly, smartphone use is fast extending to grain marketing, online shopping, task planning, paddock recording and synchronising data to other devices. In line with this, there also appears to be a trend toward the adoption of tablet PCs with large screens and keyboard to improve functionality and word-processing ability from remote locations.

Focus group discussions identified that while there was a big proportion of smartphone owners, there was a large discrepancy in the use of features and efficiency with technology. It seems that many users are simply unaware of the full potential, and are not technically literate to setup and use all the features. Anecdotally, first time users can become frustrated with the initial setup and settings, resulting in them abandoning the idea and resorting to using the phone for basic telecommunications only.

3.3. Cloud computing

The ‘cycle of speed’ dynamic means improvements in hardware and bandwidth stimulate new applications, which in turn fuels demand for more broadband coverage and capacity (Skewes, 2012).

Cloud computing can be a faster, cheaper and a more strategic way of using software and storing data in a business. Rather than owning and regularly updating software, specialised expensive applications, servers and other hardware, these can be sourced via the internet. All the user needs is a computer or mobile device with an internet connection and a web browser. Data and programs can be stored and accessed via the cloud.

An agronomist in one focus group had embraced cloud technology to increase the effective storage capacity of his smartphone and iPad to the extent that he considered his mobile devices a ‘filing cabinet in [his] pocket’. A high-gain antenna was fitted to his car to improve connectivity and his smartphone was used as a Wi-Fi hotspot for his iPad. “I have access to everything out in the paddock”, says the agronomist.

Further efficiencies of cloud computing include 24/7 access to and updating of remote data; enhanced collaboration by enabling multiple user access from different locations at the same time; and a central storage point.

The survey results showed that cloud computing was widely used by at least a third of respondents in each sector (Figure 3).

Some focus group participants flagged security concerns with the use of cloud computing. The processor/manufacturer sector ranked security concerns as one of their top five barriers to adopting

some ICT applications. This concern relates to the fact that data and programs accessed through the cloud are stored on a third party server in another location, possibly elsewhere in the world.

Other focus group participants discussed how they used the cloud strategically to store non-sensitive data for remote or multiple user access for short-term needs, and then removed from the cloud storing it back on their office computer. In his presentation to the Horsham ICT information session, Professor David Lamb outlined UNEs strategic use of cloud computing given the expanding volume of data they use on their Smart Farm.

Many farmer and agronomy focus group participants identified YouTube as a popular tuition source. This is a simple example which highlights the extra data demands today compared with just five years ago before applications such as YouTube became popular.

Given the desire to manipulate expanding volumes of data, cloud computing platforms will have a role in the development of ICT in the Wimmera Southern Mallee region, and was identified as a top five training priority.

3.4. High definition cameras for monitoring

Video-linking with HD cameras via fast streaming mobile broadband is a critical service for regional and remote communities (Lamb, 2012). This technology acts to minimise the distance issues of living in rural and remote areas by offering applications such as:

- More active and intimate experience between users;
- Sharing and analysing data simultaneously;
- Remote diagnosis
    - Technical support e.g. diagnose problems and identify specialised parts ensuring timely repair and minimise downtime, provide general advice on operation and setup of machinery and other resources,
    - Agronomy and vet services e.g. diagnose weeds, diseases or nutrition issues , revolutionising how these services are provided by replacing or enhancing paddock inspections and leading to large efficiencies and cost savings;
- Improving remote education via schooling, training, short courses, and possibly attendance at field days;
- Improve emergency health and medical services e.g. eHealth; and
- Improve support or advice on mental and emotional health in rural and remote areas
    - A focus group participant with experience in this field suggested 50 % of patients with depression are not likely to visit a doctor but more likely to access information on the internet.

David Lamb outlined UNEs research into HD optical sensors. These sensors have many potential applications including measuring livestock weight gain remotely, and aeroplane mounted sensors to simultaneously sense crop vigour and broadcast fertiliser in the same pass. David advises "There is no new science in this technology that wasn't around ten years ago, however the computer power and speed available now make it functional."

The survey indicated that HD cameras were used by up to 23 % of respondents in all sectors other than Agronomist and Employment, Education and Training (Figure 3). The 18 % use by the Professional

Services sector is likely to be the use of video-conferencing technology for seminars, webinars and client meetings.

Focus group participants flagged that HD cameras are currently being used to monitor livestock troughs and feeders, sense weeds and plant nutrition i.e. WeedSeeker™ and GreenSeeker™ technologies, and to monitor machinery movements and levels. One focus group participant had mounted cameras on his headers with the screen in the chaser tractor so the chaser driver could monitor which header to prioritise unloading first. Another participant had just converted to stall-free pig sheds which meant that employees would have more direct exposure to the animals. He was planning to use HD cameras to help monitor staff welfare. Others identified using HD cameras on unmanned aerial vehicles (UAVs) to inspect tall infrastructure, which is now common practice with electricity utilities.

3.5. Use of precision agriculture including remote monitoring

The survey results suggest all sectors, except the processors/manufacturers, used some form of PA (Figure 5 & 6). The high level of use in the professional services sector includes businesses providing PA technical support to the agricultural sector. The employment, education and training sector included Longerenong Agricultural College, who run a farming operation and use PA.

Primary producers were the largest users with 76 % of respondents using some form of PA (Figure 5).

The Wimmera Conservation Farming Association (WCFA; now the Wimmera Farming Network) surveyed 300 members in 2006 and measured similar usage (n = 147). While the survey area may have been slightly smaller than this survey, the following table of results indicates the likely growth in use of PA technologies since 2006.

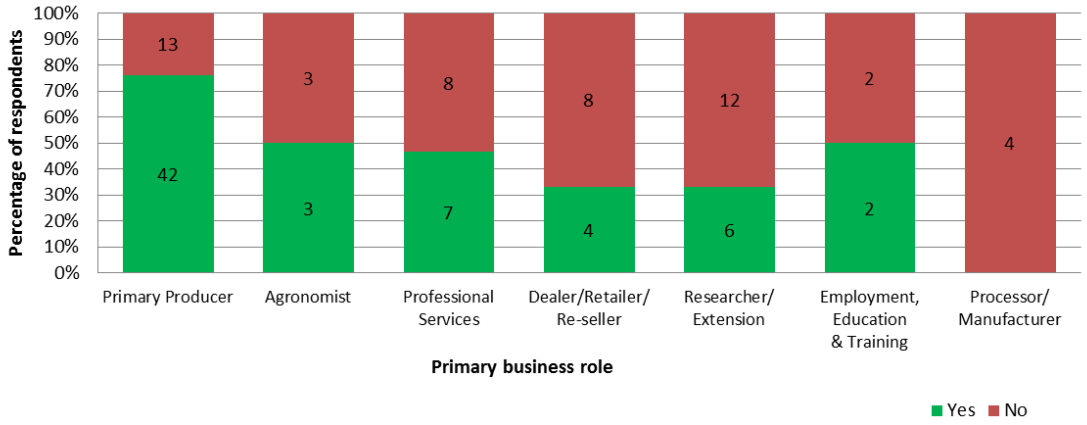

Figure 5. Users of precision agriculture by business sector (n=114)

Data sourced from yield maps are used to program variable rate technology (VRT). Results from the two surveys suggest that yield mapping use has increased approximately 30 % while the adoption of variable rate technologies has increased only 13 %. The increase in yield mapping is likely due to mapping technology becoming standard on most modern headers. Focus group discussion supported the WCFA survey conclusion that lesser variations in soil types in the Wimmera Southern Mallee resulted in minimal benefits of VRT, compared to the Mallee where there is significant separation in the soil types and characteristics. The cost of PA technology during a series of dry and unpredictable seasons during the millennium drought is another factor that may have impacted on VRT adoption.

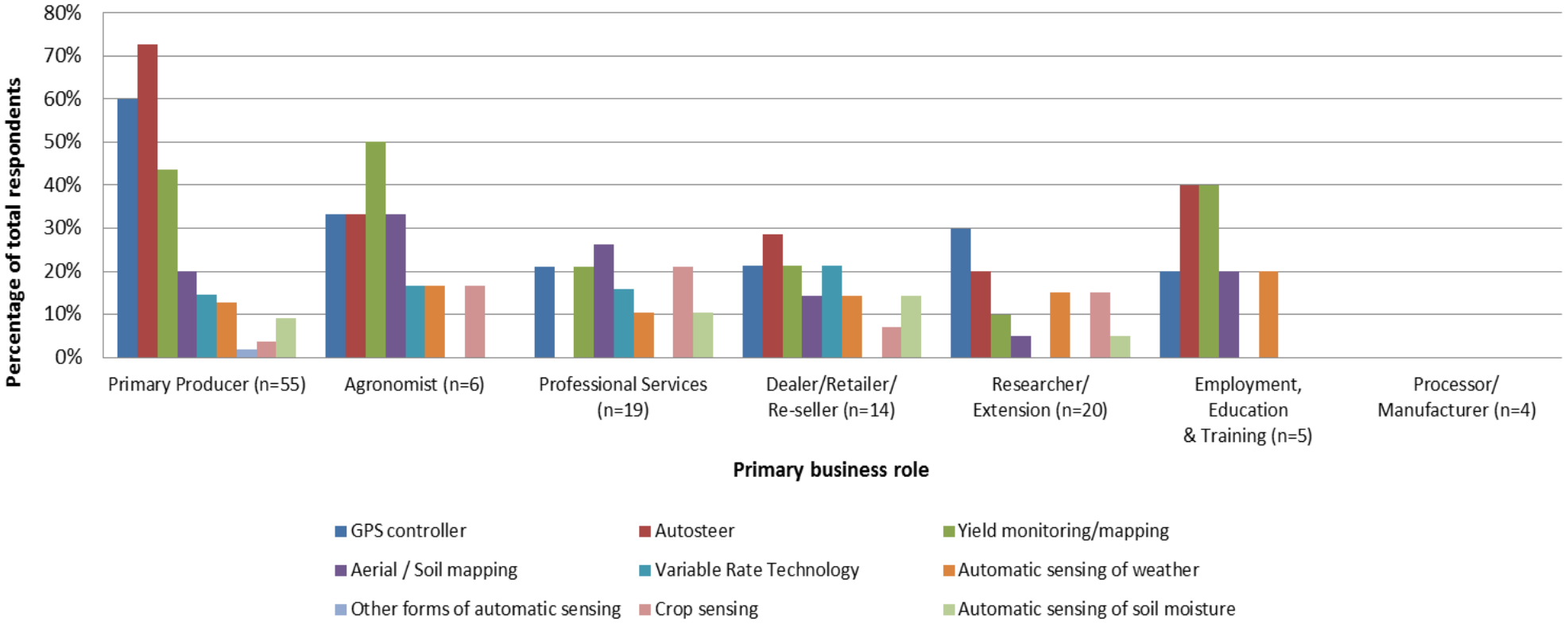

Figure 6. Precision agriculture technologies used by respondents (n=123)

When asked about the perceived benefit of PA technologies 75 % of all respondents rated yield mapping as having above average benefit, but only 50 % rated VRT as having above average benefit (Figure 7).

Focus group feedback suggested that while VRT may not be currently economical in the Wimmera many will continue to collate yield maps because:

a) It is easy to do so on any machine with the yield mapping technology being standard;
b) Ongoing research and emerging technology may 'crack the code' to interpreting these maps for economic benefit; and
c) A series of maps over several years will produce more reliable trends than one or two years' worth of data.

Of note was the number of respondents using ICT to monitor weather, moisture, crop and other environmental factors. This is expected to grow substantially as the technology improves, costs decrease and mobile coverage improves. A number of focus group participants were using soil moisture probes but could not yet monitor them remotely.

