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Bachelor of Business: Marketing

Research Honours 1st Class

The Engagement of Women and Technology in Agriculture

This thesis is submitted in fulfilment of the requirement for the degree of
Doctor of Philosophy, Management, and Commerce,
College of Business, Law and Governance James Cook University

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Statement of original authorship

The work contained in this thesis has not been previously submitted to meet the requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Rachel Hay

17 January 2018

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Acknowledgements

I am not afraid of storms, for I am learning to sail my ship (Aeschylus, 525 BC – 456BC)

To my primary supervisor Prof Lynne Eagle, thank you for allowing me to choose my path, for your support and encouragement throughout this journey. Thank you also for the many industry and academic experiences and for having faith in my ability to fulfil those experiences. Your mentorship has helped me grow… as an academic, as a teacher and as a person, thank you. To Prof David Low, thank you for always being available, encouraging me to keep going and for keeping it real! To my secondary supervisors A/Prof Trina Myers, Dr Nadine Marshall for providing encouragement and support throughout my journey.

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***Every child [academic] deserves a champion – an adult who will never give up on them, who understands the power of connection and insists that they become the best that they can possibly be (*Rita Pierson, 2013)**

Thank you for being my champions!

Statement of Contribution of Others

Nature of Assistance	**Contribution**	**Names, titles and Affiliation of Co-Contributors**
Supervision	Primary Supervisor Secondary-Supervisor Associate-Supervisor Associate-Supervisor	Professor Lynne Eagle, James Cook University A/Prof Trina Myers, James Cook University Professor David Low, James Cook University Dr Nadine Marshall, CSIRO
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Data Collection	Isolated Childrens' and Parents Association Better Internet for Rural, Regional and Remote Australia Queensland Regional, Rural and Remote Women's Network Ag-Grow Emerald Field Day	Andrew Pegler Kristy Sparrow Alison Mobbs Donna Reeves
Collaborations	<u>Co-Author Publication</u> *Impact of communication technologies on pastoralist societies*. In proceedings of the 10th International Rangelands Congress, Saskatoon, SK. *The Digital Homestead assists rangeland managers to make timely and informed decisions*. In proceedings of the 10th International Rangelands Congress, Saskatoon, SK. <u>Co-Author Parliamentary Report</u> *Smart farming.* Report. The Parliament of the Commonwealth of Australia, Canberra, ACT, Australia.	Charmley, E., Hay, R & Bishop-Hurley, G. (2016). Bishop-Hurley, G. J., Charmley, E., Mills, S., Atkinson, I., Hay, R., & Atkinson, M. (2016). Hay, Rachel, and Harrington, William (2016)
Media Support	Media Releases	Alistair Bone, James Cook University

Publications Presentations and Other Outputs from Thesis

Publications

Hay, R., Eagle, L., Low, D. R., (2017) *Marketing Social Change: Fixing Bush Internet in Rural Regional and Remote Australia*. In proceedings of the Academy of Marketing 2017 Conference, Hull University, UK.

Charmley, E., Hay, R & Bishop-Hurley, G. (2016). *Impact of communication technologies on pastoralist societies*. In proceedings of the 10th International Rangelands Congress, Saskatoon, SK.

Bishop-Hurley, G. J., Charmley, E., Mills, S., Atkinson, I., Hay, R., & Atkinson, M. (2016). *The Digital Homestead assists rangeland managers to make timely and informed decisions*. In proceedings of the 10th International Rangelands Congress, Saskatoon, SK.

Publications underdevelopment

Hay, R. & Eagle, L., (2018) *"Supporting and Extending the Role of Agricultural Extension Officers"*. Under Development for the Journal of Agricultural Education and Extension

Presentations

Hay, R., Eagle, L., & Farr, M. (2017) *"Supporting and Extending the role of Agricultural Extension Officers"*. Paper presented at the 2017 International Conference of the Australasia-Pacific Extension Network, Townsville, 12 September.

Hay, R & Eagle, L., Low, D. (2017) *Marketing Social Change: Fixing Bush Internet in Rural Regional and Remote Australia*. Presentation to the 2017 Academy of Marketing Conference, University of Hull. 4 July.

Hay, R. (2016) *PhD Research Results*: *The engagement of women and technology in agriculture.* Presentation to NQ Dry Tropics Board Members, 16 December

Hay, R. (2016) *PhD Research: The engagement of women and technology in agriculture.* Presentation to the 3 Minute Thesis Competition. 29 September.

Hay, R. (2016) *PhD Research: The engagement of women and technology in agriculture.* Presented to the Big Data for Sustainable Tropical Agriculture and Aquaculture Conference, JCU. 27 July

Hay, R. (2016) *PhD Research: The engagement of women and technology in agriculture.* Presented to the Agriculture and Aquaculture Research Capacity Discussion Day, JCU. 8 February.

Hay, R. (2015) *PhD Research Pitch: The engagement of women and technology in agriculture.* Presentation to The Australian Rural Leadership Foundation, 13 May.

Reports

Hay, Rachel (2017) *BIRRR SkyMuster Survey Results, 2017.* Report. James Cook University, Townsville, QLD, Australia.

Hay, Rachel (2016) *BIRRR Regional Internet Access Survey Results, 2016.* Report. James Cook University, Townsville, QLD, Australia.

Hay, Rachel, and Harrington, William (2016) *Smart farming.* Report. The Parliament of the Commonwealth of Australia, Canberra, ACT, Australia.

Media Interviews

A media campaign began with my honours research in 2013/14 and continued with my PhD research 2015/18 – I write all of my own media releases for approval by the James Cook University communications department.

Multiple publicity achieved (approx. 130 newspaper, magazine and online articles, radio and television interviews) on television Channel 7 and in the Queensland Country Life, ABC Regional Radio, Rockhampton News, Bundaberg News, Central Coast Radio, Western Queensland Radio, and the Townsville Bulletin. Plus, international media including the UN specialised agency for ICT (ITU), some examples are linked below.

http://www.abc.net.au/news/2016-10-26/women-take-lead-technology-rural-industries/7965582

http://southburnett.com.au/news2/2015/07/hi-tech-helps-women-on-the-farm/

http://www.canberratimes.com.au/queensland/hightech-farms-give-voice-to-rural-women-20150710-gi9ckz

https://itu4u.wordpress.com/2016/11/23/women-use-tech-to-drive-cattle-farming-business-in-rural-australia/

Note: publication of pilot study work from Honours thesis prior to commencement of PhD:

Hay, R. (2013). *Technology Adoption by Rural Women in Queensland, Australia: Women driving technology from the homestead for the paddock.* (Bachelor of Business Honours, 1st Class), James Cook University, Townsville.

Hay, R., & Pearce, P. (2014). *Technology adoption by rural women in Queensland, Australia: Women driving technology from the homestead for the paddock.* Journal of Rural Studies, 36, 318-327.

Abstract

This thesis, focussing on the engagement of women and technology in agriculture in developing countries and in the beef industry in particular, contributes to the discussion surrounding benefits to rural women, men and families from using technology. It aims to contribute to small business management in farming and to expanding knowledge on technology adoption behaviour by rural women. Adoption of agricultural technology such as remote cameras, remote weather stations, bore cameras, and other livestock management systems in the beef industry is inconsistent. Marketing of these technologies has previously been aimed solely at men as the decision makers in rural relationships. Past studies, which are traditionally linked to men’s decision-making, indicate that there are several barriers to technology adoption, such as age, attitude, and education. Barriers may also be attributed to male beef producers’ own perceptions that they do not know how to use technology or that they are not capable of using technology. This perception means technology-based decisions have been falling to rural women who are often identified as invisible farmers and therefore not recognised for their work. This thesis highlights the importance of rural women's use of, and role in managing, technology and the valuable skills and attributes that rural women bring to decision-making in management and in leadership. The study supports the research’s rationale by confirming that women adopting technology is modifying gender divisions away from traditional separate roles towards productive partnerships. The thesis also highlights that technological properties may be more attractive to both children in terms of succession and workers in terms of connectivity and may be a solution to issues surrounding an ageing rural workforce and a shortage of rural workers and it sheds some light onto technologies contribution to positive well-being. A mixed methods approach using face-to-face interviews, an online survey and focus groups was used to view and understand women’s motives, actions and intentions in terms of technology use and management, technologies effect on succession and staff retention and if technology is improving well-being in rural families. The results show that technology that is more portable, such as laptops, smart phones, and tablets are being used on farm, demonstrating that technology is being used outside of the homestead. Women are using both practical and communication technology but are moving away from things like searching on the internet, towards using social media where they run off-farm businesses or where they sell their cattle. The results of the studies reported in the thesis indicate that more men are using technology than in a previous study, but women are still responsible for purchasing, programming and teaching male producers how to use the selected technology. Having access to the internet is also increasing quality of life for both women and men as well as children and workers. While some women are still somewhat reluctant to take on technology on-farm, others feel empowered and valued in their work. The research supports previous findings that as technology are diffusing into rural settings, it is modifying gender divisions, and supporting women as they move from traditional separate roles in decision making to productive partnerships in farming families. The research encourages stakeholders to see women as both decision makers and community leaders.

Key words: Women in Agriculture, Technology Adoption, Beef, Rangelands, Social Marketing

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Definitions

The (Oxford Dictionary, 2017) defines the terms as Farmer: *"a person who owns or manages a farm"*, Producer: *"a person, company or country that makes, grows, or supplies goods or commodities for sale"*, and Grazier: *"a person who rears or fattens cattle or sheep for market"*. While farmer and producer can be used interchangeably to describe someone who produces either animal or plant food products, the term grazier is strictly used to describe someone who grows animal products. However, participants of the study do not identify as graziers. Rather, they prefer to be identified as a cattle producer, which is often shortened to producer. Therefore, the term producer will be primarily used in this thesis. However, the terms Producer Men/Women, Farmer Women/Men, and Grazier Men/Women may be used interchangeably in this document. The terms Men and Women will in most cases refer to producers, but should be read in the context of the writing at the time of reading.

Technology is defined as "the application of scientific knowledge for practical purposes, especially in industry" and as "machinery and devices developed from scientific knowledge" and the "branch of knowledge dealing with engineering or applied sciences" (Oxford Dictionary, 2017). However, rural digital technology in this research is defined as personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, National Livestock Identification Systems (NLIS), remote cameras, remote weather stations, bore cameras, satellite technology, walk over scales, in Vitro Fertilisation (IVF) technology, feedlot technology and other livestock management systems.

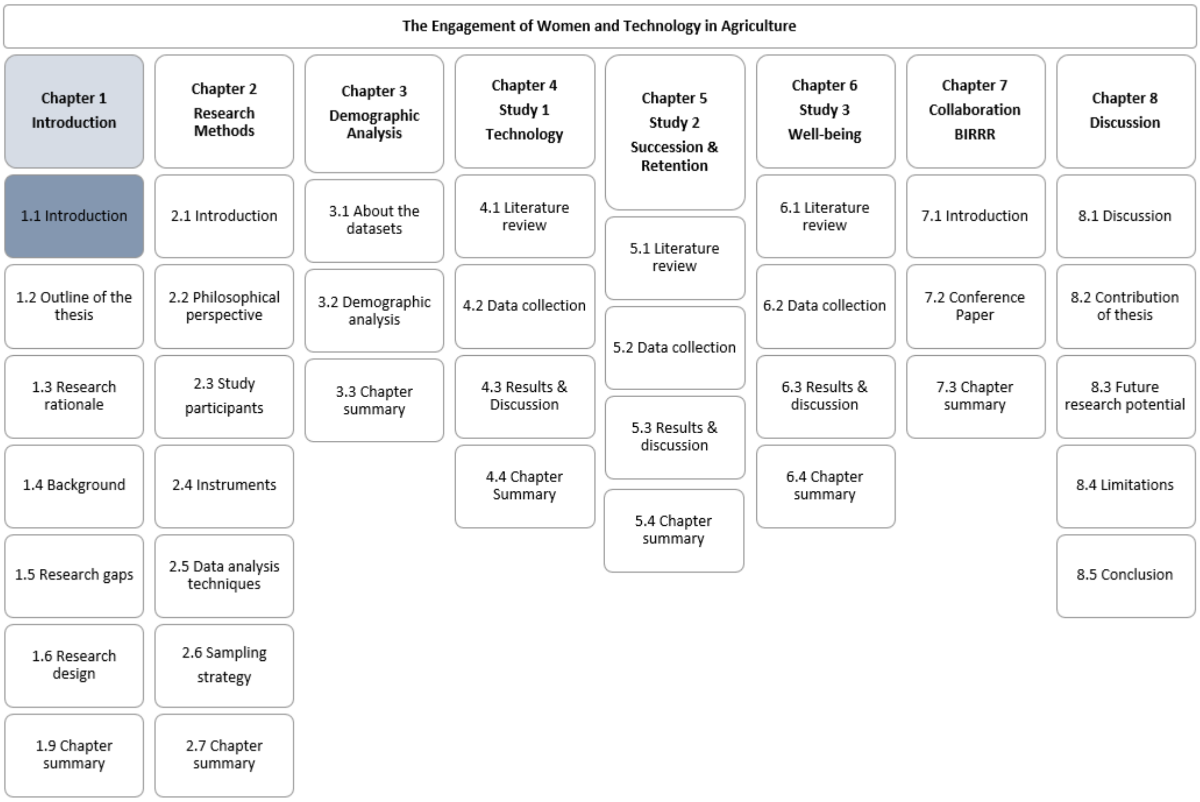
List of Acronyms

ABARES	Australian Bureau of Agricultural and Resource Economics
AWiA	Australian Women in Agriculture
BIRRR	Better Internet for Rural, Regional and Remote Australia
BOM	Bureau of Meteorology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
DST	Decision System Theory
DIM	Diffusion of Innovation Model
DTPB	Decomposed Theory of Planned Behaviour
GPS	Global Positioning System
ICPA	Isolated Childrens' and Parents Association
IDT	Innovation of Diffusion Theory
IoT	Internet of Things
IVF	In Vitro Fertilisation
MM	Motivation Mode l
Mbps	Megabits per second
MPCU	Model of Utilization
NLIS	National Livestock Identification System
PA	Precision Agriculture
PLF	Precision Livestock Farming
TAM	Technology Adoption Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
VoIP	Voice over Internet Protocol

Chapter 1 Introduction

Chapter 1 presents an introduction to the thesis as highlighted in the following chart. This chart will guide you through the thesis and is situated at the beginning of each section to help guide the reader through the thesis.

Thesis Structure Overview: Chapter 1 - Introduction



This thesis explored the benefits to, and importance of, rural women's use of and role in managing technology and the valuable skills and attributes that rural women bring to decision-making in agricultural management and leadership in developed countries. *Chapter 1* gives an overview of the thesis. Section 1.1 introduces the research problem. Section 1.2 outlines the research design, and provides a visual outline of the research see Figure 1.8. Section 1.3 discusses the research rationale and Section 1.4 provides background to the research. Section 1.5 overviews the research gaps and Section 1.6 discusses the design of the research and Section 1.7 identifies the contribution of the thesis. Section 1.8 details the limitations of the study and Section 1.9 gives a summary of the chapter.

"Technological evolution is the result of our own desire to lead a better life."
(Amblee, 2011, p. 16)

1.1 Introduction

Information and communication technology extends into almost every aspect of life. Use of home computers, for example, has given widespread access to information and products that have transformed the way we live, changing many aspects of life among a large and growing share of the world's population (Deichmann, Goyal, & Mishra, 2016). Today, information technology (the tools we use in different ways to increase efficiency) is rapidly transforming lifestyles in rural, regional and remote areas of Australia as well as in many developing countries. The widespread availability of fixed and mobile networks is connecting remote communities and opening up new opportunities in finance, marketing, health and lifestyle on a scale that was hitherto unimaginable (Charmley, Hay, & Bishop-Hurley, 2016a). While there are a large number of agricultural technology products available and access to the internet is improving, uptake rates of different forms of agricultural technology has been inconsistent across the industry (Alford, Clark, & Griffith, 2008; Charmley et al., 2016a; Lamb, Frazier, & Adams, 2008; Mooty, 2001; Rango, Havstad, & Estell, 2011)

Technology, defined as *"the application of scientific knowledge for practical purposes, especially in industry"* and "*machinery and devices [that are] developed from scientific knowledge"* (2002), has played a vital role in developing the agricultural industry: *"most fundamentally, technology used in agriculture reduces the money and time spent accessing and exchanging information"* (Deichmann et al., 2016, p. 4). Agricultural technology, i.e. "*the application of techniques to control the growth and harvesting of animal and vegetable products"* (Stewart, 2017) such as precision agriculture (PA) was first used in the cropping sector in Australia in the 1980s where the adoption of the technology was likened to a double edged sword. On one side, adopting new technologies led to increased yields, but on the other, having to retrofit equipment such as tractors was expensive and slow as producers waited for specialised parts to complete the retrofit (Cavallo, Ferrari, Bollani, & Coccia, 2014). It was not until the 1990s that PA began to be used in livestock management (Brase, 2005) where technology was used to monitor climate control, feed supply, animal weight and welfare elements (Berckmans, 2004). The National Research Council (1999) defines precision agriculture (PA), typically used for cropping, and global positioning system (GPS) based tasks as *"a management strategy that uses information technology to bring data from multiple sources to bear on decisions associated with … production"* (p. 17). Similarly, Wathes, Kristensen, Aerts, and Berckmans (2008) define precision livestock farming (PLF), used primarily in animal husbandry, as *"the management of livestock production using the principles and technology of process engineering"* (p. 2).

The inconsistent uptake of technology in agriculture is most often attributed to a lack of internet connectivity and high entry prices (BIRRR, 2016a; Curtin, 2001), but also to information fatigue (So, Kim, & Cohen, 2017), regulatory depletion (fatigue from resistance to impulses and desires in spending) (Wagner, Altman, Boswell, Kelley, & Heatherton, 2013; Wan, Rucker, Tormala, & Clarkson, 2010) and distraction from other tasks. Traditional barriers include arguments surrounding perceived cost-benefit, demographic factors such as age and education, and size of farm (Daberkow & McBride, 2003; Feder & Umali, 1993; Fountas, Wulfsohn, Blackmore, Jacobsen, & Pedersen, 2006; Kutter, Tiemann, Siebert, & Fountas, 2011). In addition, inconsistent uptake has been attributed to a lack of ability to hold technology developers accountable for the on-farm performance of their offerings (Deichmann et al., 2016; Sparrow et al., 2017). Lamb et al., (2008) state that developers may have stifled the adoption of PA by focusing on price and profit over preparation and protocols (i.e. clear user instructions), which producers value more. In addition several authors agree that there is an apparent disconnect between the user (the user's ability for using the technology), the advertised product (how marketing says it performs) and the actual product (how it actually performs) (Lamb et al., 2008; Solomon, Hughes, Chitty, Marshall, & Stuart, 2013), which may also contribute to slow uptake.

Whilst sales and marketing of agricultural technology are traditionally directed at men, women have been identified by Hay (2013) as *"important decision makers and users of technology in rural households and the producer men in the same study self-identified as being incapable or uninterested in learning technology"* (p. 29). Therefore a marketer's success when advertising agricultural technology to men may be hindered by the inability of a producer to leverage that technology to their own benefit (Deichmann et al., 2016; Tey & Brindal, 2012). Producers in the context of this research are men and women who produce beef cattle. Technology includes tools such as personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera's, remote weather stations, bore cameras, satellite technology, walk over weighing, IVF technology, feedlot technology, drones and other livestock farming systems. Farmers have readily adopted some technologies for example, the Bureau of Meteorology (BOM) weather forecasts and market prices, which directly affect the financial bottom line, as well as searching for information on machinery parts or business related information and using social media as a sales tool.

One such example comes from field work in the previous Honours study by Hay (2013). A face-to-face interview participant explained that she was having trouble deciding which bulls to take to market. She had four bulls to choose from but could only fit three bulls on the truck (it was a four and a half hour drive to the sales associated to the field day). The participant decided to put a photo of each of the bulls on her Facebook page to ask her 'friends', which bulls to take. Instead, the participant sold one of the bulls prior to the field day sales (and she achieved $1000 more than for the other bulls at auction). The participant was very pleased with the sale and having sold the bull on Facebook meant that she could take the remaining three bulls to the sales at the field day increasing her overall profit (Interview number 11).

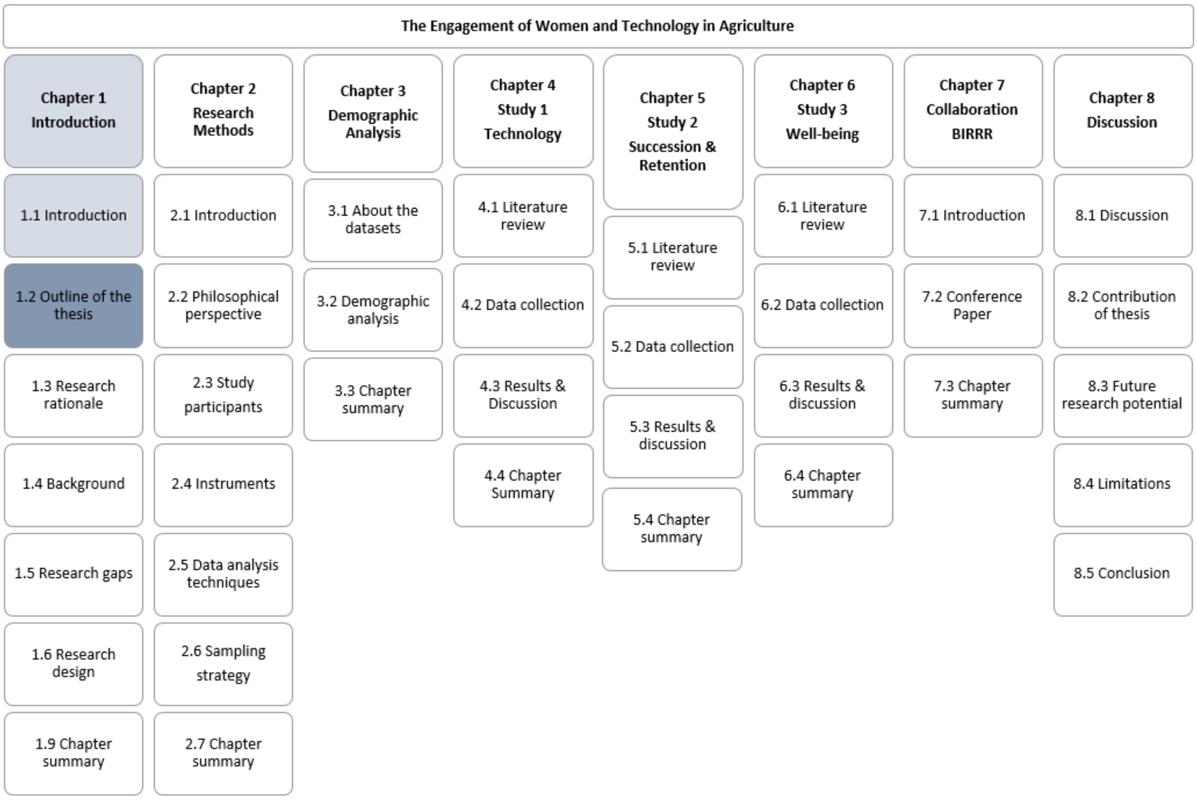
Women who choose to work off-farm achieve a higher average income than those who only work on farm, which helps to maintain the farm (Bharadwaj, Findeis, & Chintawar, 2013; Kelly & Shortall, 2002; Perry & Ahearn, 1994). However, the extant literature focusses on women's role in agriculture as traditionally associated with duties related to the homestead (Alston & Wilkinson, 1998; Bryant & Pini, 2006; Little, 2009; Whatmore, 1991). In contrast, women are increasingly playing a more important role in decisions regarding whether or not to adopt technology and thus in the diffusion of selected technological products (Hay & Pearce, 2014). While there is very little research available about women adopting technology, Hay and Pearce's (2014) study found that women, who use technology three times more than men, were responsible for researching new on-farm technology, making informed decisions with their partners about the purchase of the technology and training and using the technology on farm.

An online search of journal articles, books and newspaper articles under the disciplines of agriculture, medicine, history, archaeology, economics, information systems, business and public health shows that the extant literature on women and decision making relates to decisions about health, domestic violence, economic participation and male migration (search keywords include women, decision, decision making, gender, technology and history, timeframe unlimited). Rosenfeld (1986) observed in the Sage publication *U.S. Farm Women: Work and Occupation*, that *"If the family farm as a workplace has been largely ignored by social scientists, the work of women on farms has been almost completely neglected"* (p. 180). While the chapter is somewhat dated, its sentiment endures, given a paucity of more recent literature. At present, there is little research about the topic of rural women using technology or about how women make decisions to adopt this type of technology (Dimopoulos & Sheridan, 2000; Gregor & Jones, 1999; Lynch, 2002; Mackrell, 2006; Sheridan & McKenzie, 2009; Stewart, 1997). Farmar-Bowers (2010) was identified as the only researcher to 'specifically survey women' that work in agriculture with regard to 'decision making. Therefore, this thesis aims to explore the benefits to, and importance of, rural women's use of and role in managing technology and the valuable skills and attributes that rural women bring to decision-making in agricultural management and leadership.

Australia's high level of food security will increase demand for quality beef products and as such, production practices will need to improve to keep up with demand. The Australian beef industry needs to adopt new technology to capitalise on improved efficiencies gained from pasture and grazing management, water, waste and soil management, genetics and breeding programs, and animal health and nutrition, as well as security and safety on farms (Leigo et al., 2012; Zhang, Wang, & Wang, 2002). This thesis aims to inform stakeholders (i.e., agricultural technology marketers and rural groups), policy makers, and membership agencies of rural women's role in technology adoption to shift perceptions of rural women from representatives of the farming industry to decision makers in the farming industry. The decisions made by women in agriculture extend beyond productivity to well-being and the continuation of farming through succession (handing on the property to the next generation) and the attraction and retention of workers.

1.2 Outline of the thesis

Thesis Structure Overview: Chapter 1 – Outline of the thesis



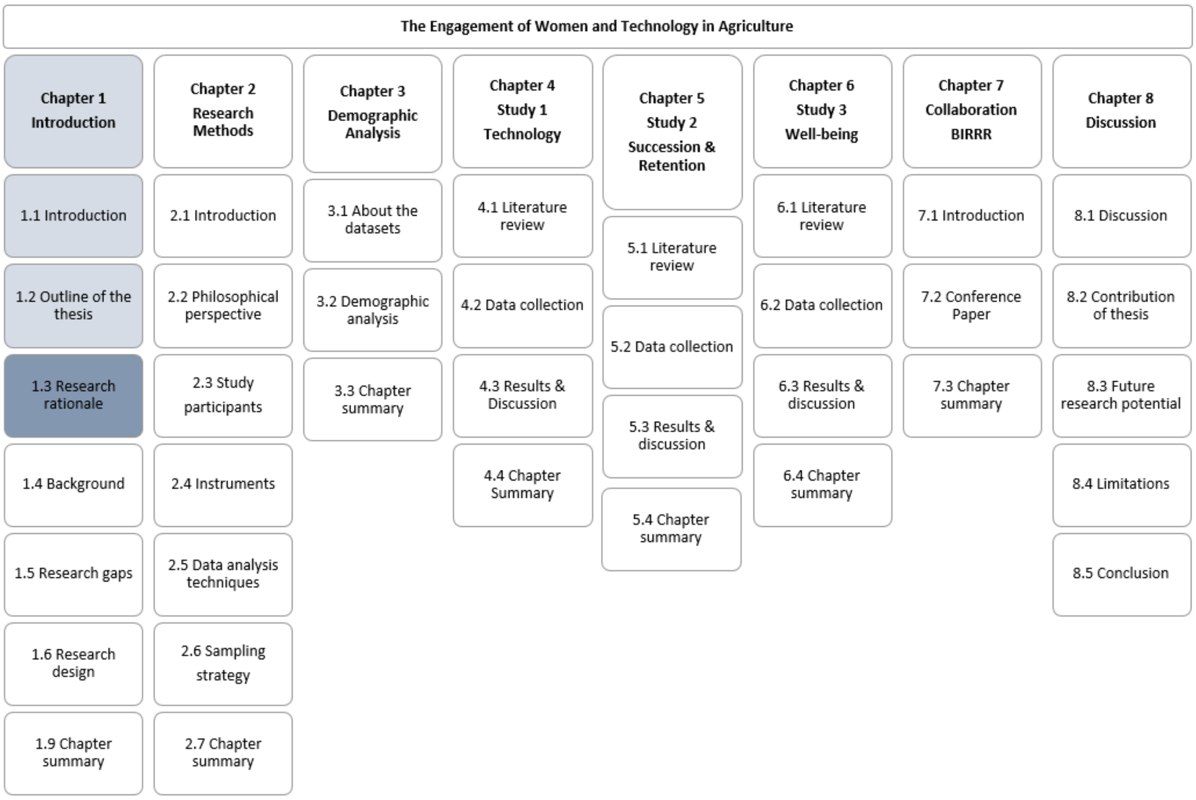
The first chapter contains the introduction and the outline of the studies, *Chapter 2* discusses the methodology used for each study, and *Chapter 3* contains the demographic data analysis. This thesis then presents a non-traditional literature review, which is divided into three individual sections that are the focus of three separate studies. *Chapter 4* presents the literature review, results and conclusion associated with *Research Gap 1 – Study 1: Producer adoption of rural digital technology*. *Chapter 5* presents the same information for *Research Gap 2 – Study 2 Technology, Farming Families, and Workers: It's all about successio*n and retention and *Chapter 6* presents the literature review, results and conclusion for *Research Gap 3 – Well-being of producers and producer families*. Each of the Chapters draws on *Chapter 3* for demographic information that is related to that Chapter see Section 3.2.

Chapter 1: Introduction	• Outlines the proposed format of the study
Chapter 2: Research Methods	• In-depth discussion of literature surrounding methodological concepts within the study
Chapter 3: Demographic Analysis	• Analysis of demographic data that is common to all studies
Chapter 4: Study 1 Technology	• Technology literature review, results and conclusion to Study 1
Chapter 5: Study 2 Succession and Retention	• Succession literature review, results and conclusion to Study 2
Chapter 6: Study 3 Well-being	• Well-being literature review, results and conclusion to Study 3
Chapter 7: Collaboration BIRRR	• Marketing Social Change
Chapter 8: Discussion	• Discussion and Conclusion of results found in the study

Figure 1.1: Outline of the Thesis

1.3 Research rationale

Thesis Structure Overview: Chapter 1 – Research rationale



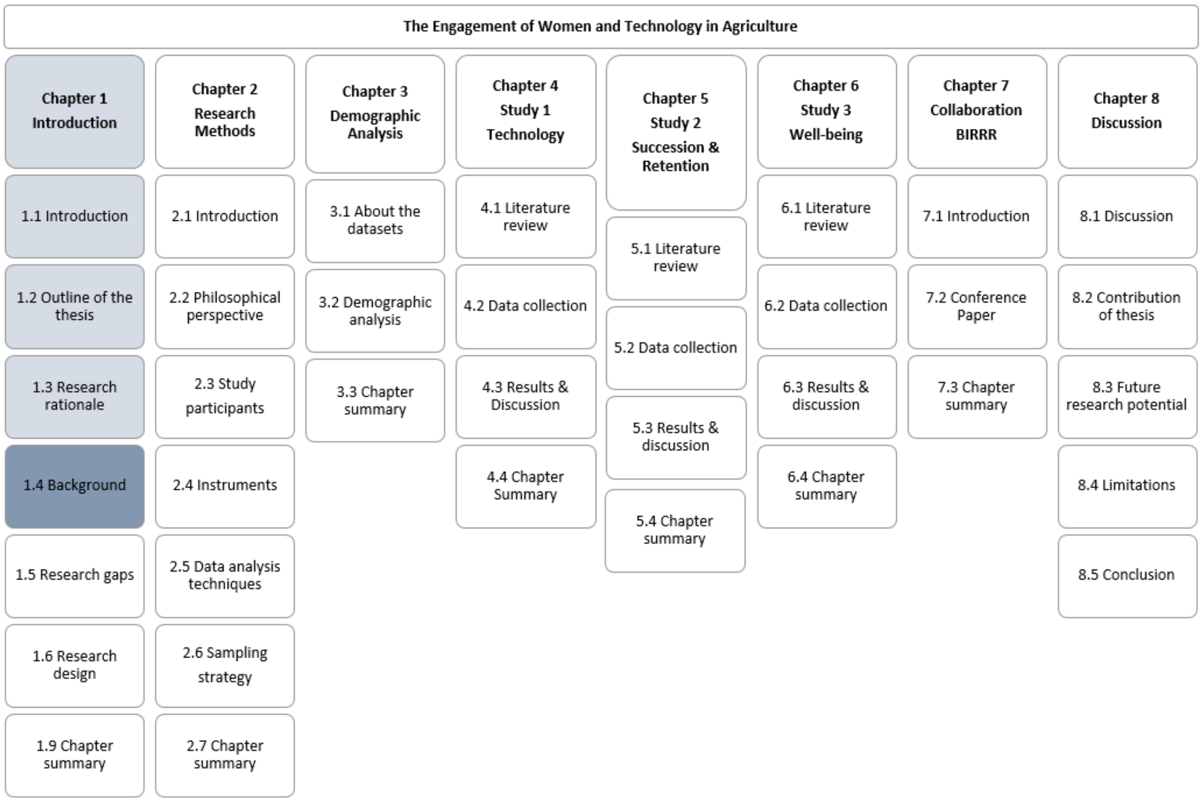
Research Rationale

A study by Hay and Pearce (2014), based on material from the first author's Honour Thesis, found that rural women using agricultural technology felt empowered and valued in their work. They found that, as technology diffuses into rural settings and is adopted by rural women, it is modifying gender divisions, specifically away from traditional separate roles towards productive partnerships in farming families (p. 318). Interestingly, the study highlighted that the use of technology may reduce isolation in farming partnerships. For example, a woman being able to use technology at night to complete digital farm management means they are available to work outside on farm during the day alongside their partner, which may reduce the isolation felt by the male producer. In turn, working alongside their partner may increase the well-being of the producer and the producer family. While the woman producer may forego any opportunity to earn an off-farm income, they are able to increase well-being within the family. Participants in this initial study also highlighted that technologically active properties might entice children back to the property, help to attract and retain workers. This would help to help resolve issues surrounding an ageing rural workforce (Wathes et al., 2008), a lack of suitably qualified stockmen and a lack of succession, where children are no longer returning to farming for adult careers (Redfurn, 2012; Wathes et al., 2008). As such, the aim of this research is three fold, containing three interrelated studies.

The first study aims to extend the Hay and Pearce (2014) study to further establish women's role in the diffusion of digital technology to beef production and changes in technology adoption since the original data was collected in 2013. The second study aims to explore the notion that women using technology can reduce isolation within the farming partnership, particularly for men, reducing isolation's effect on the well- being of the men, the women and the farming family. Finally, the third study aims to explore the attractiveness of technological properties and technology's effect on staff retention and succession.

1.4 Background to the research

Thesis Structure Overview: Chapter 1 – Background to the research



1.4.1 Australian beef industry

The Queensland beef industry produces nearly half of Australia’s beef and employs more than 18,000 people in the beef processing sector (Queensland Government, 2016). Moreover, Australia is one of the world’s most efficient beef producers and ranked first in the top 10 world beef exporters in 2015-16, with beef and veal exports valued at $8.5 billion (Meat and Livestock Australia, 2016b). The Australian beef industry supplies 96% of beef products to Australian consumers and 4% to world markets (Meat and Livestock Australia, 2013).

This study focusses on the beef industry in Queensland and more broadly the Northern Australian Beef Industry. Northern Australia defined as the parts of Australia above the Tropic of Capricorn

(23° 26’ 22’ south of the Equator) and the entire Northern Territory (see Figure 1) shows the spread of the geographic region that the research will study.

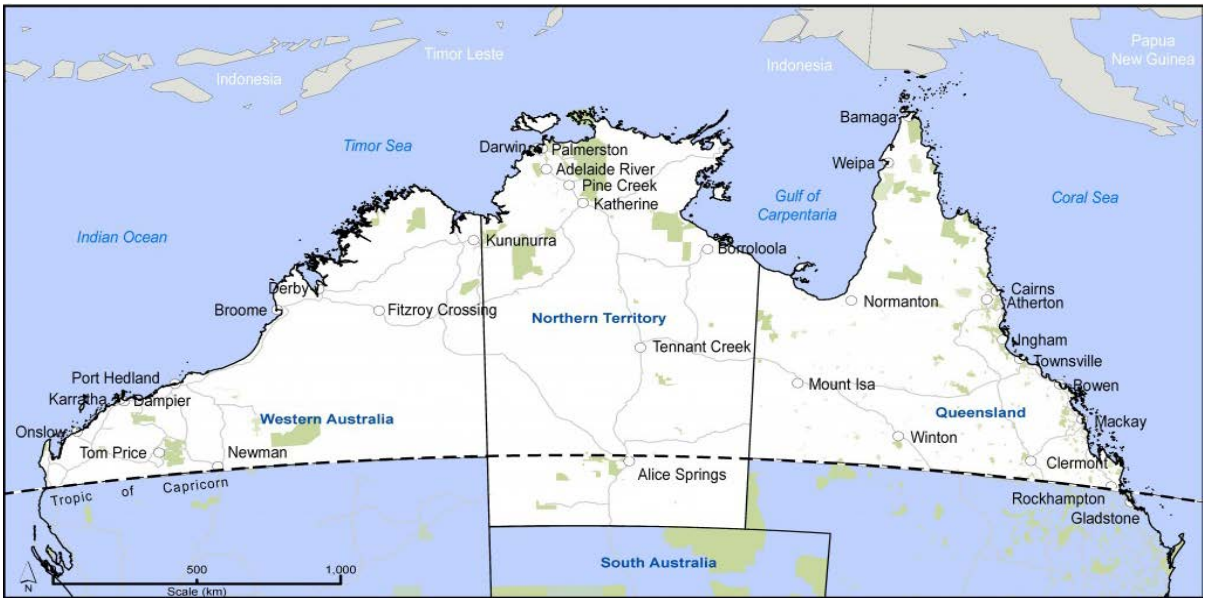


Figure 1.2: Northern Australia, Department of Infrastructure, and Development, 2015

When first engaging the research, Hay (2013) collected data from participants in Queensland where the study only engaged with beef producers. While the studies included this thesis mainly engage with beef producers, due to the nature of the databases used (see section 2.3.4 and 2.3.5 for database details), the geographic region for this study extends to producers outside of Queensland and outside of the beef industry to engage broadly with producers in the Australian agricultural industry. However, the primary focus of the studies included in the analysis remains on Queensland beef producers.

Providing support to grow Queensland’s beef exports is listed as a priority by the Queensland Government (Department of Agriculture Fisheries and Forestry, 2014). The Australian Bureau of Agriculture and Resource Economics (ABARES), cites Northern Australia as holding around 59% of the total Australian cattle herd. Of this, live exports account for approximately 74% of cattle to a value of approximately $8.5 billion (ABARES, 2012). The ABARES outlook on food demand to 2050 indicates that global demand for food is projected to be 77% higher than in 2007 (Linehan, Thorpe, Andrews, Yeon, & Beaini, 2012). Supporting this, the Queensland Government’s agricultural strategy has set a target to double beef production, reaching two million tonnes by 2040 to meet export demands (Department of Agriculture Fisheries and Forestry, 2014). In addition to food demand, food security concerns have grown in recent years. Food security is defined by the Food and Agriculture Organisation of the United Nations as *"when all people, at all times, have physical, social and economic access to sufficient, safe, nutritious food, which meets their dietary needs and food preferences for an active lifestyle"* (Food and Agriculture Organisation of the United Nations, 2017) and as having *"access by all people at all times to enough food for an active, healthy life"* (Radimer & Radimer, 2002, p. 3).

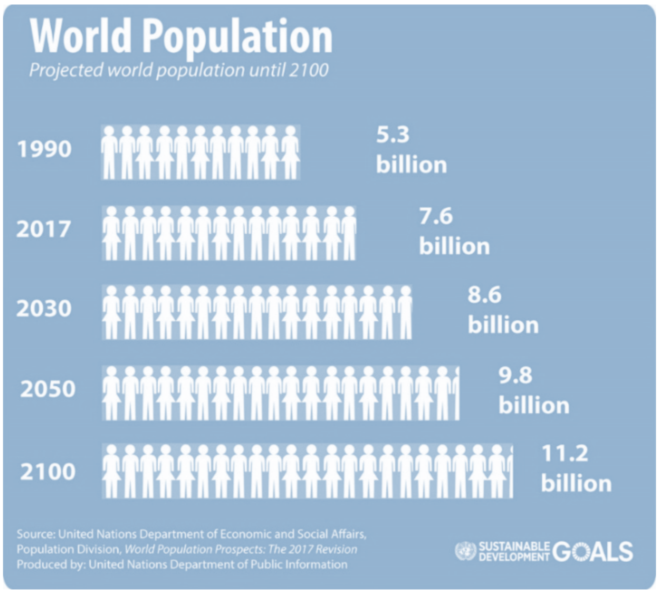


Figure 1.3: Projected world population until 2100 (United Nations News, 2017))

Australia is known to have high levels of food security, which increases demand for its food products from other countries, in turn placing pressure on Australian beef producers to produce more high quality beef products and increasing the national importance of the beef industry (Stoutjesdijk & ten Have, 2013). China and India account for much of the demand for agri-produced food due to poor food security caused by poor food policies and by the way both countries address access to food by poor consumers (ABARES, 2012; Linehan et al., 2012; Yu, Elleby, & Zobbe, 2015). Because of Australia's close proximity to Asia, demand for Australia's beef products and other agri-products is expected to rise (Zhang-Yue, 2013). Therefore, it is essential that producers, including producer women, be supported in their efforts to work hard and smart on the land (Zhang-Yue, 2013).

1.4.2 Women's role in agriculture and their adoption of technology

Very little available research identifies the factors that influence rural women's decision making regarding adoption of rural digital technology. The reviewed literature focusses on farming, but also considers technology adoption by women entrepreneurs, women in construction, and the socio-economic status of women, as well as strategies for empowerment of women through adoption of technology in the rural home (3BL Blogs, 2014; Anugwom, 2011; Ndubisi, 2007; Verma, Verma, & Rani, 2013). There is also very little historical evidence about women's motivations for adopting technology of any kind. In Cowan's (1979) article, on the topic "women as bearers of children" (p. 52) it is noted that there are many inventions that are aimed at women. For example, the baby bottle, sterilisers, childbirth interventions and the baby carriage amongst other inventions such as the washing machine and vacuum cleaner (Cowan, 1979). However, there is a paucity of historical writing about women's approach to the adoption of these technologies or any other technologies. The historical literature discusses male and female roles in purchase decisions. The literature concludes that males are the dominant purchaser of 'brown goods' i.e., goods that are for the home but not for house work, for example the stereogram and females are the decision makers for purchases of 'white goods' i.e., goods that are used for housework for example the washing machine. However, women were not seen as the drivers of purchase decisions. For the most part women made decisions in the past about food, small appliances and *"purchases that reflect female activity in the home"* (Bose, Bereano, & Malloy, 1984, p. 61) men were responsible for the remaining purchase decisions.

When discussing *"technological impacts on the ease of housework"* the very early work of Hartman (1974) suggests that if the motive when deciding that technology is adopted is because of time saving or ease of effort, then easing of effort is more important (as cited in Bose et al., 1984, p. 63). However, easing of effort for the task does not equal satisfaction, as the task still needs to be completed. Ease of effort might be one incentive for adopting technology, but it cannot be the only incentive. Motivators to adopt must go beyond perceived ease of use and usefulness, to include motivation, abilities, traits, and psychological constructs (Venkatesh, Morris, & Ackerman, 2000).

The extant literature focusses on social inequality based on gender (Little, 2009), gender relations, capital resources and decision making (Bock, 2006), and the disadvantages of rural residency and a lack of social and economic equality (Little, 2009; Penley, 1991) between genders. However, Bryant and Pini (2006) also highlight a link between gender and technology, which is supported by Saugeres (2002), linking men who use agricultural technology to reinforcing patriarchal ideologies, ultimately marginalising women to exclude them from both farming and decisions about farming. Brandth (1995, 2006) and Coldwell (2007) introduce the proposition that women's changing role on-farm may challenge men's masculinity as men associate working with machinery with leadership. While Alston (1995) argues that women contribute significantly to agricultural production, the extant literature discusses pluriactivity i.e., *"situations that combine off farm and non-farm employment or revenue streams"* (Blad, 2012; Eikeland & Lie, 1999) and diversification where women engage in non-agricultural work off farm. Over time the extant literature has shown that women have become more involved in decision making, which has led to women's role in farming being recognised as valuable (Alston & Wilkinson, 1998; Claridge, 1998; Farmar-Bowers, 2010; Gasson & Winter, 1992; Pannell & Vanclay, 2011; Rickson & Daniels, 1999; Umrani & Ghadially, 2003).

However, literature regarding women in agriculture discusses women's roles as important, but only to the domestic household. For example, women's roles in agriculture have been defined previously as small-scale commodity production and survival of the family farm (Alston & Wilkinson, 1998; Bryant & Pini, 2006; Little, 2009). The literature recognises women as only being responsible for the "*domestic reproduction of a household*" (Little, 2009, p. 316), where women were not recognised for the work that they did outside of the household (they were seen to be invisible) (Bryant & Pini, 2006). In reality, rather than household chores being a woman's only skill, domestic chores are one of many skills undertaken by women as a matter of convenience (Bryant & Pini, 2006).