Other remote monitoring applications discussed in the focus groups were related to the livestock sector:

- Dry matter and nutrient removal e.g. UNE are mapping livestock movements within a paddock and identifying ranges in grazing pressure from 5 to 200 dry sheep equivalents (DSE) per hectare on a paddock rated at 15 DSE/ha carrying capacity.
- Location e.g. a $20 ear tag that emits a signal every 15 minutes for three years are being used at UNE to identify exactly where cattle are calving and therefore enabling them to be located simply even in the middle of the night.
- Calving alerts and the ability to monitor worm burdens are currently experimental technology that is expected to be available in the near future.
- Shutter alerts are being used at a piggery to alarm the operator by SMS if the shutters had not opened when a nominated temperature was reached.

Electronic ear tagging in the sheep meat industry is expected to assist with tracking stolen stock, and more regular and automated handling e.g. weighing, drafting.

Table 1. Use of precision agriculture technologies.

Precision agriculture technology	WDA survey (2012)	WCFA survey (2006)
Auto steer	72 %	31 %
Yield Mapping	43 %	14 %
Aerial/soil mapping	20 %	6 %
Variable Rate Technology	15 %	2 %
Automatic weather sensing	12 %	Na
Automatic soil moisture sensing	9 %	Na
Automatic sensing other – nutrient, pest, livestock	2 %	Na
Crop sensing	4 %	Na

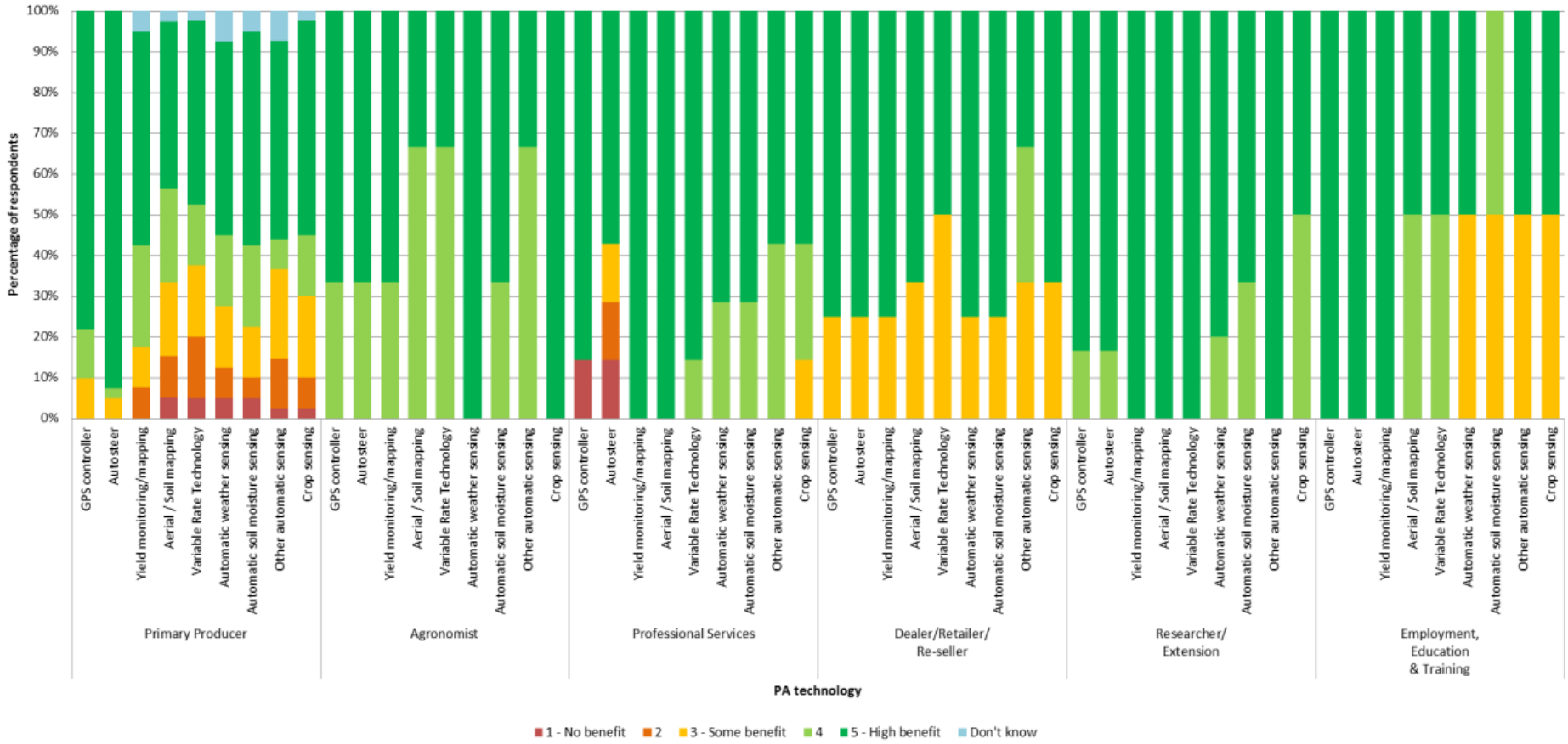

Figure 7. Benefits of precision agriculture technologies to business (n=64)

Professor David Lamb believes improved broadband technology will fuel new ideas around what is possible with PA technology. In the past a major problem has been getting the raw data from yield maps, EM38 soil moisture surveys and satellite remote sensing, to and from the mapping or PA service provider. This process will be streamlined and simplified in the future by the capacity of broadband technology. For example, eLEAF is a Netherlands based high-tech company supplying satellite 'pixel mapped' water and temperature information directly to smartphones to enable informed management decisions (http://www.weforum.org/content/smart-phones-smart-farming).

Two particular brands dominated the market for auto-steer, GPS controller, and yield monitoring equipment. Compatibility of these basic PA applications rated very well.

There was a wider variety of variable rate technology brands used by respondents, with compatibility rating deteriorating slightly.

A lack of training on PA equipment was identified as an issue throughout the focus groups discussions. However, in the cases where the equipment had come with the purchase of a new machine there was no indication that the buyer had negotiated a service agreement with the dealer to provide such support. A dealer suggested most consumers buy a car these days without any dealer support to teach them how to use the electronic technology provided as standard, and reiterated that machinery was no different.

Focus group discussions also identified that farmers often under utilise factory fitted electronic technology that comes standard with new machinery. Reasons for this included:

- They don't know what the capabilities are;
- They have never learnt how to use it;
- It is too complicated for them;
- They don't drive the machine regularly enough;
- They don't plan ahead to train themselves outside of the busy work periods; and
- There is little dealer support for training in its use.

Often it was the younger generation that started programming and using technology when they came home to the farm. They eventually trained the older generation in the use of the factory fitted electronic technology.

There are opportunities to improve awareness, training and support for PA, and factory fitted electronic technology sold with a new machine. There are also opportunities for the buyer to negotiate a service agreement with the purchase of a new machine. For example, a focus group participant suggested header training, e.g. header schools, would be more effective by scheduling one day of basic and most important feature tuition, followed by a field visit over harvest to answer questions. "Even the young farmers disengage after the first day of an intensive three day header course" said the participant. This would give the farmer time to start using the machine, and identify where they needed additional training.

3.6. Management planning and recording programs

At least 68 % of primary producers used their own management planning and recording programs, usually a simple spread-sheet, or other programs in addition to the main commercial programs listed in the survey (Figure 8). Some respondents used more than one program, which is why there is more than 100 % in total for each sector. 30 % of primary producers used Concepts Rural™, while 17 % used PAM™. If a factory fitted program was used, it was usually in integration with one of the other commercial programs so that management could conduct further analysis.

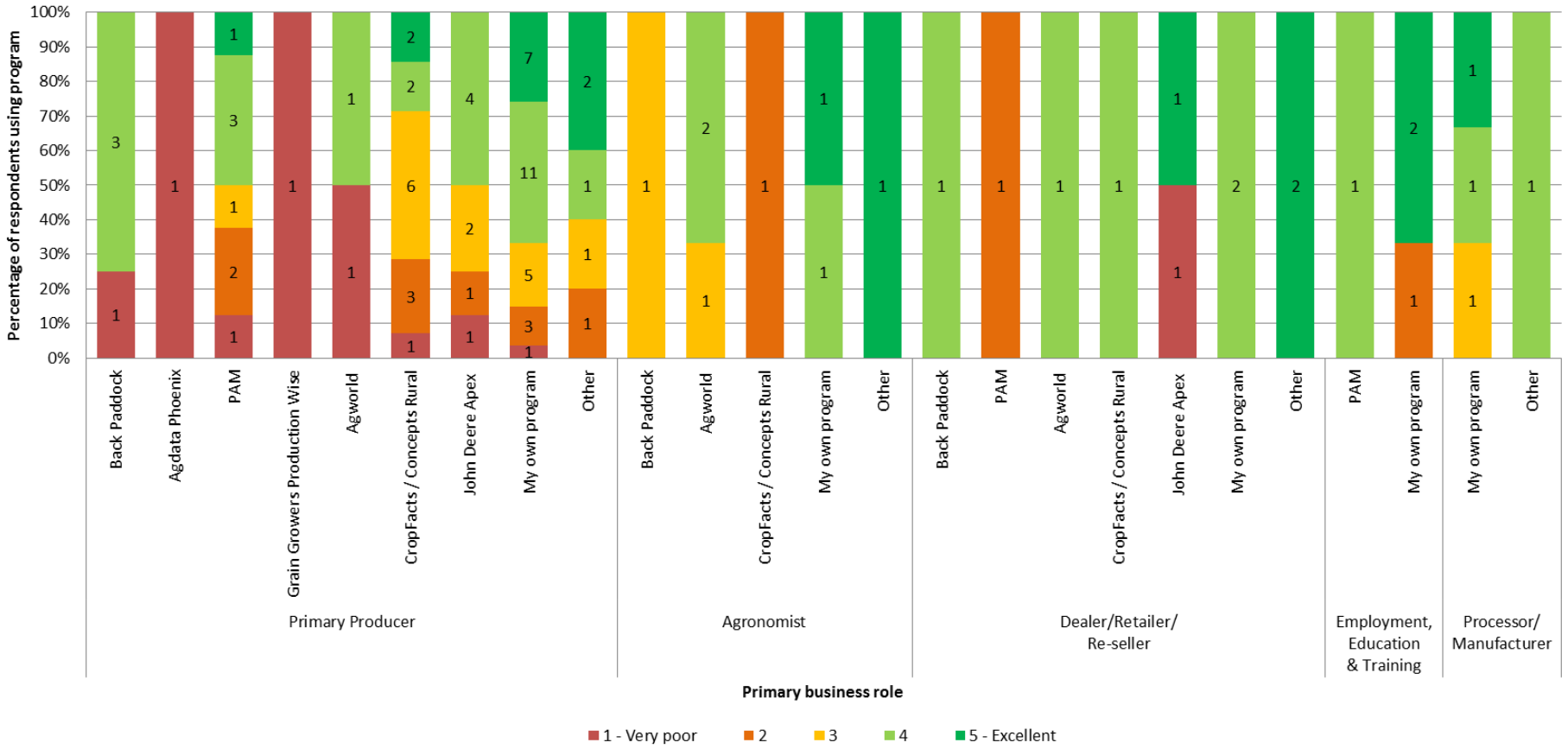

Figure 8. Management planning and recording programs used by respondents and their rating (n=53).