A rural woman's role changes as her children grow and become more independent or leave for boarding school, and following similar patterns to city or town dwellers, women choose to participate in or return to off-farm work (Haugen & Blekesaune, 2005; Whatmore, 1991) or they choose stay on farm and become more active in daily work activities. Women who worked off farm are motivated to contribute to the family income, and to form social bonds with the working community and their contribution financially, is seen as important (Haugen & Blekesaune, 2005). On the other hand, women do jobs associated with the home when they are logistically tied to the house, especially with younger children (Whatmore, 1991). Jobs associated with the home include housework and child rearing but also include using technology. However, while working in the home and raising children, women have long been expected to fill in on the farm when emergency labour is required (Alston & Wilkinson, 1998). Emergency labour might require the woman producer to participate in a vast array of farming tasks, which are equally as arduous and valuable as men's work. This in turn may challenge male producers' perceptions of 'traditional' masculinity (Saugeres, 2002).

While rural men, are recognising women's work as important and valuable (Beach, 2013; Hay & Pearce, 2014), recognition of women who work on farms is not clearly stated. In a study by Beach (2013), men depict women's roles not simply as workers, but as having important and diverse roles. The author also states that traditional notions of patriarchal farm management may be declining. Beach (2013) identifies that rural women may work on farm and be involved in decisions surrounding financial and management aspects of production, and some may work off farm and contribute financially to the business and the family, and some might do both (p. 225). However, many of the studies reported in the available literature, although somewhat dated, appear to justify the perceived subordination of women's roles relative to those of men (Hoddinott & Jarrattt, 1998; Kelly & Shortall, 2002; Little, 1987; Little, 2009; Richardson, 1993; Saugeres, 2002). Rural women are mothers, wives, stock workers, managers and community workers and they use technology to complete these tasks (Alston, 1995; Pannell & Vanclay, 2011; Penley, 1991). Beach (2013) states that women perform most types of agricultural work but are overlooked by government policy in favour of men.

Greenwood et al., (2005) notes that in the era of the household revolution, using technology (in the form household goods) was seen as women's work, therefore not a job for men. Women's technology use may stem from being housebound, and then naturally spill over into farm work, which could be seen as a driver of technology adoption (Poindexter, Meraz, & Schmitz Weiss, 2009). This might shed some light on the gender divide that is often associated with technology, but given the age of the articles, and that many of the cited studies only investigate the motives of men not women, these perceptions may no longer be current, (Bock, 2006; Brandth, 2006; Bryant & Pini, 2006; Doss & Morris, 2000; Gasson & Winter, 1992; Kelly & Shortall, 2002). Women involved in Australian beef production suggest that there is very little division of gender within the industry. Rural women see women and men as being on a level playing field…*"It's about being together, men and women on farms don't see themselves as having a gender based role, but as the job getting done by whomever is available to do it"* (Interview number 8). Beach (2013) states: *"while the discourses of the family farm and masculinization do occur…neither one is the primary discourse expressed by farmers"* (p. 225) supporting Australian rural women's views. As this thesis develops, gender-specific technology adoption in areas outside of farming will also be included.

Umrani and Ghadially (2003), supported by Haraway (1997) posit that women using technology has a positive influence and reduces women's dependency on men, empowering them, while Penely (1991) and van Zoonen (1992) claim that women using technology may be liberating for them. Given the mixed findings reported in this body of research and the fact that much of it is dated, it is evident that a more in-depth investigation is required regarding women's role in farming and pluriactivity to explore decisions that affect technology adoption, who makes them and on what basis.

1.4.3 Rural digital technology, its significance and adoption

By adopting new technologies, producers have been able to reduce costs, increase production and improve the welfare of their animals, as well as improve food security (Lawrence, Lyons, & Wallington, 2011; Leigo et al., 2012; Meat and Livestock Australia, 2013; Tey & Brindal, 2012). Aubert et al., (2012) posits that *"precision agriculture technology represents a paradigm shift in farming practices"* (p. 510). Early adoption of technology focussed on the cropping industry (Lamb et al., 2008) and revolved around global positioning systems (GPS) and field data loggers that collected data from probes into the soil that measured moisture and fertiliser rates, see Figure 1.4.

Figure 1.4: Global Positioning System and Field Data Loggers, Source: Google Images

Later technologies including remote monitoring tools such as water sensors (a), automatic bore pumps (b), remote monitoring of animals (c), pasture modelling and mapping (d), and walk over weighing systems (e) were introduced to the beef industry (Leigo et al., 2012; Meat and Livestock Australia, 2013), see Figure 1.5 (for more information on the uses of each of these technology tools, please see Leigo et al. (2012)).

a) Water Sensor

b) Automatic Bore Pump

c) Remote Camera

d) Wireless fencing, animal tracking collar

e) Walk over weighing

Figure 1.5: Examples of Agricultural technology

Rural digital technology in this research is defined as personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, National Livestock Identification Systems (NLIS), remote cameras, remote weather stations, bore cameras, satellite technology, walk over scales, in Vitro Fertilisation (IVF) technology, feedlot technology and other livestock management systems.

Precision Livestock Farming (PLF) technology has emerged as a recognized contributor to efficient and environmentally sustainable grazing practices (Aubert et al., 2012; Tey & Brindal, 2012). However, as noted earlier, adoption of these technologies has not scaled up within the beef industry and seems to be stalled at the innovators and early adopter's stage of Roger's (1962) Diffusion of Innovation model, which will be discussed as part of an extensive literature review in Section 0 of *Chapter 4*. Given the dissemination of technology into cattle production, it is important to discover the views of producer women and men regarding the adoption of future technology.

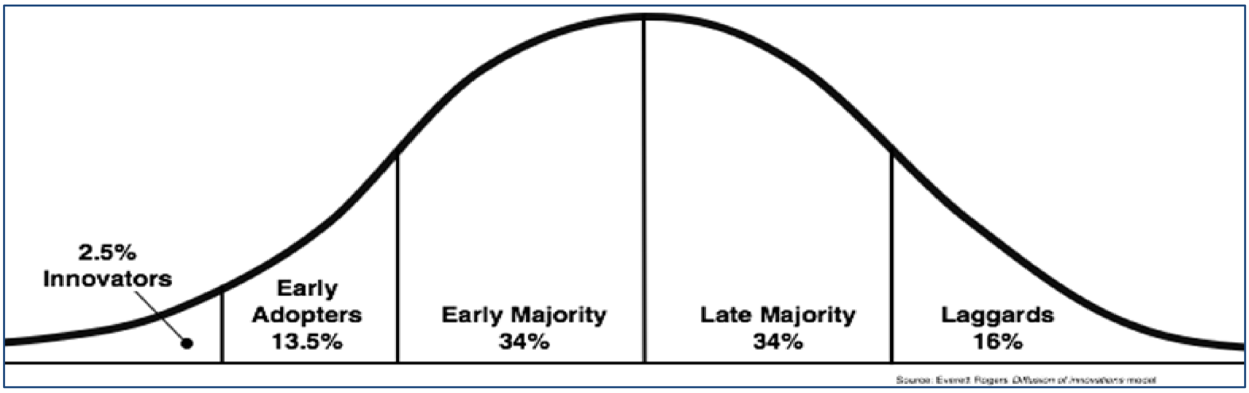
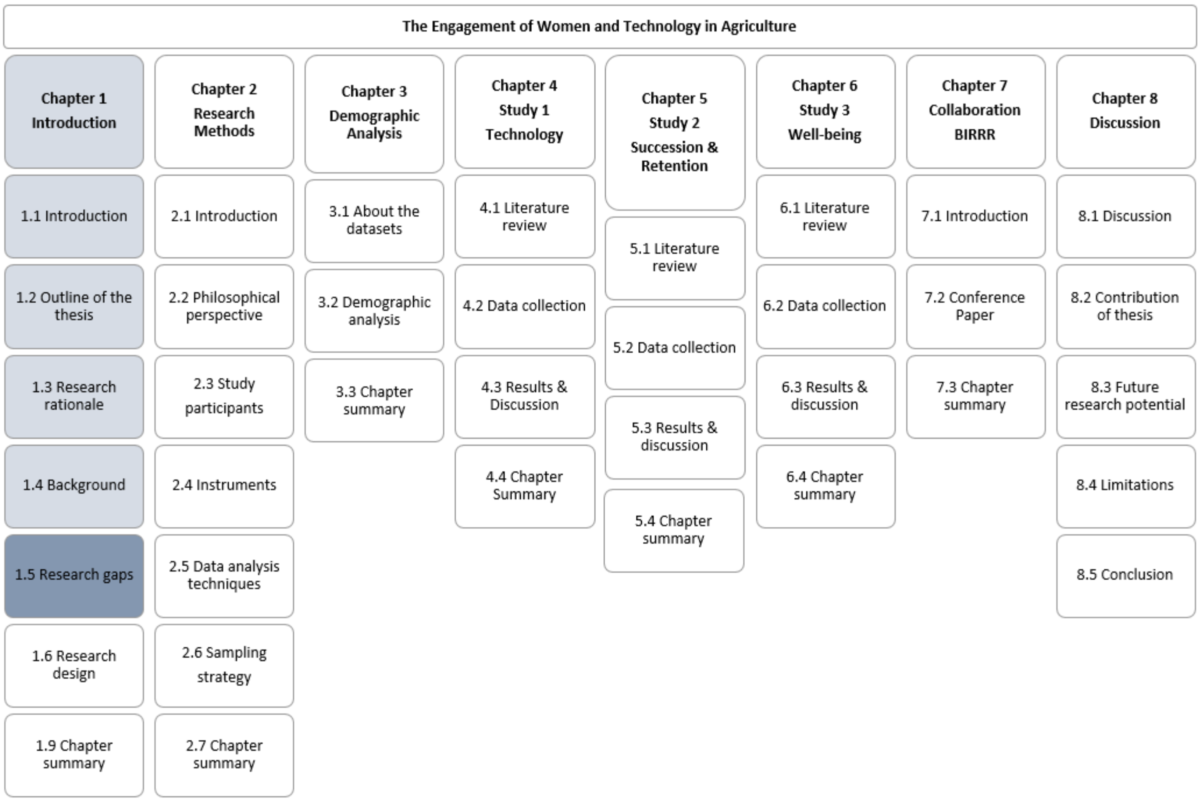


Figure 1.6: Diffusion of Innovation Model (Rogers, 1962)

1.5 Research gaps and theoretical framework

Thesis Structure Overview: Chapter 1 – Research gaps and theoretical framework



1.5.1 Research Gap 1: Women's role in the diffusion of technology into the beef industry has not yet been clarified, so it is not obvious how technology has been used by rural women

As noted previously, the uptake of rural digital technology in the beef cattle industry has been inconsistent. Whilst sales and marketing of this technology are directed at rural men (see evidence below) Hay and Pearce's (2014) study identified women as important decision makers and users of technology in rural households.

Advertising for technology as reported by respondents in 2013 is displayed in parts manuals, farming magazines, newspapers, and direct marketing (face-to-face interviews, 2013). NewsCorp Australia's readership statistics for magazines such as "Farm", "Decision Ag", "Crop Gear" and "Education" show that the reach in Queensland is 82.6% or 414,000 readers. That advertising is aimed at men is demonstrated under the section "Audiences, Regional men and women" and reads as follows:

"Come Friday afternoon he's knocked off early. It's time to shoot the breeze at the local. He's always willing to lend a mate a hand. Or an ear. Particularly if it involves a race tip.
Business is good, he's never been so busy. He's got 11 new customers this month alone. There might even be a new apprentice soon. The region is booming so there'll be no shortage of young blokes keen for the job.
This is Jack. We have another 3,074,000 more Australians just like him nationally. And this is just one example of the power our people have" (Online: News Corp Australia, 2017)

Fairfax media's rural publication, "Farm Weekly" has an average readership of 43,200 and claims to reach 84% of farmers every week, displays the following image of their readership (Fairfax Media, 2017), reinforcing the impression that farming advertising is directed at men.

Figure 1.7: Fairfax Media, 2017

Technology adoption theory

Technology adoption theories have provided an insight into the psychology of adoption by surveying men (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Rogers, 2003; Venkatesh, 2000). Only one article about technology adoption in farming has surveyed women (Farmar-Bowers, 2010). Technology adoption models add value to the research and as such, the Technology Acceptance Model (TAM), Perceived Usefulness and Ease of Use (Davis et al., 1989; Venkatesh, 2000) and to Self-efficacy, *"one's confidence in his or her ability to perform a task successfully"* (Bandura, 1977) are considered. TAM (Davis, 1989) assumes that perceived ease of use and perceived usefulness are the drivers of technology adoption is a simplistic model that is identified as a good fit for producers and will be considered in this study. However, cattle producers have been identified as having a complex personality type (Shrapnel & Davie, 2001), therefore a technology adoption model in itself, cannot explain the diversity of drivers evident in different segments that impact on producers' adoption of technology.

As such, the research will consider Tey and Brindal's (2012) adoption factors that include socio-economic, agro-economic, institutional, informational, behavioural and technical factors as well as producer perceptions, which will be used to analyse decisions being made about technology by producers. Secondly, decision system theory (Farmar-Bowers, 2010; Öhlmér, Olson, & Brehmer, 1998) has been helpful to understand the differences between male and female motivations for making decisions about technology adoption and will be considered. Finally, adaptive capacity (Berry, Hogan, Ng, & Parkinson, 2011a), which measures a producer's capacity and willingness to cope with adverse consequences and change and their willingness to take advantage of opportunities will be considered. Many parts of Australia, especially Queensland are experiencing one of the greatest droughts in 100 years (Australian Bureau of Meteorology, 2015) and this is presenting producers with many extra challenges. However, their adaptive capacity, *"the ability of a system [the producer] to adjust to changes, moderate potential damages, take advantage of opportunities or cope with adverse consequences"* (Kirch, 2008), should they possesses it, will ultimately see them through tough decisions associated with beef production.

Traditionally technology adoption models, decision systems and adaptive capacity have been used to gather data that report on male producer's technology choices. With the exception of two studies (Farmar-Bowers, 2010; Tey & Brindal, 2012), very few studies have surveyed women who were identified as drivers of technology in rural partnerships (Hay & Pearce, 2014). A gap has been identified in scholarly understanding of why and how rural women are motivated to adopt technology. This led the researcher to propose that 'rural women who have access to technology are more motivated towards management than those who do not have access to technology' and asks the question "*What are the women producer's motives, actions and intentions in terms of technology use and management?"* The Literature review, data collection technique, results and discussion and the conclusion for this study are found in *Chapter 4 Study 1 Producer adoption of rural digital technology*.

1.5.2 Research Gap 2: There is no evidence that technological properties are more attractive to staff and children or how this effects staff retention and succession

Chapter 5 investigates whether technological properties are more attractive to children and to staff and how this effects succession and staff retention. Succession is an important and difficult conversation for beef producers and their families. Tough industry conditions in beef production coupled with the effects of climate change see parents discouraging their children from returning to the family farm (Hicks, Sappey, Basu, Keogh, & Gupta, 2012). Children are encouraged to attend university studies and often choose to pursue different non-agricultural careers (Hicks et al., 2012; "Succession planning for the family business is critical," 2010). There is very little information that links technology to succession. However, in Hay and Pearce's (2014) study, there was a small amount of discussion from participants of conversational interviews and experts surrounding children and staff being more attracted to farms that had technology. The more technological the property and business becomes, the more attractive it might be to a younger generation of producers which may be a solution to problems of succession and a paucity of staff with agricultural experience. While there is a substantial amount of information available on succession, there is very little that is specific to the cattle industry or that links technology to succession. This gap identified in the literature is important to succession within the beef industry. Farming families having access to technology may provide the producer with a competitive edge, not only in terms of production, but also in terms of longevity. This gap led the researcher to propose that properties without technology are less attractive to workers and children than properties with technology and lead to the question *"How does having technology available make the family property more attractive to workers and returning children?"*

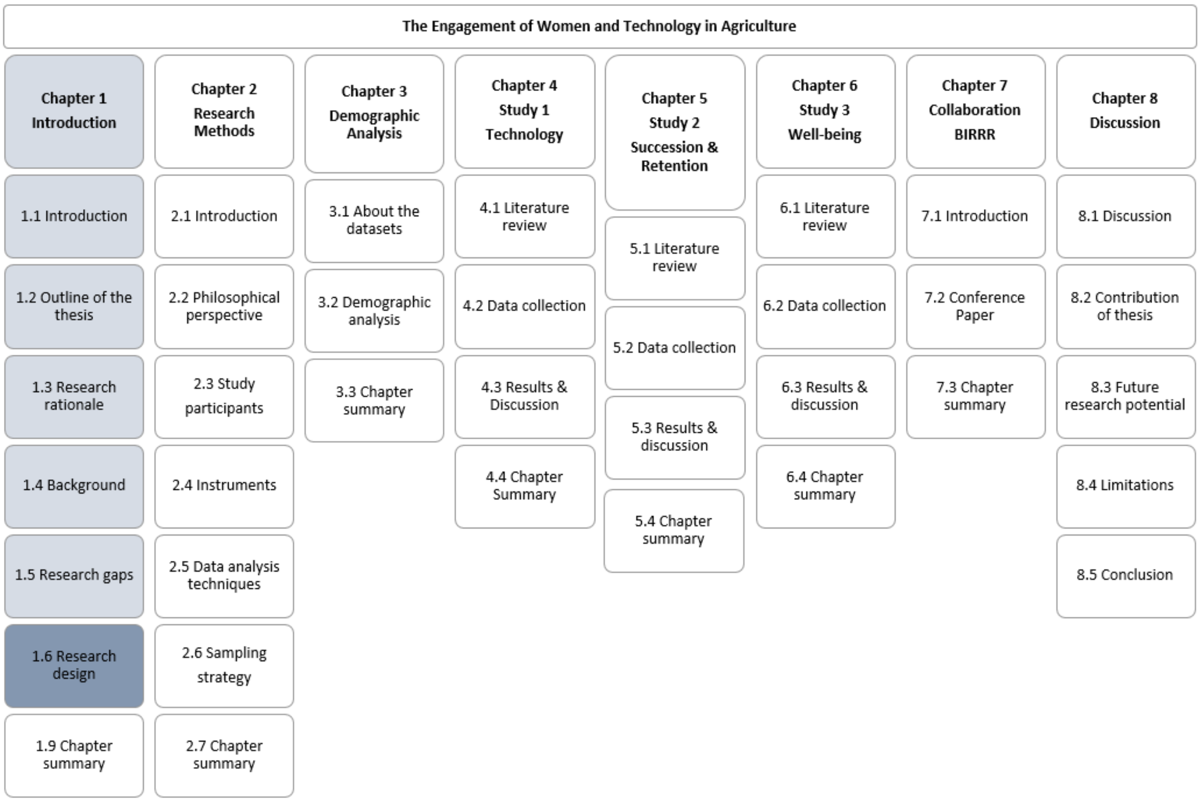
1.5.3 Research Gap 3: The relationship between technology and well-being is not clear and a key question remains about the extent to which technology can reduce isolation and increase well-being

Chapter 6 of this thesis explores the notion that having technology can reduce isolation and in turn increase well-being. The mental health and well-being of people in rural areas of Queensland is suffering under the strain of the effects of prolonged drought and other external factors (such as the interruption to live meat export trade). Live meat export from Australia worth $1.4 billion was suspended from June 2011 for 6 months due to cases of animal cruelty being exposed in Indonesian abattoirs, halting trade and devastating farmers and regional economies (McDonald, Henderson, & Middleton, 2011; Wagstaff, 2016). Extending resources and access to services as well as increasing training for health workers can improve mental health and well-being (Allan, 2010). Women who can access health and well-being programs online (Powell et al., 2012) can use their contact with the men in their family, whether they be husbands, fathers, sons or workers, to access well-being services. Women's access to male family members and workers has been identified as an entry point for male related mental health (Congues, 2014).

Women in Hay and Pearce's (2014) study identified that having technology and being able to use it at night made them available in the day time to work alongside their partners. This in turn made the men happier, resulting in increased feelings of well-being. No studies were located that investigated if technology plays a role in increasing well-being and mental health in beef producers. This gap has been identified and is important to the wellbeing of rural women, men, and families leading the researcher to propose that female producers who use technology are able to spend more time with their husbands, potentially increasing the well-being of the male producer. Therefore, research question 3 asks, *"In the producer partnership, how does a female producer using technology affect the well-being of the male producer?"*

1.6 Research design

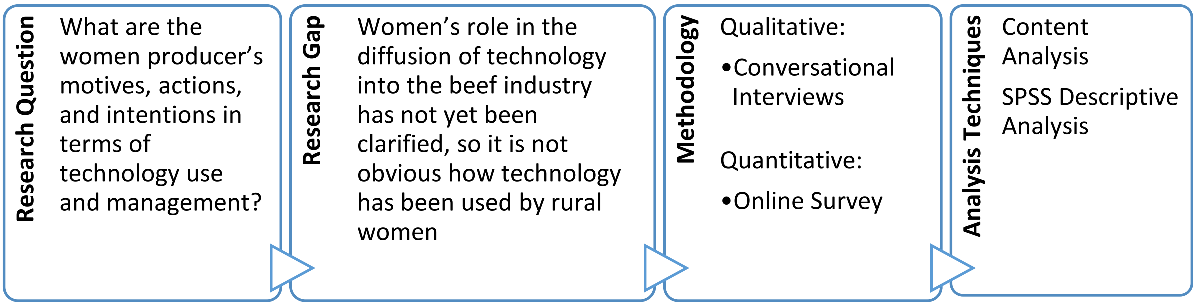
Thesis Structure Overview: Chapter 1 – Research design



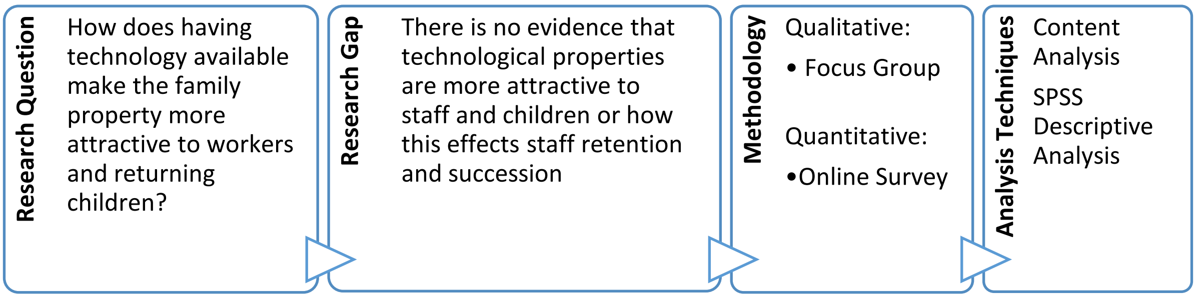
The research used a mixed methods data collection strategy to collect quantitative and qualitative data through conversational interviews, online surveys, and focus groups (Dillman, Smyth, & Christian, 2009; Krueger & Casey, 2015; Saunders, Lewis, & Thornhill, 2009). Using mixed methods allowed the researcher better opportunities to answer and contrast the research questions than a singular method. Quantitative research offered a realist perspective, which used objective and precise research, while qualitative research offered an interpretive view of the research problem, generating a rich and meaningful understanding of the topic (Yardley & Bishop, 2015). The data was closely evaluated using content analysis and statistical techniques and in turn trusted inferences, i.e. conclusions reached on the basis of evidence and reasoning ("Collins English Dictionary," 2003) about the results were made (Saunders et al., 2009, p. 153).

Figure 1.8 outlines the research design of each of the study's. All three studies are interpreted using descriptive analysis of the qualitative content. SPSS is used to interpret the quantitative data using frequency, means and cross tabulation analysis. More information on how the data is analysed is situated in *Chapter 2 Research Methods.*

Study 1: Producer adoption of rural digital technology



Study 2: Technology, Farming Families, and Workers: It's all about succession and retention



Study 3: Well-being of producers and producer families

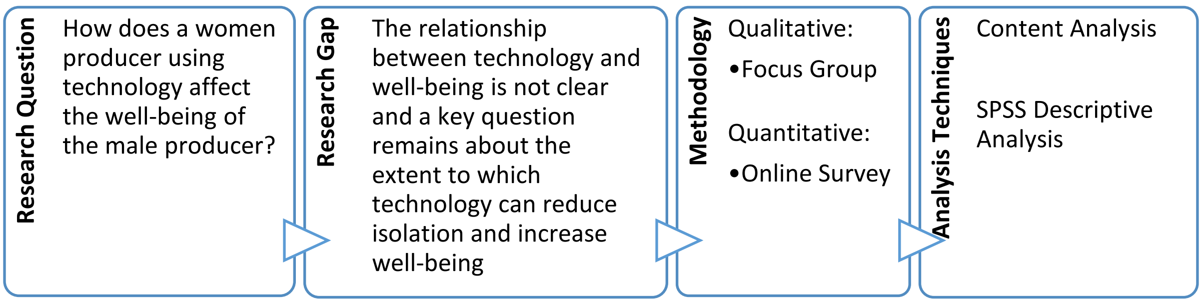
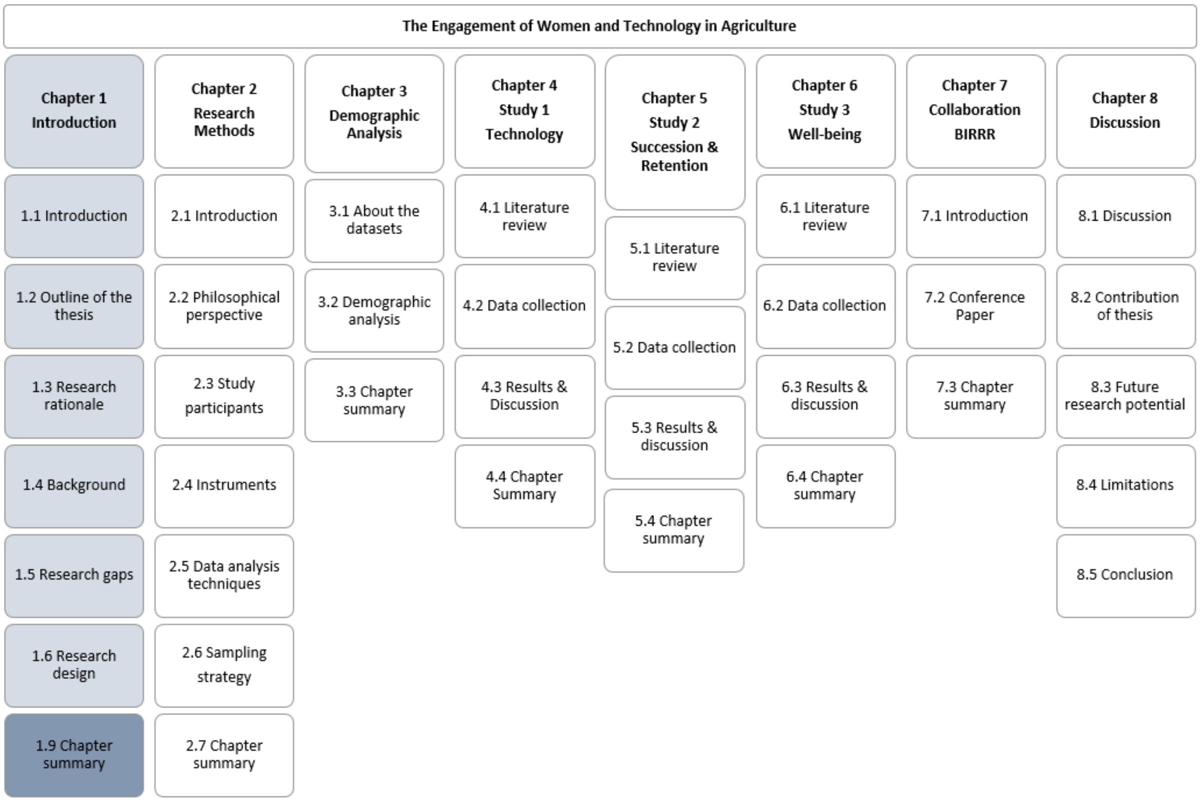


Figure 1.8: Overview of Research Design

Three separate studies were designed to build on the preliminary Honours Study by Hay (2013). The first study "Producer adoption of rural digital technology" aims to compare technology uptake (diffusion) in 2016 to previous results from 2103. The second study investigates further, participant responses from 2013 that indicated technology could be a solution to both a shortage of workers and a problems of succession. The third study seeks to establish if there is a relationship between increased well-being and technology use, which follows on from participant comments from the 2013 study, where 4 participants responded that “by having technology available to them at night, they could spend more time with their partner, which in turn made them happier (and in some cases, less suicidal). Due to the differences between the studies, they could not be brought together as one cohesive study, therefore each study is reported on as an individual study. Golden-Biddle and Locke’s (1997) guidelines for the conduct and evaluation of qualitative and interpretive field studies guided the writing of the thesis.

1.7 Chapter summary

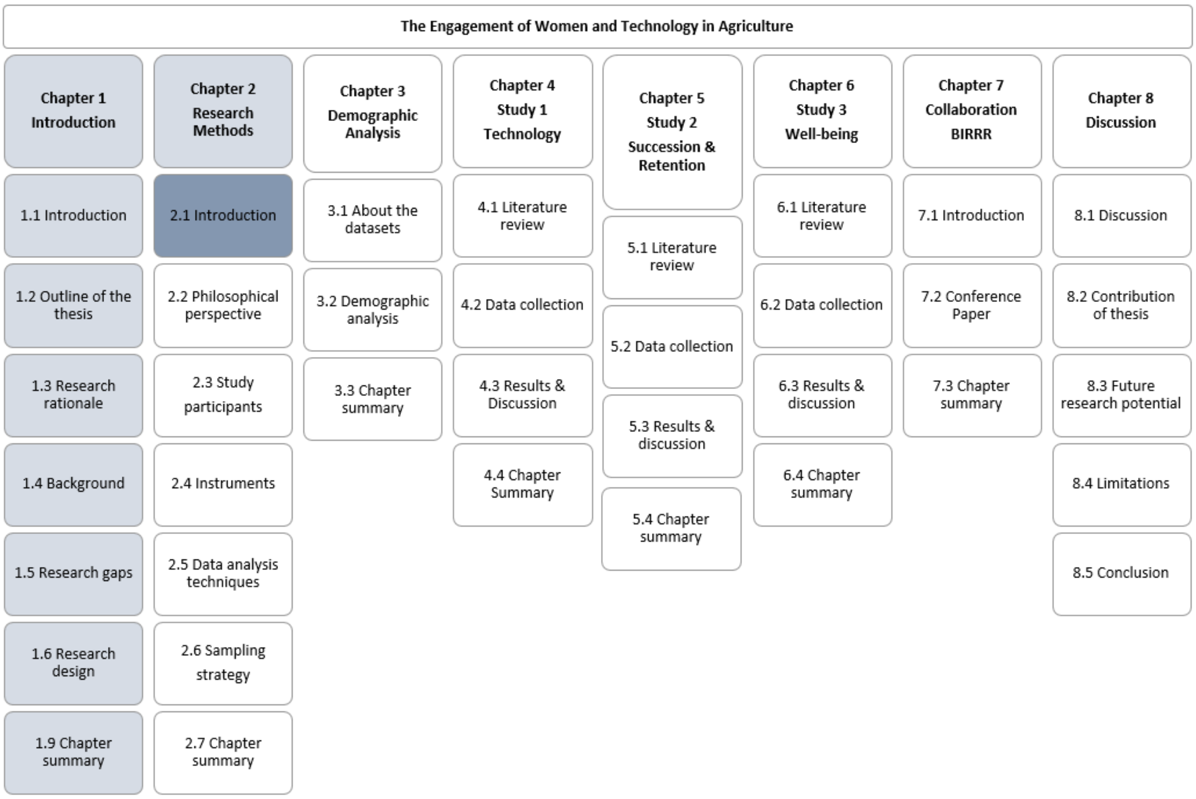
Thesis Structure Overview: Chapter 1 – Chapter summary



Chapter One introduced and gave a background overview of the study of the Australian Beef Industry and it reviewed literature relevant to the theoretical foundation of this thesis and its investigation into the engagement of women and technology in agriculture. Specifically, this chapter discussed women's role in agriculture. It defined rural women's work, discussed the gender divide and it acknowledged the paucity of literature that focuses on women who work in the cattle production industry. Next, it outlined the research gaps and research design followed by the chapter summary. *Chapter 2* now presents an overview of the research methods and survey design used to investigate the three key research gaps. *Chapter 2* also gives an insight into the philosophical perspective and it justifies the methodological and analytical approaches.

Chapter 2 Research Methods

Thesis Structure Overview: Chapter 2 – Research Methods Introduction



Chapter 2 outlines the methodology of the thesis. It offers a philosophical perspective (Section 2.2), Section 2.3 introduces the participants of the study, and the instruments used to collect the data are in Section 2.4. Section 2.5 then gives an overview of the data analysis techniques and Section 2.6 provides the sampling strategy. Section 2.7 provides a chapter summary.

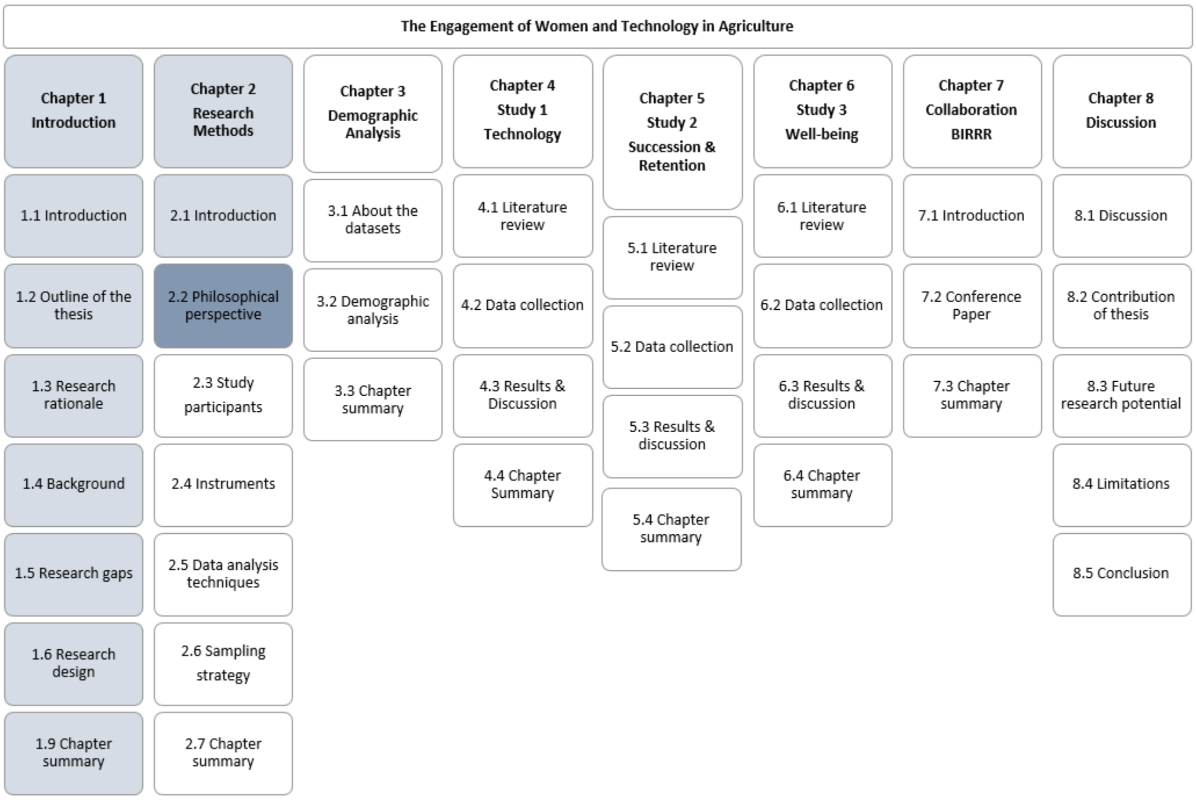
2.1 Introduction

Chapter 2 presents the research methodology. Qualitative and quantitative research designs are discussed in detail. Ethics approval H6091 was received for this project. The research was conducted under the guidance of the Australian Code for the Responsible Conduct of Research and adheres to the supporting Universities Ethical Guidelines. The guidelines are located at https://www.jcu.edu.au/research-services/ethics-and-integrity/research-code-of-conduct

The thesis uses a mixed methods approach to the research where methods are used sequentially starting with conversational interviews, which helped to develop the online survey. The online survey was then distributed to the participant groups as discussed in Section 2.3. The final method, focus groups, was used to fill in any gaps identified in the previously collected data and “to provide a better opportunity to answer the research question” (Saunders et al., 2009, p. 153). Using mixed methods allowed the researcher to triangulate the data to ensure that the data is reporting on what the researcher thinks it is reporting on (Saunders et al., 2009, p. 146).

2.2 Philosophical perspective

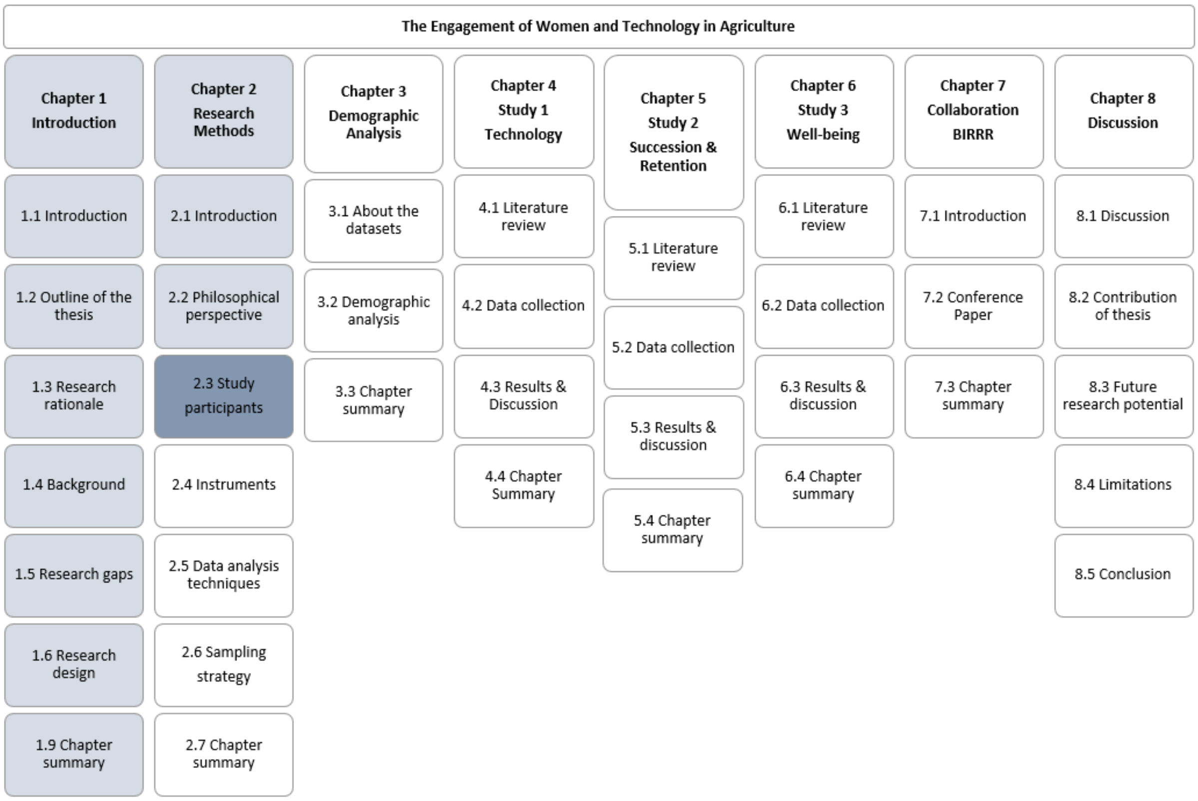
Thesis Structure Overview: Chapter 2 – Philosophical perspective



The thesis uses the valued approach of mixed methods, calling on the strength of grounded theory to engage those living the phenomenon under study (Glaser & Strauss, 1967). The relativist study allows the researcher to develop a reality among rural people through meaning and understandings gained via the researcher's conversational experience with participants (Kerlinger & Lee, 1992; Saunders et al., 2009). The research endeavours to provide a basis for understanding the subjective reality of the participants in order to view women's motives, actions, and intentions in terms of technology use and management. It also attempts to understand through subjective reality how having technology on cattle producing properties can contribute to positive well-being, staff retention and succession. An inductive approach in grounded theory is used as it seeks to "*engage a phenomenon from the perspective of those living it" (Kevin, 2015, p. 600)* with the view of *"seeking out the complexities of modern life" (Kevin, 2015, p. 601)* . As a descriptive naturalistic study, the research draws on a mixed method approach of qualitative and quantitative methodologies.

2.3 Participants of the Study

Thesis Structure Overview: Chapter 2 – Participants of the study



Firstly, participants were selected from Queensland to meet the criteria of the 2013 study to ensure that the comparison of the 2013 data with the data from Study 1 Producer adoption of rural digital technology could be achieved. Two field days were selected (see details in Section 2.3.2). The Ag-grow Field Day because it was known to highlight new technology and because it held the annual cattle sales and therefore would attract the target market of the study i.e., owners and managers of properties that produce cattle. The second field day was the Bi-Annual Beef Week field day, which attracts approximately 60,000 people over 7 days (see Section 2.3.3 for a broader overview). Three groups were chosen to distribute the online survey. One group advocates for rural, regional and remote schooling (Section 2.3.3), another advocates for "better internet for the bush" (Section 2.3.4) and the third advocates for "rural, regional and remote women" (Section 2.3.5), for an overview of each group see Section 2.3.

2.3.1 Queensland as the population

Queensland is the highest cattle-producing state in Australia managing 12.6 million head of cattle in 2011 (Meat and Livestock Australia, 2014). Figure 2.1, from the Department of Agriculture, Forestry, and Fisheries displays cattle density in Queensland (DAFF, 2013). Essentially a scattergram, the map visually displays the states cattle production, the first step in exploring data (Everitt, 1993, p. 11). The map shows the relationship between cattle production and land space in Queensland and clearly displays clustering within cattle density data. The clusters indicate the per head number of cattle per property, identifiable by red, orange, blue, and green dots. DAFF's Cattle Density in Queensland Map (2013), coupled with Queensland being the largest cattle producing state in Australia advocates Queensland as a good population source from which to recruit participants for the study. Note: Due to the researchers' expanded network, the online survey was distributed outside of Queensland to South Australia, Western Australia, and the Northern Territory to include the Northern Beef Industry.

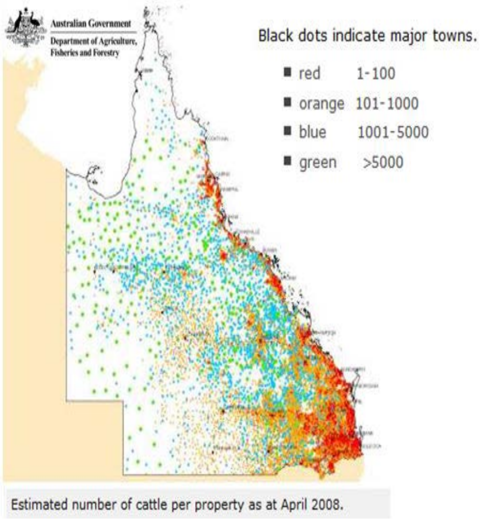


Figure 2.1: Cattle Density in Queensland, 2008 (DAFF, 2013)

The red and orange markers represent areas with less than 1000 head of cattle per property; the blue markers represent where there are 1000 – 5000 head of cattle per property; and the green markers depict where there are more than 5000 head of cattle per property.

2.3.2 Attendees of Field Days as participants

Emerald Ag-Grow QMIX Field Day

A small amount of face-to-face interview data was collected at the Emerald Ag-Grow QMIX Field Day in 2015. The Field Day, is a sponsored annual event held over three days (See Figure 2.2), which incorporates activities such as the Queensland Working Cattle Dog Championships, Queensland Superior Beef Bull Sale, Ag-Grow Invitation Horse Sale, Open and Ringer's Horsemanship Challenge and Open Cutting (Ag-Grow, 2015). The event attracts around 6000 attendees and highlights new technology and equipment to the agricultural and mining industries in Central Western Queensland, in Australia (Ag-Grow, 2015). The Ag-Grow QMIX Field day is a good fit for the 'technology adoption by rural women' project because it is "recognised as one of the largest field days on the national circuit, and as a social event for the surrounding regions", which is highly attended by rural women (Ag-Grow, 2015), additionally it is held in Queensland.

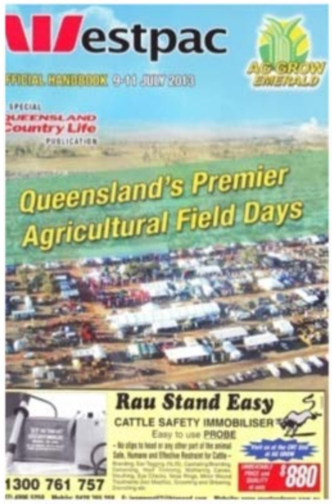


Figure 2.2: Ag-Grow Emerald Official Handbook Cover Page

Beef Australia 2015

Beef Australia is a tri-annual beef exposition. It is one of the world's great beef events held in Rockhampton, the beef capital of Australia. The event attracts people from all over the world and runs for seven days facilitating new trade and export opportunities by exposing the local supply chain to international industry leaders. Beef producers attend from all over Queensland and Australia. The event offers symposiums, seminars, property tours, and the results of new research. Approximately 60,000 people attend Beef Australia. Data from these events fed into the development of a questionnaire for each of the three studies.

Figure 2.3: Beef Australia 2015

2.3.3 Queensland Isolated Children's and Parents' Association Members as participants

The Isolated Children's and Parents' Association (ICPA) of Australia is a voluntary, not for profit, apolitical organisation of parents and individuals working together for access to quality education services for students from less populated regions (ICPA, 2017). The ICPA has 47 branches spread across Queensland (see Figure 2.4), with the distribution of branches closely matching that of Figure 2.1: Cattle Density in Queensland Map (DAFF, 2013) making the selection more representative of the intended population (Saunders et al., 2009).

Figure 2.4: The Isolated Children's and Parents Association Queensland Branches.

Each marker represents a membership branch of Queensland's ICPA

The value of using the Queensland ICPA members as participants is that they are remote technology users, and they are primarily owners and staff of isolated cattle producing properties (Personal communication with Mr A. Pegler, QLD ICPA President, 3 July 2013). The close relationship between Queensland's cattle density clusters (as shown in Figure 2.1) and the ICPA membership branches (as shown in Figure 2.4) supports Queensland ICPA members as a good sample source for this study (Saunders et al., 2009).

2.3.4 Better Internet for Rural Regional and Remote Australia (BIRRR) Members as participants

BIRRR aims to provide information and support on telecommunications services to those living in rural, remote, and regional areas. The BIRRR Facebook group was established in 2014 by Kylie Stretton (Charters Towers) and Kristy Sparrow (Alpha) who were struggling with very limited internet that they used to educate their children and run their bush businesses. Both Kylie and Kristy were experiencing unexplained excessive usage on their mobile broadband data and wanted to know how the rest of rural, regional, and remote Australia was fairing.

As others throughout rural Australia heard about their plight, many joined the Facebook group and it quickly began to grow. With support and online action gathering momentum, administrators Kristen Stahlhut-Coggan (Condamine) & Amanda Salisbury (Monto) joined Kylie and Kristy to help with demand and soon the BIRRR website (https://birrraus.com/) was formed to help answer ever-increasing range of issues and questions.

The BIRRR team gathers information across the often-confusing landscape of bush broadband and delivers it via their website and Facebook group to people in regional and remote areas of Australia. The BIRRR team uses data collected from their Facebook group, their website and from other activities such as surveys and media coverage, to lobby for better internet for rural, regional, and remote Australia.

This study uses the BIRRR membership database to distribute the online survey to approximately 6,000 members of the rural, regional, and remote areas of Australia.

2.3.5 Queensland Rural, Regional and Remote Women's Network Members as participants

The Queensland Rural, Regional, and Remote Women's Network (QRRRWN) aims to connect, develop and inspire women in rural, regional and remote (RRR) areas of Queensland. The networks goal is to legitimise the myriad of roles of RRR for which women are responsible (Queensland Rural Regional and Remote Womens Network, 2017). The focus groups were held in Emerald, QLD at the QRRRWN Annual Conference, which attracted approximately 200 participants. The value of using the QRRRWN members as participants is that they are remote technology users and they live and work in Queensland, making QRRRWN members as a good sample source for this study (Saunders et al., 2009). Participants were invited to nominate for the focus groups as part of the conference workshops. Nineteen women registered for the first focus group and nine attended. Thirteen women registered for the second focus group and ten attended. The focus groups were promoted in the QRRRWN Network Newsletter as well as directly to the conference attendees.

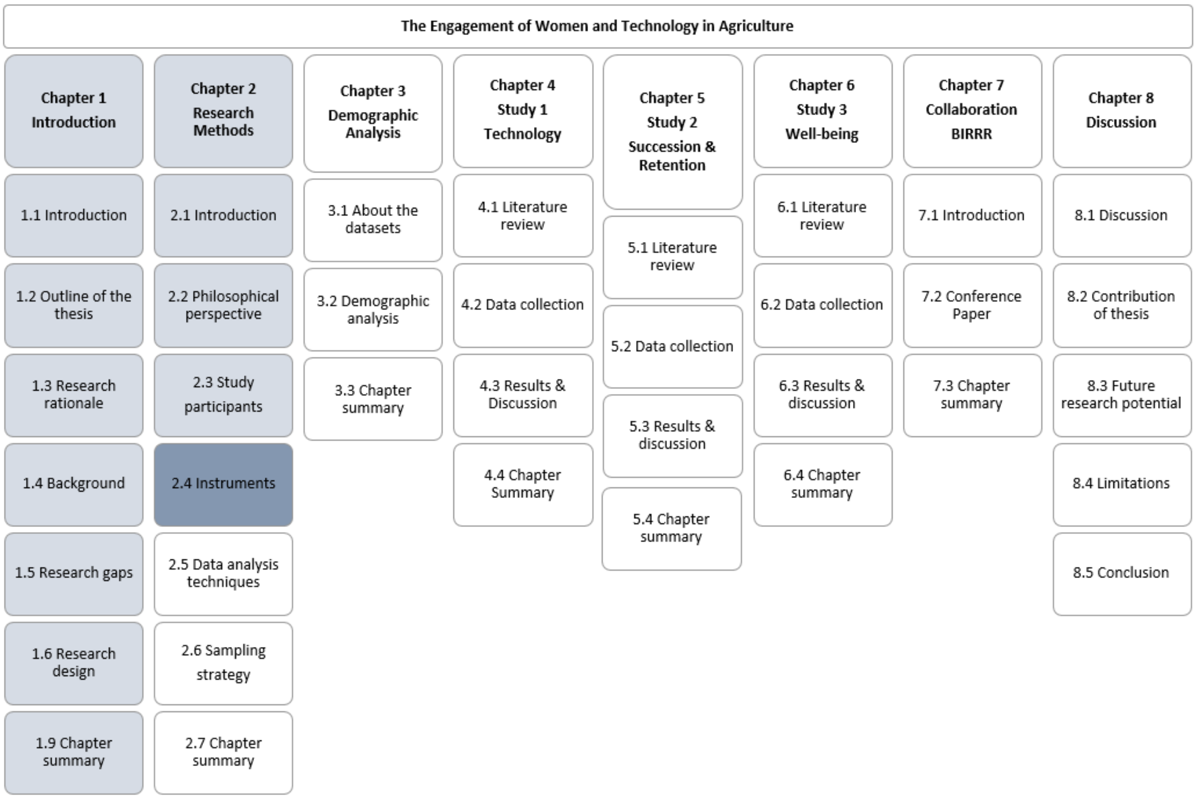
Although Queensland was the primary focus of the all three studies (see Figure 1.1 Outline of the Thesis, pg. 24), the online survey was distributed in Queensland, South Australia, Western Australia, and the Northern Territory of Australia. Data from the field day events and from the online survey feeds into reports as part of Study 1, *Chapter 4*, Study 2, *Chapter 5* and Study 3, *Chapter 6* (see Figure 1.1: Outline of the Thesis, pg. 24). The data from the focus groups seeks to fill gaps in information reported from data analysis of the online survey.

2.3.6 Australian Women in Agriculture

Australian Women in Agriculture (AWiA) is a non-profit incorporated organisation established in 1994. It is Australia's peak organisation for women across all areas of agriculture. Australian Women in Agriculture exists to ensure that agricultural women have the capacity, confidence and channel to be able to have their voice heard, from the dining table to the boardroom table to the political table (AWiA, 2018).

2.4 Instruments

Thesis Structure Overview: Chapter 2 – Instruments



2.4.1 Conversational Interviews

Conversational interviews were used to gain deeper and more meaningful information from participants (Lavrakas, n.d.). Conversational interviews allowed deviations from standard interviewing techniques and asked respondents to answer a predetermined list of questions (Roulston, 2008). In this model, the agenda for the interview was established interactively through conversation. A recursive process was used in which the interviewer's questions built on responses to previous questions and on responses from other participants (Burgess-Limerick & Burgess-Limerick, 1998). An online survey and focus groups was also used and will be discussed in the next section.

An emic (insider) approach was adopted to capture rich and descriptive data from respondents and to seek meaningful patterns from key participants (Gubrium & Holstein, 2001). The insider approach asked the researcher to wear similar clothing to the event as attendees and to maintain a natural conversational tone, allowing the researcher to blend into the environment. Interviewers were able to ask if respondents did not understand a question. They provided unscripted feedback to clarify meaning or to glean deeper and more meaningful responses from participants (Gray, 2004; Gubrium & Holstein, 2001; Lavrakas, n.d.; Roulston, 2008; Sage Publications). Conversational interviews did not require the participant to interpret the question exclusively, the researcher was able to provide any additional information needed to help the respondent map the specific terms in a question, or whenever they perceive the respondent required assistance (Lavrakas, n.d.). The aim was to learn the respondents' reasons for doing or believing in something, clarifying meaning made the technique more flexible and improved response accuracy (Kerlinger & Lee, 1992, p. 602).

Traditionally interviews are recorded using tape or video recorders to ensure that each individual's comments have been clearly captured (Krueger & Casey, 2015). In addition, the recording becomes a tool to detect problems, review progress and for evaluation. However, in this study conversational interviews were not recorded as the study considered the personality trait of the producer (Shrapnel & Davie, 2001). As cited in Shrapnel and Davie (2001) producers are very private and reserved, they dislike pretensions, and are cautious and alert to criticism. Therefore, they are unlikely to be open and honest within the context of a recorded interview. This theory was tested at one agricultural field day by recording a respondent to confirm the findings in the literature. An example recording is below. The recording device altered the ensuing conversation and created a different context in which the respondent may have answered if the interview was not recorded (Gubrium & Holstein, 2001). Recording allowed the respondent to offer 'on the record' and 'off the record' response. Typically this occurs for two reasons, "*(1) the respondent wants to talk about their own experiences or (2) the respondent does not want to talk about issues on the record for fear of retribution*" (Gubrium & Holstein, 2001, p. 92). It was clear from the following transcript that 'fear of retribution' was top of mind for this participant.

> *"I can answer this question but I will just have to check with John, can you turn the recorder off for a minute"* (Interview No. 10).

The researcher was confident in choosing not to record the interviews as supported by Gubrium and Holstien (2001) who state *"it is a hallmark of quantitative interviewing that 'unrecorded' data are as important as those derived from tape recordings"* (p. 92) as it was far more important to gain the trust of the interviewee than record the interview.

Validity and reliability are important considerations of conversational interviews. Validity in qualitative research is challenging because of the necessity to incorporate rigor and subjectivity into the scientific process. Using mixed methods systematically aims to improve the credence and legitimacy to the validity of the research (Robin, Susan, & Carol Lynn, 2001). "Validity is not an inherent property of a particular method, but pertains to the data, accounts, or conclusions reached by using that method in a particular context for a particular purpose" (Maxwell, 1996). In addition, method alone is not an assurance to validity (Robin et al., 2001). While grounded theory typically follows a sequential set of steps, the nature of this thesis i.e. relying on informants to guide the research through conversational interviews, an online survey and then focus groups, cannot rely on a rigid sequence or else it may miss out on the rich and meaningful data… the important stuff… as contributed by the participants of the study (Kevin, 2015). Reliability is concerned with whether more than one researcher would reveal similar information. One researcher completed the interviews in this study. Reliability occurred because the researchers' standard of technique remains isolated to one, therefore there is no discrepancy between interviewers. On the other hand, the researcher recognises that having only one researcher conduct conversational interviews may lead to limited validity.

Validity is concerned with the survey instrument measuring what it is supposed to measure (Gray, 2004). Internal validity is achieved through using interviewing techniques that build rapport and trust with the respondent, giving them scope to express themselves. Conversational interviews address concerns of internal validity by prompting the participants to expand on initial responses. A ten-minute conversation was deemed long enough to encourage insightful answers to eight pre-determined questions (see Appendix 4: Field Day Research Questions), which guided the broad focus of the themes the researcher wished to explore. External validity, which allows findings to be generalised to other situations and other people was strengthened through the use of a selective group of participants who met the criteria for the scope of the study, i.e.: that they lived and / or worked on a cattle producing property. In addition, a large sample size enables different perspectives to be represented establishing generalisability (Gray, 2004).

Other limitations also exist. In particular, interviewer bias, where comments, tone or non-verbal behaviour of the interviewer creates bias in the way the participant is responding to the question (Saunders et al., 2009). Interviewer bias can be avoided by being careful in interviewer responses, asking probing question to gain rich and meaningful data, without leading the participant to take a particular view. Likewise, response bias might see the participant answering in a way that portrays them in a socially desirable role, or in a way, that they think the researcher wants them to respond (Saunders et al., 2009). In an effort to avoid response bias, the researcher should "enter the conversational interview with an open mind and kept it that way" (Gray, 2004). If a socially desirable response is given, the researcher should re-frame the question to dig deeper for the participant's personal response.

Conversational interviews are typically criticised because they are viewed as a non-standardised interview technique, which is used to undermine reliability. To overcome these criticisms, the researcher completed an exhaustive search of literature on topics such technology adoption and barriers to adoption, and the women's role in agriculture and technology, which extended to include social capital, empowerment, leadership, and social exclusion. Research included adaptive capacity and the psychology of change in both female and male producers, and research methods and analysis, to ensure a high knowledge level of the topic. Knowing the topic helped the researcher to portray confidence and purpose whilst conducting interviews. A 'tick and flick' sheet of standard answers and a set of eight questions guided the broad focus of the themes the researcher wished to explore (See Appendix 5: Tick and Flick Sheet from Conversational interviews).

Conversational interviews were intended to take place in 2015/16 during agricultural field days. Pre-determined field days include Ag-Grow Emerald [a three-day agricultural event held in Emerald in the Central Highlands of Queensland (Ag-Grow, 2014)] and Beef Australia [Australia's national beef exposition celebrating all aspects of the Australian beef industry, held tri-annually (Beef Australia, 2015)]. While the researcher attended each of the field days, there were some barriers to attending both events, as discussed in the following section.

Beef Week, 2015

Barriers to Beef Week, 2015: Field Trip Data Collection Report

The aim of attending beef week was to collect 60-80 face-to-face conversational interviews over 7 days at the annual field day. The data collected was to feed into the development of the survey that was used in all three studies.

Beef Australia "Australia's national beef exposition, is one of the world's great beef cattle events and is held just once every three years in Rockhampton, Queensland, Australia" (Beef Australia, 2015). Beef Australia 2015 was held from May 4th to 9th. It celebrates of all facets of the Australian beef industry. It facilitated new trade and export opportunities, by exposing the local supply chain to the international industry leaders. Beef Australia 2015 featured more than 4500 cattle from over 30 breeds; a trade fair promoting more than 500 businesses; a conference, seminars and property tours to deliver new research information to producers; and restaurants and cooking demonstrations for visitors to appreciate the quality and flavour of Australian beef"(Beef Australia, 2015).

The researcher was invited to collect data from attendees at Beef Australia by representatives of the Department of Agriculture and Forestry, and CSIRO, who were both participants in the event. However, the researcher was subsequently refused permission to collect data by the event organisers. The reason given was that State Development was to be the singular data collection agent and that the organisers did not want to saturate the attendees with data collectors. According to the CEO of Beef Australia, Dennis Cox, the event had fallen short of its research goals over the past 3 years. Despite multiple efforts by representatives of DAF, CSIRO and State Development to reverse the decision, the researcher was declined formal access to participants of Beef Australia. This was a real set back as Beef Australia is a tri-annual event, which will not be held again until 2018, after the completion of this thesis.

The researcher was encouraged by representatives of DAF, CSIRO, James Cook University and State Development to attend the event and informally chat with attendees to gain valuable information about the current situation within the cattle industry and the use of technology. The opportunity was accepted and used to meet and talk informally to producers about their perceptions of technology and its adoption. Knowledge and information gained was fed into surveys and focus groups. The field trip was fully funded by “the Digital Homestead Project” (eResearch, JCU).

Although the researcher did not get the chance to interview many women who were cattle producers, approximately 150 people were talked to during the event, enabling an understanding of what is happening with regard to technology use in the cattle industry. Similar to the Ag-Grow Field Day, a shift towards using hand held computers in the form of smart phones was again observed. More men seemed to be open to using technology than in 2013. The small amount of women interviewed responded in the same way as at Ag-Grow, that is that although their ‘man’ was using his smart phone, it was still the woman’s responsibility to install apps, complete maintenance and to provide training to the men. During the weeklong event, the researcher was able to speak to many of the technology providers and build strong relationships with industry leaders. These relationships were used to gain access to participants for survey and focus group data and also to present and distribute research findings to producers.

Ag-Grow Field Day

The researcher was supported by the Ag-Grow Emerald field day and was directed by the convenor who introduced her to potential participants via the field day program, media releases and via live introduction to the field day participants. The interviews took approximately 5-10 minutes to complete. The researcher approached women and men and used open questions to establish how they use technology on their farm and how it affects their lives/family/skills.

Participants were alerted to the study being completed at the Field Days through an extended media campaign prior to the event. Hearing about the survey prior to the event helps to establish trust before the interviews commence, enabling the researcher to recruit participants more readily

(Saunders et al., 2009). Each participant was given a gift bag containing promotional material from the participating university (including a pen, notebook, research literature, information sheet, and a lip balm) on completion of the interview. In addition, to limit the interviewer effect, where the interviewer may be observed as an imposter through verbal and non-verbal communication and where the respondent may engage social norms (e.g., politeness, not wanting to offend) during the interview (Kreuter, 2008) the researcher dressed according to the event (as the event was an agricultural field day, jeans and a t-shirt with boots was appropriate). A conversational tone was kept during the interviews, and tactics such as not showing emotion or changing facial expression during the interview were employed (Gray, 2004; Gubrium & Holstein, 2001). Clarification of concerns from respondents was addressed through receipt of an information sheet prior to the interview. The information sheet, included in Appendix 2, contains the contact numbers for the researcher, the supervisors, and the University Ethics Committee. In addition, participants were required to sign consent form (see Appendix 3: Informed Consent) prior to the interview, which clearly stated that their responses would remain confidential.

Handwritten notes were immediately recorded and stored safely post interview, to ensure the accuracy of answers. Analysis of the dialogues proceeds by reading and re-reading the field notes and recalling rich and meaningful elements of each conversation. The notes were transcribed in three phases: initially, directly after the conversation, later that evening, and again repeatedly during the first week after the field days until the researcher's recall was exhausted (Roulston, 2008). Reading and then re-reading the transcribed notes identified and then developed the themes from the conversations. Manual content analysis was used to gain insights from the interviews, which were later used to develop the questionnaire.

In 2015, in the preliminary research phase of the current study, during the face-to-face interviews, some of the men approached were mildly hostile because they had previously heard of the study and did not agree with the findings that men were not using technology (Hay & Pearce, 2014). In such circumstances, rather than perform an interview the researcher participated in a casual conversation about how they used technology and who in their reference group (Quester, Pettigrew, & Hawkins, 2011, p. 22) were doing the same. By removing the formality of the interview the researcher was able to relate better to the interviewee and to build trust (Gubrium & Holstein, 2001, pp. 74-76) to gain valuable information. The information was later written as a reflection and the data collected was used to develop the survey questions.

Barriers to Ag-Grow Field Day, 2015: Field Trip Data Collection Report

The aim was to collect 60-80 face-to-face conversational interviews over 3 days at the annual field day.

The Ag-Grow Field day is described on their website as follows. However, in 2015 the dates of the show were changed, which had a roll on effect for the suppliers and the participants of the field day, (see discussion below):

> "*Ag-Grow in Emerald, Central Queensland, is one of the largest and most successful marketing events available to businesses wishing to access the agricultural, mining and associated demographic of Central Western Queensland and beyond. The area is home to a diverse range of industry from broad acre to horticulture entwined within the dominant mining and cattle industries. As these industries forge ahead Ag-Grow provides the new technology and equipment to service the growth attracts over 1500 companies and crowds in excess of 28,000 visitors Ag-Grow (Ag-Grow, 2013)*".

The data collection at the Ag-Grow Field day did not go entirely as planned. At some point after confirmation of the researcher attending the field day, the event date was changed by the manager of the field day causing many of the exhibitors to cancel booking. Shortly after, the dates were changed back to the original dates. However, by this stage many of the exhibitors had booked sites at alternative field days and did not attend. As a result, 150 exhibitors were not in attendance at the field day, which lead to less attendees. The researcher was made aware of the date change, but not of the reduction of exhibitors numbers.

One of the most prominent cancellations was the annual cattle sales, which were moved away from the venue due to political infighting between the Ag-Grow Field Day Manager and the Cattle Sale organisers. The sale attracts 3000 head of cattle and is usually a highlight of the Ag-Grow Emerald Field day. This information was also concealed from the researcher and had a direct effect on the interview targets. For example on the first day of data collection (the day of the cattle sales), only 876 people passed through the gates compared to 4363 in 2013. Between 10am and 2pm, the researcher approached 25 potential interviewees, of which four were cattle producers. The second day was a little better. However, due to the bull sales attracting mostly male producers, accessibility to women producers was limited. In total, the field day attracted less than 10,000 attendees over 3 days, when typically 28,000 people pass through the gates.

A further barrier to data collection was the use of a recording device. Although the researcher purposefully kept the recording device in a non-threatening space i.e. in the pocket of the clipboard folder, nearly all of the participants objected to being recorded and refused to sign the consent form. As discussed above, cattle producer’s personality traits are not conducive to being openly recorded whilst being interviewed. While a only a small amount of data was collected eleven interviews. The information collected will feed into the development of the online survey questions, as well as to support choices in methodology.

However, there was an observed change in men using technology in 2015 compared to 2013. A large contrast was noted at the 2013 field day where only around five men were observed using a smart phone. By contrast, in 2015, nearly all men at the field day were observed using a smart phone. When the researcher was unable to obtain conversational interviews, she spent time talking with the producers to gain a clear picture of their technology use. The researcher was able to gain information about smart phone use from both men and women. This information will lead questions included in the online survey for example, about smart phone use i.e. what they use it for. Why they use the smart phone but not a computer, what access they have at their farm, what apps they are using and how helpful it is having this type of technology/access.

Although the interviewer did not get the chance to interview many women who were cattle producers, she was able to talk to approximately 50 people and glean an idea of what is happening with regard to technology use in the cattle industry. A shift towards using hand held computers in the form of smart phones was observed. Approximately 10 producers said that they would be ordering some form of digital rural technology whilst at the field day (e.g. walk over weighing systems). More men than observed in 2013 seemed to be open to using technology in the form of a smart phone. The small amount of women interviewed responded that although their 'man' was using his smart phone, they were still called upon to install apps, complete maintenance and to provide training to the men.

2.4.2 Online survey

The second method of data collection used online surveys with a mix of open, intuitive, and semi-structured questions. The online survey method was chosen because the producer's geographical location is widely spread. In addition, online surveys are less expensive than face –to- face methods (Cantrell & Lupinacci; Dillman et al., 2009). Furthermore, the ICPA members belong to an online membership group where technology-using producers are already receiving data from their products, so it is assumed that they have access to the internet. In addition, online surveys reduce the opportunity for distortion of the respondent's answers and sample sizes can be quite large. Finally, there is increased accuracy and efficiency of data entry analysis when using online surveys (Saunders et al., 2009).

The online survey was emailed to the Isolated Children and Parents Association database (ICPA, 2015) via the association's secretary and to the members of the Better Internet for Rural Regional and Remote Australia (BIRRR) group and the Australian Women in Agriculture (AWiA) group via each group's membership secretary. The online survey aimed to repeat the Hay and Pearce's (2014) questionnaire collected in 2013, with the addition of questions relating to well-being and technology use in the family. Members of the ICPA, BIRRR, AWiA promoted survey distribution and producers were invited to participate through extensive media coverage.

A limitation of online survey use in this study may be reduced access to the internet due to data shaping. As the demand for internet access in rural areas increases, accessibility and speeds are affected and data shaping is being used to manage the distribution of internet access. Many of the members from the Isolated Children and Parents Association (ICPA), whose database was used for the online component of the study, have had their internet data allowances shaped (refer to Section 2.3.3 for a discussion of the role of the ICPA).

Data shaping occurs when a user exceeds their allowance of their contracted data. The service provider lowers the connectivity speed and the user's access to the internet is restricted (Kidman, 2009). Reduced data allowance was overcome by providing the survey as a fillable PDF form, which could be completed, and returned to the researcher. However, while the dropout rate was approximately 20%, none of the respondents requested a fillable PDF. Rather 36% of respondents persisted with slow connections taking between 30 minutes and 3 hours to complete the survey online.

The initial study by Hay (2013), while aimed at both genders, found that men did not respond to the online survey, rather women responded on their behalf. This is most likely because rural men approached in the study perceived that they were incapable or uninterested in learning and adopting technology (Hay, 2013). The perceptions of rural men surrounding technology were purposely managed in the studies reported in this thesis and as a result, slightly more men responded to the survey. Results are reported in Study 1. However, the response rate from men was still low. Therefore in future studies of men's use of technology, either face-to-face or telephone interviews may be more successful.

2.4.3 Focus groups

The third method, focus groups, used a roving ideas storm, which aimed to capture alternative data to triangulate the findings making them more reliable (see *Chapter 2 Research Methods*). The research sought women's views on technology use, their views on the effect technology has on well-being and their views on the effect technology has on succession and keeping staff on farm, see Section 1.5 for details of the research gaps. Questions were based on concrete insights (Sundet & Ytreberg, 2009) from the literature reviews contained in *Chapter 4*, *Chapter 5* and *Chapter 6*, and from other information contained in this thesis for example Section 1.4, Background to the research. The aim of this exploratory research was to discover concepts about technology use, well-being and succession and workers directly related from the producers of the information, i.e., the participants of the focus group. Multiple strategies of enquiry were used to avoid criticisms of focus groups for example, observation, careful questioning strategies, and management of dominant individuals. To avoid tapping into emotions, the researcher ensured she was comfortable with emotional displays and remained sensitive to the participant's feelings throughout the focus group (Krueger & Casey, 2015).

The roving ideas storm asks respondents to be active participants in the research. The roving ideas storm increases the level of participation by asking respondents to move between idea stations (which contain questions relevant to the idea) and to think about multiple topics at one time (Priestley, 2015). Each group notes their ideas, first silently, then as a group discussion and then sorts the responses into themes. The facilitator's role is to encourage discussion, keep participants on topic without stifling the activity and to manage any 'group effect' so that individual participants do not dominate other participants (Gubrium & Holstein, 2001; Saunders et al., 2009). The final stage is to give a presentation of the findings (Priestley, 2015). A thematic analysis of the responses identified themes related to the relationship between rural women and technology (Braun & Clarke, 2006).

Successful focus groups require a clear purpose and appropriate processes to be successful (Krueger & Casey, 2015). The purpose of the focus groups in this study was to understand how families feel or think about technology and how it affects the farming family. The participants were women who live on, work on, or own a cattle-producing property, which also use technology to produce their cattle. Although men were invited, they did not participate in the focus groups. The aim of the focus group was to establish as internet connectivity increases, what are the key ideas and challenges for increasing technology adoption, well-being and succession and retention of workers. Multiple strategies of enquiry were used to avoid criticisms of focus groups for example, observation, and experiential exercises, careful questioning strategies and management of dominant individuals. To avoid tapping into emotions, the researcher ensured she was comfortable with emotional displays and remained sensitive to the participant's feelings throughout the focus group (Krueger & Casey, 2015).

Participants were recruited from members of the Queensland Rural, Regional, and Remote Women's Network and the focus groups were held at their annual conference. The participants were primarily from Queensland's cattle industry and were widely dispersed throughout Queensland. The focus group was held in air-conditioned non-confronting workspace. One group of nine and one group of 10 participants were seated at large rectangular tables. The discussion began by welcoming participants, giving an overview of the topic, stating the ground rules and then beginning the questions. Each focus group took 1 hour, consistent with best practice guidelines (Stewart, Shamdasani, & Rook, 2007).

The questions were developed using open-ended one-dimensional questions to capture insights into producer behaviour with regard to technology. The researcher acted as the moderator to manage group discussions. The sessions were not recorded (see conversational interviews in Section 2.4.1 on p. 58 for an explanation about why the interviews were not recorded). Similar to conversational interviews, the researcher dressed in the same way to the participants to help establish an informal and comfortable relationship with the group. Taking an insider approach allowed the researcher to capture rich and descriptive data from respondents and to seek meaningful patterns from key participants (Gubrium & Holstein, 2001).

The material from the focus groups was coded, categorised, and re-categorised to identify explanatory concepts. Theoretical sampling (Hammersley, 2006) compared and combined the information with data from conversational interviews and online surveys to evolve the previously identified concepts. These concepts are important to developing the theory surrounding technology adoption by rural women. Figure 2.5 below, shows the relationship between the participants and data collection instruments used in the three studies.

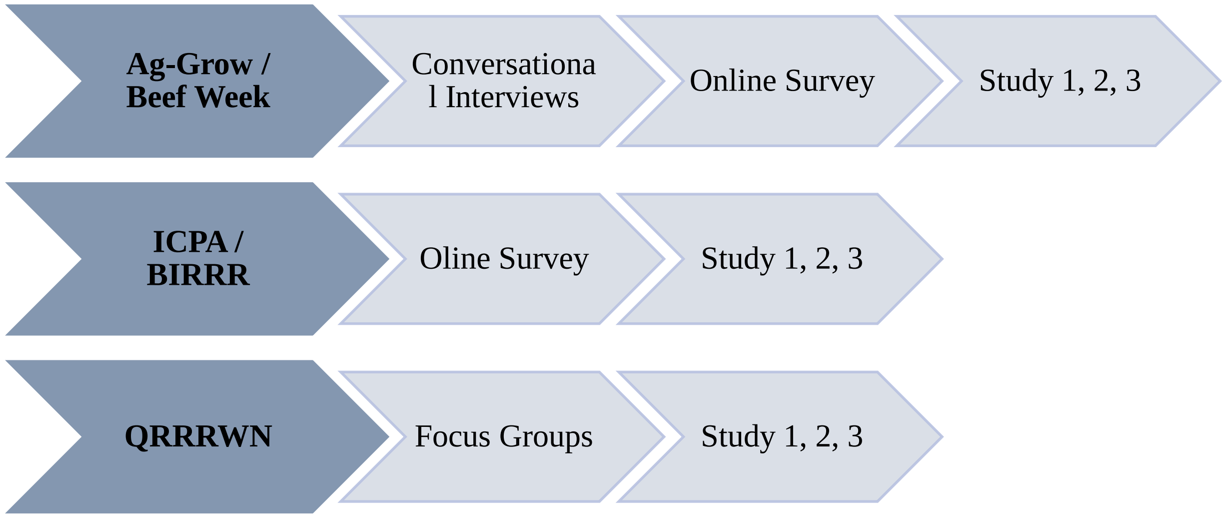
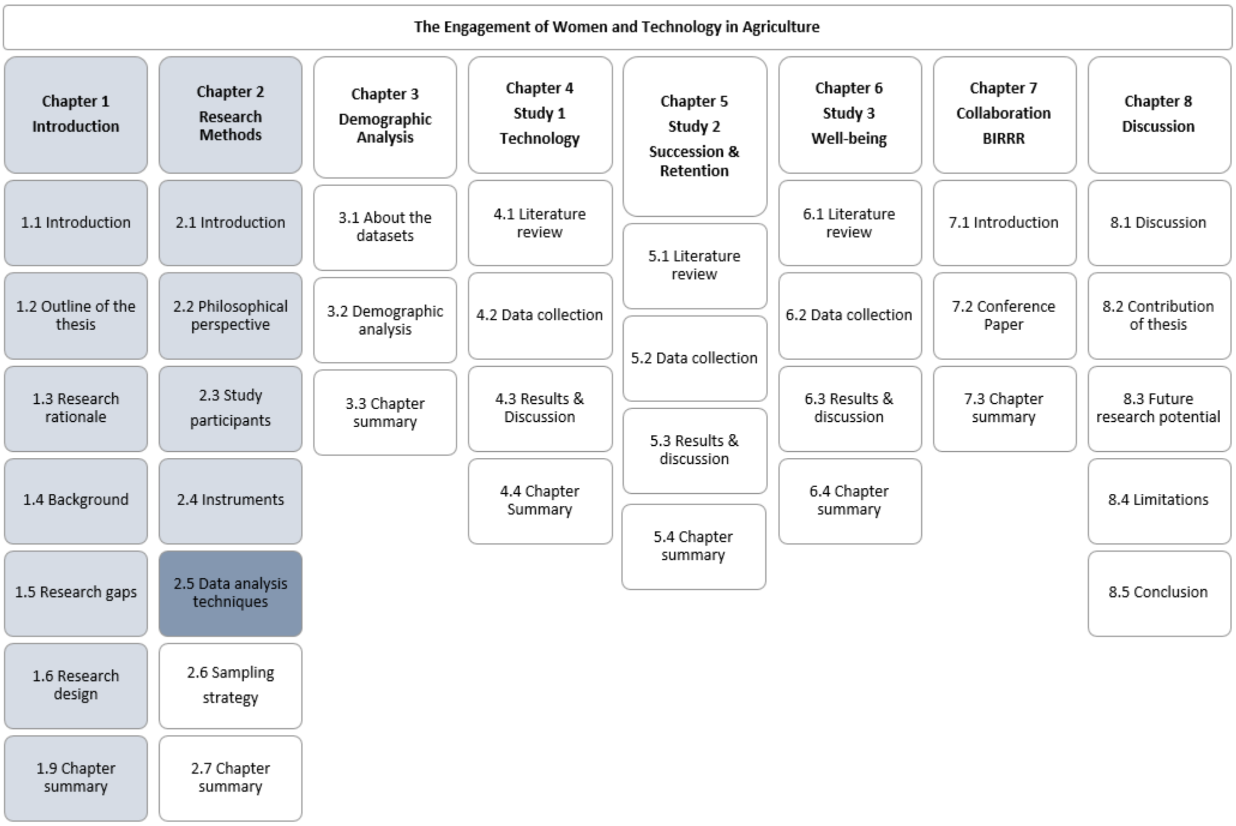


Figure 2.5: Data collection events and the associated study/s

2.5 Data Analysis Techniques

Thesis Structure Overview: Chapter 2 – Data analysis techniques



2.5.1 Analysis of the data

The first and third study, conversational interviews and focus groups, were analysed qualitatively using content analysis tools (Leximancer, see Section 2.5.5) (Smith & Humphreys, 2006) to achieve rich and meaningful technology and management experience data as a narrative. The second study, online surveys, used quantitative data, which was coded numerically and analysed descriptively using frequencies, means analysis and cross-tabulations to achieve an accurate profile of rural women's use and management of emerging livestock management tools (Gray, 2004; Saunders et al., 2009). The conversational interviews were exploratory in nature and provided an insight into key issues to the researcher. Using multiple methods allowed the researcher to answer the research questions with a high level of trust in the data, allowing inferences (conclusions reached on the basis of evidence and reasoning) to be made from the data (Saunders et al., 2009, p. 153).

2.5.2 Quantitative Data

Quantitative data is based on meanings that are derived from data that can be standardised. Analysis is carried out using *"graphs, charts and statistics, which help us to explore, present, describe and examine relationships within our data"* (Saunders et al., 2009, p. 414). Qualitative research on the other hand is more flexible than quantitative research. It recognises that not all data can be quantified into numerical finding; it is naturalistic, participatory, and interpretive allowing the researcher to make adjustments during observations (Kerlinger & Lee, 1992; Saunders et al., 2009).

2.5.3 Qualitative Data

The qualitative methodology is unobtrusive to the point that "the natural blending of the researcher into the environment reduces the amount of disruption in the setting and group under study" (Kerlinger & Lee, 1992, p. 590). Therefore, it is a good match for conversational interviews. Despite its flexibility, criticism has lead researchers to be careful to avoid experimenter bias by taking care not to view the research situation with personal bias (Kerlinger & Lee, 1992, p. 589). Ethical considerations in qualitative work are very important because personal information is recorded, confidentiality of records and information must be kept secure (Gray, 2004; Kerlinger & Lee, 1992; Saunders et al., 2009). Qualitative data was transcribed and associated documentation stored on the university's secure server.

2.5.4 Descriptive Analysis

Descriptive research is designed to *"portray an accurate profile of persons, events or situations"* (Saunders et al., 2009), which makes it suitable for this study. The results of descriptive analysis may derive from either exploratory or explanatory research. However, it is necessary to have a clear picture of what is being researched. The researcher has undertaken extensive research to ensure that all areas of the topic are familiar. The study aims to establish a causal relationship between poor rural digital technology adoption and barriers to adoption that are specific to producers.

Frequency analysis will be used to show the number of occurrences for each response chosen by the respondents. Means analysis will then be used to statistically measure the results, and cross tabulation will allow the researcher to compare one response set to another, to draw conclusions form the data.

2.5.5 Rationale for the selection of Leximancer

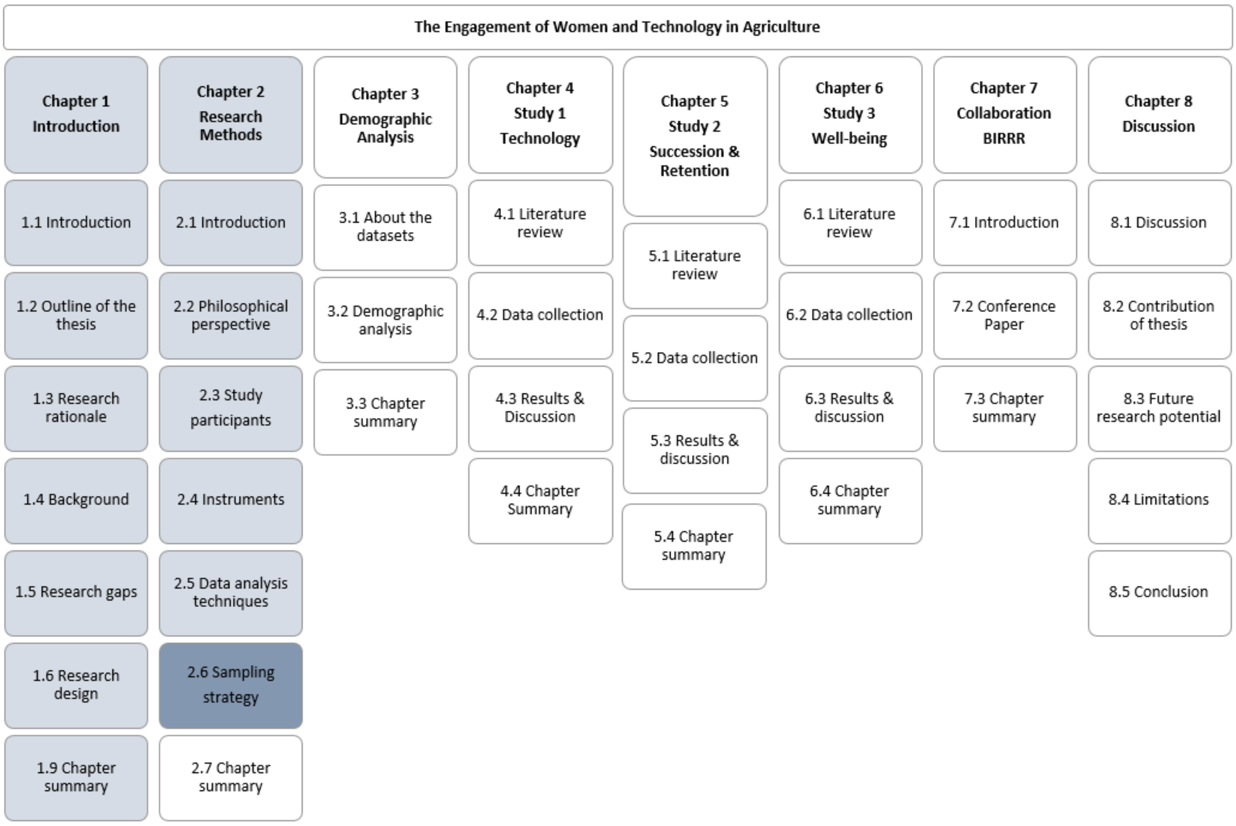
Acknowledging the potential for bias from the researchers own views Leximancer was chosen as a textual analysis tool.

> *'The Leximancer system performs a style of automatic content analysis. The system goes beyond keyword searching by discovering and extracting thesaurus-based concepts from the text data, with no requirement for a prior dictionary, although one can be used if desired. These concepts are then coded into the text, using the thesaurus as a classifier. The resulting asymmetric concept co-occurrence information is then used to generate a concept map'… 'A major goal of the Leximancer system is to make the analyst aware of the global context and significance of concepts and to help avoid fixation on particular anecdotal evidence, which may be atypical or erroneous' (Smith & Humphreys, 2006).*

This system was chosen over the more widely used NVivo software as Leximancer does not require line-by-line hand coding (Low & Eagle, 2013). There is a choice of either seeding the system with concepts or allowing the textual analysis software to calculate the themes and concepts from the text itself without any interference or direction from the researchers; by using the first methodology in this way, we could ensure that our own biases did not enter this process.

2.6 Sampling Strategy

Thesis Structure Overview: Chapter 2 – Sampling Strategy



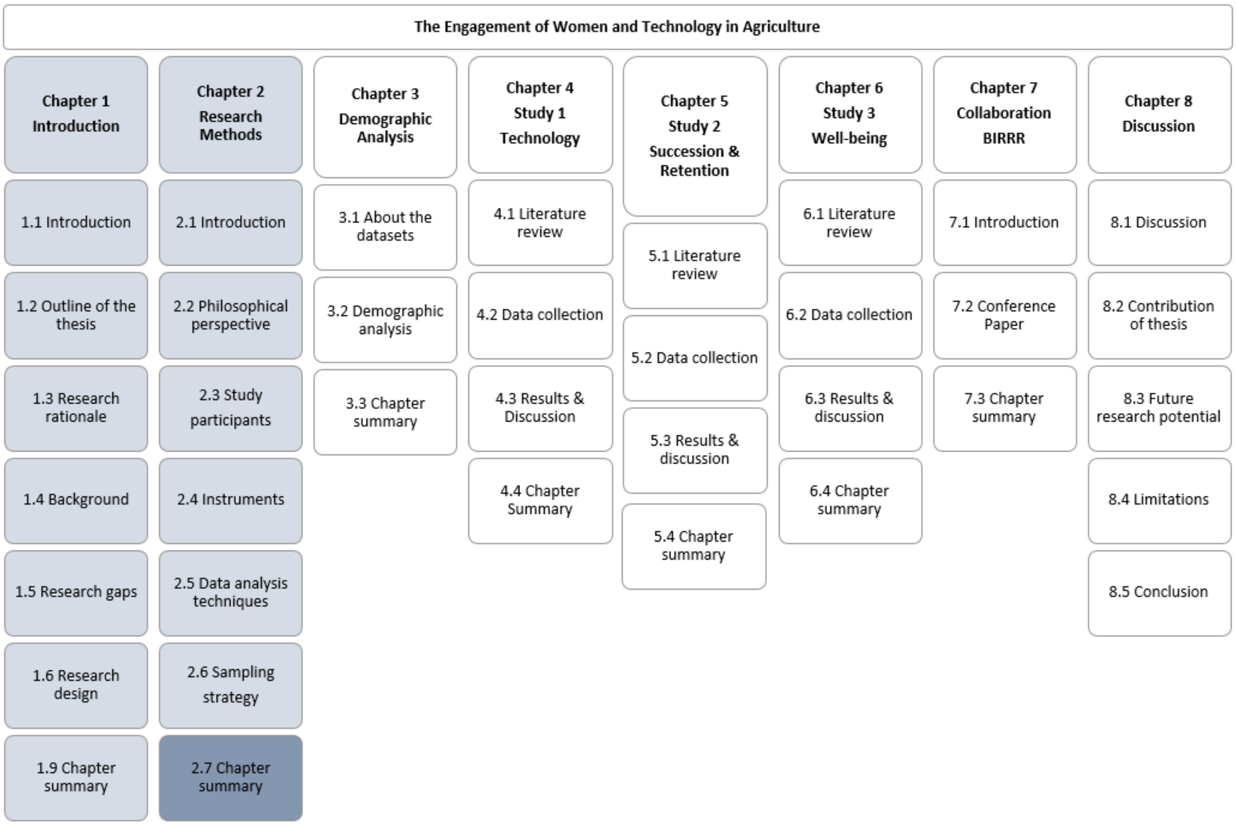
The ICPA sample was initially gathered using non-probability sampling. Cluster sampling, and then snowball sampling (Saunders et al., 2009) occurred when the members of the ICPA forwarded the survey to their other contacts and via social media and then those contacts completed the study and asked others to complete the study. As expected, snowball sampling occurred in the 2016 sample. A respondent's suitability for the survey was confirmed using filter questions. The first question asked what technology the participant had on their property. The participant's response confirmed (if they had technology) or rejected (if they did not have technology) their suitability for the study. A second filter question asked what the respondent produced confirming that the participant was within the scope of the study (that they lived and / or worked on cattle producing properties).

ICPA members rely on technology channels for communication confirming their suitability for the survey, for example private radio, extended WIFI, mobile phone, UHF CB Channels, satellite technology, and packet data (Personal communication with John Little, Queensland ICPA Information

& Communication Technology Advisor, July 3, 2013). The group's members are likely to be both innovators and early adopters of new technology (Elliott, Rundle-Thiele, & Waller, 2010; Reichardt et al., 2009). The first online survey took approximately 5-10 minutes to complete. Participants were asked to respond within 14 days.