The relatively low adoption of the main commercial programs by primary producers indicated that the applications were not always meeting their needs. There were varying responses from the regional focus groups as to why this was so, including:

- Technical support and compatibility. Some respondents used a program that was purchased by a competitor. The new integrated program was not as robust, did not have the backup technical support, and old data could not be imported to analyse trends over the longer term.
- Once bitten twice shy. A large agronomy firm had invested in a program which wasn't embraced by their farmer clients and so it was abandoned, however they are yet to replace it. Their experience suggested 'Ask 20 farmers which program they would prefer and you'll get 20 different answers'. Each business has their own preference.
- Not fit for the purpose. An anonymous survey respondent suggested "most agricultural management programs are designed poorly and even a higher amount are designed by people without any contact or understanding of agriculture. That is why few aggies trust such technology, it is poorly designed"

Some farmers in the focus groups were not sure which management and planning package to adopt, given the quick advances in ICT, and will hold back until the programs are more established and proven.

Many primary producers want the programs to be compatible and synchronise with their machinery, however an IT expert advised that there are too many variables and too much data or information to record in agriculture for one program to handle. Alternative suggestions collected from the focus groups were:

- Write individual programs for tasks rather than expecting the one program to do everything. An example may be a simple stand alone app to plan and/or record a spray job e.g. Spray App.
- Encourage machinery IT developers to offer a 'dump' facility from the machinery console, with a program that imports data into the management recording program of their choice.
- Remotely enter the data directly into the management program via:
    - Remote access to a cloud based program;
    - Remote access to their office PC; and
    - Remote data entry into a mobile device that is then synchronised back to storage.
- Encourage discussion around software standards between machinery IT developers, management recording program developers, and end users.

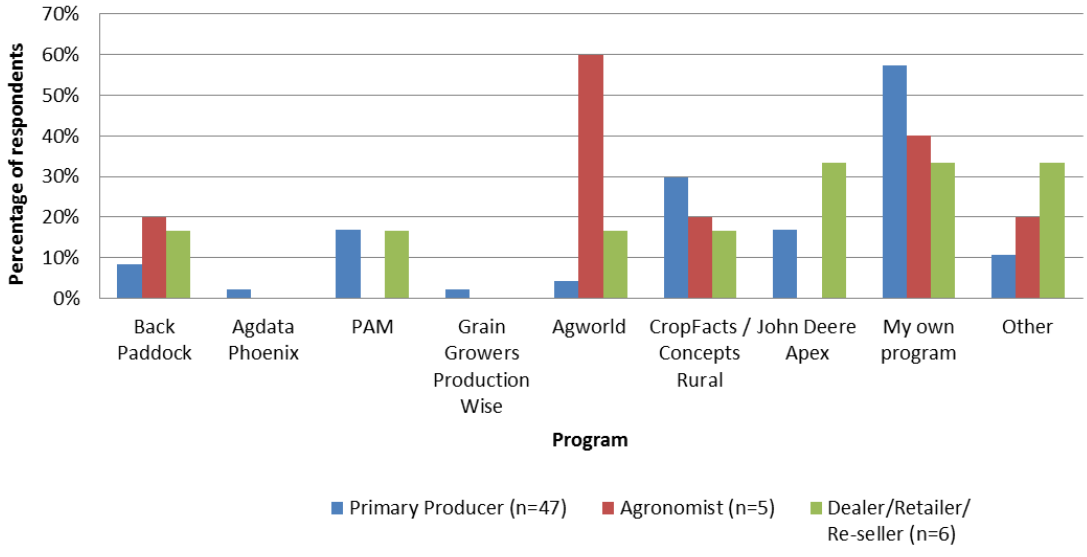

Figure 9. Management planning and recording programs used by respondents.

Despite the low use of the commercially available programs, primary producer respondents were generally happy with the programs they had selected to use.

Other programs identified in the survey are included as Appendix D.

The results indicate that there is still a lot of potential for farm planning and recording software to become more synchronised, easy to use and more widely adopted.

3.7. Electronic data capture in the workplace

Remote data capture facilitates single data entry, usually at the point where the data arises, thereby eliminating duplication and adding efficiency to the overall process.

In the past, any data captured away from the office typically underwent a series of manual transfers at various locations. The introduction of smart and cloud technology has advanced remote data capture and transfer with an increasing number of apps being developed to enable automatic transfer, or synchronisation, from the remote locations. Mobile apps are either stand alone once installed, i.e. they work independent of an internet connection, and synchronise when wireless internet is available; while others rely on a constant mobile wireless connection. The sync function also serves as a form of communication if there is more than one user accessing the data. For example, an alert can be set up on a smartphone to identify when an update is made, such as the movement of livestock by another worker. Or additionally, a manager can check an operation has been completed by checking their smartphone to confirm the livestock movement has been recorded.

The survey measured respondent's ability to:

a) Plan business operations on a portable device away from the main business office;
b) Record actual business operations on a portable device once the operation has been completed. For example, for primary producers this may include paddock operations, inputs used, grain and livestock inventory movements, or legislated recording such as workplace health and safety or chemical records; and
c) Share the data captured with other devices such as smartphones or cloud storage.

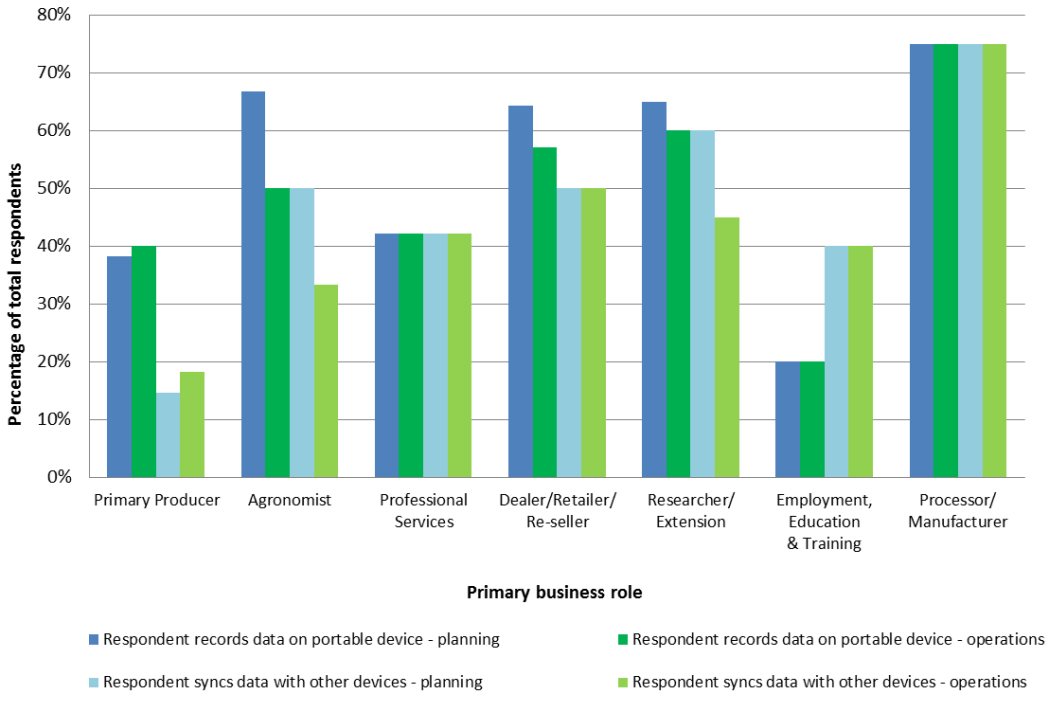

Figure 10. Electronic data capture in the workplace (n=123).

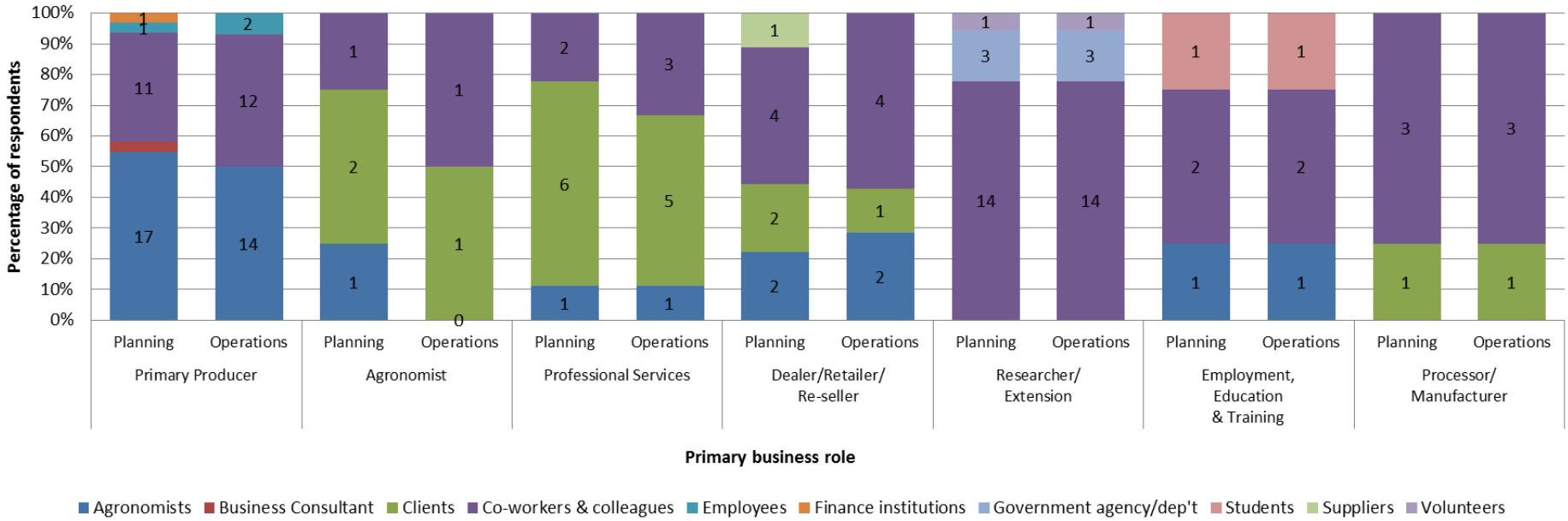

Figure 11. Who do you share your data with? (n=62)

At least 35 % of all business sectors, other than employment education and training group, were using portable devices to plan and/or record operations (Figure 10). Agronomists tended to use planning capabilities slightly more than other operators, which is indicative of their business role in setting out agronomic plans in the field for their clients.

Co-workers or employees, clients and service providers with a regular close relationship, were the main users that data was synced with from each business sector (Figure 11). For example, agronomists shared with primary producers and vice-versa; and government or students in the case of researchers and employment, education and training respectively.

The use of data synchronisation to other devices was relatively low for primary producers at 15 %, but was at least 40 % for the other business sectors represented in the survey. The low primary producer result is likely due to a combination of poor mobile phone reception and low use of management programs that facilitate this function.

Focus group discussion identified that some machinery manufactures are developing software to sync data direct to a phone app or in the cloud, thereby automating the transfer of data entered or recorded into the machine's console. As stated, farmers also identified that they would like this data to sync into their management planning and recording programs.

One farmer in the focus groups had established Wi-Fi syncing from his tractor once he got within 500m of the farm base. He also had a microwave Wi-Fi link between two farm houses 2km apart.

3.8. Remote machinery control

Focus groups identified numerous benefits in being able to monitor and/or control a machine from a distant or remote location. Some of the benefits included:

- Tracking machinery movements;
- Monitoring machinery performance;
- Aided specialist technical support;
- Aided diagnosis of breakdowns; and
- Managing skilled labour shortages.

One focus group participant had considered the introduction of auto-steer as enabling inexperienced labour to drive straight and handle large wide machinery. The flip-side is that the tractor cabin is now a highly sophisticated technological hub, requiring a ‘tech savvy’ operator to use it.