2.7 Chapter Summary

Thesis Structure Overview: Chapter 2 – Chapter Summary

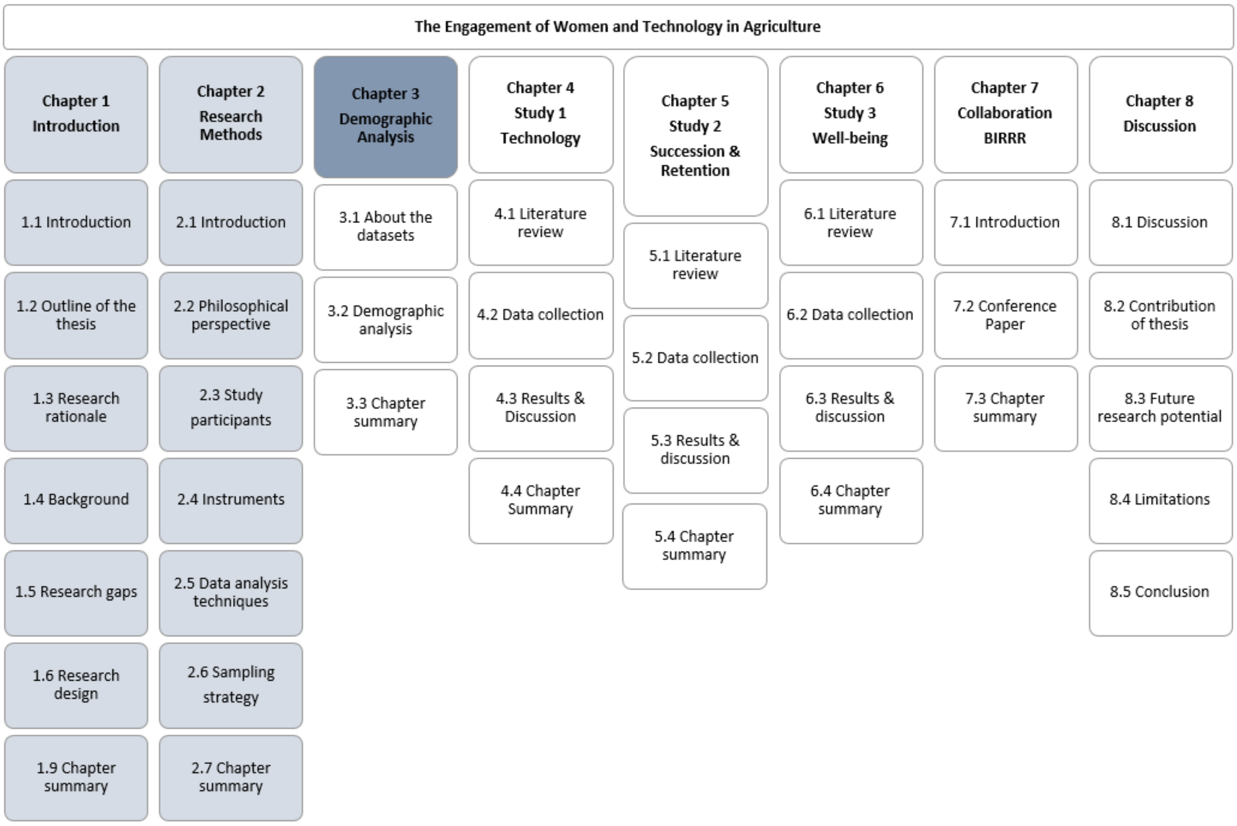


Chapter 2 presented the methodological plan for the thesis that was designed to answer research questions 1, 2, and 3. The philosophical approach used in this thesis argued that the research would be experienced through the sensations and, the images of the things that were seen in the research as opposed to observing the environment directly. The research skirted generalizations to interpret the complexity of the research topic and to make sense of the subject themes. Lived reality among rural people developed meaning and understanding of motives, actions, and intentions of technology use through experience. Analysis of observed relationships between variables and inferences are reported

for each of the three studies. Participants were deemed suitable for the study by responding positively to a two filter questions, firstly that they used technology and secondly that they fitted the designated scope for the studies that they lived and / or worked on a cattle producing property. While the online survey was distributed to Queensland based rural membership groups, due to the nature of the databases, responses were received from each State and Territory of Australia. A filter question was used to enable a comparison of 2013 Queensland data with 2016 Queensland data. Conversational interviews were used to develop the online survey questions and then focus groups investigated gaps found in the analysis of the online survey data. Quantitative and qualitative analysis were used to provide a descriptive portrayal of the research situation. The sample was gathered using cluster and then snowball sampling. *Chapter 3* presents the demographic analysis that will describe the participants in all of the studies.

Chapter 3 Demographic analysis

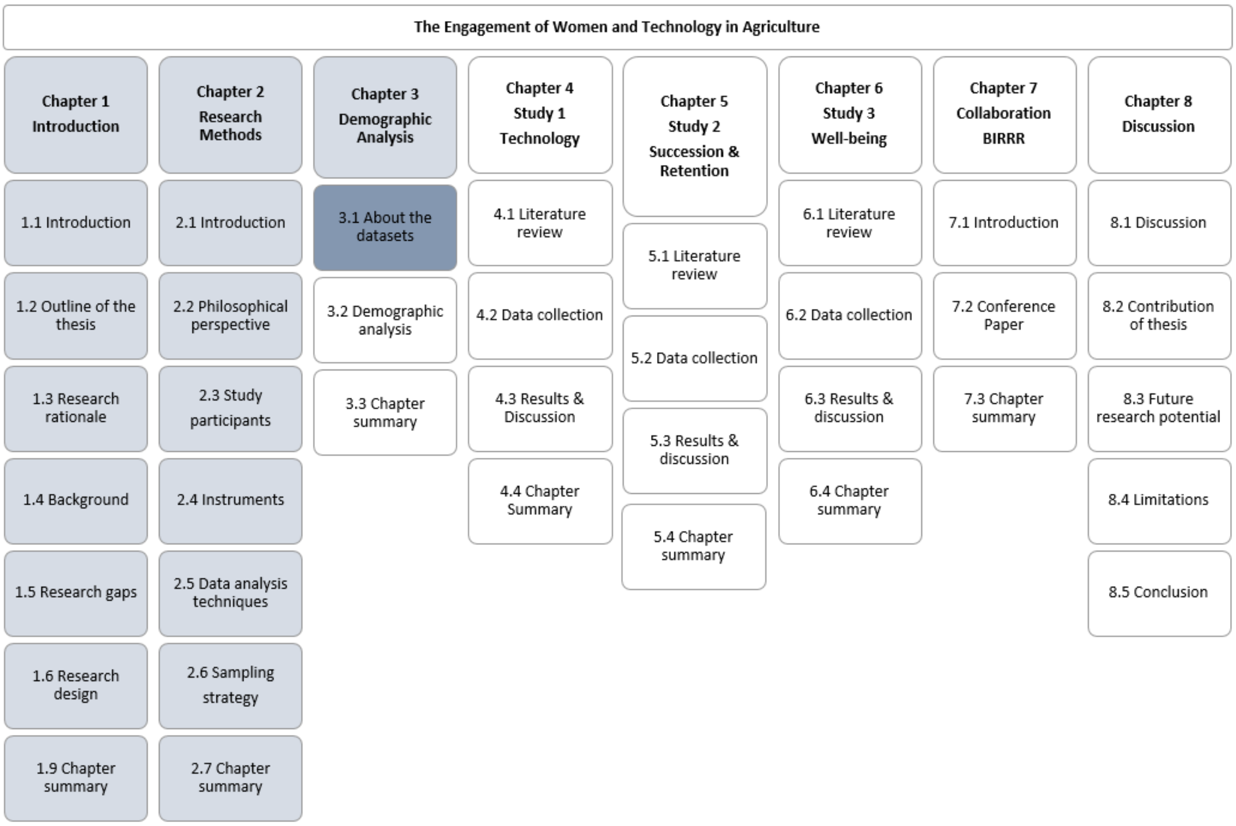
Thesis Structure Overview: Chapter 3 – Demographic Analysis



Chapter 3 presents information about the data sets and the demographic analysis of the online survey data. As noted earlier, the survey instrument was self-administered by cattle producers primarily from Queensland, but also from other States and Territories in Australia. Section 3.1 gives an overview of how the survey was designed and the types of scales used and why. The survey was pilot tested by six producers and changes implemented before final distribution. Surveys were open to people over 18 who lived and / or worked on cattle producing properties and who used technology. Filter questions allow the dataset to be split into categories for analysis i.e., by state so data can be compared between 2013 and 2016. The data was tested using frequency analysis, which showed little differences in the results so the whole database was used in the analysis. Response bias was present as there was an over representation of cattle producers. However, such bias is normatively defensive because the study occurred explicitly in the groups of agricultural participants who have access to technology. Furthermore, the research was conducted without concealment or fabrication (MacCoun,

1998). Quite, to the contrary, the research outputs and media coverage (see Publications, Presentations, and Other Outputs from the Thesis) heavily supported the research. Section 3.2 gives the demographic analysis for the entire study. Each study used selected questions from the demographic analysis, which are repeated where relevant in *Chapter 4*, *Chapter 5*, and *Chapter 6*. Limitations to do with internet connection were present and are discussed in *Chapter 7*.

3.1 About the datasets



The self-administered survey was focussed on cattle producers in Queensland, Australia's highest cattle producing state (Meat and Livestock Australia, 2016a) although, as noted earlier due to the nature of the databases used to distribute the questionnaire, some responses were obtained from outside Queensland (Section 2.3). The questionnaire included four sections. The first two sections collected demographic data and data about technology, with the same questions used in both 2013 and 2016. The third section collected data in 2016 about well-being and the fourth section collected data in 2016 about succession. Participants were asked to answer both open and closed ended questions.

A four point Likert-type scale with anchor points 1=strongly agree and 4=strongly disagree was used to both enable some comparison with the previous survey set (2013, which used a dichotomous agree-disagree scale (Rossiter, 2002)) and also to avoid a response set or halo effect potentially produced by a mid-point neutral option category in a scale (Chang, 1994). Chang (1994) notes that middle category responses are often vague and difficult to interpret. An initial survey was pilot-tested with six producers to ensure that the questions were clear and that the responses demonstrated what the question was asking (Mitchell & Jolley, 2007). A copy of the questionnaire is located in Appendix 6.

The survey was open to women and men over the age of 18. To ensure participants fit the scope of the study, they were asked if they lived and / or worked on cattle producing properties (Saunders et al., 2009) where a positive response progressed them through the survey. Participants were advised that technology should be defined as including personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, National Livestock Identification Systems (NLIS), remote cameras, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology and other livestock management systems.

Survey delivery 2013

One hundred and seventy-five respondents started the survey. Of those who started, 135 completed the survey giving a completion rate of 77%. Of the four partially competed surveys, none was more than 10% complete and therefore they were removed from the dataset. The average dropout rate was 1.63% over 16 items indicating confidence in the survey instrument (Hoerger, 2010). The majority of participants (86%) completed the survey in 5-15 minutes.

Survey delivery 2016

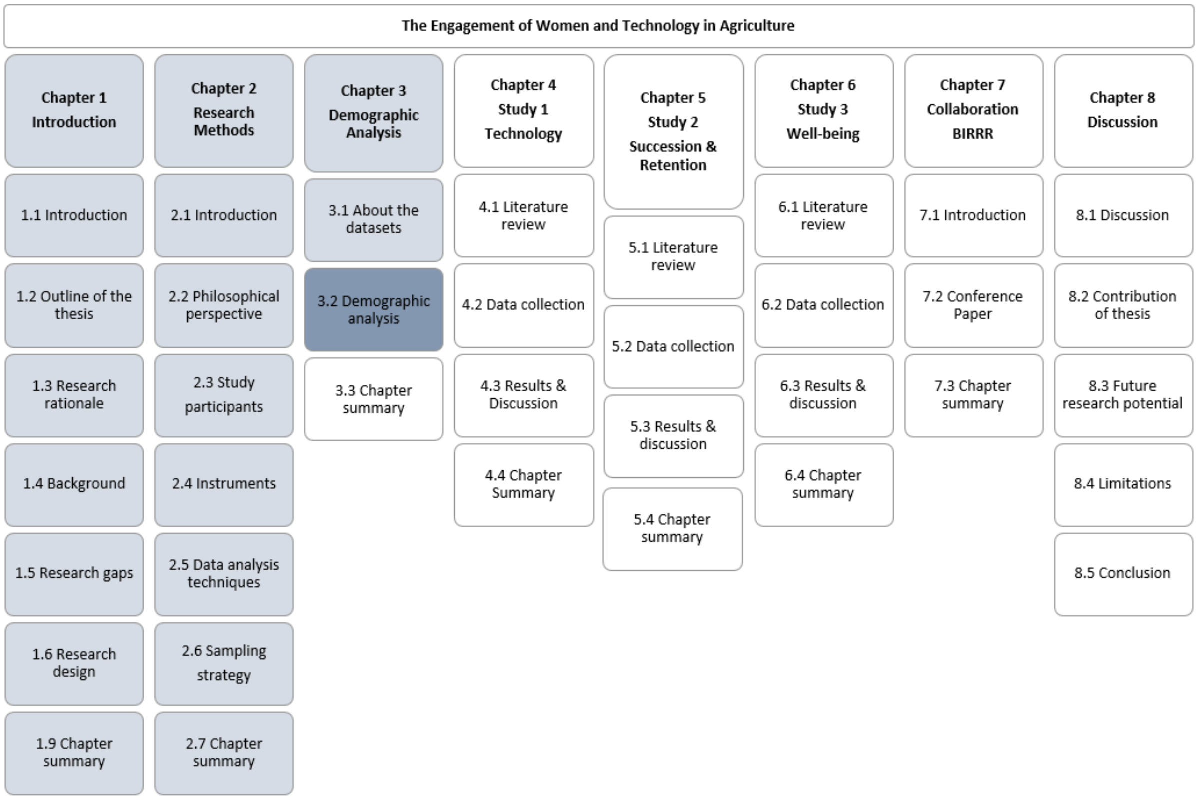
Two hundred and seventy-two people completed the survey, 10 surveys were empty, and 54 surveys had partial answers to less than 45% completion. Eight surveys had answers to between 57% and 100% completion, with only two surveys more than 70% complete. Of those who started, 200 participants completed the survey giving a completion rate of 73.5%. A frequency analysis used to compare completed and partially completed surveys showed little difference between results, therefore only 100% completed surveys were used (N=200).

The researcher acknowledges the potential for voluntary response bias, where there is overrepresentation of individuals that have strong opinions about technology use in agriculture. However, it should be noted that such bias is normatively defensive because the study has occurred explicitly within groups that are in agriculture and have access to technology and that the research was conducted without concealment or fabrication (MacCoun, 1998).

The majority of participants (86%) completed the survey in 8-40 minutes. While the survey was designed to be completed in 10-15 minutes, it was noted in some feedback from participants that slow internet, dropouts and other connectivity problems delayed the response time (BIRRR Regional Internet Access Survey Results, 2016, p. 8; BIRRR Skymuster Survey Results, 2017, p. 4).

3.2 Demographic analysis

Thesis Structure Overview: Chapter 3 – Demographic analysis



Section 3.2 analyses the demographic data collected from the online survey. The data from the 2013 study is compared to the 2016 data in *Chapter 4 Study 1 Producer adoption of rural digital technology* to see if there is any difference in how technology is being adopted and used. The demographic data is also used in Study 2 and Study 3 to identify participants in relation to responses about succession, retention, and well-being. As this is the first time these questions were asked, no comparison is made to the 2013 data.

Sixteen demographic questions asked about gender, relationships and age, together with how many children were in the family and work status. Questions also asked about what the respondent produced and where their property was located. Questions were asked in both 2013 and 2016. However, in 2016 ten extra questions were added for example ‘Do you or your partner (if relevant) have an off-farm business or work off farm’. In 2013, the completion rate of the survey was 97% and in 2016, the completion rate was 73.5%. In 2013, the majority of participants (86%) completed the

16-question survey in 5-15 minutes and in 2016, the majority of participants (86%) completed the 48-question survey in 8-40 minutes.

Table 3.1 shows the breakdown of gender and for each year of the survey. In both years, more women than men responded to the survey. However, 2016 shows a slight increase in responses from men. Similarly, in both years, respondents were mostly aged over 36 years old. In 2016, one person who was 17 years or younger attempted to answer the questions. As the survey was only open for people aged over 18, these respondents were 'skipped' to the end of the survey where it explained that they were exclude because of their age.

Table 3.1: Frequency analysis of age and gender of participants

		2013 (N=138)				**2016 (N=200)**			
		n	**Male**	**n**	**Female**	**n**	**Male**	**n**	**Female**
Age	17 or younger					1	0.5	0	0
	18 - 35	2	1.4	21	15.2	2	1.0	24	12.0
	36+	1	0.7	114	82.6	14	7.0	159	79.5
	Total	3	2.1	135	97.82	17	8.5	183	91.5

Respondents were asked how many children they had under 16 at home, under 16 at boarding school, over 16 at home, over 16 at boarding school and if they had any children over 16 not living at home. Table 3.2 shows the breakdown of children at home.

Table 3.2: Number of children in the family for Year 2016

	2016 (N=200)				
	Percent				
	One	Two	Three	Four	Five
Under 16 at home	17.0	20.0	10.5	5.0	-
Under 16 at boarding school	19.0	6.0	0.5		-
Over 16 at home	9.0	4.5	0.5	-	-
Over 16 at boarding school	12.5	1.0		-	-
Over 16 not living at home	11.5	14.5	6.0	3.5	1.5

Note: Not included in 2013 survey

Participants were asked how many generations of their family had owned the property (including children). The majority were first generation owners, followed by third generation owners, then second, fourth and fifth generation, see Table 3.3.

Table 3.3: Responses to the question 'How many generations of your family owned this property (including children)'

	2016 (N=200)
	Percent
One Generation	31.2
Two Generations	23.6
Three Generations	24.6
Fourth Generation	12.1
Fifth Generation or more	8.5
Total	100

Note: Not included in 2013 survey

The next question asked if the respondents had always worked in agriculture. The results show that just over half (51%) have always worked in agriculture. Table 3.4 below shows the diversity of employment background in the agricultural sector from the respondents who answered 'No' (49%), with the majority of responses (24%) saying that they worked in teaching or education, 11% from an administration background and 10% from nursing. When asked if the respondent would like to work somewhere else, 82% answered ‘No” and 18% answered yes (see 6.2 for a breakdown of responses coded to reflect the yes responses).

Table 3.4: Anecdotal responses to the question ‘Have you always worked in agriculture’ answered ‘No, what did you do before’

2016 (N=200)			
Employment Type	**Percent**	**Employment Type**	**Percent**
Teaching/Education	23.7	Law/Mediation	2.1
Administration	11.3	Jack of all trades	2.1
Nursing	10.3	Hospitality	2.1
Banking/Finance/Commerce	9.3	Extension	2.1
Professional	5.2	Tourism	1.0
Accounting	5.2	Recreation	1.0
Medicine	5.2	Married to someone who works in ag	1.0
Retail	4.1	Local government	1.0
Mining	3.1	Human Resources	1.0
Marketing	3.1	Customer Service	1.0
Pharmacy	2.1	Childcare	1.0
Media	2.1	Total	100

Note: Not included in 2013 survey

Respondents were asked what they mainly produced on their property. They were allowed to select more than one answer and to say what else they produced. In both 2013 and 2016, the majority of respondents produced cattle. In 2016, respondents had increased both sheep and cropping production. Beef production also rose in 2016. The high percentage total indicates that some of the respondents practiced mixed production.

Table 3.5: Frequency analysis of the question "What do you mainly produce on your property?"

	2013 (N=138)	2016 (N=200)
	Percent	
Cattle	89.1	96.5
Sheep	21.7	20.0
Cropping	18.1	21.0
Other		8.0
2016: Leaucaena, camels, goats, pototoes, farm tourism, sugar cane, agistment, carbon, hay, horticulture, timber, contract farming, earthmoving, and horses		

In 2016, the respondents were asked to how much of each product they produced. Fifty-six percent, answered that they produced 100% of cattle, 1% produced 100% sheep and 1% produced 100% of cropping. From the other responses, 1% produced 100% horticulture (see Table 3.7). A further breakdown is provided in Table 3.6.

Table 3.6: Percent of production for what is mainly produced on respondents' property

	2016 (N=200)					
	Percent of Production					
	0-20	**20-40**	**40-60**	**60-80**	**80-99**	**100**
Cattle	3.0	7.0	6.5	12.0	11.0	56.0
Sheep	6.5	6.5	0.5	3.0	2.5	1.0
Cropping	5.0	4.0	2.0	2.0	2.5	1.0
Other	7.0					1.0

Note: Not included in 2013 survey

Seven percent selected other as the product mainly produced on their property. Aside from horticulture mentioned earlier, for one respondent 60% of production is made up of hay and another has listed contract farming as 30% of what they produce on their property. Table 3.7 lists the other products and amounts produced by respondents.

Table 3.7: Percent of production for 'Other' products produced on respondents' property

		2016 (N=200)			
Product	**Percent**	**Amount Produced**	**Product**	**Percent**	**Amount Produced**
Horticulture	1	100.0	Potatoes	1	15.0
Hay	1	60.0	Farm Tourism	1	15.0
Contract Farming	1	30.0	Goats	1	10.0
Goats	1	25.0	Camels	1	0.1
Sugar Cane	1	20.0	Agistment	1	Did not say
Carbon	1	20.0	Earthmoving/goldmine	1	Did not say
Equine	1	20.0	Timber	1	Did not say

Note: Not included in 2013 survey

When asked about the location of their property, the majority of respondents answered that they were from Queensland, Australia, with respondents in all other states and territories, except for the Australian Capital Territory and Tasmania, see Table 3.8.

Table 3.8: Distribution of sample between States of Australia

	2016 (N=200)	
State/Territory	**N**	**Percent**
Queensland	176	88.0
New South Wales	8	4.0
South Australia	2	1.0
Victoria	2	1.0
Western Australia	5	2.5
Northern Territory	2	1.0
Australian Capital Territory	0	0.0
Tasmania	0	0.0
Missing	5	2.5
Total	200	100

** There were no responses from the Australian Capital Territory or Tasmania;*
**Not included in 2013 survey as the survey was previously only offered in Queensland*

Participants were asked if they owned and/or managed the property. The data indicates that less people in 2016 (74%) are both owners and managers than in 2013 (79.7%). Similarly, for those who identified as property managers, there are less respondents in 2016 (11%) than in 2013 (13%).

Participant were able to allocate another role that they fill on their property, roles such as company owner, invisible farmer (women who work on farm), family owned, lessee, joint owners, owner manager (of their own property and others), worker and that they work off farm. The role of the invisible farmer is discussed further in Section 6.3.2.

Table 3.9: Frequency analysis of the question 'Are you the owner and/or the manager of this property?

	2013 (N=138)	2016 (N=200)
		Percent
Both owner and manager	79.7	74.0
I manage the property	13.0	11.0
Other	7.2	14.5
2013: Company owner (1), invisible farmer (3), family owned (3), work off farm (1), other worker (2)		
2016: Company owner (1), invisible farmer (11), family owned (9), lessee (1), worker (2), joint owners (3), owner manager (2)		

In 2016, respondents were asked if they or their partners had an off farm business or worked off farm. Just over half of the participants (53.6%) from this survey do not participate in off farm work. Of those that do work off-farm, 26.8% work more than 20 hours off-farm and 19.7% work less than 20 hours off-farm. The survey also asked who primarily works off farm. A cross tabulation showed that only females answered the question, where 72.2% said that they work off-farm and 19.4% said that their partner works off-farm. Eight and a half percent selected that someone else primarily works off farm and those were identified as the agent, the son *"who manages the property"* and both *"partners in the business who run an online business and have shared responsibilities"*.

Table 3.10: Responses to the question 'Do you or your partner (if relevant) have an off farm business or work off farm'

Work off farm or off farm business	**2016 (N=200)**	
	n	**Percent**
No	98	53.6
Yes, I/we work more than 20 hours per off-farm	49	26.8
Yes, I/we work less than 20 hours per week off-farm	36	19.7
Missing	17	8.5
	200	100
Who primarily works off farm		
Me (Females)	26	72.2
My Partner	7	19.4
Other (tell us who): Agent, both, son	3	8.3
	36	100

** Not included in 2013 survey*

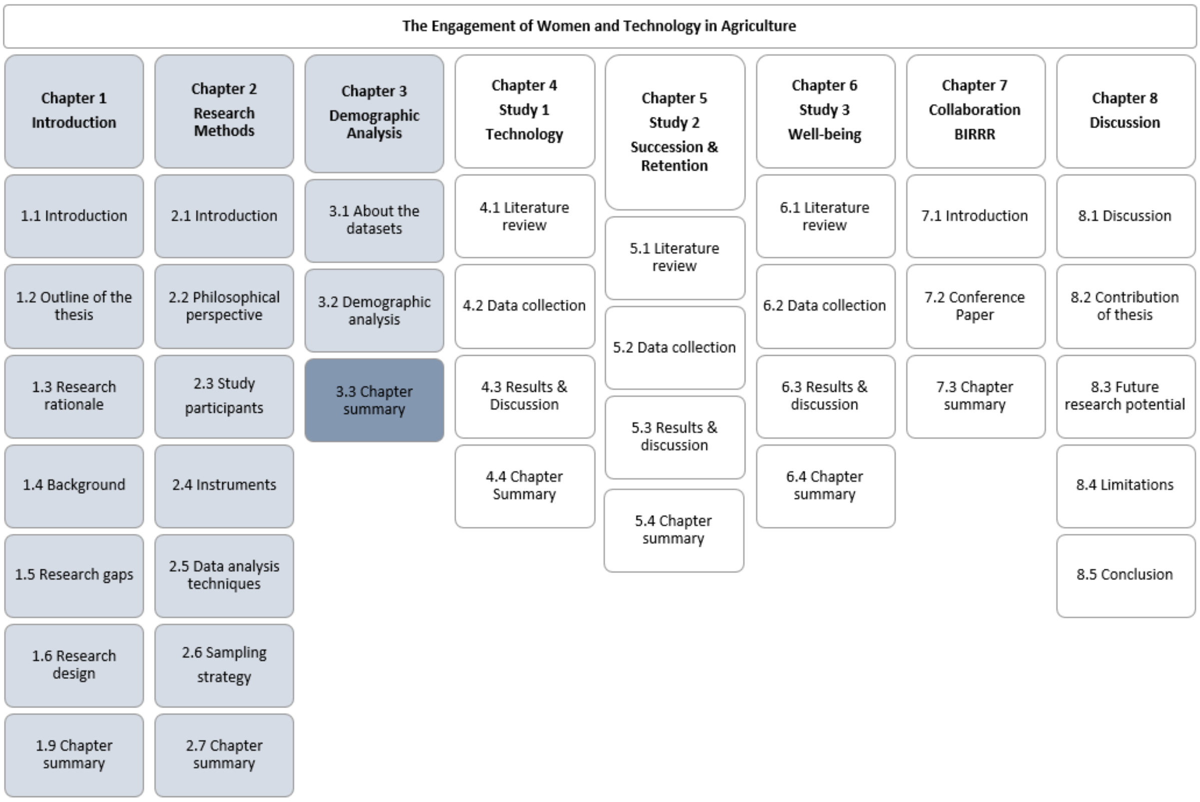
The final question in the demographic data set (Section 3.2) asks about volunteer work and not for profit businesses. Of the 8% who responded that, they complete volunteer work 2% volunteer for between 1 and 30 hours per week. Three and a half percent either work 50-60 hours per week or do not know the total hours that they volunteer, just that *"it is a lot"*. Two percent of respondents run a not for profit (NFP) business. Three respondents spend approximately 10 hours per week on their NFP Business, one spends 3 hours per week and the other spends around 25 hours per week on their NFP Business.

Table 3.11: Anecdotal comments for respondents who volunteer more than 50-60 hours (2016)

A bloody lot - who know how many - have not counted - very involved with community"
"Hard to put a number on it. Mostly done from home"
"I have been a weather recorder for BOM for 46 years"
"Many volunteer hours for community organisations"
"Unsure"
"We are club members and executives for a few clubs in our community"

3.3 Chapter Summary

Thesis Structure Overview: Chapter 3 – Chapter Summary



A self-administered online survey was distributed to four different rural membership databases (see Section 2.3). *Chapter 3* presents demographic data, which is used across the three studies included in the thesis. A four point Likert-scale with anchor points 1-strongly agree and 4=strongly disagree were used, firstly to allow a comparison to the 2013 data which used Rossiter's (2002) now highly criticised C-OAR-SE method (Ahuvia, Bagozzi, & Batra, 2014; Boshoff & Theron, 2015; Diamantopoulos, 2005) and secondly to avoid a response set or halo effect potentially produced by a mid-point (Chang, 1994). Three hundred and seventy one responses from 2013 and 2016 were included in the data analysis. In 2013, the completion rate was 97% and in 2016 the completion rate was 73.5%. Nearly 96% of respondents were female and only 4% were male in 2013. In 2016, ninety one percent of respondents were female and 8.5% were male, just over double the respondents from 2013. In 2016, 20% of respondents had children under 16 at home and 19% had one child under sixteen at boarding school. The majority of 2016 respondents were first generation farmers (this question was not asked in 2013). More than half of the respondents have always worked in agriculture, but the remainder have a diverse background with 23.7% working in teaching, 11.3% in administration, and 10.3% in nursing. Others worked as doctors, accountants, in retail or mining, marketing, pharmacy or in the media (30%). The remainder worked in law, hospitality, extension, tourism, recreation, local government, human resources, customer service, and childcare and a couple who identified as jacks-of-all-trades (15.4%) and 82% of respondents indicated that they would like to work somewhere else.

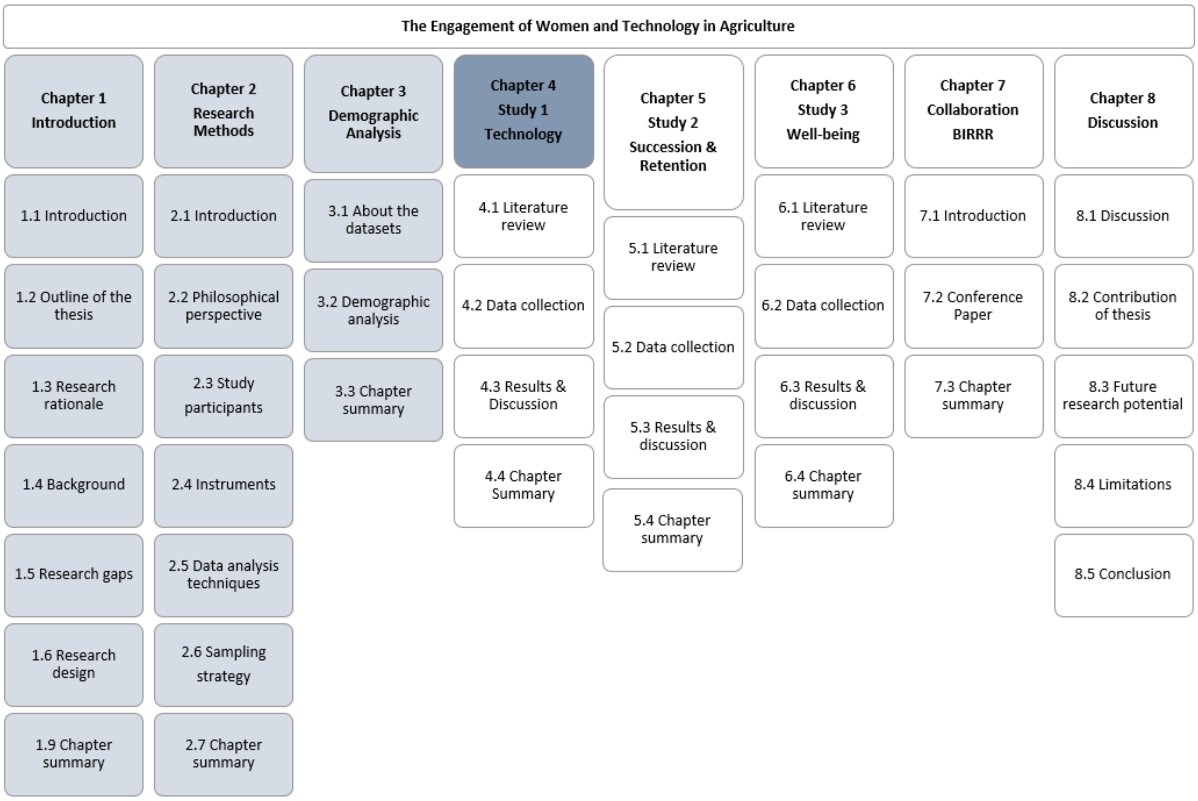
More cattle producers answered the survey in 2016 compared to 2013, which is the target market of the survey. Table 3.6 and Table 3.7 in Section 3.2 give an overview of other products produced by respondents. The majority of respondents are from Queensland (88%) with 4% from New South Wales, 2.5% from Western Australia and the remaining 3% from South Australia, Victoria, and the Northern Territory. Seventy nine percent of respondents owned their property in 2013, while slightly less (74.4%) owned their property in 2016, see Table 3.9 in Section 3.2 for a further breakdown. However, overall, farm ownership has decreased from 2013, which could be indicative of the downturn in agricultural markets during the three-year period 2013 to 2016.

Just over half of respondents did not participate in off-farm work, but of those that did 27% work more than 20 hours off-farm and 20% work less than 20 hours off-farm. The majority of those who work off-farm that responded to this survey are women (72.2%). Nineteen percent of women respondents said that their partner works off-farm. When asked to rate their emotional health on a five-point scale from excellent to extremely poor, 42.7 percent of women, and 6.0% of men rated themselves as above average or excellent. Six percent of females and 0.5% of males thought that their emotional health was poor or extremely poor. The final question in the demographic data set (Section 3.2) asks if the respondent completes any volunteer work. Only 8% responded that they do volunteer work. Two percent complete volunteer work for between 1 and 30 hours, 3.5% volunteer 50- to 60 hours per week or do not know how much time they volunteer. Two percent run a not for profit business, the remaining 2.5% did not say how much time they spent volunteering.

The data analysis in *Chapter 3* compares and contrasts results (where possible) between 2013 and 2016 data. While there are some minor differences, such as slightly more men responding to the survey in 2016 than in 2013, the demographic profile is much the same between the years. Having similar demographics strengthens the comparison between 2013 and 2016 data. The demographic data will be used to support the analysis in Study 1, Study 2, and Study 3. *Chapter 4* presents a literature review, elements of the data collection and analysis (summarised from 3.2) and the results of Study 1 Producer Adoption of Rural Digital Technology. Section 4.4 provides the summary and conclusions to *Chapter 4*.

Chapter 4 Study 1 Producer adoption of rural digital technology

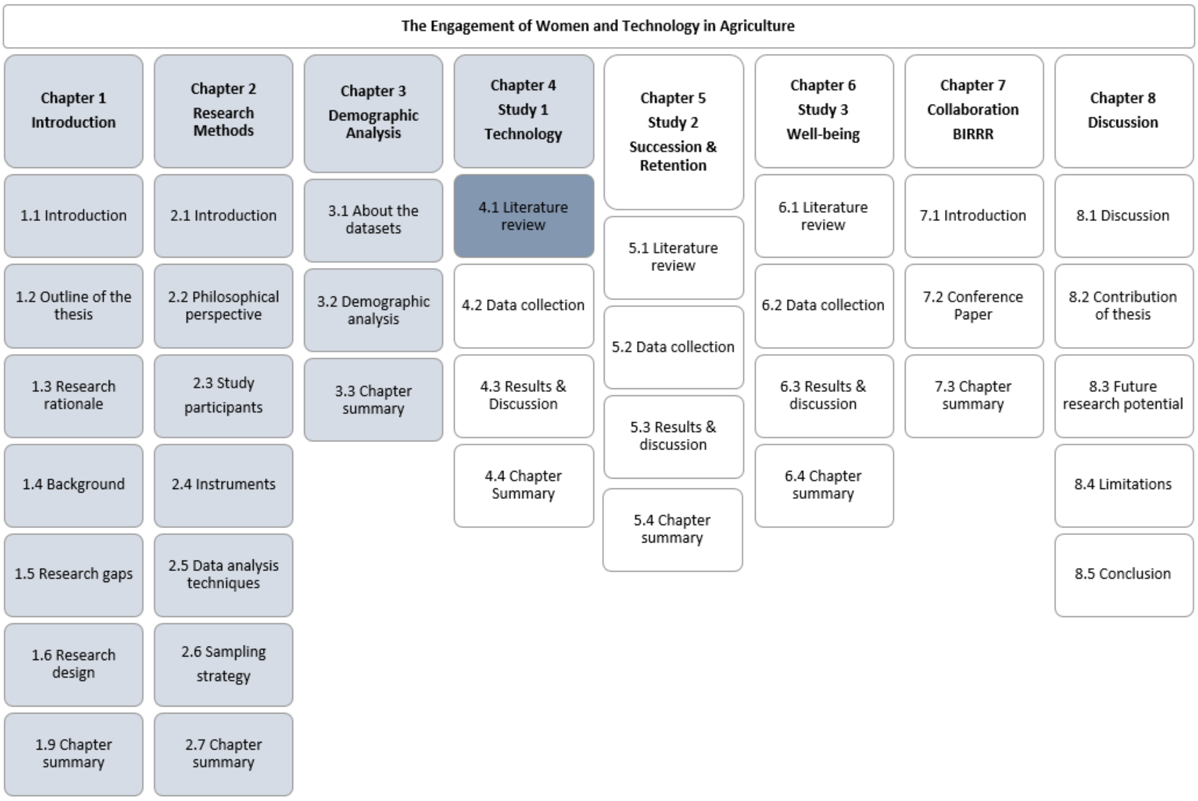
Thesis Structure Overview: Chapter 4 – Study 1 Producer adoption of rural digital technology



Chapter Four presents Study One and responds to Research Gap 1, which identifies that "Women's role in the diffusion of technology into the beef industry has not yet been clarified, so it is not obvious how technology has been used by rural women". As noted earlier, uptake rates of rural digital technology has been inconsistent in the beef cattle industry in Queensland. Hay and Pearce's (2014) study identified that women are important decision makers and users of technology. However, sales and marketing of the technology is aimed at men, see Section 1.5.1, p. 36. *Chapter 4* seeks to investigate "*What the women producer's motives, actions, and intentions in terms of technology use and management are?*" The chapter provides an overview of a range of the technology adoption models and theories of acceptance as well as factors influencing and barriers to technology adoption. It also considers Rogers (1962) Diffusion of Innovation Model initially developed in the US agricultural context but now applied to a wide range of business sectors, and Moore's (2002) revised technology adoption model (Section 4.1). It also provides a summary of how the data was collected (Section 4.2). Emerging themes fed into the questions in the online survey and are matched to the research gaps as shown in *Appendix 6: Online Survey*. Results and discussions are contained in Section 4.3 and Study One's conclusions are reported in Section 4.4. *Chapter 8* will draw the three studies together and highlight future research potential.

4.1 Literature Review

Thesis Structure Overview: Chapter 4 – Literature review



Chapter Four reviews literature on rural digital technology and how technology adoption has been managed and measured in the past. This led the researcher to critique technology adoption models, compare, and contrast them to how producers make decisions. However, a producer's choice of whether to adopt technology or not cannot only be measured by the existing models, hence an investigation into the combined effects of decision theory, adaptive capacity and the psychology of change and producer profiling and typology will evolve.

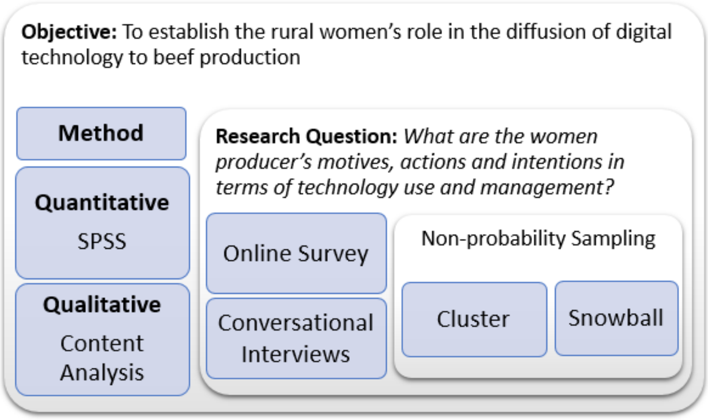


Figure 4.1: Overview of Study 1 Research Design

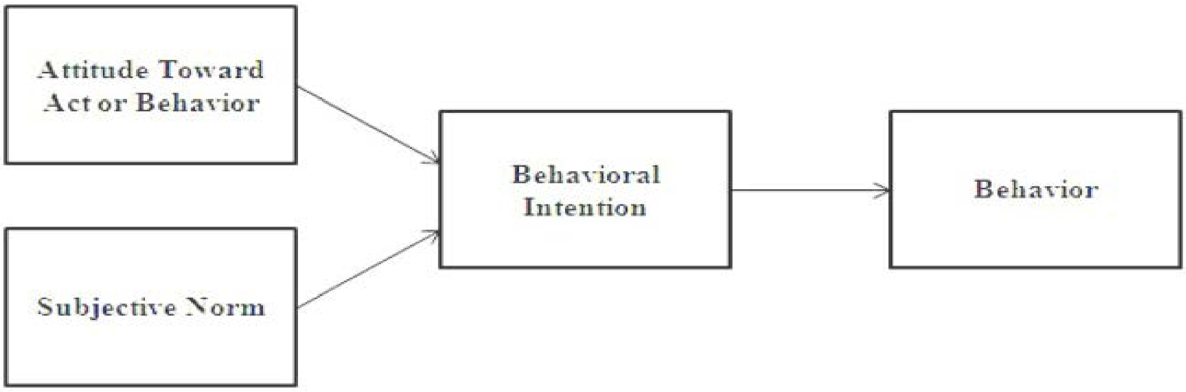
4.1.1 Technology adoption models and concepts

Several of the technology adoption models and how they are applied to farmer's decision to adopt agricultural technologies or not, are discussed in *Chapter 4*. Some of the models considered in Study One include "The Theory of Reasoned Action" (Ajzen, 2012) "Technology Acceptance Model (TAM)" (Davis, 1989), the "Theory of Planned Behaviour" (Ajzen, 1991), and the "Innovation Diffusion Theory" (Rogers, 2003) due to its use in previous agricultural research (see for example Ang, Banerjee, & Madsen, 2013; Wu & Zang, 2013; and Lee, Hsieh, & Chai-Ning, 2011) . Table 4.1 to Table 4.4 give an overview of the listed models including a description of each of the models, its core constructs, and a definition of the model. A discussion of their application to this thesis will follow.

4.1.1.1 Theory of reasoned action

Table 4.1: Theory of Reasoned Action (adapted from Venkatesh et al., 2003),

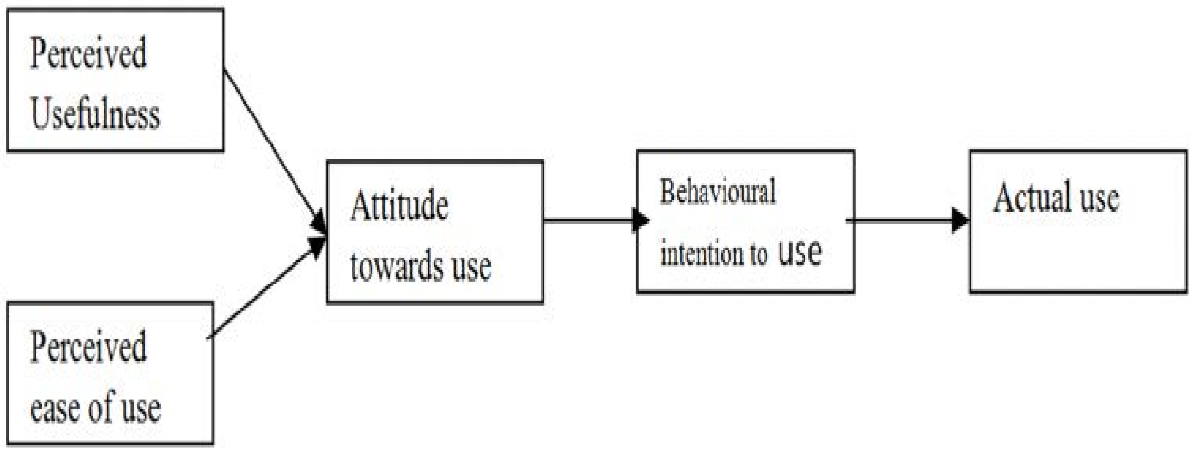
Models and Theories of Individual Acceptance (adapted from Venkatesh, Morris, Davis, & Davis, 2003)		
Model	**Core Constructs**	**Definitions**
Theory of Reasoned Action (TRA)		
Drawn from social psychology, TRA is one of the most fundamental and influential theories of human behaviour. It has been used to predict a wide range of behaviours (see Shepphard et al. 1998 for a review). Davis et al. (1989) applied TRA to individual acceptance of technology (information systems) and found that the variance explained was largely consistent with studies that had employed TRA in the context of other behaviours.	Attitude Toward Behaviour	"an individual's positive or negative feelings (evaluative affect) about performing the target behaviour (Fishbein and Ajzen,1975, p.216)
	Subjective Norm	"the person's perception that most people who are important to them think he/she should or should not perform the behaviour in question" (Fishbein and Ajzen 1975, p.302)



4.1.1.2 Technology acceptance model

Table 4.2: Technology Acceptance Model (adapted from Venkatesh et al., 2003),

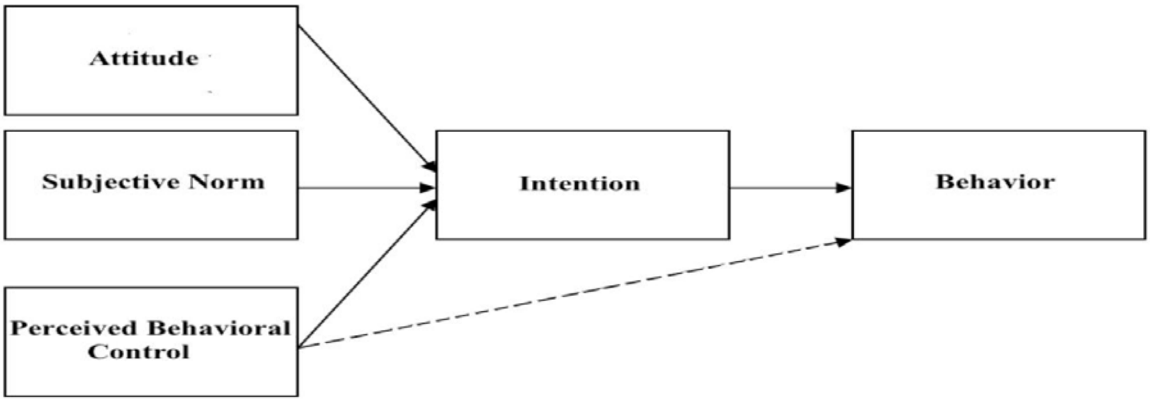
Models and Theories of Individual Acceptance (adapted from Venkatesh et al., 2003)		
Model	**Core Constructs**	**Definitions**
Technology Acceptance Model (TAM)		
TAM is technology focussed, tailored to information systems contexts, and was designed to predict information technology acceptance and usage on the job in vendor organisations such as IBM or in digital equipment organisations (Davis, 1989, p.319). Unlike TRA, the final conceptualisation of TAM excludes the attitude construct in order to better explain intention parsimoniously.	Perceived usefulness	"the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p.320)
	Perceived ease of use	"the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p.320)



4.1.1.3 Theory of planned behaviour

Table 4.3: Theory of Planned Behaviour (adapted from Venkatesh et al., 2003),

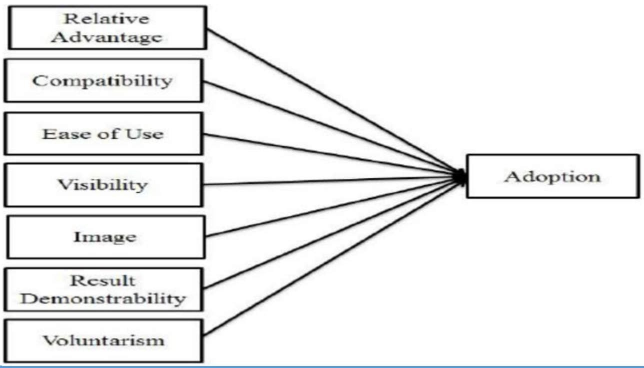
Theory of Planned Behaviour		
Model	**Core Constructs**	**Definitions**
The TPB evolved from the TRA to address the identified weakness in the model in that people may believe they have very little control over their behaviours. In the model, perceived behavioural control is theorised to be an additional determinant of intention and behaviour. Ajzen **(1991)** presented a review of several studies that successfully used TPB to predict intention and behaviour in a wide variety of settings. TPB has been successfully applied to the understanding of individual acceptance and usage in many different technologies (Harrison et al, 1997; Mathieson 1991; Taylor and Todd 1995). The model has been updated to include background influences (Ajzen, Albarracín, & Hornik, 2007; Fishbein & Ajzen, 2010). The theory has been widely applied successfully in the health sector, but it has also been applied to farming practices such as pesticide use and forestry management (Feola & Binder, 2010).	Attitude toward behaviour	Adapted from the Theory of Reasoned Action
	Subjective Norm	Adapted from the Theory of Reasoned Action
	Perceived Behavioural Control	“the perceived ease or difficulty of performing the behaviour”(Ajzen, 1991, p. 188)



4.1.1.4 Innovation of diffusion theory

Table 4.4: Innovation of Diffusion Theory (adapted from Venkatesh et al., 2003),

Models and Theories of Individual Acceptance (adapted from Venkatesh et al., 2003)		
Model	**Core Constructs**	**Definitions**
Diffusion of Innovation Theory (DIT)		
Grounded in sociology, DIT **(Rogers, 2003)** has been used since the 1960s to study a variety of innovations, ranging from agricultural tools to organisational innovation (Tornatzky and Klein 1982).	Relative Advantage	"the degree to which an innovation is perceived as being better than its precursor (Moore and Benbasat 1991, p195)
	Ease of Use	"the degree to which an innovation is perceived as being difficult to use (Moore and Benbasat 1991, p.195)
	Image	"the degree to which use of an innovation is perceived to enhance one's image or status in one's social system (Moore and Benbasat 1991, p.195)
	Visibility	The degree to which one can see others using the system in the paddock (adapted from Moore and Benbasat 1991)
	Compatibility	"the degree to which an innovation is perceived as being consistent with the existing values, needs and past experiences of potential adopters (Moore and Benbasat 1991, 195)
	Results Demonstration	"the tangibility of the results of using the innovation including their observability and communicability (Moore and Benbasat 1991, p.193)
	Voluntariness of Use	'the degree to which use of the innovation is perceived as being voluntary, or of free will" (Moore and Benbasat 1991, p.195)



There are other technology adoption models including the Decomposed Theory of Planned Behaviour (DTPB) (Hsu & Chiu, 2004; Taylor & Todd, 1995b), the Motivation Model (MM) (Davis, Bagozzi, & Warshaw, 1992; Vallerand, 1997), the combined TAM and TPB model (Taylor & Todd, 1995a), the Model of Utilization (MPCU) (Thompson, Higgins, & Howell, 1991) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Davis, 1989), plus many more. As noted earlier, these models are extensions of the individual acceptance models, which were of limited value in the context of Study One. A detailed review of these extension models is therefore outside of the scope of this study and will not be discussed in detail (see Venkatesh et al., 2003 for a review and discussion of several models).

Aubert et al., (2012) rely on the Technology Acceptance Model (TAM) and perceived ease of use and usefulness to explain farming technology adoption. Adrian, Norwood and Mask (2005) also use the TAM model but couple it with the Theory of Reasoned Action (TRA) (Fishbein, 1967; Fishbein & Azjen, 1975) and the Diffusion of Innovation Model (Rogers, 1962), citing that the individuals beliefs and perceptions of the innovation can explain adoption behaviour. Moore (2002) extends behaviour in the revised Diffusion of Innovation model to include two chasms. One that relies on the credibility of a product and the other is drive by cognitive and normative influences (see Section 4.1.2.4 for more information). The above listed studies only surveyed male farmers' opinions finding that men were perceived as key decision makers when adopting technology. By contrast, Hay and Pearce (2014) interviewed women and their findings suggest that women are significant decision makers when it comes to adopting technology for rural businesses. Venkatesh, Morris and Ackerman (2000) support this finding highlighting that *"the role of gender in technology adoption and usage behaviour is crucial"* (p. 50). Therefore, those who are interested in distributing rural digital technology should be targeting women as well as men (Hay & Pearce, 2014, p. 326).

4.1.2 Technology adoption

Concerns have been evident since at least the turn of the century that cattle producers have been inconsistent when adopting rural digital technology (Curtin, 2001). As noted in the introduction (Section 1.1), rural digital technology was first used in cropping industries in the 1980s and later in the 1990s in livestock management (Brase, 2005). However, it is still being reported that adoption and diffusion of these technologies continues to be slower than expected (Charmley, Hay, & Bishop_Hurley, 2016b; Lamb et al., 2008; Mooty, 2001; Rango et al., 2011). This may be attributed somewhat to their personality type (Shrapnel & Davie, 2001).

4.1.2.1 Producer profiling

Producer profiling has been used to implement natural resource management practices in farming. Emtage, Herbohn, & Harrison, (2007) used personality types to tailor conservation programs to specific needs and communication strategies. In conservation behaviour, typology has been used to identify target markets such as traditional farmers, supplementary farmers, business-oriented farmers and non-operator owners (Daloğlu, Nassauer, Riolo, & Scavia, 2014). When making decisions about water management using targeted practice change programs, farmer typology was applied to extension activities (Schwarz, McRae-Williams, & Park, 2009). Bohnet, Roberts, Harding, and Haug (2011) also applied typology to extension activities to tailor land management policies and programs for beef cattle producers finding that understanding grazier's values and motivations can work with specific groups to achieve results (Bohnet et al., 2011, p. 629). Shrapnel and Davie (2001) when measuring risk identified five personality styles (vigilant, conscientious, solitary, serious, and sensitive) unique to cattle producers in central Queensland (pp. 169-170). A further three key ingredients identified in 1995 by the Ecologically Sustainable Development Working Group on Agriculture are that "the farmer must want to change", that "they must know how to change" and that "they must have the necessary material to change" (Prevett, Murphy, & Smithyman, 1995). This may indicates that different strategies will be needed with each category of farmer, to achieve any form of engagement with the key issues, let alone sustained behaviour change. Typologies have been developed in other countries such as the USA (McGuire et al., 2015) and Scotland (Barnes, Willock, Toma, & Hall, 2011; Sutherland, Barnes, McCrum, Blackstock, & Toma, 2011) but may not be directly applicable here. Therefore, this thesis considers Shrapnel and Davie's (2001) model, which is a good fit for the topic of knowledge transfer and in turn technology adoption.

Shrapnel and Davie (2001), when measuring risk, used individual interviews with 30 farming families to discover five personality styles unique to cattle and crop producers in Queensland, Australia (pp. 169-170). The five personality styles present in Shrapnel and Davie's (2001) research are: vigilant, conscientious, solitary, serious, and sensitive. Shrapnel and Davie (2001) clearly state that cattle producers have personality styles that set them apart from city people, they are a "special breed". Each of the personality styles has an additional characteristic to dealing with people, see Figure 4.2 for each styles characteristics (Shrapnel & Davie, 2001).

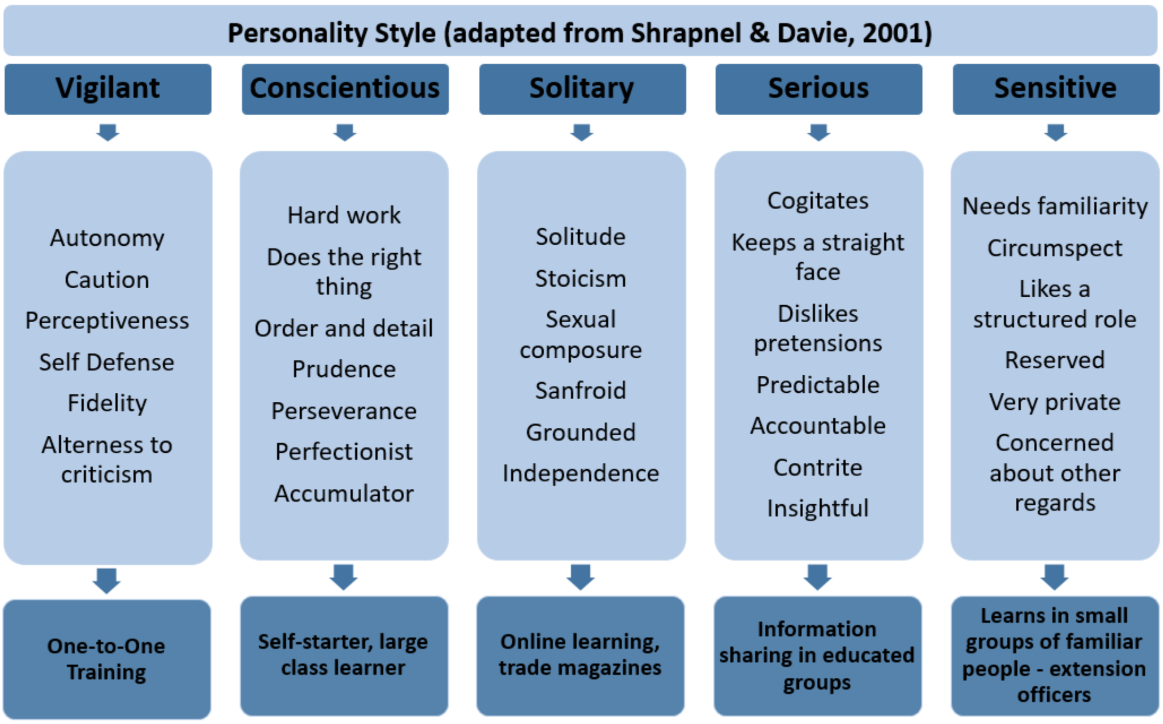


Figure 4.2: Characteristics of the predominant personality styles (as cited in Shrapnel & Davie, 2001)

When viewed in the context of learning the *"vigilant personality"* values autonomy, therefore may prefer a one-on-one approach, whereas the "*solitary personality*" feels comfortable alone, and prefers not to deal with people at all, therefore may suit an online learning environment. The *"serious personality"* is not outgoing and does not like to be told things but may value information sharing, and the *"sensitive personality"* is cautious when in groups, and is stressed by unfamiliar surrounds, therefore would learn better in small groups of familiar people (Shrapnel & Davie, 2001). According to Shrapnel and Davie (2001), the personality types then fall into three groups *"(1) those who can cope with change, (2) those who can cope with change but not under pressure, and (3) those who cannot cope with change"* (p. 174). Finally, Shrapnel and Davie (2001) state that producers must be able to have the necessary resource to cope with change. However, their failure to adopt can also be attributed the sometimes complicated process of adoption as demonstrated by technology adoption models.

Ajzen's (2012) Theory of Reasoned Action core construct - that the person's perception of how others think he/she should perform - is not a good fit with the producer personality types of solitary and vigilant. One of the traits of solitary is being independent, and one of the traits of vigilant is self-defence. Neither of these traits is a good fit with subjective norm, where the decision maker makes their decision based on whether or not someone else thinks they should. A producer with a solitary or vigilant personality type is unlikely to make a decision based on what others think. Therefore, the Theory of Reasoned Action (Ajzen, 2012) is not a good model to use when assessing technology adoption by cattle producers in Queensland.

The Theory of Planned Behaviour (Ajzen, 1991) also has shortfalls in terms of measuring producers' technology adoption. The producer's attitude about technology is heavily reliant on information received from external parties. A producer's personality trait of vigilant, solitary, serious, and sensitive may also contribute to barriers for adoption. Being independent and defensive of one's self (vigilant and solitary) coupled with the serious attributes of disliking pretensions and needing familiarity may see the producer form barriers at the information dissemination stage.

The Diffusion of Innovations Theory (DIT) (Rogers, 1962) is used as a guide of user intention and has seven constructs"(1) relative advantage, (2) ease of use, (3) image, (4) visibility, (5) compatibility" (6) results demonstrability and (7) voluntariness of use. If we compare DIT with producer personalities, it is clear that the model is not a good fit either. When discussing relative advantage, often the innovation that we are asking them to adopt does not have a clear pre-cursor i.e., the discussion around the technology is not always clear and this can present problems. In terms of image, which is defined as *“the degree to which use of an innovation is perceived to enhance one’s image or status in one’s social system*” (More and Benbasat 1991, p.195), the producer’s solitary personality trait keeps them quite grounded, not necessarily requiring image or status enhancement. While perceived status would have some grounding, it would not be a pre-cursor to adoption. Voluntariness of use could be misinterpreted also, depending on how hard the sell is by the intermediate, whether that be an extension officer or a product developer. On a positive note, compatibility and results demonstration would be a positive aspect of this model in terms of technology adoption by producers.

4.1.2.2 Technology Acceptance Model

As the name suggests the technology acceptance model was designed to encourage participation with and adoption of technology, see Figure 4.3. The model is based on the assumption of perceived usefulness and the perceived ease of use (Davis, 1989). Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989). Perceived ease of use affects perceived usefulness. A potential user of rural digital technology who perceives the technology to be easy to use, is more likely to adopt the technology (Adrian et al., 2005), if ease of use is confirmed then the adopter will consider it useful and potentially encourage others to use the technology, i.e., they become opinion leaders (Elliott, Rundle-Thiele, & Waller, 2010, p. 110). However, the model ignores a number of other factors involved in technology adoption decisions. These are discussed in Section 4.1.2.3.

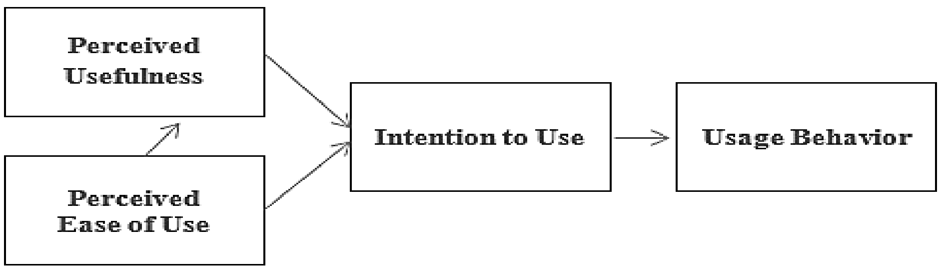


Figure 4.3: Technology Adoption Model (Davis, 1989)

An extension to the TAM model is the Unified Theory of Acceptance and Use of Technology (UTAUT) model, which incorporated additional variables such as effort and performance expectancy that made the model more complicated to apply and to measure and hard to implement (Dahl, 2015, pp. 83-84). UTAUT assumes that the person adopting the technology is goal directed and selects technology as part of a rational process and it assumes social influence will play a role. Producers are more likely to value usefulness and ease of use over other UTAUT variables, making UTAUT unsuitable to apply to producers. The Technology Acceptance Model (TAM) (Davis, 1989), which uses both perceived ease of use and perceived usefulness to determine a person's attitude towards adoption (see Figure 6), is a framework that is considered valid and reliable (Flett et al., 2004; Taylor & Todd, 1995c; Venkatesh & Davis, 1996). Perceived usefulness and ease of use are conducive to each of the five producer personality types and therefore TAM is a good fit for producers who would like to adopt technology, although not providing a complete framework for understanding technology adoption decisions.

In further support of the TAM model, Venkatesh et al., (2000) used perceived ease of use (Figure 2) to examine gender differences and the determinants of adoption and sustained usage of technology, to find that there are clear gender differences in determining individual technology adoption decisions and that the role that gender plays in technology adoption is crucial (pp. 49-51).

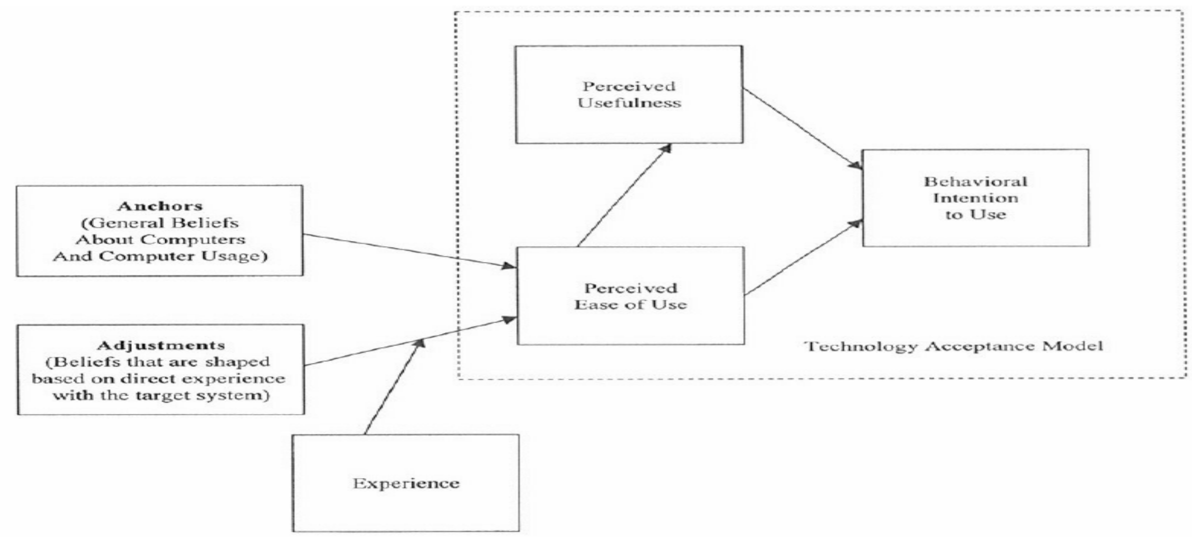


Figure 4.4: Perceived Ease of use (Venkatesh, 2000)

4.1.2.3 Other Factors that influence technology adoption

Other elements of technology adoption also need to be considered. Tey and Brindal (2012) for example, reviewed a set of published papers, which were based on data collected from men. Their research found that farming technology adoption by men is influenced by seven individual factors: socio-economic factors, agro-economic factors, institutional factors, informational factors, producer perception, behavioural factors, and technological factors as shown in Figure 4.5.

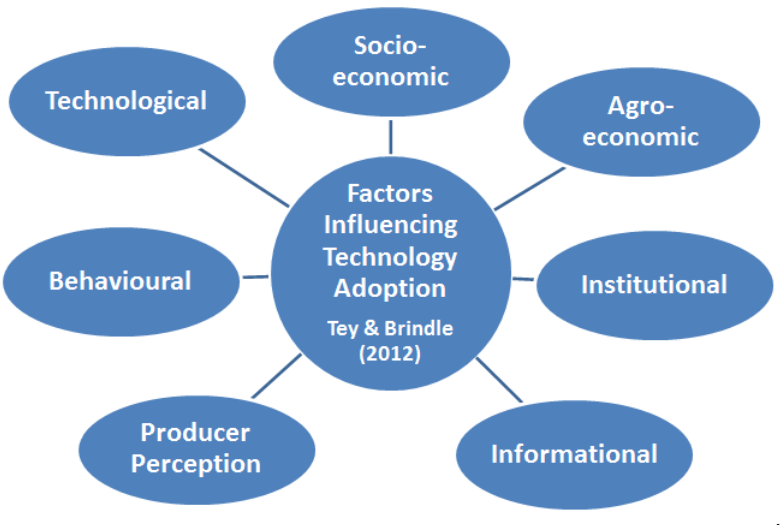


Figure 4.5: Factors Influencing Technology Adoption, Tey & Brindle, 2012

Socio-economic factors refer to the adopter's personal background. Highly intensive technologies require a high level of engagement, therefore the producers' capacity and ability to use the technology will clearly influence his or her adoptive decisions (Tey & Brindal, 2012, p. 723). Agro-ecological factors consider for example, what type of farming is being undertaken, land size, and financial status may be considered, whereas institutional factors relies on the region in which the farm is located and the pressure on that area to develop. Pressure on the producer from urban development, may cause a negative impact on technology adoption (Tey & Brindal, 2012, pp. 723-724).

Informational factors include information received from extension services or product consultants. Rather than adopt the technology him or herself, producers might engage a contractor depending on what type of information about the technology he/she has received. In addition, information on the technology might not be readily available causing a negative effect to adoption.

State Governments cutting costs have also disengaged with extension services, which has made information less accessible to producers (Parliment of Australia, 2006).

The implications for technological factors include the types of technology available and the human operator required to use them e.g., computers. Computers are used to analyse the data that is collected by the rural digital technology, therefore if the producer – as an operator - has a negative relationship with computer technology (negative perceived ease of use), he or she is unlikely to adopt the technology (Tey & Brindal, 2012, p. 725). Producer perception and behaviour will also drive adoption (perceived usefulness). If the producer perceives the technology to be both useful and easy to use then adoption will readily happen (TAM, Davis, 1989) and when behaviour is positively influenced by time and capital, and willingness and effort, adoption of technology will ensue. By contrast if they are negative, then the opposite occurs (Tey & Brindal, 2012). However, there are other influencers to adoption and non-adoption, which are discussed in the following sections.

4.1.2.4 Diffusion of Innovation Model

Rogers (1962) Diffusion of Innovation Model shows a fluent movement through the bell curve from innovation to early adoption through to laggards. The bell curve implies that adoption would begin with the early adopters and would peak with the early and late majority and decline with laggards until 100% diffusion of innovation was completed. It was seen as a given that adoption would take place.

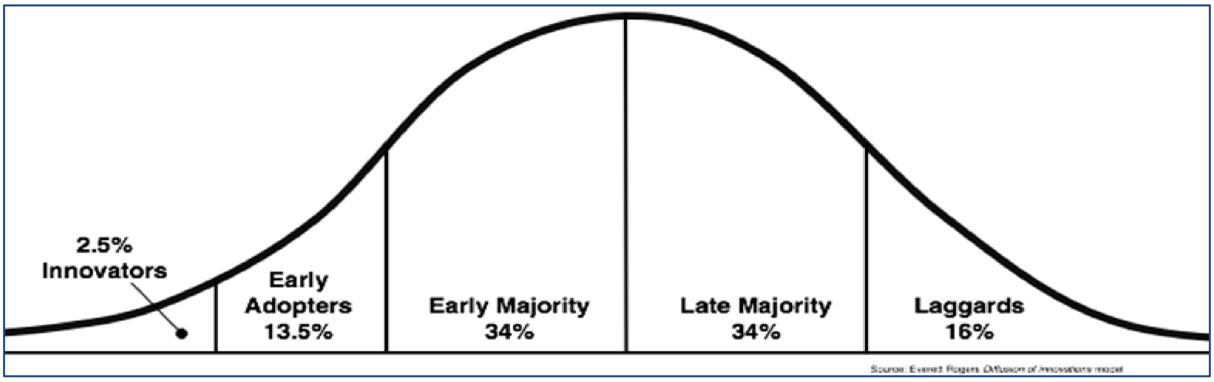


Figure 4.6: Diffusion of Innovation Model (Rogers, 1962)

While there is an assumption that innovations will be completely adopted, there is the chance that they can be abandoned. Rogers (1962) cites five characteristics of innovations that must be met for the adoption to occur 1) where the innovation must give relative advantage, that is, it must supersede or perform better than its predecessor. 2) It must be compatible with existing values, past experiences and the needs of the adopter. 3) The innovation must be relatively easy to understand, if not then adoption will not occur. 4) Adoption will occur more readily if the adopter has an opportunity to trial the innovation and 5). The results of the innovation must be observable by others, for if they can see the results, they will more readily adopt the innovation (pp. 15-16). Furthermore, cognitive and normative beliefs may also influence decisions to adopt innovations.

Moore (2002), in a revised Diffusion of Innovation model has positioned abandonment as a chasm between the early adopters and the remaining adopters, identified as the early market and the mainstream market. The early market is made up of the innovators and the visionaries, while the mainstream market is made up of pragmatists, conservatives, and sceptics, see Figure 4.7.

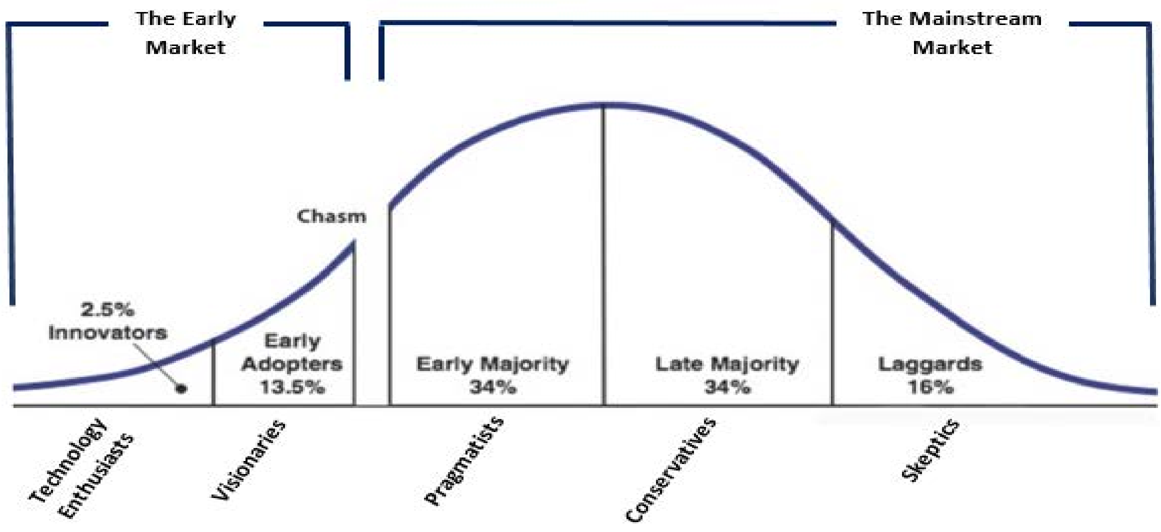


Figure 4.7: Revised Diffusion of Innovation Model (Moore, 2002)

Producers tend to sit in the mainstream market because they are not normally risk takers (Marshall, Stokes, Webb, Marshall, & Lankester, 2014). There are two other chasms that Moore (2002) refers to as "cracks in the bell curve" (p. 17) that are not shown in this image. One chasm is between innovators an early adopters – where there is a proven and credible product but the world audience or other technology has not caught up, it is not proven so there is no adoption e.g. neural networking software where computers learn things as they do them. The other is between the early and late majority where the early majority are happy to try because the market says the product is tested, for the late majority the product must also be easy to use for example it must have better instructions, easy to use functions, if they are not sure how to use something then they will wait the market out until the product becomes easier to use (Moore, 2002).

The real interest is in the great dividing chasm between early adopters and the early majority. Early adopters are usually change agents, the first to implement something new and then tell others about it. In contrast, the early majority want the product they choose to fill a gap, to increase productivity for existing operations, they want to evolve processes and they want the products to work properly – if they don't then they will be part of the late majority and will wait for others to test the product to ensure it works in the way it is advertised (Moore, 2002). However, it is more complicated that the simple chasm. Producers are driven by both cognitive and normative influences. Cognitive influencers are guided by the producer's reference group (Bearden & Etzel, 1982) and they rely on "*shared perspectives and scripts for understanding the world"* (Miller, Le Breton Miller, & Lester, 2011, p. 3). These reference groups may not have the information required to make a decision to adopt. Normative influences that stem from *"shared values and a sense of responsibility to the [proximate] reference group [such as family*]" (Miller et al., 2011, p. 3) also provide a barrier to adoption. Producers' priorities include providing financial security to the family and protecting the family business (Miller et al., 2011). Therefore depending on the strength of the cognitive and normative beliefs and the strength of the influence of their reference group, there is an opportunity for the producer to be influenced to take on a conservative strategy to adoption new technology and processes to preserve the business entity for future generations and as such remain in the chasm (Moore, 2002; Sunyoung, Mathiassen, & Gallivan, 2009).

Understanding user acceptance of digital technologies is critical because it will provide points of potential focus, which can be used to "*create favourable perceptions and thus foster user acceptance and usage*" (Venkatesh, 2000, p. 343). Hay and Pearce's (2014) study identified women as decision makers in technology adoption, whereas previous researchers primarily focused on surveying men as decision makers. Study One aims to focus on women as adopters and determine the motivators that rural women use to adopt technology. It will consider TAM (Davis, 1989) and focus on Venkatesh's (2000) perceived ease of use as well as Tey and Brindal's (2012) factors influencing technology adoption in conjunction with decision theory, which is the focus of Section 4.1.2.5.

4.1.2.5 Decision Theory

Decision theory can be defined as *"the act toward making sense of how individuals and groups make or should make decisions"* (Resnik, 1987). There are two main branches of decision theory (1) where the researcher seeks out how decisions are made (Descriptive) and (2) where the researcher prescribes how decisions are made or can be expected to be made (Normative or Prescriptive). This study engages descriptive decision theory to investigate decisions made by rural women and men about technology adoption.

The buying decision process begins with an initiator and ends with a buyer (Soloman, Hughes, Chitty, Marshal, & Stuart, 2014). According to Soloman et al. (2014) the first step is to recognise that there is a problem that will involve a purchase decision. The second step is to complete an information search, which in farming families is often completed by women. Step 3 is an evaluation of alternatives. Results from Study One's data analysis shows that evaluation is considered either by women alone or by both producer men and women together. Step 4 involves selecting a supplier and purchasing the product and step 5 is the post purchase evaluation. Men, who typically inherit the farmland, are seen as decision makers because they are the owners of the farm's capital resources (Bock, 2006). Decision making, as a prelude to an action, is extremely important (Farmar-Bowers, 2010). All decisions, in the context of the farming family, no matter how trivial, have consequences for the family and the family business. According to Öhlmér Olson and Brehmer (1998), male producers make decisions based on *"four phases: problem detection, problem definition, analysis and* *choice and implementation"; and "four sub-processors: searching and paying attention, planning, evaluating and choosing and checking the choice"* (Öhlmér et al., 1998, pp. 273-290) as shown in Figure 4.8. On the other hand Farmar-Bowers states that producer women make decisions based on *"five concept lenses: (1) motivation stories (the families aspirations), (2) personal career path (individual career path), (3) decision systems, (4) suitability and availability (of opportunities), and (5) lenses (how the individual decision maker see options to create opportunities"* (Farmar-Bowers, 2010, p. 142), see Figure 4.9.

In phase one of the Öhlmér et al., (1998) study, producers who had not formulated any goals were identified as intuitive and farmers who had identified goals were analytical. When detecting decisions, there was usually more than one decision to be made, where the decisions were related to either unsatisfied goals or external changes (Öhlmér et al., 1998, p. 282). In phase two, the problem was defined in terms of its effect on important goals and its definition was influenced by the importance of completing that goal (Öhlmér et al., 1998). In phase three, analysis of choice were mostly made intuitively, very few farmers made choices based on tested models for example budgeting, or computer models (Öhlmér et al., 1998, p. 283). Phase four saw decisions implemented based on day-to-day decisions.

	Subprocess			
Phase	Searching & Paying Attention	Planning	Evaluating& Choosing	Bearing Responsibility
Problem Detection	Information scanning Paying attention	________	Consequence evaluation, Problem?	Checking the choice
Problem Definition	Information search Finding options	________	Consequence evaluation, Choose options to study	Checking the choice
Analysis & Choice	Information search	Planning	Consequence evaluation, Choice of option	Checking the choice
Implementation	Information search Clues to outcomes	________	Consequence evaluation, Choice of corrective action(s)	Bearing responsibility for final outcome, Feed forward information

Figure 4.8: Revised concept of the decision making process Öhlmér et al., (1998)

Farmar-Bowers developed the “Decisions Systems Theory (DST), shown in Figure 4.9, from in depth interviews with farming families to develop an understanding of the strategic decisions of farming women” (Farmar-Bowers, 2010). Farmer-Bowers (2010) study found that *“farming women make decisions based on intrinsic interest (personal interests), family considerations (needs of the family), personal components (within the family), social considerations (norms and ethics), and external components (access to credit, information, grants etc.)”* (p. 149), which guide her decisions about living, and earning a living, the family unit, and the skills she has (Farmar-Bowers, 2010). His study therefore, indicates that DST may play a substantial part in the women graziers’ decision to uptake rural digital technologies.

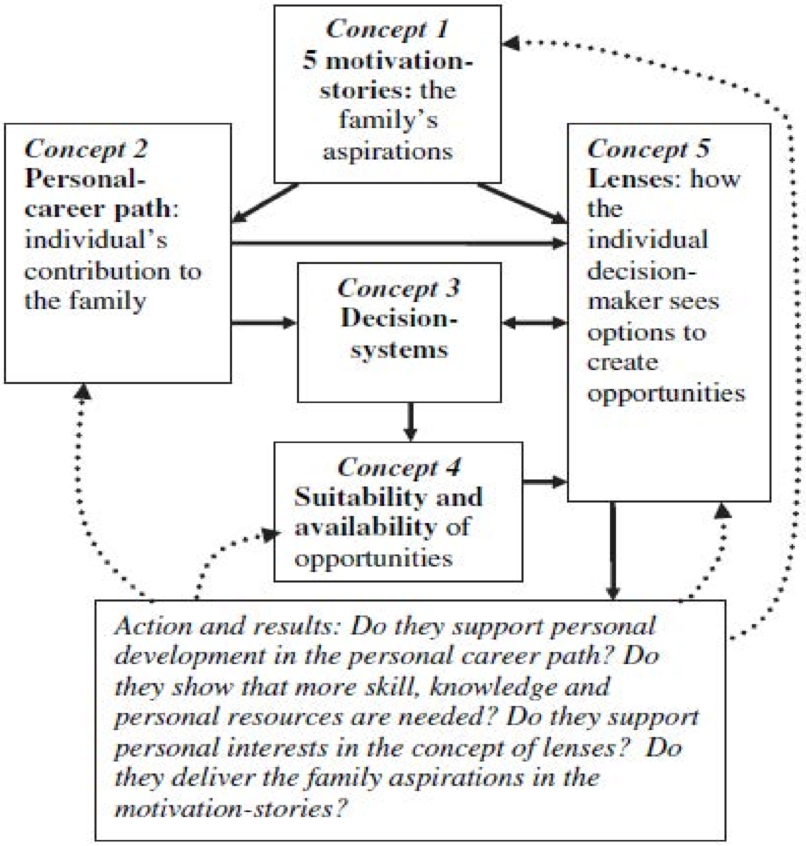


Figure 4.9: Decision System Theory (Farmar-Bowers, 2010)

Öhlmér et al., (1998) processes are supported by the Farmar-Bowers "Decision System Theory" (2010). The first and second concept lens 'motivation stories and personal career path' can be compared to 'problem detection' in the revised concept of the decision making process. The second and third lens 'decision systems and suitability and availability' reflect the 'problem definition'. Finally, the fifth lens 'how the individual decision maker sees options to create opportunities' is akin to 'analysis, choice and implementation' (Farmar-Bowers, 2010; Öhlmér et al., 1998). However, Farmar-Bowers study surveyed women about their decision systems and Öhlmér et al., (1998) surveyed men.

Although the aforementioned technology adoption decision drivers can also be attributed to women's decision-making, very few have been. This is unsurprising as succession typically falls to men, making them the owners of the farms capital resources and therefore the owners of decision-making (Bock, 2006). However, as noted earlier Hay & Pearce's (2014) study found that men were averse to learning and using technology, therefore were not seen as technology adoption decision makers. However, this may be changing as observed during conversational interviews held at the 2015 Ag-Grow Emerald Field Day and Beef Week 2015 (*The Engagement of Women and Technology in Agriculture: Conversational Interview Transcripts*, 2015) where men were observed using smart phone technology.

Previously, Hay & Pearce's study observed that very few male producers had adopted mobile technology. During the field data collection in 2013, only one or two men were observed using smart phones. In 2015, while collecting data it was observed that more beef producing men are taking an interest in using technology, particularly the smart phone. The introduction of the smart phone has made it easier for men to learn how to use and rely on technology. Participants in the 2015 study also suggested that having a hand held computer that fits in your pocket and can be used in the paddock means that they can look things up when they need to (e.g., weather, water sensors, tractor parts, and cattle prices). Having a small hand held device also means that they can learn in private without fear of being ridiculed or starting arguments with family members, especially women, whether they be wives or daughters (*The Engagement of Women and Technology in Agriculture: Conversational*

Interview Transcripts, 2015). More in-depth research is required to quantify the change in male producer's opinions on technology use. Section 4.3.1 provides some insight into current use by men who answered the online survey.

The present research considers that technology uptake by producer women is driven by combination of the consumer decision-making process, decision systems theory and the technology adoption model of perceived usefulness and ease of use. However, it also considers the typology of the producer, their adaptive capacity, and the psychology of change discussed next in Section 4.1.2.6. These elements were used to produce the research instruments (survey, and interview questions) to establish how women and men use rural digital technology.

4.1.2.6 Adaptive Capacity

The Encyclopaedia of Public Health defines adaptive capacity as "*the ability of a system to adjust to changes, moderate potential damages, take advantage of opportunities or cope with adverse consequences*" (2008, p.9). In the context of this thesis, the system is the producer. Key determinants of adaptive capacity include the ability to learn, to store knowledge and experience and to approach solving problems in a creative, novel and flexible ways (Berry, Hogan, Ng, et al., 2011a).

Figure 4.10: Example of farmer creative problem solving, Google Images

It appears by the image in Figure 4.10 that producers do take a novel approach to solving problems. These problems extend beyond fixing fences, to other areas like drought, climate change, pasture management and animal health as well as family concerns. The ability to adapt to challenges requires the producer to be resilient. Berry et al., (2011a) identify resilience as a combination of "*personal psychological coping assets and social capital that provides people with the will and the mental toughness to make necessary changes in the face of severe and continuing adversity*" (p. 4041). The adaptive capacity survey returned five overarching concepts that are indicators for change: "*(1) that the producer must* *believe in what they are adapting too (in this case climate change), (2)desire for financial assistance and advice, (3) social connectedness, (4) information seeking and (5) adverse farm conditions"* (Berry, Hogan, Ng, et al., 2011a, p. 4046).

Social connectedness indicated that farmers with a greater social support, a sense of belonging and trust and reciprocity were healthier than those that did not have the said support. Social connectedness may also be a motivator for women to adopt technology. In Hay and Pearce's (2014) study, women responded that *"technology allowed them to keep in touch with friends and neighbors, 'especially when it's too busy to leave the property' (Kelly).* Others said that *"access to social media made them feel less isolated"* (p. 325). Importantly, social connectedness is also a theme sought in well-being (Berry & Welsh, 2010), which is discussed in *Chapter 6* Study Three Well-Being of producers and producer families.

4.1.2.7 Infrastructure

"Rural Australia's Internet Is So Bad It Needs Its Own Lobby Group" (Johnston, 2016)

"Farmers report worst internet of all" (Vidot, 2016)

While technology adoption models (Section 4.1.1), producer profiling (Section 4.1.2.1), decision theory (Section 4.1.2.5) and adaptive capacity (Section 4.1.2.6) all play a part in encouraging behaviour change towards technology adoption, connectivity still remains the biggest barrier to technology uptake, where there is a strong positive link between internet access and economic development (Australian Medical Association, 2017; Fan, 2002). Having access to the internet allows people to work in new ways, changing processes that stimulate productivity, yet *"despite its tremendous growth, internet access is not distributed equally within Australia, and internet use by country people has yet to reach the level of use in capital cities"* (Australian Medical Association, 2017).

While, 69% of Australians live in major cities, 20% live in inner regional areas and 9% live in outer regional areas, it is the 2.3% that live in remote or very remote areas (Baxter, Hayes, & Gray, 2011) and a proportion of the outer regional dwellers that is of interest to this study (Figure 4.11). The remote and very remote (rural) population of Australia represents approximately 498,000 people (Australian Bureau of Statistics, 2008), and is the home to many of Australia's agricultural industries.

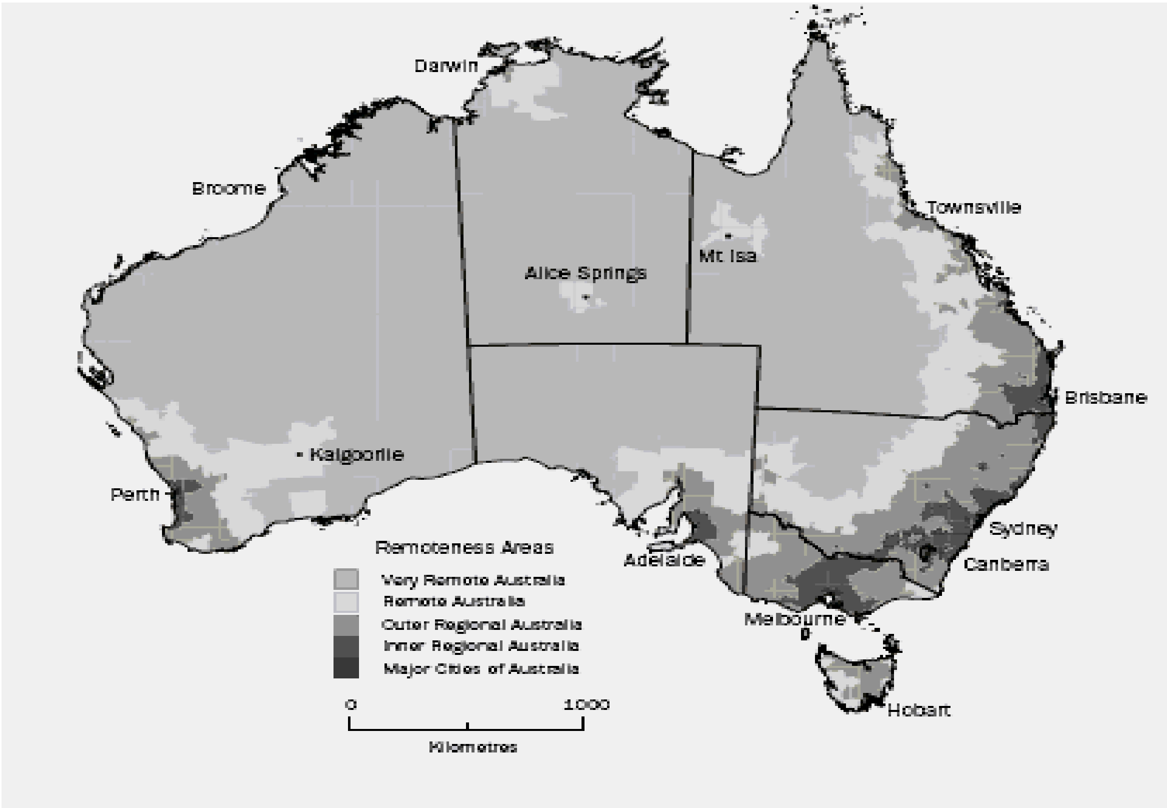


Figure 4.11: Remoteness areas and population distribution 30 June 2006 (Australian Bureau of Statistics, 2008)

In 2011, there were approximately 157,000 farmers in Australia (Australian Bureau of Statistics, 2012) and in 2016, the value of the Australian agricultural production was approximately $56 billion (Australian Bureau of Statistics, 2017). However, rural people cannot take full advantage of the information economy because of inequitable access and unaffordable pricing of internet connectivity (BIRRR, 2016b, 2017b; Fan, 2002). For example, remote rural enterprises dependent on nbn™ satellite for their internet service, do not have access to a business-grade internet solution and rural businesses are having to rely on single personal retail plans, which are very expensive, to support the complex needs of the business, family and workforce (Resing, 2017). Mobile broadband (3G, 4G, wireless internet and Next G) and ADSL services, while available in some rural areas are priced differently to nbn™ satellite and although the products are available, rural people are still disadvantaged by access, speed, cost and reliability of their internet connection (BIRRR, 2016b).