ICT advances are expected to allow an expert to dial in on a mobile device and monitor a machine, re-set the settings, or view the operator's issue and explain how to carry out the procedure to resume operation. This also provides an opportunity for a business to recruit staff based on different characteristics, e.g. less skilled labour. This technology will be invaluable in an industry that has an ageing workforce, sometimes not interested in learning new ICT, and that suffers from a shortage of skilled labour in general. Nevertheless, it will require robust mobile phone coverage to be effective.

It appears the main machinery manufacturers are now building machines with modems built-in to facilitate the above mentioned functions. These do not appear to be in use in the Wimmera Southern Mallee region at this point in time.

The survey indicated that 17 % of most sectors were using remote machinery control of some sort (Figure 3). Researchers and the employment, education and training respondents surveyed were not using remote machinery control at all.

3.9. Unmanned aerial vehicles

Unmanned aerial vehicle (UAV) technology exists and has been in use for some time in the police and military sectors, particularly overseas. These remotely controlled flying machines, commonly referred to as drones, can be used for aerial searching, close inspection of difficult locations, spraying, fire-fighting, ground-truthing satellite imagery, and sensing crop nutrient requirements. Their commercialisation for agricultural use appears to be in its infancy. It is expected that this form of ICT will develop quickly in coming years.

UNE is experimenting with a $17,000 UAV, requires a full pilot's licence to operate. There are strict restrictions on their use in Australian air-space. Aside from researchers, businesses that can spread the cost over a larger client base may have the potential to adopt of this technology initially.

In the Horsham information session Professor David Lamb introduced the concept of small 'spider' ICT machines. Driverless tractors have been discussed and researched for some time, however there is some debate regarding concerns about the technology steering off-track and causing an accident or incurring cost. Spider technology is based on the premise that, rather than large scale machinery, many smaller 'spiders' are deployed 24/7 in the paddock refilling more regularly. If these units go off-track they would cause little damage. As one focus group participant identified, current optical sensor technologies would be more affordable on a smaller 'spider' machine that ran 24/7.

A very small percentage of primary producers and researchers or extension staff were using UAVs, however the specific details of their use were not captured (Figure 3).

4. What else would you like ICT to do for you in your business?

Responses from the Horsham information session, regional focus groups, and the survey suggested they also wanted ICT to provide:

- A mechanism to promote, or defend, agricultural practices e.g. 'Agvocacy', through the use of social media. ICT advances have accelerated the adoption of social media, which can be used as a strategic ally in terms of promotion, marketing, information gathering, and general industry collaboration. Nevertheless, it use needs careful planning and management to ensure its effectiveness. Higgins (2013) describes social media as the 'Trojan horse' of the 21st century;
- Remote real-time commodity marketing;
- Virtual applications, such as virtual fencing or virtual shopping;
- Cost effective robotics e.g. some dairies use robotic technology now;
- Satellite monitoring of pastures e.g. integrated use of Normalised Difference Vegetation Index (NDVI) as a graphical indicator to analyse remote sensing measurements;
- Crowd-sourcing. Higgins (2013) described Google's potential use of six million android subscribers to crowd-source a weather network for the common good of commuters, travellers and pedestrians everywhere. Rather than pulling from 20,000 weather stations across the country, they could be pulling from 20,000 barometric sensors in a single neighbourhood or city from the barometer in every android phone. A wine company has designed an app to ask users to rate their beverages and provide feedback on preferred characteristics, an efficient way of capturing direct customer feedback.
- Crowd-sourcing has many potential applications for use in agriculture, ranging from more reliable rainfall predictions to mapping incidents of insect infestations or rust outbreaks
- Retina or fingerprint scanning for security; and
- GPS levelling to replace laser levelling.

5. ICT training and delivery

5.1. Training

Collectively, the highest priority for training was in the area of efficient use of smartphones, tablet PCs and apps (Table 4). This was not surprising given the large uptake of smartphones and the proven efficiencies that the technology is delivering.

The second highest priority was advanced use of the Internet for applications such as banking, video-conferencing and web-conferencing.

Individual business sectors priorities reflected the technology used in the business, and the perceived benefit. For example, primary producers had the lowest use of cloud technology and while 65 % rated it as some benefit or greater, they also recorded the highest number of don't know responses at 10 %. Conversely, the business sectors that recorded a high use of cloud computing, rated its benefit highly, indicating they were clear about its benefits and had no don't know responses. Cloud computing was also in their top five for training needs.

Don't know responses to Q 13, 'The degree to which respondents believe ICT will benefit their business, regardless of whether they use it now', of the survey are a flag to identifying other ICT areas for awareness training.

Training should:

- Include some economic analysis, such as how will it save time and/or money, improve the stewardship of the business or engage the current or a new customer;
- Provide a practical and interactive experience;
- Provide proven and robust examples that are fit for purpose and add value, avoiding disengaging participants is if the technology fails at demonstration and conversely encouraging rapid adoption where users see value;
- Be tailored to the target audience. For example:
    - Length and content. If introducing social media to first time users then limit training to a couple of popular mediums rather than the full range available.
    - Age and accepted knowledge level. While there will be people in all age groups with an interest in ICT, it is well recognised that Generation Y's (c. 1978 – 1994) are technology literate, and Generation Z's (c. 1995 onwards) are highly technology savvy with a high dependence on technology and social media. Therefore, their needs and initial knowledge level will be different.
    - Terminology. In many cases the KISS (keep it simple stupid) theory applies'.

Table 2. Top 5 ICT training options for respondents' businesses

Primary business role	Ranking in order of priority				
	1	2	3	4	5
Primary Producer	Smart phones, iPads, tablets and apps	Internet advanced	Remote applications	PA	General awareness of current and emerging ICT in agriculture
Agronomist	Smart phones, iPads, tablets and apps	(a) Remote applications (b) General awareness of current and emerging ICT in agriculture (ranked equally)	Internet advanced	PA	Cloud computing
Professional Services	Cloud computing	PA	Smart phones, iPads, tablets and apps	Remote applications	Aerial observation or other applications
Dealer/ Retailer/ Re-seller	Smart phones, iPads, tablets and apps	PA	Internet advanced	Remote applications	General awareness of current and emerging ICT in agriculture
Researcher/ Extension	Internet advanced	Smart phones, iPads, tablets & apps	Remote applications	General awareness of current & emerging ICT in agriculture	HD cameras
Employment, Education & Training	Smart phones, iPads, tablets and apps	Cloud computing	Internet advanced	Remote applications	HD cameras
Processor/ Manufacturer	Internet advanced	(a) Cloud computing (b) Remote applications (equal ranking)	Smart phones, iPads, tablets and apps	HD cameras	Planning, costing, purchasing and managing an ICT system

Results for all respondents	
1	Smart phones, iPads, tablets and apps
2	Internet advanced
3	Remote applications
4	PA
5	Cloud computing

Focus group and survey feedback suggested training in the following areas should include smartphones, tablet PCs and apps as a priority.

- Purchase options to enhance functionality and productivity;
- Evaluation of data capacity requirements and mobile plan options;
- Basic apps to enhance productivity e.g. remote access to emails and calendar functions, including synchronising to office PC;
- Categories of apps available;
- Evaluation of apps, especially given the large choice available;
- Purchase and download of apps;
- Wi-Fi availability and options;
- Optimising mobile reception; and
- Security and protection of intellectual property.

One focus group participant suggested there was a market opportunity for a 'one stop shop' offering mobile computing advice, saying "I don't know what I need but I know what I want to achieve. Based on my brief, I would pay good money to have someone identify the most appropriate apps and data package for my business, load them onto the most appropriate mobile device(s), and show me how to use it all". He was not aware of a market delivering this service at this point in time.

Cloud technology:

- How can it add efficiency to our business?;
- Outsourcing all aspects, versus just the data storage;
- How to setup and start using the cloud; and
- The process to select a cloud based company and ensure data is secure.

Other training and awareness issues identified throughout the project were:

- Planning an ICT system e.g. how do you plan and select the technology;
- Management of ICT in a business e.g. budgeting for repair and maintenance, obsolescence and replacement; maintaining or enhancing ICT skills within the business to ensure employees do not become obsolete; and the security of intellectual property ;
- Optimising speed and reception of the internet;
- Encouraging industry stakeholders to write peer reviews and blogs to assist meeting the training shortfall e.g. YouTube tutorials, farming blog sites, etc;
- Raise awareness and promote networking, knowledge sharing and/or collaboration on ICT research and application in agriculture e.g. UNE plans to host a Digital Rural Futures Conference in June 2013; and
- Opportunities to learn how other industries have adopted and used information and communications technology. Roberts (2012) suggests the cotton and livestock industry are ahead of grains in their adoption of ICT, which is possibly due to the adoption of social media to address environmental or animal welfare issues in an expedient manner.

There are many opportunities to provide ICT training in agriculture, but priority should start with well adopted technologies to enable users to gain confidence and maximise their efficiency with the product.

5.2. Training delivery method

The preferred training delivery method for all business sectors was face-to-face, either a small workshop or one-on-one training (Table 5).

Respondents prefer to see real-life practical examples of how technology works and can apply to their business. In the case of auto-steer in tractors, the economics said one thing, however, it wasn't until the operator experienced the technology in real-life, often on their own machine, that they could fully evaluate the benefits, especially the intangible ones.

Table 3. Ranking of respondents' preferred training delivery method

Primary business role	Ranking in order of priority				
	1	2	3	4	5
Primary Producer	Small workshop	One-on-one	Seminar	Online	Printed material
Agronomist	One-on-one	Small workshop	Seminar	Online	Printed material
Professional Services	Small workshop	One-on-one	Seminar	Online	Printed material
Dealer/ Retailer/ Re-seller	Small workshop	One-on-one	Seminar	Online	Printed material
Researcher/ Extension	One-on-one	Small workshop	Seminar	Online	Printed material
Employment, Education & Training	Small workshop	Online	Seminar	One-on-one	Printed material
Processor/ Manufacturer	One-on-one Small workshop (equal ranking)	Seminar	Online	Printed Material	

Results for all respondents	
1	Small workshop
2	One-on-one
3	Seminar
4	Online
5	Printed material

6. Barriers to adopting ICT technology

In the focus groups and survey, the two highest perceived barriers to adopting ICT were poor mobile phone reception and internet dropouts or speed (Table 6). Psychological factors such as age, skill level, confidence in the technology were not in the top five perceived barriers, nor was technical support for ICT applications.

Table 4. Barriers in adopting current or emerging ICT in respondents' businesses

Primary business role	Ranking in order of the most significant barriers				
	1	2	3	4	5
Primary Producer	Mobile phone reception	Cost of the technology	Internet dropouts or speed	Compatibility of products	Technical support
Agronomist	Mobile phone reception	Internet dropouts or speed	Compatibility of products	Cost of the technology	My trust and confidence that the technology will deliver
Professional Services	Mobile phone reception	Internet dropouts or speed	Product availability	Technical support	Compatibility of products
Dealer/ Retailer/ Re-seller	Internet dropouts or speed Access to or availability of training (equal ranking)	Technical support	Mobile phone reception	Compatibility of products	Product availability
Researcher/ Extension	Mobile phone reception	Internet dropouts or speed	Product availability	Compatibility of products	Access to or availability of training
Employment, Education & Training	Cost of the technology	Mobile phone reception	Internet dropouts or speed	Product availability	Compatibility of products

Results all respondents	
1	Mobile phone reception
2	Internet dropouts or speed
3	Compatibility of products
4	Access to or availability of training
5	Cost of the technology

6.1. Mobile phone reception

Survey participants were asked to rate their mobile phone reception in three specific locations. While these locations will vary in proximity to mobile phone towers, e.g. an agronomist in the office is more likely to be based in town compared to a primary producer in their office, they do provide an indication of reception.

The locations were (i) at the office/farm base/sheds, (ii) in the paddock, and (iii) travelling in your local district.