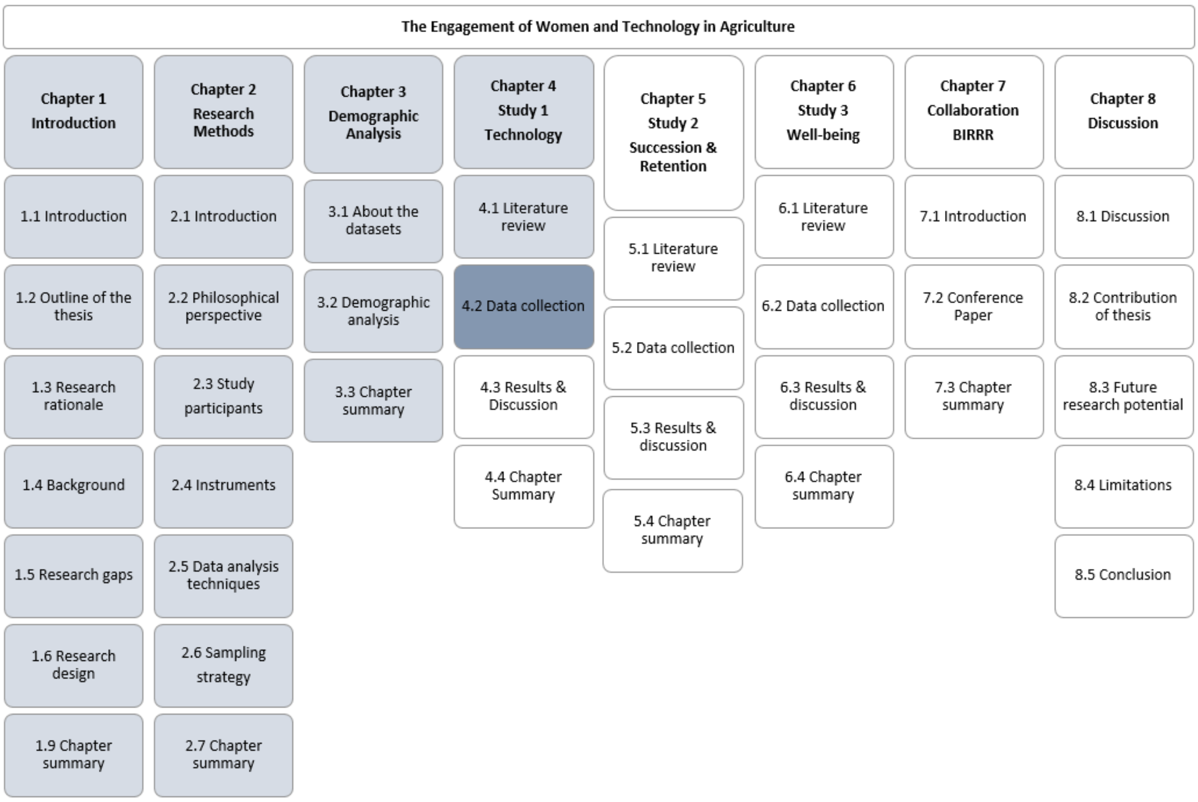
Telstra claims their mobile network reaches 99.3% of the Australian population (Telstra is Australia's leading telecommunications and technology company, offering a full range of communications services and competing in all telecommunications markets (Telstra, 2017a)), but the company does not offer information about how reliable their service is. An independent regional internet access survey shows that 88% of rural, regional and remote users current data limits did not meet their needs, 63% were shaped (where the internet is slowed to dial up speed) more than six times per year and 74% were experiencing download speeds under 5 megabits per second (Mbps). Seventy three percent did not have reliable mobile coverage and 72% had to purchase extra equipment (costing between $1,000 and $2,000) to get the service to work (BIRRR, 2016b). A similar survey was completed for nbn™ satellite broadband services in 2017, which reported 86% of users having connection issues, 20% had installation issues, 60% said the data limits did not meet their needs. Seventy two percent are not using off peak data (because it is only available between 1am and 7am and was seen as "inconvenient and therefore unusable" (BIRRR, 2017b, p. 61)).

The cost, speed and reliability factors act as barriers to the potential of the Internet of Things (IoT) (the connection via the internet of computing devices embedded in everyday objects that send and receive data) that are currently being spruiked as the next generation of high-tech agriculture (Telstra, 2017b). Farmers are limited by their access to connectivity to complete simple daily tasks such as receiving email, online banking, using cloud based software such as accounting or farm management software and for the delivery of education. Therefore using tools from the suite of IoT technology such as drones, water and soil sensors, remote cameras, remote health services (tele-health) or smart home technology (Telstra, 2017a, pp. 8-12) may seem unattainable to people in rural, regional and remote areas. The Better Internet for Rural Regional and Remote (BIRRR) Australia is a voluntary group of cattle producer women who are lobbying for better access to the internet in rural, regional, and remote areas. The group has completed two large surveys on Regional Access (N=716) and on Sky Muster nbn™ access (N=805). While connection to the internet is outside of the scope of this thesis, *Chapter 7* contains details of a collaboration between the researcher and BIRRR, which presents a case study of advocacy using social marketing to create change to policy and increase access to the internet for rural regional and remote farmers in Australia.

The next section (4.2) discusses data collection and analysis followed by the results and discussion section (4.3), which analyses the online survey and focus group outcomes. Section 4.4 follows and provides a summary and conclusions to *Chapter 4*.

4.2 Data collection

Thesis Structure Overview: Chapter 4 – Data Collection



As earlier noted, three studies were used to answer questions identified in the research gaps in Section 1.5. A single survey was used to ask questions about the topics in each of the three studies (*Study One: Technology (Chapter 4), Study Two: Succession and Workers (Chapter 5), and Study Three: Well-being (Chapter 6*). Selected questions drawn from the single survey were attributed to the topics in in each of the three studies. A summary of the sampling strategy and the participants is included in this section. For a more in depth view of the sampling strategy, see Section 2.6. For information about the data set see Section 3.1 and for the demographic analysis see Section 3.2. Each study (*Chapter 4, Chapter 5 and Chapter 6*) contains a summary of the focus group outcomes. Data in Section *Chapter 4* was analysed using descriptive analysis including frequencies and a Chi-squares test for independence with Yates' Correction for Continuity, which is designed to compensate for an overestimation of the chi-square value when using dichotomous data in 2 x 2 tables (Pallant, 2016). Section 0 Study One Results and Discussion, focusses on the motives, actions, and intentions in terms of technology use and management from data collected in 2013 and 2016. It describes how the respondents perceive and use technology on their property, and the role they play in the diffusion of technology into the beef industry and compares 2013 data to 2016 data.

4.2.1 Sample

Cluster sampling, which divided the population into groups to draw a simple random sample was used to distribute the survey via Qualtrics (2013) to the membership database from the Queensland Isolated Children's and Parents' Association (ICPA) (approximately 1200 members). The sample included 47 branches of the membership, which allowed for variations in the population, maximising representativeness (Everitt, Landau, Leese, & Stahl, 2010; Saunders et al., 2009). As discussed in Section 0, the ICPA is a membership group of parents and children who live and work on isolated properties, which are mostly cattle producing (ICPA, 2017). A snowball sample occurred through cross membership with other ICPA Branches within Australia who were alerted to the study via Facebook. The online survey was also distributed to the Better Internet for Rural Regional and Remote Australia (BIRRR) group, which had approximately 6000 members at the time of the survey (note that not all of the BIRRR members produce cattle, which is a key criterion for inclusion into the study). To give all potential and current cattle producers the opportunity to complete the survey a media release was distributed to all rural newspapers in Queensland Australia inviting participation.

4.2.2 Online survey

As previously noted, a single survey was used to ask questions about the topics in each of the three studies. Twenty-six questions about technology use were extracted from the single survey and analysed in Section 0. The online survey was open to women and men over the age of 18, to ensure participants fit the scope of the study, they were asked if they lived and / or worked on cattle producing properties (Saunders et al., 2009) where a positive response progressed them through the survey. Participants were advised that technology should be defined as including personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, National Livestock Identification Systems (NLIS), remote cameras, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology and other livestock management systems, see Figure 4.12 for examples of on farm technology.

Figure 4.12: Examples of on farm technology provided to participants

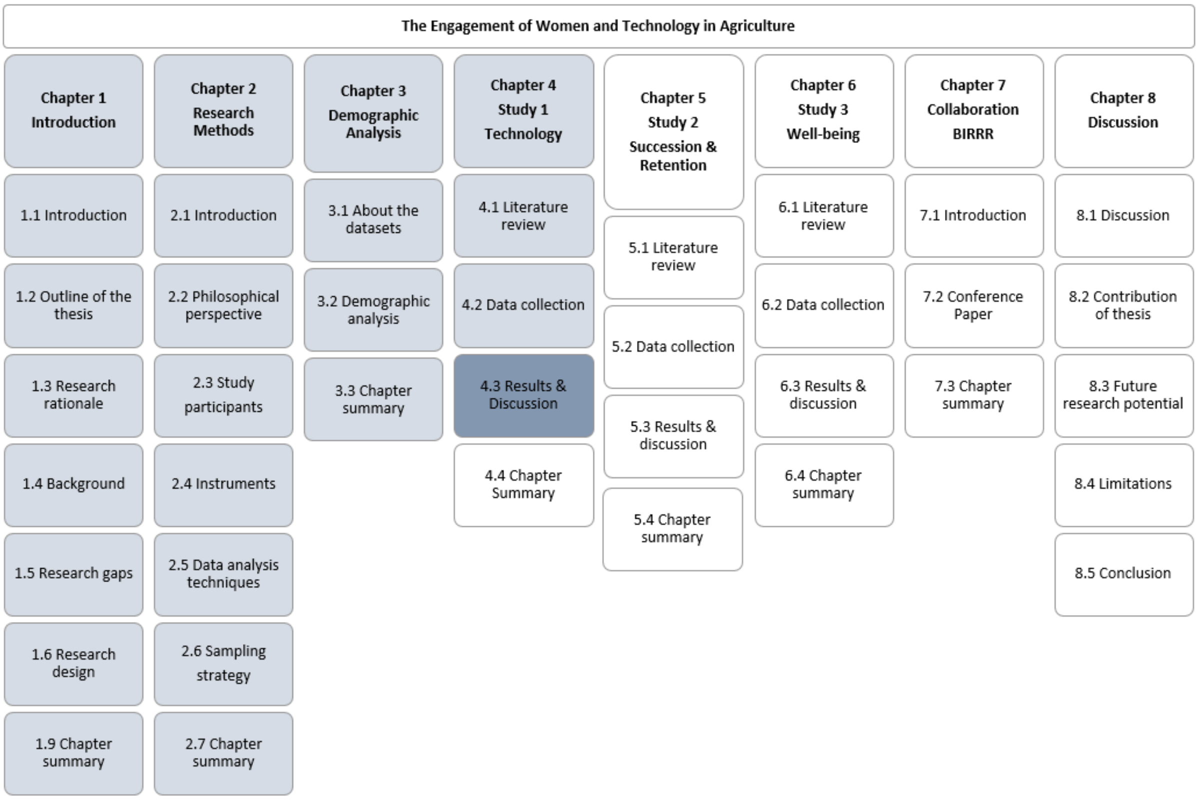
Data from 2016 in Section 4.3 has been compared to data collected in 2013 to measure differences in responses from participants between the years. Responses from the 2016 study, which were collected using a four point Likert scale of 1=strongly agree, 2= agree, 3=disagree and 4=strongly disagree, have been re-coded to dichotomies for *Chapter 4*. The responses 1=strongly agree, 2=agree, 3=disagree and 4= strongly disagree were re-coded to 1 & 2 = agree or strongly agree and 3 &4 = disagree or strongly disagree to enable comparison to the 2013 data, for which the analysis was directed by the now highly criticised C-OAR-SE Theory by Rossiter (2002). Three extra cases of completed data were found in the 2013 data set due to the survey being closed after the initial analysis in 2013. The data in 2013 was analysed using 135 responses and in this study, the same 2013 data contains 138 responses. While this does not present a problem for the comparison in this study, it does report the data slightly differently i.e. +/- 1-2% in the published 2014 paper by (Hay & Pearce, 2014). In summary, the following analysis was completed using dichotomous responses 1=agree; 2=disagree for 2013 (N=138) and 2016 (N=200) data to compare responses from participants between the years.

Focus Groups

Two focus groups were held at the Queensland Rural, Regional and Remote Women's Network annual conference. Data collected from the focus group supports the findings from the survey. Results are included within the online survey analysis where appropriate and are summarised in Section 4.3.4. The material from the focus groups was coded, categorised, and re-categorised to identify explanatory concepts. Theoretical sampling (Hammersley, 2006) evolves the previously identified concepts by comparing and combining information with data from conversational interviews and online surveys. These concepts are important to developing the theory surrounding technology adoption by rural women. The focus groups were open to both women and men who live on, work on, or own a cattle-producing property, which also use technology to produce their cattle. However, only women attended the focus groups.

4.3 Results and Discussion

Thesis Structure Overview: Chapter 4 – Results and Discussion



The same twenty questions about technology use were asked in both 2013 and 2016 with six extra questions added in 2016. Five of the six extra questions were asked only of the men and were about how men purchased, set up, and used their technology device and about the benefits of having a smart phone. The sixth extra question asks only women how technology usage has changed over time.

4.3.1 Demographics - Technology Survey

In 2013, 138 people responded to the survey, 2.1% were men and 97.8% were women. In 2016, 200 people responded to the survey, 8.5% were men and 91.5% were women. Despite the survey being open to both male and female respondents, men did not participate as highly as women did in either year. Over both years, 2.4% of male participants were aged 18-35 and 7.7% were aged over 36 years of age. The majority of women in 2013 were over 36 years old (82.6%) and in 2016, 91.5% of women were over 36 years of age. In 2013 and 2016, 27.3% of female participants were aged between 18 and 35.

Table 4.5: Frequency analysis of gender and age

	2013 (N=138)				2016 (N=200)			
	Percent							
	n	Male	n	Female	n	Male	n	Female
17 or younger	0	0.0	0	0.0	1	0.5	0	0.0
18 - 35	2	1.4	21	15.3	2	1.0	24	12.0
36+	1	0.7	114	82.6	14	7.0	159	79.5
Total	3	2.1	135	97.8	17	8.5	183	91.5

Eighty eight percent of responses were from the state of Queensland Australia, which was the focus of the study. The remaining 12% came from New South Wales (4%), South Australia (1%), Victoria (1%), Western Australia (2.5%), and the Northern Territory (1.0%). Ninety six percent of 2016 participants were cattle producers and 89.1% of 2013 participants produced cattle. In addition to cattle production, just over 40% of participants also produced sheep over both years and nearly 40% produced crops. Twelve percent of participants over both years produced something other than or additional to cattle see Table 4.6.

Table 4.6: Frequency analysis of the question "What do you mainly produce"

	2013 (N=138)	2016 (N=200)
	Percent	
Cattle	89.1	96.5
Sheep	21.7	20.0
Cropping	18.1	21.0
Other	4.3	8.0

2013: not stated

2016: Leaucaena, camels, goats, potatoes, farm tourism, sugar cane, agistment, carbon, hay, horticulture , timber, contract farming, earthmoving, and horses

The majority of respondents had large properties. Sixty-two percent had 20,000 acres or more, 14% have between 10,001 and 20,000 acres, 9.5% have between 5001 and 10,000 acres and 5.5% had between 1001 and 5000 acres. Eight and a half percent or respondents had less than 1000 acres.

The next section (4.3.2) presents the results and discussion section, which analyses the online survey and focus group outcomes, Section 4.3.4 summarises the data analysis. Section 4.4 then follows and provides a summary and conclusions to *Chapter 4.*

4.3.2 Online Survey

The first question asked participants to nominate 0=no or 1=yes to a list of technology products that respondents might be using on their property. A preliminary means analysis was performed to determine if there was any change in use of technology on the survey participant's property between 2013 and 2016. The initial analysis shows that there was increased use of all technology in 2016 except for the home computer (2016: M=0.74; SD=0.440) and walk over scales (2016: M=0.48; SD=0.501). There was a significant difference between 2013 and 2016 in the use of tablets (2016: M=0.70; SD=0.459), satellite imagery (2016: M=0.48; SD=0.501) and smart or mobile phones (2016: M=0.87; SD=0.343) in 2016 compared to 2013. To test if the change was significant a Chi-squares (with Yates' Continuity Correction) test was completed. Results follow in Table 4.7. There was also a difference between 2013 and 2016 for the 'Other' category, where respondents were asked to enter any other technology they were using. A thematic analysis was performed and the results show that respondents are using much the same equipment in 2016 as they were in 2013, with more using digital monitoring equipment in 2016 than they were in 2013. See the bottom of Table 4.7 for a breakdown of responses.

Table 4.7: Means analysis for 'Select the types of technology you use on your property?'

	2013			2016		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**
Smart/Mobile Phone	**0.73**	138	0.445	**0.87**	200	0.343
NLIS (with or without wand accessory)	**0.80**	138	0.404	**0.85**	200	0.363
Laptop	**0.82**	138	0.387	**0.83**	200	0.377
Home PC	**0.78**	138	0.419	**0.74**	200	0.440
Tablet	**0.48**	138	0.501	**0.70**	200	0.459
Satellite Imagery	**0.32**	138	0.468	**0.48**	200	0.501
Walk Over Scales	**0.54**	138	0.500	**0.48**	200	0.501
Remote Cameras	**0.15**	138	0.360	**0.19**	200	0.389
Satellite Phone	**0.18**	138	0.387	**0.17**	200	0.372
Remote Weather Stations	**0.07**	138	0.248	**0.11**	200	0.314
GPS Collars	**0.06**	138	0.235	**0.09**	200	0.287
Bore or Remote Water Trough Cameras	**0.07**	138	0.248	**0.09**	200	0.280
IVF Technology	**0.04**	138	0.205	**0.05**	200	0.208
*Drones				**0.05**	200	0.208
Feedlot Technology	**0.04**	138	0.205	**0.03**	200	0.171
Other -	**0.08**	138	0.272	**0.12**	200	0.320

2013: GPS auto steer(3), GPS cropping (1), GPS property management (1), GPS not collars (1), 2Way radio (1), water monitoring (1), embryo transfer (1)

2016: Water monitoring (11), GPS auto steer (4), pregnancy testing (2) and video conferencing, GoPro camera, DNA performance monitoring, and remote monitoring for liquid additives mixing (4)
Not asked in 2013

A Chi-squares test for independence (with Yates' Continuity Correction (YCC), see Section 4.2 for an explanation of YCC) indicated that the most significant change in technology equipment being used on-farm between 2013 and 2016 was the tablet computer $\chi^2\ (1, n = 338) = 15.949,\ p = .000, phi = .223$, see Table 4.8. There was also a significant difference in the use of the smart/mobile phone $\chi^2\ (1, n = 338) = 8.579,\ p = .003, phi = 0.167$. The final statistically significant piece of technology equipment in use was satellite imagery $\chi^2\ (1, n = 338) = 8.089,$ $p =..004, phi = .161$, which may be used in mapping the participant's properties. In a list of anecdotal comments collected from Question 24 'How has technology changed farming on their land' respondents list "mapping their land" as an important change in farming from technology, see Table 4.25 on pg. 145.

Table 4.8: Chi-squares test for the question 'Select the types of technology that you use'

Chi-Square Tests (N=338)

	Continuity Correction[b] Value	**df**	**Asymptotic Significance (2-sided)**	**Phi**	**Expected count**
Smart/Mobile Phone[a]	8.579	1	0.003	0.167	26.13
NLIS (with or without wand accessory) [a]	0.989	1	0.320	0.062	24.09
Laptop[a]	0.014	1	0.905	0.014	24.09
Home PC[a]	0.377	1	0.539	-0.400	33.89
Tablet[a]	15.949	1	0.000	0.223	53.89
Satellite Imagery[a]	8.089	1	0.004	0.161	57.16
Walk Over Scales[a]	1.075	1	0.300	-0.620	68.18
Remote Cameras[a]	0.410	1	0.522	0.043	23.68
Satellite Phone[a]	0.058	1	0.810	-0.210	23.68
Remote Weather Stations[a]	1.465	1	0.226	0.076	12.66
GPS Collars[a]	0.772	1	0.380	0.059	10.62
Bore or Remote Water Trough Cameras[a]	0.215	1	0.643	0.036	10.62
IVF Technology[a]	0.000	1	1.000	0.004	6.12
Drones[a]	cannot be computed because only 2016 data				
Feedlot Technology[c]	0.129	1	0.719	-0.036	4.9
Other[a]	0.768	1	0.381	0.58	13.88

a. 0 cells (0.0%) have expected count less than 5.

b. Computed only for a 2x2 table

c. 1 cells (25.0%) have expected count less than 5

Finally, the question was tested to see which of the males and females were using the technology on their property. A cross tabulation of ‘Gender’ and ‘Select the types of technology you use on your property’ reports that women are using most of the technology more in 2016 than they were in 2013. Exceptions include home PCs, laptop computers, satellite phones, and walk over scales, which have declined or only had a small amount of growth overall between 2013 and 2016. Men are using home computers (pc’s), tablets and smart phones more in 2016 than they were in 2013. Men are also using NLIS technology, remote cameras, and satellite imagery more than women are in 2016, but all other technology use has declined for men on their properties since 2013. See Table 4.9 for a breakdown of responses.

Table 4.9: Cross tabulation analysis for 'Select the types of technology you use on your property?'

	2013 (N=138)				2016 (N=200)			
	Percent							
	n	Male	n	Female	n	Male	n	Female
Home PC	3	2.2	104	75.4	12 ↑	6.0	136 ↓	68.0
Tablet	3	2.2	63	45.7	11 ↑	5.5	129 ↑	64.5
Laptop	3	2.2	110	79.7	15 ↑	7.5	151 ↓	75.5
Smart/Mobile Phone	3	2.2	98	71.0	13 ↑	6.5	160 ↑	80.0
Satellite Phone	3	2.2	22	15.9	3 ↓	1.5	30 ↓	15.0
NLIS (with/without Scanner)	3	2.2	107	77.5	13 ↑	6.5	156 ↑	78.0
Remote Cameras	3	2.2	18	13.0	5 ↑	2.5	32 ↑	16.0
Remote Weather Stations	3	2.2	6	4.3	4 ↓	2.0	18 ↑	9.0
Satellite Imagery	3	2.2	41	29.7	11 ↑	5.5	85 ↑	42.5
GPS Collar	5	3.6	8	5.8	3 ↓	1.5	15 ↑	7.5
Walk Over Scales	3	2.2	72	52.2	4 ↓	2.0	92 ↓	46.0
Bore or Remote Water Trough Cameras	3	2.2	6	4.3	3 ↓	1.5	15 ↑	7.5
IVF Technology	3	2.2	3	2.2	1 ↓	0.5	8 ↑	4.0
Feedlot Technology	3	2.2	3	2.2	1 ↓	0.5	5 ↑	2.5
*Drones	0	0.0	0	0.0	0 ⇨	0.0	9 ⇨	4.5
Other	3	2.2	8	5.8	2 ↓	1.0	21 ↑	10.5

Other included:

2013: GPS auto steer(3), GPS cropping (1), GPS property management (1), GPS not collars (1), 2Way radio (1), water monitoring (1), embryo transfer (1)

2016: Water monitoring (11), GPS auto steer (4), pregnancy testing (2) and video conferencing, GoPro camera, DNA performance monitoring, and remote monitoring for liquid additives mixing (4)

**Not asked in 2013*

Respondents were asked what size their property was to determine if the size of a property had an effect on the diffusion of rural technology. Kutter et al. (2011, p. 6), Daberkow and McBride (2003, p. 166) and Feder and Slade (1984, p. 316) cite that property size can act as either a barrier or an enabler of technology adoption. In terms of being a barrier, if the property is too small, then technology will not be adopted and vice versa, if the property is large then technology may be more readily adopted. However, while the results from this thesis show that a lack of connectivity is a larger barrier than property size as discussed in *Chapter 7*, it also confirms that the size of the property may have an effect on the type of technology adopted. The stage of diffusion of technology must also be considered but is not included in this analysis as it is outside of the scope of the study. Instead, it is assumed that most of the technologies listed in this study are past the innovation stage of

Rogers (2003) Revised Diffusion of Innovation model (Figure 4.7). They are either in the early market (innovators (2.5%), early adopters (13.5%)) or mainstream market (early majority (34%), late majority (34%) and laggards (16%)), with some technology sitting in the chasm where decisions are not only driven by proof, credibility and useability of product but also by cognitive and normative influences, see Section 0 for more discussion on these influencers.

The data in Table 4.10 shows that the diffusion of technologies included in this survey have increased in properties larger than 20,000 acres between 2013 and 2016. While the diffusion of satellite phone technology has increased in properties larger than 20,000 acres. The technology may not have been adopted by smaller properties because of their size but also because of their geographic location (i.e., where connectivity is more accessible and therefore the satellite phone is redundant), refer to Figure 2.1 which identifies cattle density of >5000 to be situated in more remote regions of Queensland. Participant's use of drones was not asked in 2013. However, 2016 data shows that drones are being used in properties larger than 10,000 acres and not at all on smaller properties. Properties between 10,001-20,000 acres are using remote cameras, satellite imagery, walk over scales, NLIS technology, and feedlot technology more in 2016 than in 2013.

In 2016, for properties between 5001 and 10,000 acres, participants reported using most technology less than in 2013, with the exception of remote cameras, which increased by 2.8%. Respondents on properties between 1001 and 5000 acres reported using technology such as remote water cameras, GPS Collars, Satellite imagery, and NLIS technology more in 2016 than in 2013. By contrast, respondents are using home computers, remote weather stations and cameras, and tablets and smart phones less in 2016 compared to 2013. This may be because respondents are using more than one type of technology to manage other technologies being used on the property. For example, the minor variation in 2013 (6.2%) and 2016 (6.0%) for use of the laptop may indicate that participants are using the laptop to manage remote weather stations and cameras, where before they may have used the desktop or the tablet computer to manage the technology on the property, see Table 4.10.

For properties less than 1000 acres, there was a decrease in use of technology in 2016 compared to 2013. Many of the technologies surveyed in this study were in the innovation/early adopter stage in 2013. Technology entered the early market via innovators and early adopters who had easy and affordable access to the innovations. Continued use may not have occurred as the technology may not have been suitable to the users' needs or it may be abandoned until it is further developed (Moore, 2002). An example may come from IVF technology where respondents may have trialled the innovation in 2013 without success (for example experiencing increased costs, sub-optimal embryonic and fetal survival or birth defects, Hansen, 2006, p. 121), and therefore may not have adopted the technology in 2016, see Table 4.10.

Table 4.10: Multiple response cross tabulation of the types of technology used on the property and the property size

2013 (N=138) - 2016 (N=200)

	Less than 1000 acres		**1001 - 5000 acres**		**5001 - 10,000 acres**		**10,001 - 20,000 acres**		**20,000 + acres**	
	2013	**2016**	**2013**	**2016**	**2013**	**2016**	**2013**	**2016**	**2013**	**2016**
Satellite Phone	8.0	3.0	0.0	0.0	8.0	0.0	8.0	0.0	76.0	97.0
*Drones		0.0		0.0		0.0		11.1		88.9
Bore or Remote Water Trough Cameras	22.2	0.0	0.0	5.9	11.1	0.0	11.1	17.6	55.6	76.5
GPS Collars	25.0	0.0	0.0	11.1	12.5	5.6	25.0	11.1	37.5	72.2
Satellite Imagery	4.5	4.2	0.0	3.1	13.6	6.3	13.6	16.7	68.2	69.8
IVF Technology	33.3	11.1	0.0	0.0	16.7	11.1	16.7	11.1	33.3	66.7
Walk Over Scales	4.0	3.1	2.7	5.2	22.7	8.3	13.3	16.7	57.3	66.7
Home PC	2.8	5.4	9.3	5.4	14.0	10.1	15.9	14.9	57.9	64.2
Remote Weather Stations	22.2	18.2	11.1	4.5	11.1	4.5	11.1	9.1	44.4	63.6
Laptop	5.3	7.8	6.2	6.0	13.3	9.6	15.0	13.9	60.2	62.7
Remote Cameras	9.5	5.4	14.3	2.7	9.5	16.2	19.0	13.5	47.6	62.2
NLIS (with or without wand accessory)	2.7	6.5	2.7	5.9	17.3	10.1	14.5	15.4	62.7	62.1
Tablet	6.1	7.9	9.1	7.9	10.6	10.7	22.7	12.9	51.5	60.7
Smart/Mobile Phone	5.0	9.8	8.9	5.8	15.8	9.8	15.8	14.5	54.5	60.1
Feedlot Technology	33.3	0.0	0.0	16.7	16.7	0.0	16.7	50.0	33.3	33.3

**Not asked in 2013*

The next question asks respondents ‘Who completes the technology based tasks on their property. Women’s use of technology has not changed since 2013. In both 2013 and 2016 activities such as banking, accounting, checking business and personal emails, social media and communicating with friends and neighbours are completed by more than 60% of women on their properties. Although it was not asked in 2013, 30% of women in 2016 are completing the task of running a business online. By contrast communicating with friends and neighbours is a task that is being completed by less women in 2016 (60.5%) than in 2013 (70.7%). Men are following the same pattern. While overall, men are using technology less than women are. Their usage habits have stayed much the same. More men are completing NLIS tasks, but they are checking business emails less and not searching the internet as much. By contrast, men are searching online news more, using social media more, and checking remote bore cameras more than they did in 2013. Similar to women, 8.5% of men are running an online business in 2016, see Table 4.11 for a complete breakdown of the data.

Table 4.11: Frequency analysis for 'Who completes the technology based tasks on your property?'

	2013 (N=138)				2016 (N=200)			
	Male		Female		Male		Female	
	n	Percent	n	Percent	n	Percent	n	Percent
Online Banking	14	9.8	119	**85.9**	23	11.3	170	**84.8**
GST / Accounting	17	12.0	119	**85.9**	23	11.5	155	**77.5**
Checks Business Email	38	27.2	101	**72.8**	47	23.5	137	**68.5**
Checks Personal Email	39	27.9	100	**72.1**	52	26.0	136	**68.0**
Social Media	17	12.0	87	**62.7**	40	19.8	124	**61.8**
Communicate with Friends and Neighbours	39	27.9	98	**70.7**	55	27.5	121	**60.5**
Searching the Internet	53	**38.4**	85	**61.6**	69	**34.5**	120	**60.0**
Online News	36	**26.1**	67	48.6	65	**32.3**	105	52.3
Online Weather	73	**52.5**	65	46.7	103	**51.5**	90	45.0
NLIS Management	52	**37.3**	68	48.9	62	**31.0**	89	44.5
*Running online business					17	8.5	60	30
Cattle Management Software (iHerd, Stockbook etc)	27	19.6	33	23.9	42	21.0	55	27.5
Manage the Business Web Page	5	3.6	22	15.9	4	1.8	43	21.3
Managing Feed Supplies	52	**37.7**	28	20.3	74	**37.0**	42	21.0
Satellite Technology	31	22.1	18	12.7	40	20.0	30	15.0
Remote Cameras (wild animal control, anti-theft)	16	11.2	7	4.7	30	14.8	14	6.8
Check Remote Bore Cameras	5	3.3	5	3.3	14	6.8	7	3.3
Remote Weather Stations	5	3.3	5	3.3	10	4.8	7	3.3
GPS Cropping Systems	21	14.9	5	3.3	37	18.5	5	2.5
Manage IVF Technology	4	2.9	3	2.2	8	3.8	5	2.3
GPS Collars	6	4.3	7	4.7	12	6.0	4	2.0
Other (see below)	6	4.3	4	2.9	6	3	14	7
Other included:								

2013: GPS property management, weed monitoring (3), Community groups (1), Two way radio (1), Satellite internet (1), Property mapping (1), Online study (1), Water monitoring (1)

2016: Water monitoring (3), Aviatio oz runways (1), Design advertising (1), Education (5), Drone (1), Monitoring share portfolio (1), Research (1), Volunteer (1), Medical (1)

**Not asked in 2013*

The next question asks the respondent to consider technology managed by the participant, from their homestead and how they came to be using it. In 2013, 40.6% of women answered that technology management naturally fell to them as the woman in the homestead, 30.1% said that they chose to manage the technology and 27.8% said they had no choice but to use technology. In 2016, women seemed less constrained to technology use, where 29.0% of respondents said that technology management naturally fell to them, 27.3% chose to manage technology, by contrast only 15.3% of women felt that they still had no choice but to manage technology compared to nearly 28% in 2013. This change in responsibility for technology management may indicate at shift towards men and others using technology. Nearly 28% of responses from women indicated that others were using technology too (see Table 4.12 for a summary of results). To clarify the responsibility for technology management, the 2016 survey participants were asked who else was responsible for using technology on their property. The responses are in Table 4.13.

Table 4.12: Frequency analysis of 'How did women choose to use technology'

	(N=138)		(N=200)	
		Percent		
	n	**2013**	**n**	**2016**
Technology management naturally fell to me as the woman in the homestead	54	40.6	53	29.0
*I used to be the only person responsible, but now other's use it too			51	27.9
I chose to manage the technology	41	30.1	50	27.3
I had no choice, it needed to be done, and it was up to me	37	27.8	28	15.3
We have technology products, but I do not use any of them	2	1.5	1	0.5
**Not asked in 2013*		100		100

Participants in the 2016 survey were asked to select 'Who uses it [technology] now that didn't use it before?' A frequency analysis showed that 22.5% of participants said that their husband or partner was using technology, when they did not use it before see Table 4.13.

Table 4.13: Frequency analysis of 'other people on farm using technology other than the women'

	2016 (N=200)
	Percent
Husband/Partner	22.5
Workers (male)	3.5
Workers (female)	3.5
Children (female)	7.0
Children (male)	11.0
	100
** This question was not asked in 2013 nor was it asked to male respondents*	

Table 4.13 also indicates that male children (11.0%) more than female children (7.0%) were also using technology, which agrees with findings from Kramer and Lehman (1990). Kramer and Lehman's (1990) study suggests that *"boys were three times more likely than girls to use a computer and participate in computer related activities"* (p. 158). Although according to Dixon et al., (2014b) this gap is diminishing and while women [and girls] have more access to computers, *"men [and boys] are more intense internet users than women"* (p. 994). Finally, the data in Table 4.13 shows that

3.5% of male workers and 3.5% of female workers were also using technology. Female workers use of technology is supported by interviewees of the Ag-Grow Field day, where one participant said, *"I feel as a woman it gives me an edge over the boys [male workers], they don't like it but it's important for me to use technology so I can keep working"* (Interview number 10).

While children were not considered in the literature review contained in this thesis, their use of technology as highlighted in the responses requires clarification. Further investigation of male and female children's use of technology considers the views of several researchers (Cooper, 2006; Correa, 2010; Huff & Cooper, 1987) as cited in Dixon et al., (2014b) who suggest that social development, social expectations, stereotypes and the gender divide of girls and boys is related to them being socialized to computers through video games and that the competitiveness is more attractive to boys than to girls. This does not seem to be the case in this study of participants from an agricultural background. A cross tabulation of children who use technology now rather than before and the number of children living at home was performed to indicate technology use by children as reported by participants see Table 4.14. Livingstone and Helsper (2007) in a national survey of UK 9-19 year olds, found that there was no gender difference in computer usage among children younger than 11, but the gender gap towards boys increased significantly by the time the children were older than 16. The results for rural children under 16 in Australia as answered by the respondents (Table 4.14), indicates that the opposite may be the case, i.e., more boys under 16 (8.8%) than girls under 16 (4.4%) were using technology now rather than before. However, for those over 16 the data in this study supports Livingstone and Helsper (2007) where, boys (11.5%) more than girls (7.1%) over 16 years of age were also using technology more than before (see Table 4.14). The increased technology use by girls over 16 may be related to a shift into domestic duties (including computer related duties) that often occurs for rural women (Alston & Wilkinson, 1998; Little, 2009), likewise boys over 16 tend to move into work outside of the homestead (Brandth, 1995) leaving them less time to partake in technology related activities and may account for their technology use.

Table 4.14: Cross tabulation of children using technology now rather than before and the number of children in the family

	2016 (N=200)					
	Female	**Male**	**Male Under 16**	**Female Under 16**	**Male Over 16**	**Female Over 16**
Child under 16 at home	6	11	11	6		
Child under 16 at boarding school	2	5	5	2		
Child over 16 at home	3	8			8	3
Child over 16 at boarding school	3	4			4	3
Child over 16 not living at home	7	9			9	7
Total (n)	**21 (11.5%)**	**37 (20.3%)**	**16 (8.8%)**	**8 (4.4%)**	**21 (11.5%)**	**13 (7.1%)**

Note: 49.2% of 2016 respondents answered this question (N=182)

Participants were asked how they found using technology. In 2013, 47.8% selected that they always find it easy to use technology, 45.9% selected the same in 2016. The respondents were asked if they found it harder in the beginning to use technology. Nearly half of the respondents in 2013 found it difficult to use the technology, compared to 19% in 2016 and less than 3% over both years *"simply can't get the hang of it"*.

Table 4.15: Frequency analysis of the question 'How easy do you find it to use the technology?'

	2013 (N=138)		2016 (N=200)	
	n	**Percent**	**n**	**Percent**
I find it really easy to use, I enjoy it	66	47.8	84	45.9
I struggled at the beginning, but now I find it easy to use	66	47.8	35	19.1
I simply can't get the hang of it	3	2.2	1	0.5

The next question asked whose decision is was to bring technology to the property. In 2013, the dominant answer to the question was that decisions were made either together (73.9%) or predominantly by the women (16.7%) of the property. In 2016, the spread of decision-making is almost equal between joint decisions (49.7%) and the woman (43.7%) making the decisions about bringing technology to the property. However, men appear to be making decisions about technology much more in 2016 (22.1%) than in 2013 (2.9%). External decision makers have also increased in 2016 (10.1%) compared to 2013 (5.1%). Approximately 2% are not using technology on their property in 2016 see Table 4.16. The respondents were asked to identify who the external decision maker was. The responses are located at the bottom of Table 4.16. The majority included the accountant (n=10) as the main decision maker, followed by government regulation (the introduction of GST and other regulations) (n=5) and product developers (n=3). Others include the school, the bank, the telephone company, the animal nutritionist, the consultant and the owner (n=7). Having an external decision maker may mean that the participant had no choice but to adopt the technology recommended by that decision maker, whether the technology suits its purpose or whether it is easy to use and useful or not.

Table 4.16: Responses to the question "Whose decision was it to bring technology onto the property?"

	(N=138)		**(N=200)**	
	2013		2016	
	n	Percent	n	Percent
Both male and female producer decided together	102	73.9	99	49.7
The female producer	23	16.7	87	43.7
The male producer	4	2.9	44	22.1
An external decision maker (e.g. the accountant, please specify)	7	5.1	20	10.1
We do not use technology on our property	3	2.2	4	2.0

2016: External decision makers specified include: Accountant (10), Government regulation /Introduction of GST (5), Paddock/cattle management program developer (3), PCAP provided a computer for school (2), Bank manager (1), Telephone company (1), Animal nutritionist (1), Consultant (1), Owner (1)

A cross tabulation between “Are you male or female” and “Do you agree that adopting new technology such as an accounting program has made adopting other farming technology easier” revealed that 65% of women agreed with the statement in the 2016 survey, implying that they thought having technology was a gateway to further adoption. Although men were asked this question, they chose not to respond (this question was not asked in 2013).

The respondents were asked to answer 1=Strongly Agree or 2=Strongly Disagree to the question “How has adopting new technology affected you?” A cross tabulation between “How technology has affected you?” and “Are you male or female?” showed that only females answered the question. A preliminary means analysis was performed to determine if there was any change in how technology was affecting the survey participant’s between 2013 and 2016. In 2013, women strongly agreed that gaining more skills from technology was the most important aspect of having technology (2013: M=1.01: SD.086). However, in 2016, women who responded to the survey strongly agreed that having control over the accounting and or cattle programs was more important (2016: M=1.34; SD=.476). Gaining new skills in 2016 was strongly agreed as the next important aspect (2016: M=1.41; SD=.493), followed by technology giving respondents a feeling of achievement (2016: M=1.46; SD=.500). The respondents strongly agreed that learning how to use technology is empowering and that it improved their self-worth (2016: M=1.48; SD=.501). The mean score for ‘I would rather someone else did it’ indicates a dis-agreeance with the statement, indicating that they would still like to be responsible for technology use on their property.

Table 4.17: Means analysis of ‘How technology has affected the respondents’

	2013			2016		
	Mean	N	SD	Mean	N	SD
I like to have control over the accounting and/or cattle management programs	1.16	135	0.371	1.34	183	0.476
I have gained new skills	1.01	135	0.086	1.41	183	0.493
Managing the technology gives me a feeling of achievement	1.16	135	0.371	1.46	183	0.500
Learning how to use technology is empowering and improves my self-worth	1.19	135	0.396	1.48	183	0.501
I would rather someone else did it	1.81	135	0.390	1.56	183	0.497

A chi-square test for independence (with Yates' Continuity Correction (YCC), for more on YCC see Section 4.2) was completed to test if 2016 respondents more than the 2013 respondents:

- like to have more control over accounting or management programs;
- if using technology gave them a feeling of achievement;
- if it was empowering or improved self-worth or
- if they gained new skills

The chi-square test for independence indicated a significant difference in how respondents were affected for each statement between 2013 and 2016. The largest effect (Cohen, 1988) being in gaining new skills $\chi^2\ (1, n = 338) =\ 66.98,\ p = 0.00, phi = 0.47$, indicating a significant association between year of study and gaining new skills, i.e., women are gaining more skills from technology over time. This is supported by 'managing the technology gives me a feeling of achievement $\chi^2\ (1, n = 338) =\ 30.299,\ p = 0.00, phi = .32$, which has a greater effect than the other statements, and indicates that managing technology increases the feeling of achievement over time.

Table 4.18: Chi-square test for independence on statements related to technologies effect on the respondent

Chi-Square Tests (N=338)

	Continuity Correction[b] Value	df	Asymptotic Significance (2-sided)	Phi	Expected count
I like to have control over the accounting and/or cattle management programs	12.129	1	0	0.202	36.08
Managing the technology gives me a feeling of achievement	30.299	1	0.000	0.315	45.42
Learning how to use technology is empowering and improves my self-worth	25.906	1	0.000	0.292	47.97
I would rather someone else did it	21.178	1	0.000	-0.265	44.58
I have gained new skills	66.982	1	0.000	0.466	32.26

a. 0 cells (0.0%) have expected count less than 5.
b. Computed only for a 2x2 table

The next question asked 'How has having technology changed your lifestyle?' A frequency analysis shows that respondents agreed overall that technology had positively changed many aspects of their lifestyle except for spending time with the family, see Table 4.19. Sixty three percent of respondents disagreed with the statement "It [technology] allows me to spend more time with family" indicating that more than half of the respondents did not spend more time with their family because of having access to technology. Likewise technology does not allow men to spend more time with their family as indicated by 71.6% of respondents disagreeing with the statement. The high disagreement with two statements, indicate little has changed since 2013, about technology allowing men and women to spend more time with their families in both years.

Respondents in both years disagreed with the statement "I find technology a big waste of time, I would rather not have it" indicating that most respondents did not find technology to be a waste of time. However, there were more respondents who agreed with the statement in 2016 (14.2%) than in 2013 (6.7%) indicating that more respondents in 2016 thought technology was more of a waste of time than respondents in 2013 did. This is supported by comments from focus groups held at the 2017 QRRRWN Annual Conference (see Section 4.3.3 for details) where participants agreed that *"technology can be mind-numbing, repetitive and lead to a loss of productivity"*(Participants of Queensland Rural Regional and Remote Women's Network Annual Conference, 2017). A new variable for 2016 asked if having technology had allowed the participants to start an online business, nearly one-third (26.8%) agreed that they had started an online business.