Collectively 32 % of all respondents rated the quality of mobile phone coverage as 2 out of 5, while 10 % had no service at all (Figure 12). Many 'black spots' were identified in the report (Appendix G).

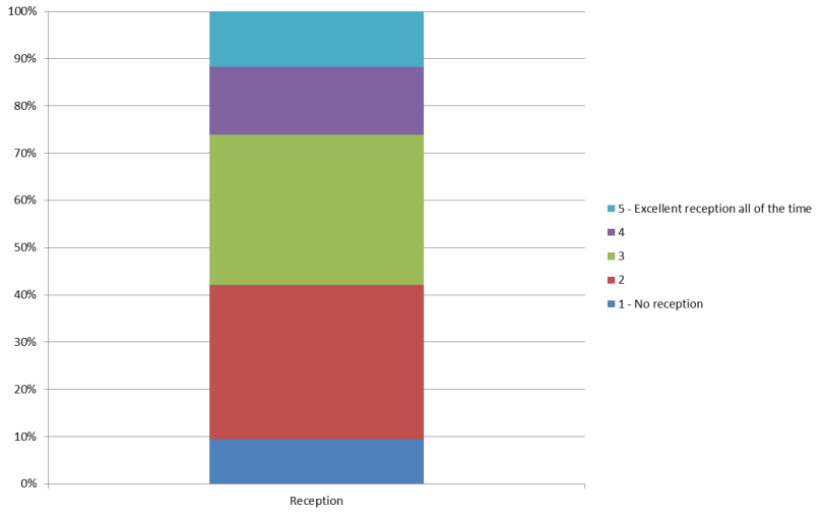

Figure 12. Mobile phone reception - all areas.

In the Wimmera Southern Mallee ICT study 2010, conducted by the Centre for eCommerce and Communications at the University of Ballarat, including all industries not just agriculture, 36 % of respondents rated the quality of mobile phone coverage as poor, 10 % very good and 3 % excellent.

Generally, reception overall does not appear to have improved over the last two years.

When the response is broken down into the three specific locations, 38 % of respondents in each location rated the service as 2 out of 5 (Figure 13). The highest 'excellent reception' result came from the office/farm base/sheds location.

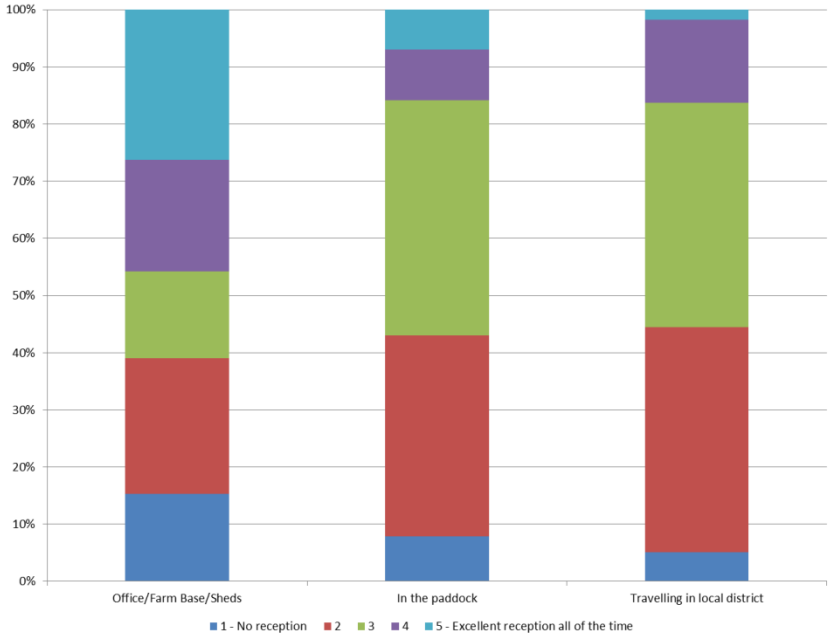

Figure 13. Mobile phone reception by location.

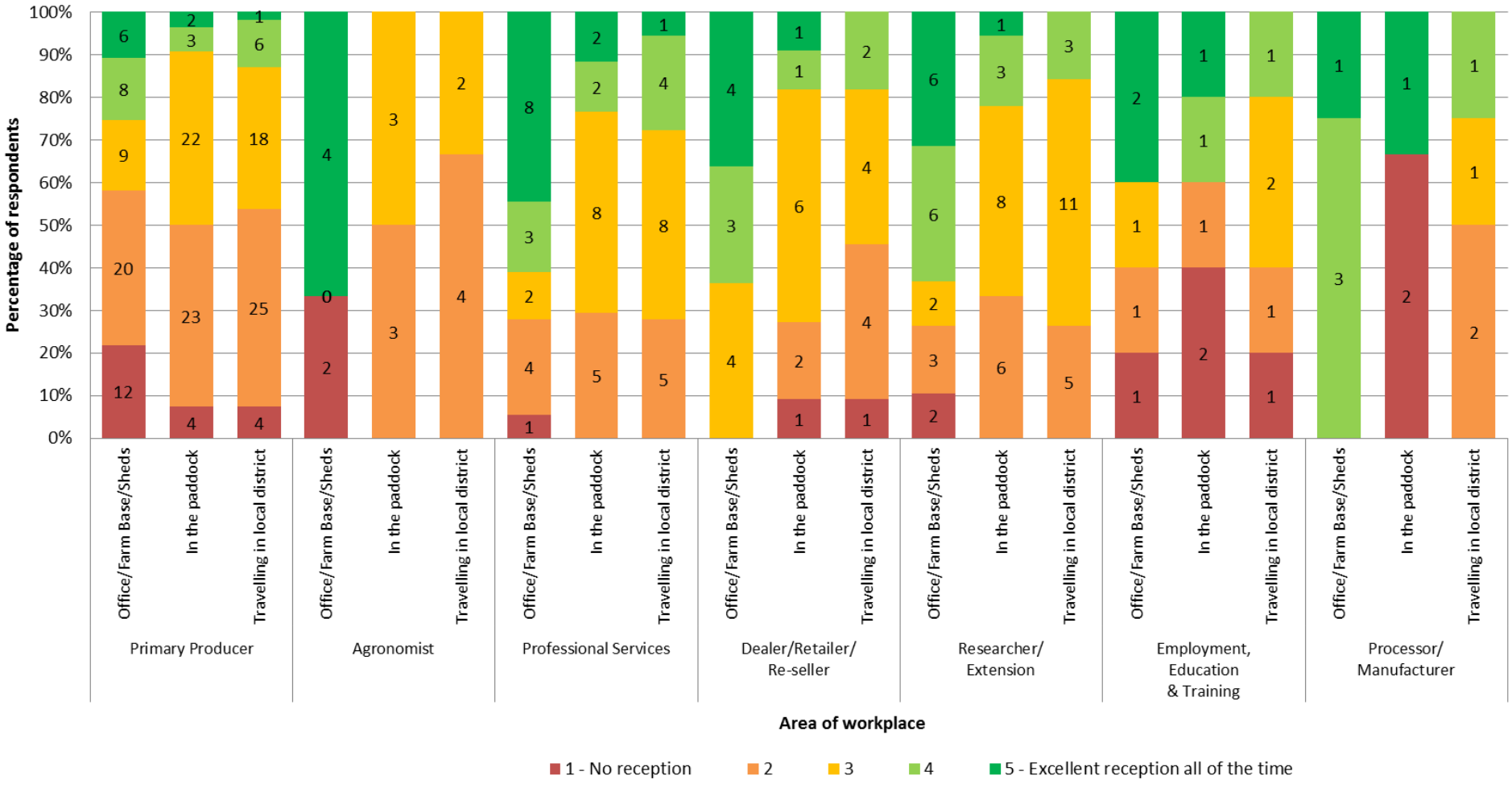

Figure 14. Mobile phone reception in the workplace (n=115).

Approximately 20 % of farmers responded that they had no reception at the office/farm base/sheds, which reduced to fewer than 10 % once they got out in the paddock or travelling in the local area (Figure 14). Some focus group participants discussed infrastructure such as tin roofs as impacting on the signal around the base, and therefore had installed aerials on the roof to manage this issue.

The results for agronomists around the office/farm base/shed were at the extremes. Just over 30 % of agronomists responded no reception in this location, while the remaining 70 % rated it excellent all the time. Once away from the base, the agronomists rated the reception as below average to average, again indicating room for improvement.

At least 40 % of the employment, educations and training sector rated reception at the office/farm base/sheds, and in the paddock (up to 60 %) as 2 out of 5 or lower, which was below average. They rated travelling in the local district as similar to primary producers and agronomists.

For the other business sectors that responded, reception at the office/farm base/shed scored at least average or better. However away from the base the trends of poorer reception were consistent with other sectors.

6.2. Internet service

The most commonly used internet services was mobile wireless at 41 % and ADSL at 35 % (Figure 15).

In the Wimmera Development Association's 2010 ICT survey to all businesses the most common types of internet access were ADSL at 54 % and mobile wireless at 27 %. It is clear that mobile wireless is a popular internet service in all business sectors, likely due to its mobility.

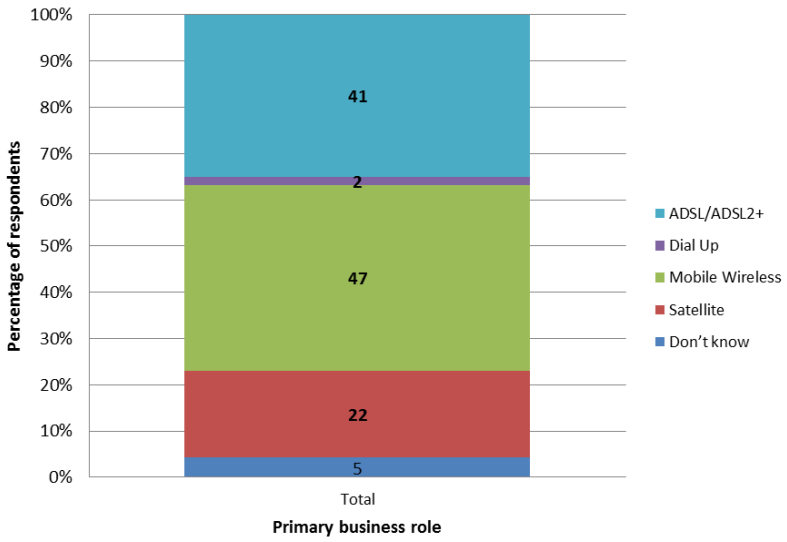

Figure 15. Type of main internet service in the workplace (n=116)

Indicative of primary producer's limited access to the full range of internet services, most used either mobile wireless (56 %) or satellite (31 %) (Figure 16). Mobile wireless use seemed high given the reception issues identified earlier in the survey, but not so given the mobility of the service, and dropout or latency issues experienced with satellite. 62 % of users had one or more dropouts per day. 11 % were using ADSL, indicating they lived in town or were in close proximity to an exchange, enabling access to this type of connection.

Education employment and training also had a high satellite usage at 50 %, with 74 % of those respondents had one or more dropouts per day.

Outside of primary producers and employment, education and training, ADSL made up at least 50 % of services, indicating respondents were close to an exchange.

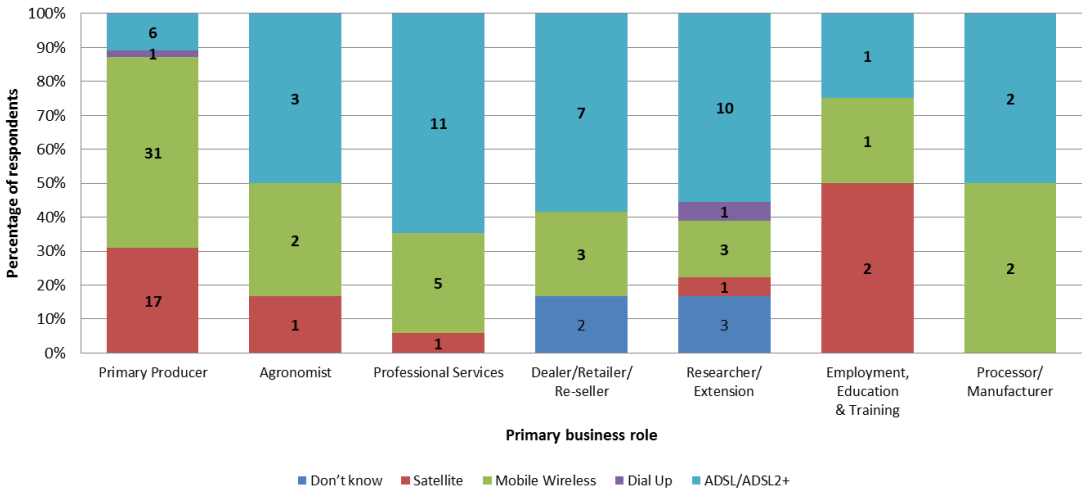

Figure 16. The main internet service in the workplace by business sector (n=116).

By far the largest internet service provider is Telstra Big Pond servicing 64 % of respondents (Figure 17). The next highest was Activ8 servicing 7 %. These companies were 43 % and 13 % respectively in the Wimmera Development Association's 2010 ICT survey to all businesses.

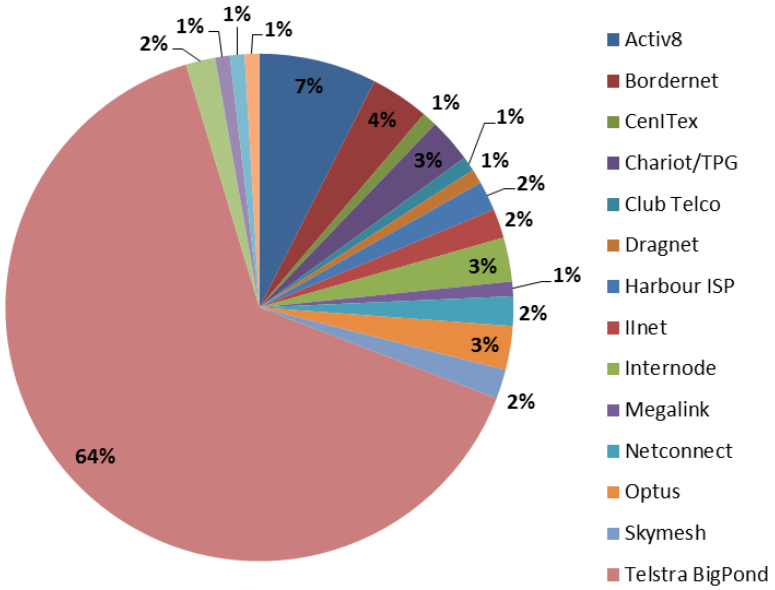

Figure 17. Internet service provider used by respondents (n=107).

6.3. Internet speed

Overall 32 % of respondents rated internet speed as slow or very slow (Figure 18).

In the Wimmera Development Association's 2010 ICT survey to all businesses, below average internet speed was rated the same.

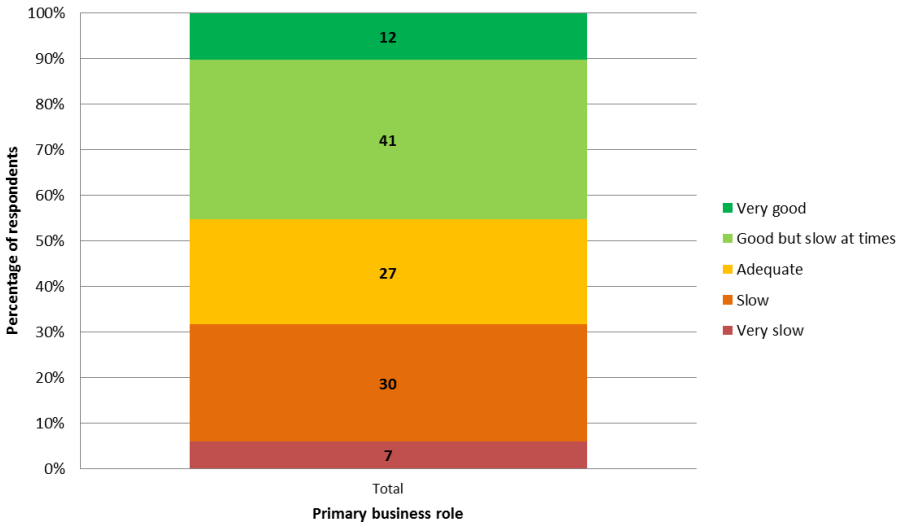

Figure 18. Workplace internet speed (n=116).

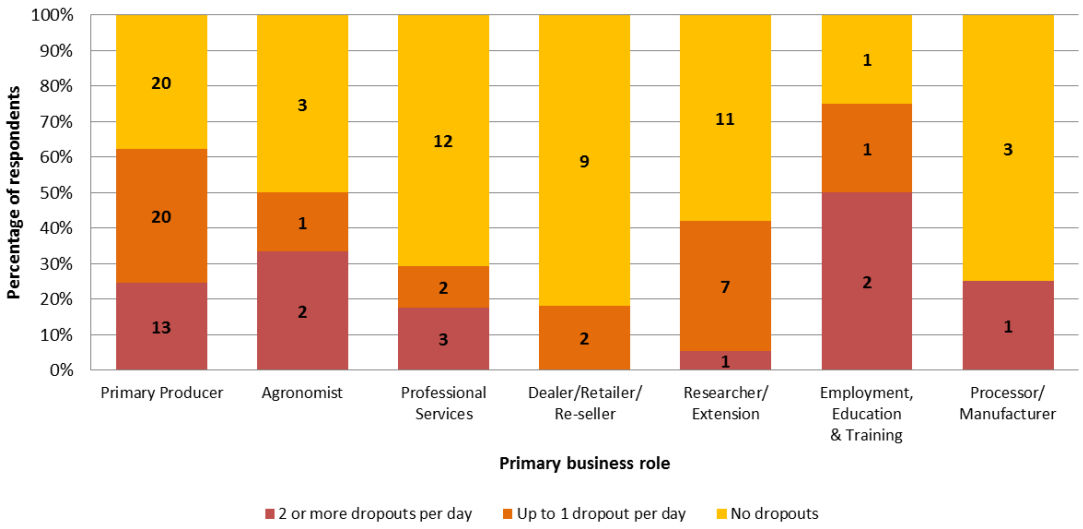

Figure 19. Quality of internet service in the workplace (n=14).

Primary producers rated internet speed the worst, with 45 % suggesting it was slow to very slow i.e. below average. The next worst was the employment, education and training sector with 50 % rating speeds as slow, however the remaining 50 % of respondents rated it as good. Outside of these two sectors, at least 74 % in each sector rated speeds adequate or better. Researchers rated speeds the best with 80 % indicating above average speeds.

Survey comments on internet speed are attached as Appendix I.

6.4. Engagement

It was challenging to engage participants in the focus groups and to complete the survey. The poor coverage issues may be a reason; also some may have had negative experiences with ICT underperforming in the past.

Nevertheless, there was also a sense of 'people don't know what they don't know'. Apple founder Steve Jobs once said when asked what market research he did on his customers "None, because customers don't know what they want until we've shown them." Regular awareness programs throughout the Wimmera Southern Mallee region will be important to stimulate thinking around ICT applications.
One focus group participant advised "I upgraded to a smartphone and at the end of the first day I was ready to throw it away in frustration; but I persisted and by the end of the second day I couldn't live without it once I worked out what it could do."

One of the challenges in the modern IT world is that very few products come with instruction manuals. Hence, it is left to the user to work it out themselves and get over the knowledge 'hump'. Nevertheless, the technology needs to be useful, usable and available and include support of some kind (Sudholz, 2013). Nowadays the support is often facilitated by online peer reviews or blogs.

6.5. Software compatibility

Software compatibility appears to be a significant problem in the information and communications industry, as experienced when organising the video link between two locations for the Horsham information session. Each location had substantial broadband capacity but the software between the two universities would not 'talk' to each other.

Software compatibility has been an issue for PA for some time, and was also indicated as a problem in being able to download information from machinery consoles into a management recording program.

While software compatibility will likely remain as issue in the ICT industry, there are opportunities to raise user awareness of the capabilities of software by facilitating the linkages between users and developers or programmers. You can pretty much program software to do anything, and then it's just up to the hardware capacity to carry out the task (Wherret, 2013). This would aim to raise understanding and confidence of where to get impartial advice, so that users can make a more informed decision when planning and choosing ICT in the future.

Other barriers identified in the focus groups are attached in Appendix E.

7. Broadband technology

Development of new and emerging platforms will continue to fuel demand for more broadband coverage and capacity. For example, the increase of mobile computing since the introduction of smartphones and tablet PCs is already placing strains on existing mobile tower infrastructure originally designed for predominantly voice transfer (Mundy, 2013).

Higher data capacity and speeds improves our 'connectiveness' to the rest of the world, and opens new opportunities that haven't yet been conceived. Therefore there is a need to adopt a different mindset to an outward looking approach. Futurist Paul Higgins (2013) describes the opportunities for 'collaborative networking'. His examples are the development of a prosthetic mechanical finger and a movie, both developed over the internet using collaborative input from interested persons from around the world, or 'digital nomads' traversing the world. He explained the challenge of such collaboration is to effectively facilitate the network when figures suggest 90 % of collaborators 'lurk' but don't add value, 9 % add some value, and 1 % adds 90 % of the value. There are business opportunities to coordinate such networks.

The survey measured respondent's knowledge and understanding of what the NBN rollout will deliver to their respective sectors, and what capacity they believe they may need to operate ICT in their business in the future (Figure 20).

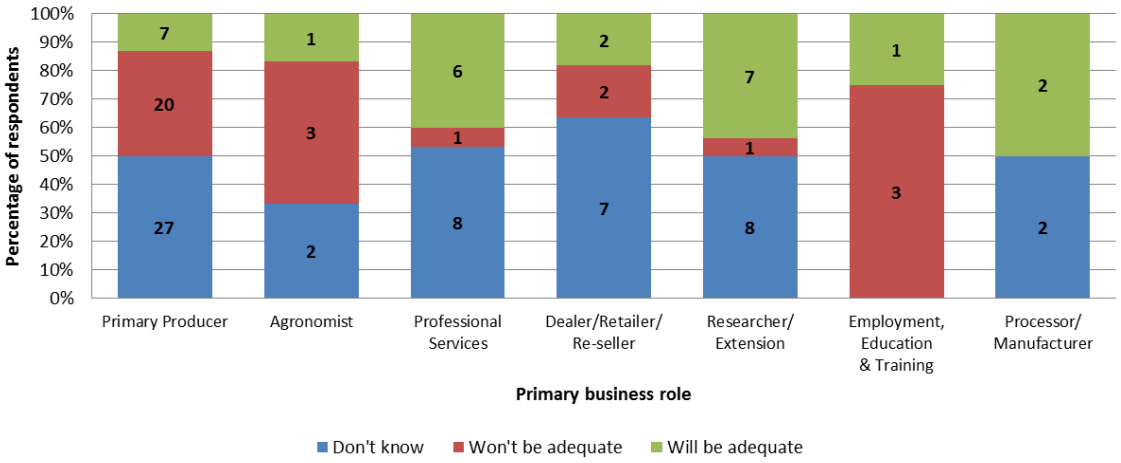

Figure 20. Perceived adequacy of the NBN in meeting future ICT needs (n=110).