Table 4.19: Frequency analysis of the question 'How has having technology changed your lifestyle'

	2013 (N=138)				2016 (N=200)			
	Percent							
	n	Agree	n	Disagree	n	Agree	n	Disagree
Access to the internet saves time because I no longer have to travel to town to pay bills	107	**79.3**	28	20.7	162	**88.5**	21	11.5
It has improved my communication with friends and neighbours	103	**76.3**	32	23.7	158	**79.0**	86	13.7
Managing the technology keeps me involved with production practices (e.g. NLIS management, Stockbook, IVF programs) on the property	99	**73.3**	36	26.7	143	**78.1**	40	21.9
Technology has removed my feeling of isolation	83	**60.1**	52	38.5	138	**75.4**	45	24.6
It has increased my workload because I work outside on the property during the day and inside at other times	71	**52.6**	64	47.4	105	**57.4**	78	42.6
Technology takes me away from outside duties that I would rather be doing	64	**47.4**	71	52.6	98	**53.6**	85	46.4
It allows me to spend more time with family	37	27.4	98	**72.6**	66	36.1	117	**63.9**
It allows the male in the partnership to spend more time with the family	27	20.0	108	**80.0**	52	28.4	131	**71.6**
I find technology a big waste of time, I would rather not have it	9	6.7	126	**93.3**	26	14.2	157	**85.8**
*It has allowed me to start up an online business					49	24.5	134	73.2

**Not asked in 2013*

A Chi-squares test for independence (with Yates' Continuity Correction, see Section 4.2) indicated that the most significant change between 2013 and 2016 was that technology had removed the participants feeling of isolation $\chi^2\ (1, n = 318) = \ 6.47,\ p = .011, phi = -.15$. There was also a significant difference for the statement "It [technology] has improved my communication with friends and neighbours" $\chi^2\ (1, n = 318) = \ 4.67,\ p = .031, phi = -.13$. Also statistically significant was the statement "Access to the internet saves time because I no longer have to drive to town to pay bills" $\chi^2\ (1, n = 318) = \ 4.43,\ p = .035, phi = -.13$.

The final statement “I find technology a big waste of time, I would rather not have it” is also statistically different $\chi^2\ (1, n = 318) = 3.77,\ p = .052, phi = -.12$ where more people agreed with the statement in 2016 than in 2013.

Table 4.20: Chi-squares test for the question 'How has having technology changed your lifestyle

Chi-Square Tests (N=318)

	Continuity Correction[b] Value	df	Asymptotic Significance (2-sided)	Phi	Expected count
It has improved my communication with friends and neighbours	**4.665**	**1**	**.031**	**-.129**	**24.2**
Access to the internet saves time because I no longer have to drive to town to pay bills	**4.431**	**1**	**.035**	**-.127**	**20.80**
Technology has removed my feeling of isolation	**6.468**	**1**	**.011**	**-.150**	**41.18**
Technology allows me to spend more time with family	2.279	1	.131	-.091	43.73
Technology allows the male to spend more time with the family	2.513	1	.113	-.096	33.54
I find technology a big waste of time, I would rather not have it	**3.773**	**1**	**.052**	**-.119**	**14.86**
It has increased my workload because I work outside on the property during the day and inside at other times	.539	1	.463	-.048	60.28
Managing the technology keeps me involved with production practices (e.g. NLIS management, Stockbook, IVF programs) on the property	.741	1	.389	-.056	32.26
Technology takes me away from outside duties that I would rather be doing	.941	1	.332	-.061	66.23

a. 0 cells (0.0%) have expected count less than 5.
b. Computed only for a 2x2 table

Respondents were asked ‘In what way do you think that technology is useful on your property?’ See Table 4.21 for results. Participants responded that it has streamlined farming systems, with 81.3% agreeing in 2016 and 67.4% agreeing in 2013. In 2016, nearly 80% selected ‘It has helped increase productivity’ as their response. Both statements are supported by authors such as Lawrence et al. (2011), Leigo et al. (2012), Tey and Brindal (2012), Aubert et al. (2012) and (Block, 2012) in discussions about the relationship between technology and increased productivity. Seventy nine percent (2016) said that having internet access on the property means that workers (including adult children) were happier on the property, which means that they will likely stay longer. A factor that is very important to Australian farming (Falkiner & Steen, 2016). Happiness and technologies effect on succession and workers, and well-being are discussed more in *Chapter 5* and *Chapter 6*. More women are working outside during the day in 2016 (66.1%) than were in 2013 (62.5%). When asked if working outside during the day and inside at other times suited the respondents (in a separate question), 78.7% of 2013 respondents agreed that working outside during the day and inside at night suited them most of the time, and 21.3% said it never suited them. For 2016 respondents, 73.2% agreed that they were always ok with working outside during the day and inside at other times, slightly less than in 2013, and 26.8% said that they were ok with it most of the time. Sixty-five percent of respondents indicated that technology is useful because it saves time, allowing both men and women to do other jobs on the property. This represents a 19.5% increase in responses since 2013. Nearly 60% of 2016 respondents agree that they are able to run the farm more efficiently because of technology. Both statements support claims that using technology can be more efficient (Aubert et al., 2012; Tey & Brindal, 2012).

More respondents agreed in 2016 (38.7%) than in 2013 (19.6%) that technology takes the woman away from outside duties resulting in having to employ someone else to manage the workload, implying that as technology diffuses into the agricultural industry, the way women are working on the land may be changing. However, overall the majority of respondents disagree with the statement indicating that technology was not taking women away from outside duties and therefore not employing extra staff.

Table 4.21: Frequency analysis of the question 'In what way do you think that technology is useful on your property?'

	2013 (N=138)				2016 (N=200)			
	Percent							
	n	Agree	n	Disagree	n	Agree	n	Disagree
It has streamlined farming systems (e.g., walk over weighing, NLIS tracking)	93	**67.4**	45	32.6	161	**81.3**	37	18.7
It has helped to increase productivity	85	**61.6**	53	38.4	158	**79.8**	40	20.2
*Having access to the internet means that workers (including adult children) are happier on the property and will most likely stay longer					158	**79.4**	41	41.2
Allows me to work outside for the day and inside at other times	85	**62.5**	51	37.5	121	**66.1**	62	33.9
Saves time, allowing male and female property managers/owners to do other jobs	63	**45.7**	75	54.3	129	**65.2**	69	34.8
Because of technology, we are able to run the farm more efficiently using only family members or less workers	61	**44.5**	76	55.5	117	**58.8**	82	41.2
Technology takes the woman away from outside duties, which means we need to employ someone else	27	**19.6**	111	80.4	77	**38.7**	122	61.3

** Not asked in 2013*

In the 2016 survey, respondents were asked to write comments on how they thought technology had changed farming on their land. Eighty-three responses were recorded and coded into themes that are presented in the following tables. Thirteen comments were not used as they stated that they thought they had already answered the question previously or did not have enough information in the comment to make it relevant to a theme, for example *"having the internet is good"*. To check if both men and women responded to the question, a cross tabulation of 'male and female' responses and the question 'How has technology changed farming on your land" was completed. The results show that only female participants commented on the question. The anecdotal comments provided for the question 'How has technology changed farming on your land' are presented in Table 4.22 to Table 4.33.

One comment in particular supported women being the managers of technology. While technology was helping management practices on the property, it was also frustrating in terms of learning pressures and the cost of upgrading equipment or that the upgrades were not compatible other technology that they already owned.

Table 4.22: Anecdotal comment from one participant - Frustration

"GPS for spraying saves time, fuel, [and] chemical therefore money. Can research issues, market info, agri politics. Adds to my frustration as husband just not interested in learning so all up to me and does not allow time for Tru-test extra info entry - just wants weights, NLIS pain in butt with non-reading tags and poor transfers at sale yards. I Need to be better at adopting & upgrading tech but expensive and when upgrade find for example new laptop not compatible with Tru-test cord (pins), update in software not compatible etc. I am not a throw away person so my laptop is 4 years old, Desktop about 7,Ttru test 6 years old, mobile only one since CDMA ended - need to upgrade to new laptop but I know Tru test will not be able to connect as it is not blue tooth."

Three other comments were themed around the cost of upgrading equipment. While the comments are positive in that technology assists with management practices, the respondents are critically aware of the cost of keeping up with technology purchases and upgrades, which is a long known barrier to technology adoption (Daberkow & McBride, 2003; Feder & Umali, 1993; Fountas et al., 2006; Kutter et al., 2011).

Table 4.23: Anecdotal comments from participants - Expensive to upgrade equipment

"Basically information is quicker to and fro i.e. fax, scan, emailing. Seems to take just as long to do accounts although paying them directly is not as expensive. Paperwork is still massive and we seem to have so much old useless technology bits and pieces of equipment that are all obsolete and taking up a massive amount of room in the office."
"It hasn't really changed the way we operate the general business. But it has made things easier with book keeping. Less paper as such. it has made things a bit more expensive though, through the use of technology"
"The use of satellite imagery has allowed better maps for planning etc. Accounting programs has made book work more efficient. If we were to afford remote monitoring of waters it would be helpful whilst away from the property for peace of mind and during the wet when we can't access some waters due to a creek, but initial cost and maintenance is holding us back. Again walk over scales would also change managing our cattle but cost is a problem."

The next four comments also praised improved management practices, but negatively commented on the impact of extra jobs and reduced security (in terms of stock theft) caused by technology.

Table 4.24: Anecdotal comments from participants - Negative effects of technology

"When the internet allows, accounting programs have become a lot more streamlined, property mapping has allowed us to plan infrastructure improvements quickly and to cost them out more accurately and the same mapping has given us the capability to negotiate more effectively with mining companies that wish to come onto our land. Cattle management programs are still frustrating as many rely on the retention of NLIS tags, which are still not being retained over time. The internet has allowed us to get the best price for parts etc. and broadened our ability to source these items from across the globe. It is also a great cause for frustration as it is often hampered by slow speeds, drop outs and technical glitches that often require a lot of time, research and effort to rectify as we don't have access to a tech expert who can just drop round to correct it for us!"

"GPS systems are used for the cropping part of the business, NLIS tags have created another job to be completed."

"Has allowed for very fast bill paying and book keeping. Can monitor fires and weather instantly. Monitor sales of your cattle by the neighbours!!!"

"NLIS is just another job that needs doing and we have found it to have no benefits. We have still had copious amounts of livestock go missing as the devices are easily removed by anyone should they choose to. Just another job and another cost that we as the producer must factor in. Walk over scales are helpful but a good cattleman will be able to judge the weight by eye and be only marginally wrong. The stock records are a great assistance but they are time consuming and tedious. We always managed to run business before computer without a stock system but I do admit that it has simplified the whole process."

Twelve comments were presented that implied better management practices were made available through using technology on the participant's property. For the majority of respondents, technology has assisted with mapping their property. It has helped to meet production requirements by analysing data and using apps to assist with tasks. Technology is used for accounting and financial management practices and for communication with peers and suppliers. For one participant, technology (water sensors) is allowing them to manage distant properties from the homestead as well as provide access to schooling via distance education. Another participant commented that having technology makes it harder to recruit staff who are not always tech-savvy or who do not want to use technology, see Table 4.25.

Table 4.25: Anecdotal comments from participants - Better management practices

"Satellite maps help with vegetation management, fencing, and water infrastructure".
"Yes, with mapping and iHerd type technology especially - much better for planning ahead and utilising our assets".
"Mapping is a useful tool"
"It has given us the ability to monitor results of grazing practices, track changes, view water points without driving saves time".
"More effective ability to meet market specs Improved management of cash flow & budgeting"
"Technology has made things like book keeping, cattle numbers, banking easier for our business. As we do not have mobile phone service out here we miss out on a lot of the up to date technology benefits".
"Use of Apps like iHerd and Map my land, use of Xero cloud accounting software, cattle management, ability to analyse carcase feedback data from meatworks, for us further potential is in the use of drones and telemetry water remote indicators."
"It has streamlined accounting practices and communication with accountants with up to date data. We are more in touch with peers and the outside world. We can track our business better. It allows us to source instant information in relation to questions and parts. If we had decent internet we could do more with it."
"Using technology we can map our paddock sizes and areas, to use in our grazing management practices. However, overall, I think the property would run just as well without it because my husband carries all that sort of information in his head! Doing the accounting/bookwork on the pc means we can see at our fingertips what we are spending on certain items (fodder/freight etc.) which is useful."
"It has improved record keeping and financial management (e.g. tax)."
"We have several properties some distance away from us and being able to "run the waters" via remote cameras has generally saved us managers/caretakers wages. We do school via Distance Education, and access to the internet for their lessons has of course made their lessons easier as the teacher can directly teach the lesson, and can see the children's efforts for that lesson straight away(when it works). This saves time in the schoolroom, allowing me to go out afterwards to check what I have to while my husband is away on the other properties. We don't get mobile reception here."
"Has made it more difficult to obtain staff. Not all farm workers are literate or want to use technology"

There were twelve other comments that were related to the theme 'access to information'. Respondents commented that access to information such as weather, markets and mapping, can improve "predictions to improve planning". Respondents also commented that having technology allowed them to research information and that it made communication quicker and easier.

Table 4.26: Anecdotal comments from participants - Access to information

"Better access to weather reports/predictions to improve planning."

"Better access to "instant" info like weather, markets, news, and info. Better herd management."

"Can access decision making tools immediately in the paddock. Can record data on site, can put fence/water lines on exactly the right spot"

"Enabled access to on-line markets like AuctionsPlus. Improved knowledge and connectedness in livestock marketing - KLR Mastermind Group Easy to upload stock movements via NLIS website Improved financial management using a livestock based accounting package"

"Access to information via the Internet, book keeping, and record of NLIS has made operating the business much easier. Communication is quicker and easier with email and texting."

"The property we are on is just one link in a long chain. We do not have a lot of the technology you ask about. The main link in our chain would be able to say, overall weather technology has changed things for the absolute better."

"Technology has assisted us in being able to do research about different things associated with the property."

"To some extent with the accounting programme and use of google maps etc. Also being able to do on line research is good."

"The most useful technology is being able to track the rain. Walk over scales is useful with the cattle management. Internet is good for cattle market reports and bill paying."

"The use of various mapping programs is an asset, and the weather is interesting but so general and can be sole destroying when desperate for rain."

"Weather apps have certainly allowed us to make more informed decisions. We have increased efficiency by adopting GPS technology. Online banking has made it easier to pay bills and wages etc."

"Weather forecasting technology has especially helped us with cattle and farming decisions. We realise the limitations of forecasting but it is a very helpful tool even knowing it is not infallible. Being able to do all our accounting on computer also makes it more efficient."

Respondents are disappointed with connectivity and commented that technology would be more useful if they had better connection, more data, and more reliable internet. Technology connection is discussed further in *Chapter 7* of this thesis. Participants commented that while technology is useful for management practices, it is hard to keep up with assumptions from "departments" that they have the connectivity to complete tasks such as compliance requirements. One participant commented that technology is making people less social and another commented again that technology is affecting the security of stock as well as the traceability being gone when ear tags are removed. Once an ear tag is removed identification of ownership becomes difficult and there have been instances in Australia where whole herds of cattle have been stolen (Kellner, 2016).

Table 4.27: Anecdotal comments from participants - Connectivity

"It has improved book keeping, management both farm and financial but we are held back enormously by poor quality and expensive internet services. I cannot believe this survey hasn't asked about quality of service. It is a massive headache. I find time and time again give departments and others just assume we can do more and more online just because they don't realise how difficult rural service can be. Our business has gone off line from many compliance retirements e.g. tax office, simply because of the poor quality of our internet service. It costs us time and money to do things the old fashioned way"

"Not much as we have no mobile phone signal so cannot use a lot of the items mentioned above - we use lap tops and accounting programme and some others but the capability is compromised by slow internet. It is impossible to use an iPad - just too slow."

"Technology provides us with an ability to plan our property developments, conduct NLIS transfers, plot flight paths as well as stay up to date with financial transactions and accounting systems. The speed and capacity still inhibits the range of technology that we could use to further enhance our business."

"There is a difference between access and reliable access at appropriate speed. None of these are useful without the correct access. We are trying to use them but have so many issues we often end up doing it both ways."

"Our internet is patchy at best and not an incentive to any outsiders. Personally though, I can see a negative impact of the internet and its hold on people as they are becoming increasingly antisocial."

"Technology hasn't done much for us. And it won't until we see decent internet out here and mobile coverage. With NLIS, that has enable more people to steal stock. Very easy to remove and replace the NLIS tag, so the life time traceability is gone".

Similar to management practices, respondents commented that technology was good for keeping records. Tasks include sharing records with agents, banks, and clients and keeping information for example grazing charts, animal registration, health programs, and National Vendor Declarations, which are used by respondents to help with planning, see Table 4.28.

Table 4.28: Anecdotal comments from participants - Record Keeping

"Allows for easier reflection through records of profitability, comparisons etc. Always contactable & connected - can have both good & bad point's
"Enable more accurate and detailed record keeping, easier sharing of information with agents, accountants, bank and clients."
"Grazing charts, running multiple budget scenarios have increased efficiency"
"Improved performance analysis of most of the herd - Improved record keeping e.g. For running AI programmes, animal registration, health programmes plus some others. Conversely, if the technology is not working for any reason, it can hold up the work programme, plus give the data operator longer 'catch- up' time."
"Record keeping of livestock production and grazing management streamlined."
"We use a forage budgeting app that is backed up offsite to manage grass feed. We download most forms and/or email those including National Vendor Declarations (which can be an issue when the internet is out). We have a cattle management program and a mapping program with satellite imagery. We use the internet most of the time to find staff via Facebook and Gumtree. We weigh our cattle regularly with weigh scales and read their tags with a NLIS panel reader. We receive meatworks grids via email as well as our kill feedback sheets. We subscribe to many business e-newsletters. We use various apps for climate data; scanning documents; reminders; notes; contacts and calendars. We use the internet to source parts and equipment as well for weather reports. We have an accounting program and also Banklink with our accountant."

There were four comments related to decision making. Respondents commented that they have access to useful data and information that can be used for critical and better-informed decisions.

Table 4.29: Anecdotal comments from participants - Decision making

"Has allowed us to make better decision with regards to stock management and obtain very useful data on our animals for the purposes of breeding and selling cattle".
"Has helped to get an up-to-date information for making critical decisions in our company"
"Helps keep us better connected in the industry which helps us make better informed decisions. Gives many different reporting tools to have a better grasp on your business."
"Internet allows us to compare prices when we buy products e.g. ear tags...and to buy online. Our accounting program is a must. We are not up with remote cameras yet."
"We have GPS guidance for tractors. Being able to send photos for identification of problems saves time and waste. Technical data / data sheets are just a click away. Up dated information is essential and can be carried around. Lots of machinery has remote tracking of errors or breakdowns and resetting of programs. Access to relevant and international data allows for better decision making, choice of machinery or inputs and new technologies."

Some participants found that having technology on the property had changed their roles in the farming family and others found technology to be intrusive. Two participants commented that they spend a lot more time *"inside instead of outside, so less work gets done outside"*. Another commented that her *"working day is longer"* and that technology has *"added new stress into the system (e.g. property operators and staff need to far more skills and attention to detail and willingness to embrace new technology - to be constantly learning)."* While another commented that the expectation of others for the participant to perform is draining. A third comment highlights the invasion of privacy that technology allows.

Table 4.30: Anecdotal comments from participants - Changing roles, intrusive

"I know spend most of my time in an office instead of outside"
"More time seems to be spent in the "office" so less work done outside"
"Technology has meant we can do far more analysis and tracking and allowed faster turnaround of information, parts ordering, marketing scheduling etc..... It has also certainly made the working day FAR LONGER and in many ways added new stress into the system (e.g. property operators and staff need to far more skills and attention to detail and willingness to embrace new technology - to be constantly learning. In our operation we now have more people doing inside work - there is MORE work in general generated with running a business, not necessarily due to technology but with rules and regulations)"
"Yes, it has helped big time, but it is left up to the female to making that big transition and when it fails, you take the blame. Our connectivity is shocking and this adds to my responsibility for the outcome".
"It allows over educated , under qualified, university graduates (no offence to yourself) to think they know better how to care for the land and raise livestock / crops than do 4th and 5th generation folk who have managed to keep their home land in pristine condition and produce prime produce. We take pride in our management and do not appreciate the invasion of privacy that the technology allows. (e.g. satellite surveillance, drones etc.) ."
"Life is more frustrating. Speed, expectations of others, and poor sport makes their use very draining"
"A lot of things we need to use technology for has been forced upon us. E.g. online banking because local bank closed, paying bills because mail means bills arrive too late to pay by cheque on next mail, cattle prices are emailed rather than phoned through, research re parts can be done online rather than via phone/mail. Information sent via email can be kept/printed and read at a convenient time."

Four participants commented that technology on their farm has improved communication with industry and markets, their peers and their customers and that technology make them feel less isolated.

Table 4.31: Anecdotal comments from participants - Communication

"Technology is helping farming communities stay up to date with what is going on in their industry and markets."
"Think it tends to make people discuss different ways of doing things and compare new technologies."
"Ability to connect with our customers directly via social media"
"Not so isolated; safer; better education for the kids; better management practices and up-to-date."

The next set of responses focused on time and money saving. Participants commented that the most time was saved in not having to travel to water points, and that *"technology has made the world a smaller place"* implying that they have a bigger reach for information. In terms of cost, participant's comments highlight a reduction in fees for accountants, reduced cost for inputs such as fuel, seeds and chemicals. Technology has made work on the property more efficient so that less staff are required, saving money in wages.

Table 4.32: Anecdotal comments from participants - Time and money saving

"Remote water checking has freed up people to do other jobs."
"Technology has made the world a smaller place & has enabled us to save time & increased accuracy in many aspects of running our business."
"Technology has meant more time on our hands to get jobs done. For example, we are no longer traveling frequently to other properties to check troughs as we have a monitoring site."
"Definitely made it a lot more cost efficient"
"Technology has helped to get primary production more economically viable by reducing accountant fees; cost of fuel/seed/chemicals/ for farming with GPS; traceability for animals etc."
"Technology makes you able to handle the property with fewer workers and therefore more efficiently"

The final comment is a personal reflection about past experience and the loss of information that technology will cause for future generations, and of the importance of technology to the future of farming.

Table 4.33: Anecdotal comments from participants - Reflection

"Our records have always been detailed over the last 80 years and are available for this generation to read of past experience and results of certain weather, production, sales fires, health of animal etc. I feel this will be lost to the future land managers of our family in digital form. I agree the tables and graphs as a result of the information is quickly available to us now and the requirements of the legal business returns for government and banks would only be able to be produced by the digital information as often and quickly as we need them now. We could not run our business without this modern technology. The postal service cannot serve isolated businesses to the standard we require so we need emails and online banking."

The findings from the anecdotal comments are somewhat juxtaposed by responses to the next question which asks, "In terms of value from technology, do you agree or disagree with the following statements" as contained in Table 4.34. While 92% of respondents, slightly more than in 2013 (90.4%) agreed that they were enjoying learning new skills, so therefore found technology personally valuable, anecdotal comments from the 2016 online survey indicated that respondents were feeling frustrated with having to take on extra duties to do with changing roles. Eighty-four percent of women in 2016 and 81.5% in 2013 thought knowing how to use and manage technology on the property made women more valuable in the rural partnership. Anecdotal comments from 2016 respondents support the position that technology had improved management practices, decision-making, record keeping and planning and it gave participants access to information that they would otherwise not be able to gather whilst situated at their property. Just over two thirds (69.9%) of respondents in 2016 indicated that 'being tech savvy gave them better standing in the community' and 57.9% selected that 'using technology allows time for other jobs' reflecting the anecdotal comments that, while technology can be intrusive, it can save time, save money and allow for broader communication with peers, industry and customers.

Table 4.34: Frequency analysis of the question "In terms of value from technology, do you agree or disagree with the following statements"

	2013 (N=138)				2016 (N=200)			
	Percent							
	n	**Agree**	n	Disagree	n	**Agree**	n	Disagree
I enjoy learning new skills, so find technology personally valuable	122	**90.4**	13	9.6	170	**92.9**	13	7.1
I think knowing how to use and manage technology on the property makes women more valuable in the rural partnership	110	**81.5**	25	18.5	154	**84.2**	29	15.8
Being tech savvy gives me better standing in the community	69	**51.1**	66	48.9	128	**69.9**	55	30.1
Using technology allows time for other jobs	63	**46.7**	72	53.3	106	**57.9**	77	42.1

Next, the participants were asked where they looked for information when purchasing products for the property. More than 90% of 2016 participants responded that they seek information online (93.0%), by word of mouth (93.0%) or from friends and family (91.0%). In 2013, the majority also used online information (89.9%) or word of mouth (89.9%). More respondents in 2016 found information from field days (79.9%) to be very important for finding information about new products than in 2013 participants (49.3%). In 2016 participants found rural newspapers (70.9%), trade and farming publications (66.8%), and extension officers (62.3%) to be more important for information than major newspapers (27.1%). In 2013 and 2016, participants also looked to others for information. 'Other' in 2013 includes, rural distributors, local IT shops or technical support, a combination of resources their accountant or social media contacts and in 2016 respondents added industry research bodies and forums or training as sources of information, see Table 4.35.

Table 4.35: Frequency analysis of the question "When purchasing new technology, where do you look for information?"

	2013				2016			
	Percent							
	n	Very Important	n	Not important	n	Very Important	n	Not important
Online information	124	89.9	14	10.1	185	93.0	14	7.0
Word of Mouth	124	89.9	14	10.1	185	93.0	14	7.0
*Friends and Family					181	91.0	18	9.0
Field days	68	49.3	70	50.7	159	79.9	40	20.1
Rural Newspapers (Queensland Country Life, The Land etc.	68	49.3	70	50.7	141	70.9	58	29.1
Trade and Farming Publications	45	32.6	93	67.4	133	66.8	65	32.7
Extension Officers	Not asked				124	62.3	74	37.2
Major Newspaper (The Australian, Courier Mail etc.)	13	9.4	125	90.6	54	27.1	145	72.9

Other

2013: Rural Distributor (4), Local IT Shop or Technical Support (3), Accountant (2), Combination of Listed Sources (2), Social Media Contacts (1)

2016: Rural Distributors (7), Local IT Shop or Technical Support (4), Combination of listed sources (3), Accountant (1), Industry Research Bodies (1), Forums/Training (1)

**Not asked in 2013*

Participants were asked who mainly makes the decision to purchase when buying technology for the property. They were asked to consider if the product was for inside or for outside the homestead or if the decision was made together, or to supply an 'Other" response if the decision was made another way. When the cost of the purchase is high, the majority of decisions (93.0%) are made together, slightly more than in 2013 (90.6%). In 2016, 81.9% of women are making decisions about inside purchases, more to than in 2013 (68.8%) and in 2016, 79.9% of men are making decisions about outside purchases, more than in 2013 (57.2%). In terms of decision making, trends follow Bose et al. (1984) in that women are making decisions for inside the home purchases and men make decisions for outside the home purchases. However, more men and women are making decisions together.

Table 4.36: Frequency analysis of the question "Who mainly makes decisions to purchase when buying technology for the property?

	2013 (N=138)				2016 (N=200)			
	Percent							
	n	Agree	n	Disagree	n	Agree	n	Disagree
We both do, depending on the size of the purchase (i.e. if the purchase is a high cost purchase, we will discuss it together)	125	90.6	13	9.4	185	93.0	14	7
The female, if the technology is to be used for inside the homestead (e.g. a new computer, accounting, cattle management or education program etc.)	95	68.8	43	31.2	163	81.9	36	18
The male, if the technology is to be used outside of the homestead (e.g. walk over scales, remote weather stations etc.)	79	57.2	59	42.8	153	76.9	46	23.1

Other

2013: Depends on what it is (1), Owner (1), Schooling - female (1)

2016: Accountant recommends software (2), All family if a large purchase (2), Joint decision, we both have an interest (2)

In 2016, participants were asked what they mainly used the internet for. A multiple response on the answer 'most used' indicated that the internet was mostly used for business (49.5%), then research and development (22.1%), followed by social (20.8%). Only 4.7% of respondents use their internet for their staff. Other responses include the accountant, banking, cloud computing, community development and organisations, distance education, mental health, Wi-Fi for phone and outside employment (2.8%). One respondent noted that there was not enough data to allow kids or staff to use the internet.

Table 4.37: Multiple response analysis on 'most used' for the question 'what do you mainly use the internet for?'

	2016 (n=200)	
Business	157	49.5
Research & Development	70	22.1
Social	66	20.8
For staff	15	4.7

Other

2016: Accountant (1), banking (1), cloud computing (1), community development (1) and organisations (1), distance education (1), mental health (1), Wi-Fi for phone (1) and outside employment (1)

In 2016, participants were asked what the top three reasons why having access to the internet is important to them. Participants gave 580 responses. The responses were coded using a thematic analysis. The process was repeated until there were 14 different themes. The top response for Reason 1 and Reason 2 were communication (53 responses) and accounting or banking (47 responses). The top response for Reason 3 was communication (48 responses) and then information (38 responses). Communication included responses such as sending and receiving emails, communication with business partners, family, schools, friends, and the world. Accounting/banking included responses such as accounts, banking, receiving accounts and book keeping and information included responses such as finding equipment and parts, products, general information, research, staying up to date with information and market reports. Other themes that were extracted were business administration, education, personal use/social media, weather, health and well-being, cloud computing, online business/off-farm work, water monitoring, online shopping, community groups and staff satisfaction, see Table 4.38 for a list of the top three reasons having access to the internet is important to participants.

Table 4.38: Anecdotal responses to the question "What are the top three reasons that having internet access is important to you?"

Reason 1 (n)	Reason 2 (n)	Reason 3 (n)
• Communication (53)	• Accounting/Banking (47)	• Communication (48)
• Accounting/Banking (46)	• Business Admin (39)	• Information (38)
• Business Admin (37)	• Communication (32)	• Personal use/Social (26)
• Education (33)	• Information (32)	• Business Admin (21)
• Information (14)	• Education (17)	• Accounting/Banking (13)
• Health & Well-being (5)	• Personal use/Social (12)	• Education (13)
• Cloud Computing (4)	• Weather (5)	• Weather (10)
• Weather (2)	• Health & Well-being (4)	• Health & Well-being (5)
• Online Business (1)	• Water Monitoring (3)	• Online Business/off-farm work (5)
• Water Monitoring (1)	• Cloud Computing (2)	• Cloud Computing (3)
	• Online Business (2)	• Online Shopping (3)
		• Community Groups (2)
		• Water monitoring (1)
		• Staff Satisfaction (1)

In 2016, participants were asked if they had a smart phone and what they used it for. Of the 8.5% of men who responded ‘yes’ to having a smart phone, 20% were using their phone to manage a business web page (5%), to manage feed supplies (5%), to check remote bore cameras (5%) and for GPS cropping (5%). Four percent of male respondents were using their smart phone to check remote cameras and 3.5% were using their smart phone to communicate with friends and neighbours. Another 3.5% were checking remote weather cameras using their smart phone. Other tasks completed by male respondents included searching the internet, for social media, to check business email, for NLIS management, for satellite technology (stock management) and to track GPS collars. Female respondents were much more active on their smart phones, with more 60% using their smart phone to search the internet (65%), communicate with friends and neighbours (64.5%), and check online weather (61.5%). Fifty eight percent of women used their smart phone to check personal email, 57% used it for social media, and 52% used their smart phone to check business email. Forty four percent of women used their smart phone to complete online banking and 40% checked the online news. Women use their smart phones to manage the business website, for NLIS management, for cattle management software, for satellite technology and to manage feed supplies. Women also used their smart phone to check remote bore cameras, track GPS collars, check remote weather and wild animal cameras and for GPS cropping, see Table 4.39 for the percentage of use for each item.

Table 4.39: What tasks do you use your smart phone for on your property?

	2016 (N=200)			
	Male (n=17)		Female (n=183)	
	n	Percent	n	Percent
To search the Internet	1	0.5	130	65.0
To communicate with friends and neighbours	7	3.5	129	64.5
To check the online weather			123	61.5
To check personal email			117	58.5
For social media	1	0.5	114	57.0
To check business email	1	0.5	104	52.0
To complete online banking			88	44.0
To check the online news			80	40.0
To manage the business web page	10	5.0	15	7.5
For NLIS Management	4	2.0	14	7.0
For cattle management software (iHerd, Stockbook)			13	6.5
For satellite technology (e.g. paddock / stock management)	1	0.5	13	6.5
To manage feed supplies	10	5.0	12	6.0
To check remote bore cameras	10	5.0	7	3.5
To track GPS Collars	1	0.5	3	1.5
To check remote weather cameras	7	3.5	2	1.0
To check remote cameras (wild animal control, anti-theft)	8	4.0	2	1.0
For GPS cropping systems	10	5.0	2	1.0
Other	1	0.5	14	7.0
phone calls and texts			6	3.0
Advertising jobs			1	0.5
Email whilst away from property. No reception on property	1	0.5		
Camera e.g. for broken dozer parts to order when get home			1	0.5
Photographs			1	0.5
NVD Forms			1	0.5
Crop sales and prices			1	0.5
For off-farm business			1	0.5
Photo monitoring sites			1	0.5
Water Sensors			1	0.5

**Note this question was not asked in 2013*

Participants were asked to enter any ‘Other’ tasks that they completed with their smart phones. Men responded that they check their email whilst away from the property (0.5%) and women added that they primarily use their smart phone to make phone calls, to advertise jobs, use the smart phone to take photos of broken machinery and photographs in general. Women also use their smart phone to submit compliance forms, look up crop and sales prices and they use it for off-farm business, photo monitoring of remote sites and water sensors, see Table 4.39.

The following set of questions were only asked to men to measure their views on women using technology

In both 2013 and 2016, men were asked to answer in their view, how has adopting technology affected the female in the partnership. While only 19 men responded to the question (2013=3; 2016=16) they all agreed that women had gained new skills, that women felt more confident and that learning how to use technology has been empowering for the female in the partnership. They agreed that having the female of the partnership use technology has helped to maintain the budget and that it gave the female more control over the business. Men agreed with women, by recognising that the women would rather someone else did it [used technology], see Table 4.17 (p. 136) and Table 4.18 (p. 137). 'Other' comments include that *"it allows her [the female in the partnership] to have a sense of ownership of the business"* and one male response states that *"she [the woman] has time to wait for fixes to problems"* implying that men are too busy to complete technology based tasks. While the results give an idea of men's involvement, the sample size is too small to generalise to other men in the producing cattle.

Table 4.40: Frequency analysis of the question "How has adopting technology affected the female in the partnership"

	2013 & 2016 (N=19)			
	Percent			
	n	Agree	n	Disagree
She has gained new and valuable skills	19	100.0	0	0
She has more confidence to complete business tasks	15	93.8	1	6.3
Learning how to use technology has been empowering for her	17	89.5	2	10.5
It has helped to maintain our budget	17	89.5	2	10.5
She has more control over the business	16	84.2	3	15.8
She would rather someone else did it	9	47.4	10	52.6
Other				
Allows her to have a sense of ownership of the business (1), she has the time to wait for fixes to problems (1)				

During face-to-face interviews in both 2013 and 2016, women were surprised at men's positive responses about the value that women add to farming. Equally, men were just as surprised that women did not know they had such a positive opinion. It is important that women's work, especially with technology is recognised and that men's opinions about women's work with technology is also recognised, therefore in 2013 and 2016, men were asked 'When thinking about how valuable the female in the partnership is, in terms of the work she does using technology. How do her duties add value to the business?' While only 19 men responded to the question, they all agreed with the statements that women learning and managing technology is positive for business (94.7%) and that their contribution to accounting saves the business time and money (84.2%). More than half of the male respondents agreed that they think women learn technology quicker than men (63.2%) and therefore their contribution to farming is more valuable. By contrast, 10.5% of men's responses indicate that women's use of technology does not add any value at all to farming. Men added other comments to support their views on women's use of technology. For example, that a woman keeping up with technology allows better decision making and that women using technology makes them a valuable part of the team. Also that women using technology speeds things up, leaving more time to do things as a family – highlighting that – *"people really have no idea how important this* [having more time for family] *is to people in rural Australia"* and the final comment states that technology gives shared knowledge and therefore shared understanding. Overall, the comments and responses provided indicate that men in the survey value the contributions of women to the faming business, supporting the 2013 survey results. While the results give an idea of men's involvement the sample size is too small to generalise across the cattle producing industry.

Table 4.41: Frequency analysis of the question "When thinking about how valuable the female in the partnership is, in terms of the work she does using technology. How do her duties add value to the business?"

	2013 & 2016 (N=19)			
	Percent			
	n	Agree	n	Disagree
Women learning and managing technology allows the business to keep moving forward	18	94.7	1	5.3
The females contribution to GST/Accounting and other duties saves the business time and money	16	84.2	3	15.8
I think women learn about technology more quickly than men, therefore their contribution is very valuable	12	63.2	7	3.38
I don't think her using technology on the property adds any extra value at all	2	10.5	17	89.5

Other

2013 & 2016

By her keeping up with technology allows us to make decisions on what technology we will take up, helps with joint decision making (1), My spouse and daughters are an incredibly valuable part of my team, having access to technology to do the job and do it well is a bonus (1), Getting things done faster frees them up to spend more time doing things as a family - people really have no idea how important this is to people in remote Australia (1), Shared knowledge n shared understanding (1)

The next set of questions asked only in 2016 aimed to determine men's actual involvement in the purchase, learning, and setup of their smart phone or tablet. Only 16 men responded to the question. Of the 16 that responded more than two thirds (68.8%) said that they had purchased their phone themselves, 25% indicated that their wife or partner purchased the product and 6.3% selected that someone else purchased their smart phone or tablet. When asked who that was, the respondent answered that the phone was a hand-me-down from his daughter. When asked who set up their phone, just over half (56%) of male respondents said it was their wife or daughter who set up the phone or tablet and 43.8% selected that they set up their phone or tablet themselves. When asked who taught the men to use their phone 56.3% of men selected that they learnt how to use the phone/tablet themselves, 37.5% said that their wife or partner taught them how to use it and 6.3% said that their son taught them how to use their phone/tablet. While the results give an idea of men's involvement the sample size is too small to generalise across the cattle producing industry.

Table 4.42: Frequency analysis of questions that determine men's involvement in the purchase, learning and setting up of their smartphone/tablet

	2016 (N=16)	
Who purchased your smart phone or tablet?	**n**	**Agree**
I did	11	68.8
My wife/partner did	4	25.0
Someone else did (who was this)?	1	6.3
Other		
A hand me down from my daughter (1)		
Who set up your smart phone or tablet?	**n**	**Agree**
I did	7	43.8
My wife/partner did	8	50.0
Someone else did (who was this)?	1	6.3
Other		
Daughter (1)		
Who taught you how to use the smart phone or tablet?	**n**	**Agree**
I did	9	56.3
My wife/partner did	6	37.5
Someone else did (who was this)?	1	6.3
Other		
Son (1)		

When asked how men used their smart phone, the majority in both 2013 and 2016 responded that they use their smart phone t to make telephone calls and to text, to look up new product information and to use apps such as weather forecasts. Other tasks include as a GPS, for banking and social media and for checking remote cameras.

Table 4.43: Cross tabulation of how men use their smart phone and year of survey

	2013 (n=138)		2016 (n=200)	
	n	Percent	n	Percent
I use it to look up new product information on the internet	3	2.2	13	6.5
I use it just to make telephone calls	1	0.7	3	1.5
I use it to make telephone calls and text	3	2.2	14	7.0
I use apps, such as the weather on my smart phone	3	2.2	12	6.0
What else do you use it for? (Please Specify)			5	2.5
Other				
2016: As a GPS for traveling (1), Banking n social media, SMS weather checks (1), Banking, streaming video, checking remote cameras, Bluetooth devices, GPS remote access for gates and tanks and pumps etc. (1), Cattle breeding info, weather, GPS measurement, maps, NAVMAN, reminders, alarms etc, Monitor Waters (1)				

The final question for the *Chapter 4* online survey asked men "What the benefits of having a smart phone or tablet are? The question was answered by 16 male respondents, where the majority (87.5%) of respondents indicated that benefits include being able to search for things and research parts, stock prices etc. Seventy-five percent indicated that they benefited by using the smart phone to check the weather. More than half of the male respondents indicated that it was of benefit that they did not have to ask others to use technology for them or that they did not have to return to the homestead to find out the information that they needed. However, a cautionary note here is required as one of the outcomes of the focus groups (see Section 4.3.3) was that technology was making people less social and reducing interactivity between family members and employees, which may lead to isolation and hence lower levels of well-being (well-being is explored more in *Chapter 6*). Nearly 44% of male respondents indicated that one of the benefits of having a smartphone or tablet was that they can learn the technology by themselves, supporting research by Correa and Pavez (2016), see p. 109.

Table 4.44: Multiple response analysis of the question "What are the benefits of having a smart phone or tablet?

	2016 (N=16)			
	n	Agree	n	Disagree
I can search for things and research stuff e.g., parts, stock prices etc.	14	87.5	2	12.5
I can check the weather	12	75.0	4	25.0
I don't have to ask someone to do it for me	9	56.3	7	43.7
I don't have to go back to the homestead to find out the information I need	8	50.0	8	50.0
I can learn it myself	7	43.8	9	56.2

Other
Emails, phone calls wherever I am (1), It only works in network range so gives me a phone away from home (1)

The next section discusses results from the focus groups held at the Queensland Rural, Regional, and Remote Women's Network Annual conference held in Emerald from the 19th to the 21st of October 2017, and is followed by a Chapter Summary.

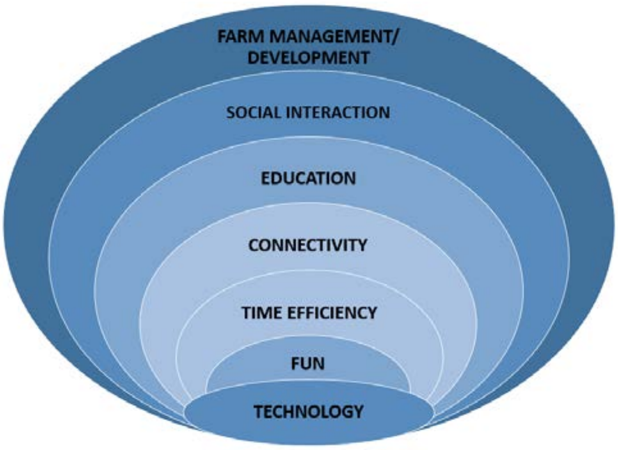
4.3.3 Focus Groups

The material from the focus groups was coded, categorised, and re-categorised to identify explanatory concepts. Theoretical sampling (Hammersley, 2006) evolves the previously identified concepts by comparing and combining information with data from conversational interviews and online surveys.

4.3.3.1 Technology Group 1 – Producers

The first group of participants identified six themes surrounding the question "What are the women producer's motives, actions, and intensions in terms of technology use and management?" Themes include that technology is fun, time efficient, that the participants are connected, that they can access formal and informal education, have social interaction and that it can be used for farm management and development. Each of the themes is expanded in the next section.

Figure.4.13: Group 1, themes relating to women producer's motives, actions, and intensions in terms of technology use and management



Group 1 Technology themes

Group 1 Fun: Participants used technology for entertainment, online shopping, dating online, for virtual holidays and for their *"sanity"*. When asked to elaborate how technology helps the participants "sanity", they responded that it gives them time away from daily farming duties, to escape and remove themselves from isolation *"even if its online and only for a few minutes"*.

Group 1 Time efficiency: Participants responded that *"technology was time efficient"*, that it *"made life easier"*, and that it *"decreased their workload"*. The participants particularly saved time by using online banking to run their business, reducing the need to drive, sometimes for many hours, to town to complete banking tasks such as paying wages.

Group 1 Connectivity: Participants of the focus group discussed connectivity citing that *"it was different from social interaction"*. They responded that connectivity allowed them to *"be aware of what is happening outside of the home"*, which meant that they could *"keep up with current affairs, the news and other information"*. Being connected allowed them to take on more responsibility for marketing their own products.

Group 1 Education: Participants were extremely happy that technology gave them better access to education for their children, and for themselves to attend further education. They said that it *"streamlined the processes and cut through a lot of red tape"*. They were also happy that their workload was reduced by *"not having so much paper work to put in the filing cabinet"*.

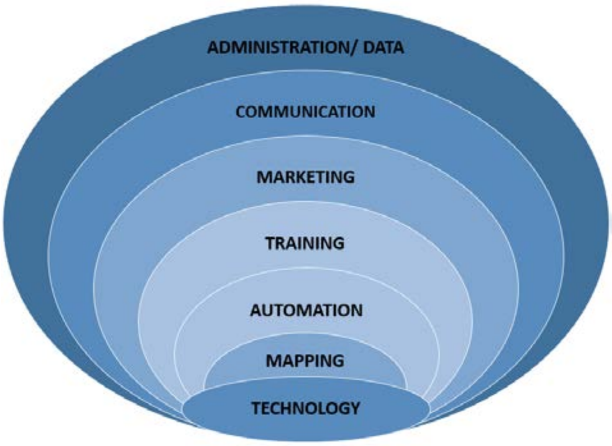
Group 1 Social interaction: Social interaction was important to the participants. The most responses returned were related to socialness, being able to interact socially while being isolated and connectedness. Having access to technology allowed the respondents to communicate with others either by social media or via email and was particularly important for networking with others. Most of all they responded that *"having the ability to connect with others helped with [the feeling of] isolation"*.

Group 1 Farm management / Development: Most of all, technology helped the respondents with farm management and development. Respondents noted, "Technology helped to increase profitability and made processes more efficient". "Captive data (for example data from NLIS ear tags that is sent directly to the computer) made the producer more accountable". The producers were engaged with this process because it not only made them accountable for their products, but others accountable too, which "added protection for the food chain as a whole industry". Having technology meant that "producers could make improvements on their farm and increase safety for the family and the workers", for example using quad bike trackers to ensure that workers or family returned home from designated tasks. The producers use technology to keep everyone in the business connected, which "helped to avoid conflict in business decisions and for smoother future planning". Technology has helped some of the focus group participants to diversify their business and make their processes more streamlined and efficient, ultimately increasing profitability. However, there was an overarching discussion that technology could be "time wasting and expensive to replace".

4.3.3.2 Technology Group 2 – Agricultural extension officers or other service providers

The second group of participants identified six themes surrounding the question "What are the women producer's motives, actions, and intensions in terms of technology use and management?" Themes include that technology is used for mapping, that automation is cost effective and that technology is used for training, marketing and communication. Admin and data were also identified as important themes. Each of the themes are expanded in the next section.