Some focus group participants identified robust ICT infrastructure as essential to maintaining population and the liveability of regional and remote communities. A few focus group participants acknowledged ICT and its infrastructure as a strategic utility much like road, water and power, that will determine where economies develop and where people reside.

It was notable that some participants in the focus groups hadn't considered what influence the NBN would have on their communities. The reasons for this appeared to be a combination of lack of awareness, apathy, or that it was too far away to think about.

Excluding the education, employment and training sector, at least 32 % of respondents in each sector responded that they don't know whether the NBN would be adequate for their future ICT needs. This could mean that they either don't know what the NBN will do, or they don't know what data capacity they will require in the future.

Only 12 % of primary producers believe the NBN will be adequate in enabling them to operate their future ICT needs. This reflected feedback from the regional focus groups that they feel the NBN has a city focus and they will be left with:
A slow satellite upload speed, i.e. quoted by NBN to be a dedicated 1mbps upload; as against a 12mbps download, with enduring latency problems;
A limited ability to connect to the NBNs fixed wireless west of Horsham and north of Nhill and Warracknabeal, due to distance from towers; or
An already poor mobile broadband service through existing carriers.

Agronomists, dealers and employment education and training sectors had similar adequacy responses of 18 %, 19 % and 25 % respectively. Professional services, researchers and processors measured higher adequacy responses of 40 - 50 %.

An economic analysis on the impact of the NBN on the Wimmera Southern Mallee region would assist in quantifying the benefits to the region.

Awareness of broadband technology like the NBN needs to improve in the region.

8. Open comments about data delivery in the Wimmera Southern Mallee region or the Wimmera Development Association

- Agriculture is fast becoming one of the most technologically advanced industries in Australia, with some of the lowest levels of phone & data reception. Farmers need up to the minute, reliable information to make informed decisions, and to get the most from efficiency improving technology.
- Cost should not be a barrier just because we live beyond the Urban sprawl of Melba.
- Gaming and entertainment should have lower priority on satellite clocking.
- Improved mobile phone service would be a tremendous assistance.
- Keep striving to keep the Wimmera region up there in innovation and development. We can't afford to be left behind! Most farmers are open to new ideas/technologies. It just needs to be affordable. It may be a long term plan that will take a number of years to achieve.
- Primary producers need cheap easy access to a “static IP” address.
- Quality mobile service is restricting my profitability by around 4 to5 %.
- Should now focus on how the technology makes farming more efficient and ways that it saves/makes money for the manager/farming business.
- There presents a huge opportunity in growth harnessing digital technologies, we need access and speed that is reliable and affordable...otherwise we are stuffed!
- We are on the brink of the next evolution in Precision Ag tools (usage), Cloud computing and improved management tools for the office - let's not be left behind!

9. Recommendations

Table 5. Recommendations for awareness and engagement

Theme	Task	Ref.	Priority
Awareness and engagement	The WDA can play a key role in a Wimmera Southern Mallee advocacy group to advance ICT awareness, capabilities and infrastructure needs in the Wimmera Southern Mallee region.	6.4. 7.	H
	Raise community awareness on broadband technology, such as the NBN, through regional forums or smaller community information events.	7.	H
	Advocate the need for ICT to be a strategic priority for industry groups to include in their planning and industry functions e.g. conferences and field days. This could include the incorporation of trade displays at events. Examples of industry groups include Birchip Cropping Group (BCG), Victorian Farmers Federation, Grains Research and Development Corporation and Victorian No-Till Farmers Association (Vic Not-Till).	6.4.	H
	Identify locals with a passion and interest in ICT to be part of advocacy and/or extension groups to assist 'champion' the awareness and training on ICT capabilities.	5.1.	H
	Improve mobile phone reception, internet connectivity and data speeds. Forward a copy of this project report to regional telecommunications providers e.g. Telstra, Optus.	6.0.	H

Table 6. Recommendations for training and adoption

Theme	Task	Ref.	Priority
Training & adoption	Foster development of training programs matched to the priority of each business sector as indicated in Tables 4 and 5. Training priorities collectively across all business sectors are advanced internet applications, smart phone applications in business, remote applications, precision agriculture and cloud computing.	5.1.	H
	Provide an extract of this project report to machinery dealers including sections 3.1.5 (Use of PA) and 3.1.8 (Remote machinery control). Discuss with dealers what role they can play in improving awareness and training users to maximise productivity with factory fitted technology on machines, and addressing software compatibility issues.	3.5.	M
	There are many regional training providers that can design ICT training courses to fill the market gaps. These may include Longerenong College, University of Ballarat, Wimmera HUB, industry groups (BCG, Vic No-Till), agricultural	5.	H

	consultants, and other independent private operators.		

Table 6. Recommendations for training and adoption, continued.

Theme	Task	Ref.	Priority
	Foster development of a group dedicated to promotion, information and adoption of ICT in agriculture in the digital economy. Examples of existing adoption groups are Vic No-Till (No-till farming practices) and SPAA (PA technology). An 'ICT in Agriculture' group may be a collaborative internet based group.	6.4. 7.0	H
	Encourage training and awareness amongst service providers with current, ongoing and strong relationships with the ICT end user e.g. farmer, agronomist, consultant.	5.1.	M
	Bring stakeholders together to create links to give users confidence to potentially bring their ICT ideas to fruition, or identify where to go to solve ICT issues. This could include: • A database of what services are provided in the ICT sector. This could be an App. • An annual regional conference, trade show and panel session bringing together users, developers, programmers and service providers. Opportunities exist to look to other agricultural industries that are more advanced with ICT and/or to other regional ICT initiatives, e.g. NBN4bendigo, to share their experience in ICT awareness, engagement and training.	5.1.	M
	Promote business opportunities that exist in the region in servicing ICT in the digital economy. This may include: • Technical support; • Consultancy advice; • Facilitation of online collaboration networks; and • Development of apps, etc.	5.1. 3.5.	L
	Survey again in two years to benchmark adoption of ICT practices in agriculture in the Wimmera Southern Mallee region		L

Appendices

Appendix A: Remote data use in agriculture survey

1. **How would you describe your primary business role?**
   Primary Producer; Agronomist; Professional Services (e.g. accountant, consultant); Dealer / Retailer / Re-seller; Researcher/Extension (e.g. DPI, BCG, Vic No Till); Employment, Education & Training; Processor/Manufacturer; Other (Specify)

2. **What is your postcode?**

3. **What is your age bracket?**
   Less than 20 years; 21-30 years; 31-40 years; 41-50 years; 51-60 years; 61-70 years; Over 70 years; Refused

4. **What is your gender?**
   Male; Female

5. **On a scale of 1 to 5, where 1 is no reception and 5 is excellent reception all the time, please rate your mobile phone reception in your workplace.**
   Office / Farm Base / Sheds; In the paddock; Travelling in your local district

6. **What specific locations are the worst for reception/dropouts (specify)?**

7. **What is the main internet service that you use in your workplace? [One response]**
   None; Dial Up; ADSL/ADSL2+; Mobile Wireless (3G or 4G Dongle); Satellite; Don't know

8. **Who is your Internet Service Provider (ISP)? Please specify (e.g. bigpond, activ8, skymesh, etc).**

9. **Please rate the internet service in your workplace**
   1 = No Dropouts; 2 = Up to 1 dropout per day; 3 = 2 or more dropouts per day

10. **Please rate the internet speed in your workplace**
    1 Very slow; 2 Slow; 3 Adequate; 4 Good but slows at times; 5 Very Good

11. **Do you think line speeds after the rollout of the NBN will be adequate for your future ICT needs?**
    Yes; No; Don't know

12. **Please indicate whether you use the following ICT applications in your business:**
    Internet advanced (banking, webinar, videoconferencing, team viewer, online shopping, online training); Smart Phone, iPad, Tablet & Apps; High definition cameras (in workplace or remotely located) for monitoring; Remote machinery control (i.e. the ability to access the console of a machine over the internet for you or a technician to diagnose a problem or to instruct the operator); Cloud computing (including storage of data, or data sharing with Dropbox, Google docs, etc); Aerial observation or other tasks (e.g. spraying) with unmanned aerial vehicles (UAV's)

13. **On a scale of 1 to 5, where 1 is no benefit, 3 is some benefit and 5 is high benefit, please indicate the degree to which you believe the following ICT applications would be of benefit to your business, regardless of whether you use them now.**
    Internet advanced; Smart Phone, iPad, Tablet & Apps; High definition cameras for monitoring; Remote machinery control; Cloud computing; Aerial observation or other tasks (e.g. spraying) with unmanned aerial vehicles (UAV's)

14. **Please feel free to add any comments in relation to your responses for this page if you wish (optional)**

15. **Do you use agriculture technologies in your business?**
Yes; No [If answers "no", skip question]

16. **Please indicate which precision agriculture (PA) technologies you use in your business.**
GPS controller; Autosteer; Yield monitoring/mapping; Aerial / Soil mapping (e.g. satellite imagery or EM38); Variable Rate Technology for seeding or spreading; Automatic sensing of weather; Automatic sensing of soil moisture; Other forms of automatic sensing (for example nutrients, pests, livestock movement); Crop sensing (for example Weedseeker, Greenseeker)

17. **On a scale of 1 to 5, where 1 is no benefit, 3 is some benefit and 5 is high benefit, please indicate the degree to which you believe each of the following PA technologies would be of benefit to your business, regardless of whether you use it now:**
GPS controller; Autosteer; Yield monitoring/mapping; Aerial / Soil mapping (e.g. satellite imagery or EM38); Variable Rate Technology for seeding or spreading; Automatic sensing of weather; Automatic sensing of soil moisture; Other forms of automatic sensing (for example nutrients, pests, livestock movement); Crop sensing (for example Weedseeker, Greenseeker)

The following question is optional. By answering the following additional question, this will allow us to identify compatibility and training solutions.

18.

    a. **In your experience how compatible are these PA technologies in communicating with other ICT technologies you use, using a scale of 1 to 5 where 1 is not at all compatible and 5 is very compatible.**

    b. **Please specify the brand of PA you use.**
    GPS controller; Autosteer; Yield monitoring/mapping; Aerial / Soil mapping (e.g. satellite imagery or EM38); Variable Rate Technology for seeding or spreading; Automatic sensing of weather; Automatic sensing of soil moisture; Other forms of automatic sensing (for example nutrients, pests, livestock movement); Crop sensing (for example Weedseeker, Greenseeker)

19. **Please answer the following questions in relation to:**
    - Planning (e.g. what you plan to do with a paddock, or general plans for your business including job list management or what you plan to do for a client)
    - Actual operations (e.g. what you actually did to a paddock, or what general task you did in your business or for a client)
        a. **Can you enter data into a device like a smartphone, tablet or PC out in the paddock, or at a location away from your main office?**
        Planning Y/N; Operations Y/N
        b. **Is this data then shared (synchronised) between devices ((e.g. other smart phones, PC's, cloud storage)**
        Planning Y/N; Operations Y/N

20. **Who do you share this data with (e.g. co-workers; agronomist; etc)?**

21. **Please indicate which of the following management planning/recording programs you use and rate them on a scale of 1 to 5 where 1 is very poor and 5 is excellent. You may use more than one.**
Back Paddock; Agdata Phoenix; PAM; Grain Growers Production Wise; Agworld; CropFacts / Concepts Rural; John Deere Apex; My own program (e.g. an excel spreadsheet); Other (specify)

22. **What else would you like ICT to do for you in your business? Please specify.**

23. **Below is a list of possible areas of ICT training for your business. Please indicate from 1 to 5 your top 5 in terms of their priority for training for your business. Please select "N/A" for the remaining options.**
Internet advanced (banking, webinar, videoconferencing, team viewer, online shopping, online training); Smart phones, iPads, tablets & Apps; Precision Agriculture ; Cloud computing (including storage of data, data sharing with Dropbox, Google docs, etc) ; Remote applications such as remote capture of data and/or synchronising to other devices (e.g. smartphones or computers) or remote access to machinery controls (i.e. the ability to access the console of a machine over the internet for you or a technician to diagnose a problem or to instruct the operator); Aerial observation or other applications (e.g. spraying) using unmanned aerial vehicles (UAV's); High definition cameras (in workplace or remotely located) for monitoring; General awareness of current & emerging ICT in agriculture; Planning, costing, purchasing and managing an ICT system

24. **Please rank from 1 to 5 your business's preferred training delivery method.**
One-on-one; Small workshop; Seminar; Online; Printed Material

25. **From the list below, please indicate from 1 to 5 the five most significant barriers you face when adopting current or emerging ICT in your business where 1 is the highest barrier and 5 is the fifth highest barrier. Please select "N/A" for the remaining options.**
Mobile phone reception; Internet dropouts or speed; Product availability; Compatibility of products; Access to or availability of training; Technical support; Cost of the technology; Security concerns with the technology; My trust and confidence that the technology will deliver; My confidence to learn the technology; My current skill level; My age; Other (Please specify in the comments box below)

26. **Other barriers.**

27. **Do you have any further comments about data delivery in the Wimmera region or the Wimmera Development Association?**

Appendix B: Response rates to online surveys

The online survey had 123 responses. The response rates to online surveys show great variation and can be affected by certain characteristics:

1. Who is targeted.
   A common differentiation is:
   a. Internal staff or students (one site suggests 60-90%)
   b. Customers or members - for example program participants (the same site suggests 5-40%)
   c. General public. The remote use of data survey was directed at a targeted sector of the general public. A range of sources quote response rate between 1% and 20%. Rates can be improved marginally when follow-up reminders are sent.

2. Length of survey. Optimal length appears to be 5-10 minutes to complete with a maximum of 15 minutes. One source suggests that surveys longer than 11 minutes are likely to have a high rate of abandonment. The remote use of data survey was estimated to take 20 minutes to complete.

3. Reminders can increase response rates. These were sent by ORM.

4. Incentives can increase response rates by 10-15%. No incentives were provided for this survey.

From the information provided, it is estimated that 480-680 potential respondents were contacted directly, with the survey and survey link advertised on the client's website. However, there is no data available to indicate where the respondents found the links. From previous experience with general advertising of a survey, we would expect this method to provide a small number of respondents at best.

The 123 responses represent 18% of 680 direct email notifications. Taking into account the target audience and the length of the survey, this appears to be a very good response rate that compares favourably with the rates indicated from a range of online survey providers and users.

Comments by Roberts Evaluation.

Appendix C: Use of apps in the region

- Accounting software
- Aussie dollar
- Banking
- BankLink
- Camera
- Carsales
- Compass
- Connected farm
- DPI Crop Disease app
- EBay
- Find my friends
- Find my phone
- Fire danger indicator
- Fitness tracker
- FTrack; GTasks HD; Orchestra
- Games
- GoodReader
- Google Earth
- Google+ (Hangouts)
- GoToMeeting
- GPS related – distances, travel time, directions
- Grain Marketing – Grain Corp (iPhone only at this stage) and Grain Growers have recently released apps for live site pricing
- GRDC Weed ID
- Hey Tell – voice message sent via sms
- Magnifying
- Mapping
- Pest Genie
- Pocket PAM 2I
- QR Reader
- Radio scanner, emergency services
- Shopping
- Skype
- Speedo
- Spirit Level
- Strobe light
- TAB
- TeamViewer (Remote Access)
- Toggle Time Management
- Torch
- Track packages
- Travel, trip advisor
- Tweet
- Ubersense Golf
- Unit converter
- Video recording
- Weather
- Wine apps
- YouTube

Appendix D: Other management planning and recording programs used by survey respondents

- Agrobase, and other in house programs like "field capture" and "konnect"
- ArcPad
- Documents to Go (Apple devices), allows transfer of Microsoft documents between devices for use in the paddock and office
- Farm Works
- Gatekeeper
- GPS and ArcView, MobileMapper with CyberTracker
- iFarm
- My own proprietary system
- PASource
- QuickBooks
- Waiting on John Deere to release Mobile Farm Manager app for tablets, which will connect to John Deere customers' Apex farm management software
- WHMCS
- Yield Prophet

Appendix E: Other barriers identified in the focus groups that did not arise in the survey

Awareness:

- Awareness of opportunities that exist
- Don't know where to go to find the services (training, tech support) to support the technology

Lack of competition:

- A major problem has been that only Telstra or Telstra resellers of ADSL can provide ADSL services in Warracknabeal i.e. TPG which has a direct effect on competition and price.

Attitudes:

- Personal confidence
- Reliability - "I just want to know it works" i.e. plug & play
- Safety (driverless tractors)

Compatibility:

- Some machinery manufacturers are dictating what system they want farmers to use – a closed system – works well in the States because producers are so parochial about the colour of their machines, but may not work in Australia".

Economics:

- Capital cost of the technology
- Don't know how to evaluate the cost: benefit (because many intangibles?)
- Ongoing running costs
- Poor seasons means less $ to spend on the wish list items
- Size of operation can't always justify cost or investment in the IT

Appendix F: Open comments made in the survey with respect to the NBN

- A simple telephone call via satellite after 2022 will not be satisfactory, as the 2second delay will make this un-workable and not acceptable. PS. the wireless at 12/1 or satellite at 12/1 ISN"T any better than what we are currently doing at 6/1
- I don't think that the speeds will be adequate because the signal will not reach my farm using current towers and hence will be irrelevant.
- NBN isn't going to be rolled out in Birchip. Will stop at Sea Lake apparently - disappointing.
- Need to ensure NBNCo deliver broadband effectively to rural areas.
- The NBN has more to offer agriculture economic activity but only if the developers and providers of that technology get far better attuned to the specific requirements of agricultural problems and managers. That must be the message of the WDA when speaking about technology.
- The NBN will unlock a huge potential of technology development for agriculture. However, the onus will be on technology developers to develop software and systems that can effectively utilise the capacity of the NBN to deliver useful, usable and available systems. The NBN alone will not change the face of agriculture in Australia, but coupled with some effective technology development, the industry is set to enter a period of boom like none before.
- The trick is not having lots of data, but has only the data that is truly useful in solving or managing the problems/challenges you face. While it may seem that technology simply appears, it does not. It is designed.
- With the NBN, it is going to be a complete services package, which includes telephone. For a National communications package it's pretty poor for this area. After 2022, we will finish up going backwards in regards to basic communications and speed will be no better than what we are currently doing now. The NBN's quotation is 10/100/1000 times faster than the connection you had before, in reality the cities are going to be 10/100/1000 faster than rural customers and they will have normal telephone calls whereas we will have the 2 second delay. We are in trouble.

Appendix G: Specific locations identified as the worst for mobile phone reception or dropouts

- Anywhere 5 kms from tower
- Areas of Laen, between Minyip and Donald.
- Areegra area half way between Donald and warracknabeal
- Bangerang district & when on move around patrs of lah east
- Bangerang Galaquil
- Banyena, Laen, Watchem, Boolite
- Banyena, Marnoo, Marnoo West, Callawadda, Glenorchy, Wal Wal, Lubeck
- Between Horsham and Warracknabeal,
- Between Hopetoun and Sealake, Clearlake
- Between Toolondo and Balmoral
- Callawadda area
- Cnr w'beal-dimboola and blue ribbon roads kellalic bridge to w'beal airport 3km nth along brikkle road, crymelon couzner rd, willenabrina
- Coonooer bridge
- Crymelon and Antwerp/Warracknabeal RD about 5km east of Katyil
- East of the sheephills road
- Goroke
- Home
- I can walk 50 m and there will be no signal. We get to know on our 9,000 acre farm where the phone will or will not work. Even within the house it will only work in specific locations
- Inside the house.
- Jeffcott Area
- Laharum, Wartook, Brimpaen, Grampians national park,
- Lorquon 3418
- Massey Road to Sunraysia Hwy Areegra exchange Rd between Borung Hwy to Birchip-Warracknabeal Rd Rupanyup Road from Sheep Hills road to Warracknabeal - Birchip Rd Carron Rd from Borung Hwy to Watchem
- Minimay, Goroke, Frances, Little Desert, Wortook,
- My area of employment is across the Rainbow Nhill area and reception lasts approx 5 kms out of Rainbow and 8kms out of Nhill
- My jobs takes me to a number of regions and reception varies deamaticaly, sometimes even from day to day.
- Natya
- North or Stawell
- Numerous areas between Birchip and our trials sites throughout the Wimmera and - --Mallee regions.
- Office Marnoo.
- Out from Nhill and a few holes anywhere once 15km from Horsham
- Shearwood and Smiths Road, Jung
- Some undulating country causes mobile towers to be out of range
- South of Horsham, i.e. Brimpaen, Wartook, Laharum, Harrow, Goroke
- South of Rupanyup
- Telopea Downs, speaking to clients in Yanac/ Broughton
- Travelling by car between Warracknabeal and Horsham is terrible!
- Travelling from Rupanyup to Stawell on the Stawell-Warracknabeal road, From Horsham to Rupanyup via Lubeck
- Wooroonook, Lalbert, Litchfield to Warracknabeal around Areegra, between Horsham and Warracknabeal, between Minyip and Henty Highway, Batchica for dropouts.
- Yarriambiack creek and Henty hwy crossing

ppendix H: Survey comments on internet speed

- 4G is a fairy tale, the only true high speed will be the cities, our 3G is not even reliable yet
- ADSL1 8Mb connection it is the fastest we can get and expensive compared to ADSL2 in Metro areas.
- Can be adequate depending on what is being viewed More and more equipment now is shown on YouTube and very slow to load the videos
- Depends on your definition of good! Compared to the speed that I have used overseas in the USA the speed is slow. Compared to a few years ago here the speed is good but slow at times!
- Disappointing
- Due to remote location, we are limited to our internet service options therefore we use wireless broadband which is expensive per meg and limited to 15 gig per month
- expensive, can't get enough data allowance
- Have had times when internet doesn't work. It has taken 21 days and 25 days before a technician can come to fix problem.
- Have had to install an external aerial to get adequate reception
- I have recently had NBN satellite installed --was told that it would be up to 12 times faster than my old satellite service -I suggest that it is very little quicker ---disappointed
- It is normally very good except for when there is a weather change occurring
- limited to ADSL, would love ADSL2+, 4G or NBN
- Mobile Internet at farm is very slow compared to broadband at home in town (which is not that fast either, compared to Melbourne)
- Now on NBN due to lack of wireless internet availability
- Satellite at farm house is very slow, almost unusable.
- Satellite service is inferior to the rest of the NBN Co
- Slow in the afternoon
- Sometimes our workplace is mobile. Mobile data access is poor at times when out on the road.
- Telstra appear to have a very low care factor. Unfortunately we have no alternative provider of high speed internet other than satellite and accordingly they take us for granted and don't treat us fairly.
- the Next G stick is actually faster and cheaper than the satellite so abandoned the latter as too expensive
- There was a very poor period at the start of 2012, but has improved substantially since then. Most days have a slow patch rather than a drop out.
- We're on the new Wireless 4G Dual band network however we only get 3G coverage and the speed is slow. (i.e. Ping result of 105ms, Download speed average 0.72 Mbps and Upload speed average 0.10 Mbps)
- Works well in Nhill but regular drop outs in Kaniva office.
- YouTube stop start, poor flow, lose the point of communication.

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