Figure 4.14: Group 2, themes relating to women producer's motives, actions, and intensions in terms of technology use and management



Group 2 Technology themes

Group 2 Mapping: Women are using technology as a navigation tool so that they can *"use google maps as a navigation tool"*. They are also using technology to *"view the real countryside"*, which is helpful when mapping their properties.

Group 2 Automation: Participants of the focus group discussed "automation as being cost effective" and that by automating "they could use less seasonal workers, they had more time for other things and that there were financial benefits".

Group 2 Training: Participants were using digital technology to access training and skills development. By doing so, they were *"gaining more confidence, had better time management and more independence"* and that having technology *"gave them the motive to utilize technology successfully in production outputs"*. By contrast, Group 2 thought *"having access to connectivity limited women's involvement"* and *"they were not sure how to access training in all available technology"*.

Group 2 Marketing: Having technology allowed participants to "find innovative solutions to achieve value adding, processing or packaging, to access market information or free market research (e.g. to help with marketing or product development)". Technology also allowed participants to "use social or digital media to market or promote their business".

Group 2 Communication: Technology gave participants "access to critical information for farm administration, access to emails for contacting people and communicating with the wider community". Participants "use social media to connect with customers and the wider community and to keep in contact with people". Technology "saves time and gathers information for business communication".

Group 2 Admin and Data: Participants highlighted the importance of using technology for administration and record keeping (data). Participants used computer programs to *"create documents and record information collected from the paddock"*. They used tablets *"(IPAD) to record photographs and use data programs"*. Technology is *"streamlining farm administration e.g. cloud accounting and internet banking"*, and *"it helps with record keeping, it's very useful for audits/certification"*.

Summary

Group One, who were mainly producers thought practically about using technology on a personal level. They discussed technology being fun and it gave them an outlet for social interaction. Technology increased time efficiency and connectivity. More importantly, technology gave them access to education for children, family members and for workers and helped with farm management and development. Group Two also focused on the practical side of technology, highlighting technologies usefulness in business. They discussed technologies use in mapping, training and marketing and communication. Above all else, Group Two thought that technology would assist with administration and recording data, which was important for compliance (audits, certification, NLIS). The next section provides a summary of the data analysis.

4.3.4 Summary of data analysis

Study 1 provides a comparison of technology use by women and men in rural, regional, and remote areas of Queensland, Australia. While the studies focus is on women's use of technology, the survey and focus groups were open to both women and men. However, very few men responded to the survey and none responded to the focus group. A cross tabulation was applied to all questions to test if the male responded to each questions or not. Where there is no response from men, the text has only referred to women as the responders.

Types of technology used

Women and men in 2016 were using technology more so than in 2013, with a particular focus on tablet computers, water monitoring, satellite imagery, and smart phones. The tablet computer was first introduced in 2010, as such in 2013 may still have been in the innovation/early adoption stage of Rogers (2003) Diffusion of Innovation Model (DIM), see Figure 4.6: Diffusion of Innovation Model (Rogers, 1962). By 2017, the tablet computer had moved into the early majority phase of Rogers DIM (2003), where approximately 50% of Australian technology users owned a tablet computer (ACMA, 2017). The ACMA Telecommunications Report 2016/17 cites that people are using tablets because they are lightweight (88%), cheap (40%), fun (61%) and easy to transport (91%) (ACMA, 2017), which may give some insight into the increase in use by participants in this study who are using technology more, outside of the homestead. In addition, focus group participants identified the tablet computer as easy to use for taking photos and using data based computer programs outside of the homestead (see Section 0). Similarly in the early adoption stage of the DIM (Rogers, 2003), smart phones were relatively new to rural areas in 2013. While women were using smart phones in 2013, the majority of men interviewed were not. Only one man (76 years old) presented with a smart phone during face-to-face data collection (see Section **2.4.1**) and three responded positively to the online survey in 2013 to having a smart phone. However, men's smart phone use had had changed when speaking with attendees of Beef Week 2015 (see Section **2.4.1** for more). This is supported by responses to the 2016 online survey where 13 men responded that they were using a smart phone. While the number of responses is small and therefore cannot be generalised, it is important to recognise men's increased use of technology.

Property size

The results confirmed that property size had an effect on technology adoption (Daberkow & McBride, 2003; Feder & Slade, 1984; Kutter et al., 2011). Larger properties (>5000 acres) are using water sensing technology, satellite phones and imagery, remote cameras, walk over scales, NLIS and feedlot technology. While smaller properties (<5000 acres) are also using water sensing technology, they are by contrast using GPS collars, home computers, laptops, NLIS, tablets and smart phones. In all cases, while men are using the technologies more in 2016 than in 2013, women were using the listed technologies more than men were in both years.

Technology based tasks

Women's technology based tasks have not changed since 2013. In both 2013 and 2016 tasks such as banking, accounting, checking business and personal emails, social media and communicating with friends and neighbours are completed by more than 60% of women on their properties. In addition, 30% of women were using technology to run an online business in 2016. Less women agreed that technology management naturally fell to them in 2016. Likewise, less women specified that they had no choice in managing technology, indicating that women have more control over the decision to manage technology in 2016 than they did in 2013. Alternatively, women indicated that men (22.5%) were responsible for technology management in 2016, which was not the case in 2013. While the 2013 study, identified less than 3% of rural men as technology users it is clear there is a change men's technology use between 2013 and 2016. The following statement gives an example of a face-to-face interview about one farmer's (from Beef Week, 2015) level of use of technology (note although John is a sheep farmer rather than a cattle producer the example of the use of technology can be applied to cattle production):

> *John is a sheep farmer from South Australia and for the first time he was able to travel from his property in South Australia to the largest beef expo held in Queensland, Australia (some 2,000+ klm). This was because John had recently installed water sensors and camera's on all of his water tanks on the farm. John was able to show me the app that had graphs of the water levels and images of the sheep drinking. John said "you see this dip here on the graph that shows me that I lost 50,000 litres of water from my tank overnight… it's alright my neighbour checked it and there was something stuck in the float… its fixed now. But if I didn't have the alarm on my phone, I would not have been able to alert my neighbour and I would have gone home to a paddock full of dead sheep". I asked John if he purchased his phone, he said, "No, Kate (his wife) did"…, I asked if he knew the button where his graphs were was an app, and John said he didn't know what an app was. Finally, I asked John if he set up his phone and he said, "No, Kate did that too". While John was happy to learn how to use his phone, it was his wife that researched, purchased, set up and was teaching John how to use it, highlighting John's limited knowledge of technology" (John & Kate, Beef Week 2015)*

The increased use of technology by rural men may be due to the recent adoption of the smart phone that allows men to have a hand held computer in their own space providing an opportunity to experiment and build confidence and skills with technology (Correa, 2010). An example of men learning autonomously comes from a face-to-face interview held with a participant of an agricultural field day, as follows:

> *"My husband has been hiding down the shed lately, I didn't know what he was doing, and every time I tried to find out he would get cranky and send me away. Then one day, I saw he was using his new mobile phone. It turns out he was hiding in the shed trying to learn how to use it. He said he didn't want me or our daughter to laugh at him so he was teaching himself", (Interview number 11).*

Having access to their own space at home to learn has the greatest impact on rural men's digital mastery because it allows them to experiment with technology while learning how to use it (Livingstone & Helsper, 2007).

Children and workers

Women indicated that male children (11%) over female children (7%) were responsible for technology management in 2016 and that more boys than girls were using technology now (2016) than they were before (2013). Kramer and Lehman's (1990) study suggests that *"boys were three times more likely than girls to use a computer and participate in computer related activities"* (p. 158). Although according to Dixon et al., (2014b) this gap is diminishing. Technology use by girls over 16 may be related to a shift into domestic duties (including computer related duties) that often occurs for rural women (Alston & Wilkinson, 1998; Little, 2009). Likewise, boys over 16 tend to move into work outside of the homestead (Brandth, 1995) leaving them less time to partake in technology related activities and may account for their technology use. Women participants of the study also indicated that male and female workers were responsible for managing technology more so in 2016 than in 2013. Female workers use of technology is supported by interviewees of the Ag-Grow Field day, where one participant said, *"I feel as a woman it gives me an edge over the boys [male workers], they don't like it, but it's important for me to use technology so I can keep working"* (Interview number 10).

Women's use of technology

While there was a change in men's, children's, and workers' use of technology, there was no change in the ease of use and enjoyment of using technology for women between 2013 and 2016. In addition, less women were struggling with learning to use technology, and even fewer could not get the hang of it. Men reinforced women's ease of use of technology stating in comments in the survey that they thought, "*women learn technology easier than men do*". Women's ease of use and increased use of technology in this study supports the theory behind the Technology Adoption Model, were perceived usefulness and perceived ease of use leads to adoption (Davis, 1989).

Decisions about technology

Fewer participants are making decisions together about the technology brought on to the property in 2016. While the online survey data shows that women are the primary decision makers regarding brining technology onto the property, it also shows that more men and external decision makers (accountant, government regulation, program developers, and others) were also making decisions about technology adoption in 2016. While women thought that adopting one technology lead to the adoption of other technologies, men did not respond to the question. Men also did not respond to the question of how technology has affected the user. In 2013, women highlighted that technology had helped them to gain new skills and in 2016, that technology gave them more control over accounting or cattle management programs was more important, and gaining new skills was less important. However, technology giving the female respondents a feeling of achievement and that using technology was empowering and improved their self-worth was important in both 2013 and 2016. While technology has saved time, improved communication, and involvement in production practices, and removed the feeling of isolation, it has not given women or men more time to spend with the family. For many women it has increased their workload and taken them away from other duties that they would rather be doing.

Access to technology

In 2016, having access to technology has allowed nearly one quarter of respondents to start up their own online business. Survey participants found it useful for streamlining farming business and technology has increased productivity in both years, but more so in 2016, which is supported by authors such as Lawrence et al. (2011), Leigo et al. (2012), Tey and Brindal (2012), Aubert et al. (2012) and (Block, 2012) in discussions about the relationship between technology and increased productivity. Respondents indicated that technology is useful because it saves time, allowing both men and women to do other jobs on the property. Nearly 60% of 2016 respondents agree that they are able to run the farm more efficiently because of technology. Both statements support claims that using technology can be more efficient (Aubert et al., 2012; Tey & Brindal, 2012).

Technology's effect on farming

Participants were asked to provide comments about how technology has changed farming on their property, only females responded to the question. Overall, participants of the online survey indicated that they were feeling frustrated with having to take on extra duties to do with changing roles, and that upgrading infrastructure is expensive, and that they are frustrated with the lack of internet connectivity. By contrast and importantly, participants commented that having technology on the property has improved management practices, decision making, record-keeping and planning and that technology gives participants access to information that they would otherwise not be able to gather whilst situated at the property. While technology can be intrusive, participants commented that it saves time, money and allows for broader communication with peers, industry, and customers. Women who participated in the study indicated that they found learning new technology based skills personally valuable, even though they were feeling frustrated with having to take on extra tasks. Similar to 2013, women found that knowing how to use technology made them more valuable in the rural partnership and that being 'tech savvy' has given them a better standing in the community.

Information about technology

There was no change to where participants found information about technology they would like to purchase, with the top sources of information being found online, then by word of mouth, followed by information from friends and family. Decisions to purchase large pieces of technology were made by both males and females. Decisions to purchase technology for inside the home was made primarily by women, and for outside the home, made primarily by men. This type of decision-making process seems not to have changed much historically, except that women as technology users and managers are now seen as drivers of technology purchase decisions.

Uses of the internet

Participants are mostly using the internet for business, research, and development, and socially, with only a small number of participants using the internet for staff. Other responses include the accountant, banking, cloud computing, community development and organisations, distance education, mental health, Wi-Fi for phone and outside employment. One participant stated that children and workers are not allowed to use the internet, as there is not enough data (this topic is discussed more in *Chapter 7*). When asked what the top three reasons why having the internet is important to participants, they responded it was important for communication, accounting, or banking and for information. Communication included responses such as sending and receiving emails, communication with business partners, family, schools, friends, and the world. Accounting/banking included responses such as accounts, banking, receiving accounts and book keeping and information included responses such as finding equipment and parts, products, general information, research, staying up to date with information and market reports.

Use of smart phone

Women were using their smart phone more while on their property than men were for tasks such as searching the internet, communicating with friends and neighbours, and checking online weather. They used their smart phone to check personal and business email, social media, and online news and to complete online banking. Women use their smart phones to manage the business website, for NLIS management, for cattle management software, for satellite technology and to manage feed supplies. Women also use their smart phone to check remote bore cameras, track GPS collars, check remote weather and wild animal cameras and for GPS cropping. While away from their property, women are using their smart phone to make phone calls, advertise jobs, and take photos. Whereas, men are using their smart phone from the property to manage a business web page, to manage feed supplies, to check remote bore and weather cameras, for GPS cropping, and to communication with friends and neighbours. Other tasks completed by male respondents included searching the internet, for social media, to check business email, for NLIS management, for satellite technology (stock management) and to track GPS collars. While away from the property men use their smart phone to check email.

The following set of questions were only asked to men to measure their views on women using technology

Note: While the results give an idea of men's involvement the sample size is too small to generalise across the cattle producing industry.

In both 2013 and 2016, men were asked to answer in their view, how has adopting technology affected the female in the partnership. While only 19 men responded to the question (2013=3; 2016=16) they all agreed that women had gained new skills, that women felt more confident and that learning how to use technology has been empowering for the female in the partnership. They agreed that having the female of the partnership use technology has helped to maintain the budget and that it gave the female more control over the business. Men agreed with women, by recognising that the women would rather someone else did it. During face-to-face interviews in both 2013 and 2016, women were surprised at men's positive responses about the value that women add to farming. Equally, men were just as surprised that women did not know that men had such a positive opinion of their value. It is important that women's work, especially with technology is recognised and that men's opinions about women's work with technology is also recognised. When asked how the women's duties add value to the farm, men responded that women learning and managing technology is positive for business and that their contribution to accounting saves the business time and money. Men think women learn technology quicker than men do (63.2%) and therefore their contribution to farming is more valuable. However, a small number of male respondents indicated that women using technology did not add any value at all to farming. Overall, the comments and responses provided indicate that men in the survey value the contributions of women to the faming business, supporting the 2013 survey results.

In 2016, men were asked in the face-to-face interviews who purchased their smart phone or tablet. The majority answered that they had made the purchase. When they were asked in the face-to-face interviews, who set up their phone/tablet the majority said that their female partner set the smartphone/tablet up. Men in the face-to-face interviews also said that their partners taught them how to use the smartphone/tablet. This question was asked again in the online survey. The majority of men had responded that they had purchased their own phone. Just over half of male respondents indicated that their wife or daughter had set up their smart phone. However, for more than half, the men had taught themselves to use the new technology. Men were using their phone to make calls and send texts, to look up new product information, to use apps such as weather forecast, the GPS and for banking, social media and for checking remote cameras.

The final question for male participants asked, "What are the benefits of having a smart phone or tablet". Male respondents indicated that benefits include being able to search for things and research parts, stock prices etc., and to check the weather. More than half of the male respondents indicated that it was of benefit that they did not have to ask others to use technology for them or that they did not have to return to the homestead to find out the information that they needed. However, a cautionary note here is required as one of the outcomes of the focus groups (see Section 0) was that technology was making people less social and reducing interactivity between family members and employees, which may lead to isolation and hence lower levels of well-being (well-being is explored more in *Chapter 6*). Nearly 44% of male respondents indicated that one of the benefits of having a smartphone or tablet was that they can learn the technology by themselves, supporting research by Correa and Pavez (2016), see p. 109.

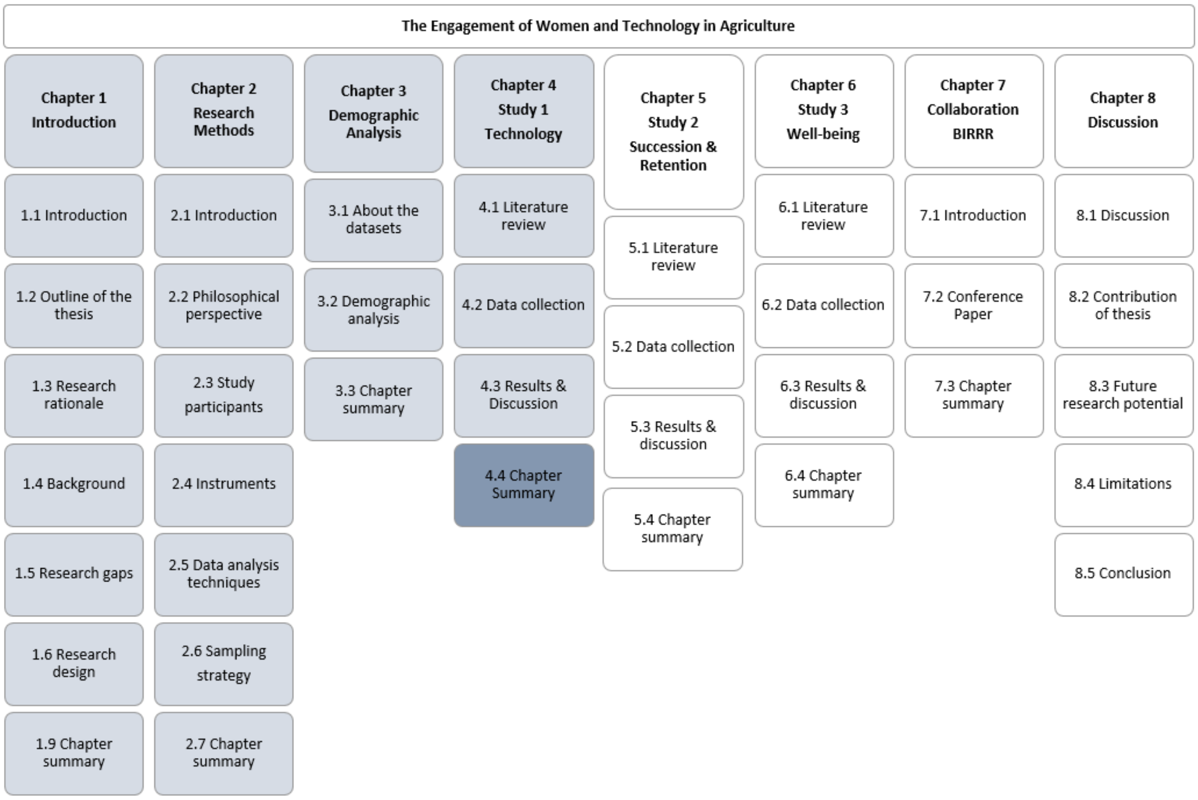
Focus groups

Overall themes relating to technology from Group 1 in the focus group included that using technology is social. It saves time and makes communication easier. On the other hand, it is hard keeping up with technology and it is expensive keeping up to date upgrading both skills and equipment. This was seen by the focus group participants "as a really big barrier" to adopting technology. The participants would like to see technology providers take a different approach by changing technology products to suit the users, rather than the users having to upgrade or change technology to suit the developers. Group 2 discussed having access to technology as gender equalizing. They felt that using technology means that men and women can be on a more even level of understanding, where men can get a break from outdoors and women can get a break from indoors. Technology helps both genders to be equal. It breaks down gender stereotypes. On the other hand, they questioned if there was a gender divide in technology use on the land and why that would be.

The next section provides a summary of and conclusions from, *Chapter 4*.

4.4 Chapter 4 Summary

Thesis Structure Overview: Chapter 4 – Summary



Chapter Four Producer Adoption of Rural Digital Technology proposed that rural women who have access to technology are more motivated towards management that those who do not have access to technology. While the studies focus is on women's use of technology, the survey and focus groups were open to both women and men. However, very few men responded to the survey and none responded to the focus group. A cross tabulation was applied to all questions to test if the male responded to each questions or not. Where there is no response from men, the text has only referred to women as the responders.

Women's role in the diffusion of technology into the beef industry has not yet been clarified, so it is not obvious how rural women have used technology. The chapter addressed a gap in scholarly understanding of why and how rural women are motivated to adopt technology and the associated study used an online survey and focus groups to establish "What are women producer's motives, actions and intentions in terms of technology use and management?" Summaries of the study including the literature review and the results are concluded below.

A review of technology adoption models reflect that producer's choice to adopt technology cannot be measured by the models alone, but must also consider the combined effects of producer profiling, decision theory, adaptive capacity and infrastructure available in order to obtain positive adoption behaviour change. While technology adoption models consider attitude towards behaviour, norms, and behaviour intention (TRA, Ajzen, 2012), usefulness and ease of use (TAM, Davis, 1989), and behavioural control (TPB, Ajzen, 1991) and are grounded in sociology (DIT, Rogers, 2003), the extant literature highlights that adoption must include other key influencers, such as how producers learn, for technology to be adopted. Knowing how producers learn may influence how they adopt innovations. Dissemination of information about rural digital technology is paramount to diffusion of technology to producers. In the past government agencies, educators and developers have favoured groups as the preferred method of learning (Atkinson & Charmley, 2015; Shrapnel & Davie, 2001). Shrapnel and Davie have clearly identified producer typology as a potential barrier to technology adoption. It is clear from their study that cattle producers need individual or small group communication to recognise their unique personality styles and suppliers of rural technology should recognise this constraint. Personality styles and their effect on technology adoption by women and men producers warrant further investigation that is beyond the scope of this study.

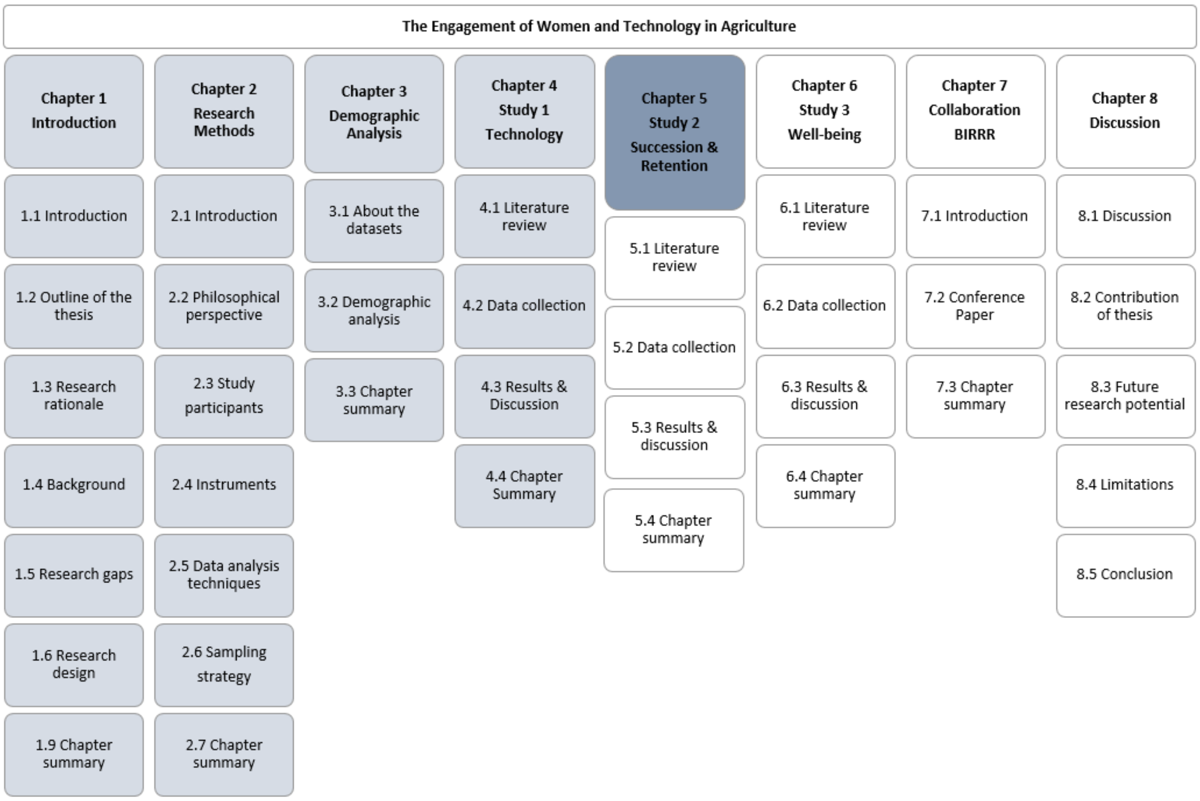
The online survey and focus group results demonstrate that women continue to be the main drivers of technology and that, men are using technology more in 2016 than they were in 2013. The study confirms that problems with connectivity remains the largest barrier to adoption of rural digital technology and the internet of things (Sparrow et al., 2017; Yan, Yan, Ke, & Tan, 2016). Other barriers identified by women include that respondents were feeling frustrated with having to take on extra duties to do with changing roles, and that upgrading infrastructure is expensive and is often associated to continual upgrades by developers. This is a long known barrier to technology adoption: respondents feel they should not have to pay for these upgrades (Daberkow & McBride, 2003; Feder & Umali, 1993; Fountas et al., 2006; Kutter et al., 2011). Size of property, lack of security (related to NLIS technology being removed from stock that is subsequently stolen) and that technology is time wasting are also identified as barriers to technology adoption in this study.

Conversely, factors that influence women to adopt technology include having more control over the business, gaining new skills, and a feeling of achievement when using technology, women also reported that learning how to use technology was empowering and it improved their self-worth. Women were gaining more skills over time and feeling a sense of achievement while doing so, supporting their adaptive capacity (Berry et al., 2011a). Other aspects such as removing isolation, increasing communication with friends and neighbours, and that having technology saves time, depleting the tyranny of distance (Blainey, 1983) also influence women's adoption of technology. For both men and women, having access to technology has streamlined farming systems, and helped to increase productivity (Aubert et al., 2012; Block, 2012; Lawrence et al., 2011; Leigo et al., 2012; Tey & Brindal, 2012) and it has improved workers well-being by making them happier to be working on the property. In addition, men and women are finding technology used to run the farm to be more efficient, and useful because it saves time allowing them to do other jobs on the property (Aubert et al., 2012; Tey & Brindal, 2012). Importantly, having technology on the property has improved management practices, decision making, record-keeping and planning and it has given study participants access to information that they would otherwise not be able to gather whilst situated at the property. While technology can be intrusive, participants commented that it saves time, money and allows for broader communication with peers, industry, and customers.

Land managers profiles in the study are consistent with much of the extant literature. The majority of participants in both years produced cattle, with about 40% having a mixed farming business and were located in Queensland, which is the focus of the study. The vast majority were using technology with most respondents frustrated by the lack of internet connectivity. Similar to 2013, in 2016 not many participants were using technology directly related to production e.g., walk over scales. However, overall there was an increase in the use of such technology. Women were still the main users of technology, although the data shows that they have more choices about their use of technology in 2016. The female respondents indicated that men and children were more involved in the use of technology at the time of the survey. Overall, the findings of Study One show that women are motivated by personal, family and business decisions to adopt technology, they are supported by men in their decisions, which are valuable to the productivity of their farming business. The study, like in 2013, confirms that women adopting technology is modifying gender divisions away from traditional separate roles towards productive partnerships

Chapter 5 Study 2 Technology, Farming Families and Workers: It's all about succession and retention

Thesis Structure Overview: Chapter 5 – Chapter 5: Study 2 Technology, Farming Families, and Workers: It's all about succession and retention

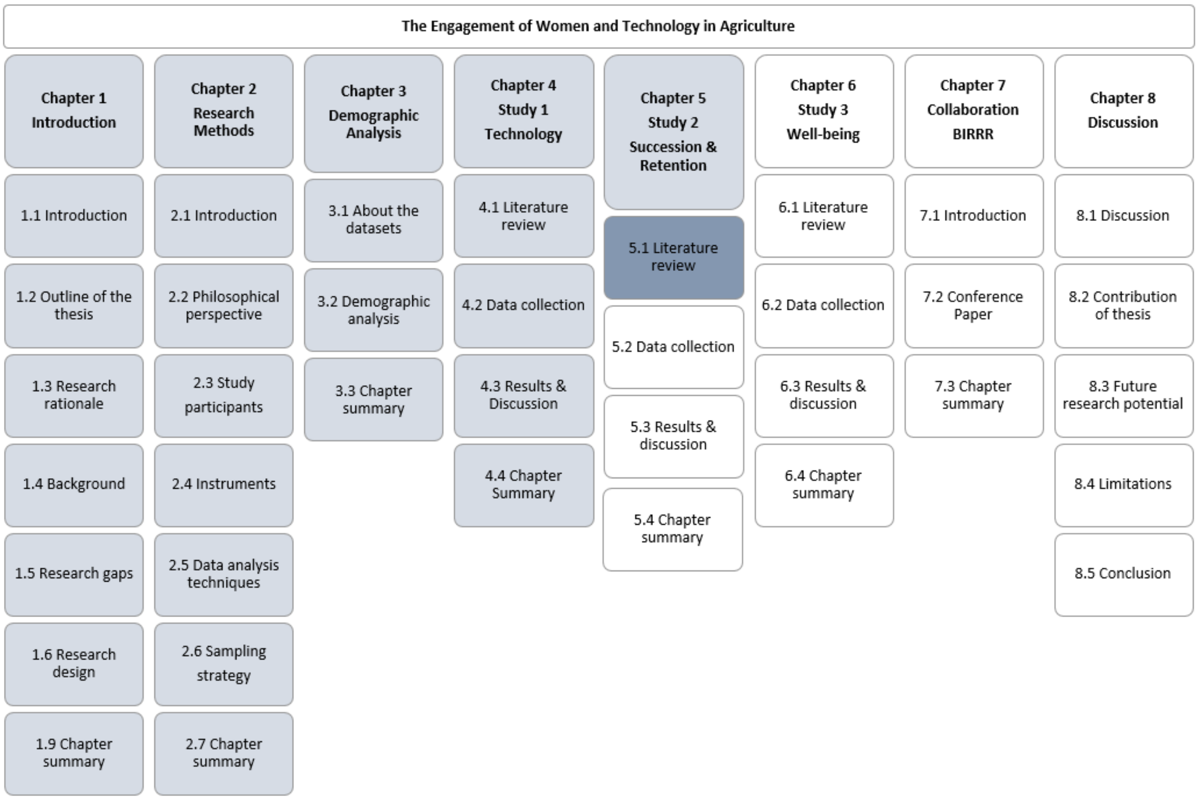


Chapter Five presents Study Two and responds to Research Gap 2, which identifies that 'There is no evidence that technological properties are more attractive to staff and children or how this effects staff retention and succession'. Technology in this context refers firstly to connection to the internet (Christensson, 2015) and secondly to the use of digital agriculture tools (CSIRO, 2015) tools, see Section 1.4.3. Succession *"involves the transfer of leadership, managerial control and ownership of family and farming assess from one generation to another"* (Falkiner & Steen, 2016, p. 2). Whilst there is a plethora of literature about succession, there is very little information that links technology to succession.

Hay and Pearce's (2014) study identified that children and staff may be more attracted to properties that are connected to the internet, highlighting a gap in the existing literature. The more technological the grazing property and business becomes, the more attractive it might be to a younger generation of producers which may be a solution to problems with succession and to a shortage of workers, see Sections 5.1.1 and 5.1.2. *Chapter 5* seeks to investigate *"How does having technology available make the family property more attractive to workers and returning children?"* The chapter provides an exploratory overview of topics related to succession (Section 5.11) and to farm/rural workers (Section 5.12) in the agricultural sector. It also provides a summary of how the data was collected (Section 5.2). Emerging themes fed into the questions in the online survey and are matched to the research gaps as shown in Appendix 6: Online Survey. Results and discussions are contained in Section 5.3 and Study Two's conclusions are reported in Section 5.4. *Chapter 8* will draw the three studies together and highlight future research potential.

5.1 Literature Review

Thesis Structure Overview: Chapter 5 – Literature review



Chapter Five reviews literature on succession and it introduces a discourse surrounding the attractiveness of technology connected farming properties to workers in an attempt to identify if having technology available makes rural properties more attractive to workers and to returning children. The benefit of technology to agriculture was discussed earlier in Section 0. While succession and workers' relationship with technology is not the primary focus of the study, these aspects are potentially important and are therefore incorporated into the thesis.

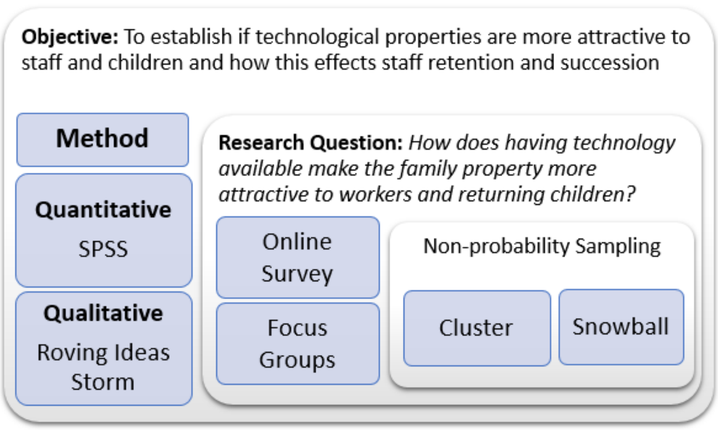


Figure 5.1: Overview of Study 2 Research Design

5.1.1 Succession

Discussion about succession is important because, at the same time Australia has both an ageing workforce and a shortage of rural workers (2016), yet the Queensland Government had set a target to double agricultural production by 2040 (Crowley, 2015, p. 87). In addition, fewer younger people are entering the agricultural industry, resulting in a shortage of suitably qualified workers as well as a lack of suitable candidates for succession of the business (O'Callaghan & Warburton, 2015; Redfurn, 2012; Wathes et al., 2008). The shortage of workers, Australia's ageing agricultural labour force and increased demand for food security will continue to push producers towards adoption of rural digital technologies to improve output efficiency (Hay & Pearce, 2014). In turn, the adoption and use of rural digital technologies may help to overcome the constraints of both fewer workers and less experienced employees (Wathes et al., 2008).

Family farming in Australia has been in slow decline over many years. To keep up with demand, retain communities and enhance food security (Linehan et al., 2012), Australia needs to keep family farming at sufficient and sustainable levels to meet the rise in consumption (Hicks et al., 2012). According to Hicks et al. (2012) succession planning is one way to achieve food security in family farming. Succession between generations within a family ensures continuity of the farming business and the farming community that surrounds it (Gill, 2013). However, succession decisions are driven by many influencing factors including longevity of the family farm, social, environmental and economic changes, and tax implications (Falkiner & Steen, 2016). The existing body of literature regarding surrounding succession investigates themes such as agency (Block, 2012; Schulze, 2005), stewardship (Eddleston, Eddleston, & Kellermanns, 2007), dialectics (the investigation of truth or opinions) (Pitts, Fowler, Kaplan, Nussbaum, & Becker, 2009). Resilience (Grubbström, Stenbacka, & Joosse, 2014), temporality and place identity (Downey, Threlkeld, & Warburton, 2017; Gill, 2013) as well as patriarchy (Falkiner & Steen, 2016; Grubbström et al., 2014) and gender (Price, 2010, 2012). Each of these will now be discussed. There is also much discussion on which child or which children (Brandth & Overrein, 2012; Massis, Chua, & Chrisman, 2008; Tunkkari-Eskelinen, 2016) and, more recently, daughters (Luhrs, 2016) should inherit the farm as well as concern about the spouses of those children and their position in terms of succession (Falkiner & Steen, 2016): it is a complex topic. A review of each of the major aspects noted above follows.

Agency: Agency in succession may be encountered when one family member owns the farm and others manage the property or the farming business. Agency theory in its simplest form is when *"one party acts on behalf of another"* (Shapiro, 2005). A problem with agency surrounds asymmetric information (Shapiro, 2005) where, as the older generation becomes less involved in the farm and farming practices change with the new generation of farming, their knowledge may differ from those who are managing the farm. There may be a conflict with regard to the 'best' knowledge required to manage the farm effectively. The younger generation, who are responsible for the management of the property, will have a different knowledge base than previous generations potentially causing tension in decision-making.

Dialectics: Dialectics, *"the art of investigating or discussing the truth of opinions"* (Oxford Dictionary, 2017) suggests that people may have different views with competing relational forces that may exist in a push/pull interplay (Gill, 2013; Pitts et al., 2009). Therefore *"different weights might be attached to the voices of senior farm operators and their offspring"* (Pitts et al., 2009, p. 62), which may have an effect on succession planning and decision making. Altruism also plays a part in agency because "*often it compels older generations to care for their children and be considerate to one another, it fosters loyalty and commitment to the family business"* (Schulze, Lubatkin, & Dino, 2003) placing extra pressure on decision making, particularly about investment into the property vs. investment into retirement.

Block, in an investigation into research and development (R&D) investment in family firms cites that lone founder firms are more likely to invest intensely in R&D and in turn in productivity, than family firms are. Lone founder firms are single owners that are active in the business and have no relatives involved in the firm, while family firms have at least two family members involved in the firm (Block, 2012). While investment into R&D can influence the development of new products and the adoption of new technologies *"that may enhance productivity"* (Block, 2012, p. 248), the same investment may have the opposite effect for retirement (Block, 2012). In family firms, which are similar in structure to multi-generational farms, decisions about the amount of R&D investment may be positively affected by the level of agency within the relationships of the business as *"heritage and tradition and the intended transfer of the farm to the next generation leads family owners to be effective monitors [of the business] in the long term"* (Block, 2012, p. 252). This may lead to higher levels of both R&D investment and productivity. On the other hand agency decisions may be negatively affected through dialectics because of *"deep seated patriarchal, rural ideologies of older generational farmers that promote an absolute conception of ownership and control"* (Falkiner & Steen, 2016), which may stifle investment into R&D because of alternative generational views that are often cited in farming families.

While young family members might aim to farm independently, they may also at least particularly reliant on altruism and the experience of older generations especially in their early period of operation (Pitts et al., 2009). Eddelston and Kellermans, in terms of stewardship state *"while the family can be a source of strength to a family business, it can also cause its demise"* (2007, pp. 545-546). Multi-generational farms may be more careful spending on R&D because they have other factors to consider. For example supplying an income to more than one family, providing a retirement income for ageing generations, managing complex tax issues and preserving capital in the business for future generations (Falkiner & Steen, 2016; Pitts et al., 2009; Schulze et al., 2003). To ensure the survival of the farm, family units must pay attention to agency, dialectics, and altruism and in turn invest more into R&D that leads to increased productivity to remain competitive into the future. Regardless of whether the property is handed down to future generations or used to fund retirement.

Resilience: As younger generation farmers either move into management positions or inherit the farm they will need to relate and adapt to ongoing processes of change both in the agricultural sector and in the way the family farm is managed (Grubbström et al., 2014). Stressors stem from challenging economic, political and social factors as well as emotional stress (Grubbström et al., 2014). To cope with these stressors young generation farmers need to show resilience, *"the ability to withstand or recover from difficult conditions"* (Oxford Dictionary, 2017). Grubbström et al., (2014) see *"resilience as a process at both individual and societal level rather than a fixed condition, which means that the focus is placed on dynamic relationships and strategies"* (p. 152). The dynamic relationships that result from succession will require strategic responses to agency decisions and the younger generation's resilience will play a part in their new role. Grubbström et al. (2014) cite that succession is an extended process with many obstacles for younger generation farmers, and that 'resilient future farming' is defined as *"the ability to create a resilient business that can cope with change and uncertainty based on individual and contextual conditions"* (p. 159).

Temporality and Place Identity: Succession planning is influenced by past, present and future decision making and may be a powerful tool used by farming individuals and families to control and shape the future (Gill, 2013). This author's study focussed on succession planning and temporality i.e. *"the state of existing within or having some relationship with time"* (Oxford Dictionary, 2017). Two key findings are evident from Gill's (2013) studies. On one hand families with a long history in their communities have a sense of obligation to their forebears, to the land, to the community and to their children to continue farming, which is not dissimilar to altruism (Schulze et al., 2003). On the other hand, families who fill a management role on the family farm may either inherit the farm directly or the farm may be split up amongst the siblings or sold off, leaving an uncertain future for the family farm manager (Gill, 2013). Those who stay on the land become knowledge bearers of that property and the farming upon it, older generations that stay on the farm do so to pass on their knowledge, if agency allows them to (Gill, 2013; Shapiro, 2005). This knowledge transfer provides continuity in the farming land and *"results in farmers experiencing strong ties to the past and the farmers lived experiences, which in turn, guides their decisions for the future"* (Gill, 2013, p. 80). The state of existence for all parties must be a consideration in terms of succession as *"farms are both homes and places of production"* (Downey et al., 2017). Place identity or peoples' cognitive relationship with place may influence people's engagement in change, particularly for those with traditional farmer identities who are rooted to the land (Downey et al., 2017; O'Callaghan & Warburton, 2015). Patriarchal structures of succession exclude women as helpers and include men as farmers (O'Callaghan & Warburton, 2015).

Patriarchy and Gender: In the 1970s feminist studies aimed to bring women into the fields of vision of gender relations (Price, 2010). By the 1980s *"feminist geography aimed to promote changes in gender relations"* (Price, 2010, p. 82) to empower women and by the 1990s women's value was acknowledged (Price, 2010). Gender research in rural geography explored the lives of farming and rural women beyond patriarchal roles and inheritance (Brandth, 2006; Price, 2010). While men are seen as having a singular role as a 'farmer', women have many different roles (Whatmore, 1991). However, while historically these roles have not influenced decisions of succession, women are increasingly seen as joint farm managers (Falkiner & Steen, 2016) and hence the hidden workforce of the family farm business (Dumas, Dupuis, Richer, & St.Cyr, 1995; Gasson & Winter, 1992; Price & Evans, 2006). While men were seen as providers for their families, the women's role also involved preparing the children for succession (Cassidy & McGrath, 2014). Men with dual roles as both fathers and farmers also helped in preparation for succession by teaching their children how to farm (Brandth & Overrein, 2012). However, these skills may become lost as children move away from the farm for schooling. Children leaving the farm for schooling may leave a gap in knowledge and in relationships with the previous successor, which may leave the potential successor with limited skills to take over the farm (Massis et al., 2008) and therefore become a barrier to succession.

Farming roles, scripted over time, condition children towards succession where the *"farming way of life is the most significant norm"* (Cassidy & McGrath, 2014, p. 401). Scripts are defined by Schank and Abelson as "*a predetermined, stereotyped sequence of actions that define a well-known situation*" as cited in Vanclay and Enticott (2011). Historically scripts socialised farming children into roles either of succession or marriage, or education where Cassidy and McGrath (2014) suggest that *"the succession of the family farm into the next generation is a constant and organising force"*. Scripts often follow the patriarchal model of succeeding sons over daughters where sons are seen as the natural successor (Cassidy & McGrath, 2014; Downey et al., 2017; Falkiner & Steen, 2016; Luhrs, 2016; Price, 2012; Silvasti, 2003). However, excluding daughters may reduce the sustainability of rural communities (Geldens, 2007; Little & Panelli, 2003; Luhrs, 2016). While women's role in farming is increasingly recognised in management (Falkiner & Steen, 2016), the out-migration of daughters may affect the availability of seasonal workers, carers, wives and the maintenance of rural community institutions, such as sports clubs and voluntary organisations according to Luhrs (2016), adding to the decline of family farming in Australia.

Technology can support succession in many ways. Primarily investment into technology can increase production and reduce costs (Falkiner & Steen, 2016; Hicks et al., 2012; Submission, 84, 67, 87, 94, "Smart farming: Inquiry into agricultural innovation," 2016, p. 61). It can allow the farmer more time by streamlining processes and it can bridge the gap between generations by providing an outlet for increased communication and information (Falkiner & Steen, 2016). Adoption of agricultural technology may help farmers to overcome problems such as market access, extension services, information and it may help to improve supply chain management and productivity (Deichmann et al., 2016). Therefore, it is important that technology be adopted on farm. While the older farming generation is altruistic and because they rely on past scripts, differing levels of agency can negatively affect decisions to adopt new processes including technology that may assist in farming. To open a discussion about the relationship between technology use and succession, a series of questions was asked to beef producing families in Queensland Australia about access to the internet and technology used on their property and whether technology will benefit their children.

5.1.2 Workers

As previously noted, agribusiness in Australia is suffering a skills shortage of workers from leaders to labourers. Fewer workers in remote and regional areas reduce the viability of communities and result in fewer farming communities (Becker, Hyland, & Soosay, 2013). A recent Australian Parliamentary enquiry into Agricultural Innovation found that fewer young people are entering agriculture and that *"the trend may be due to negative perceptions of farming and particularly a failure to connect to agriculture with innovation"* (Submission 57, "Smart farming: Inquiry into agricultural innovation," 2016, p. 59). The report also highlighted the aging population as a contributor to the shortage (p. 57). The scarcity of skilled workers appears to have generated an increased interest in the adoption of technology and innovation. However, there are barriers related to a lack of leadership due to the ageing demographic of farmers (Submission 95, "Smart farming: Inquiry into agricultural innovation," 2016, p. 57) and a lack of technology education offerings to support the adoption of new technologies (Section 5.34 Access to Skills, "Smart farming: Inquiry into agricultural innovation," 2016, p. 62).

In terms of workers, technology gives staff connectivity to the outside world, entertainment for the down time (i.e., non-work time) and independence. Staff can also use the internet to research information or for further education. As technology diffuses into agriculture, producers will need to consider employing *"a more diverse and highly skilled workforce with skills across a wide range of disciplines"* (Australian Government, 2015, p. 4), therefore access to the internet to enable the learning of new skills, particularly about technology, becomes essential for workers. However, focus group participants highlighted that they had concerns about *"who would pay for the internet for staff"* because they *"did not have enough data for the kids or workers".*

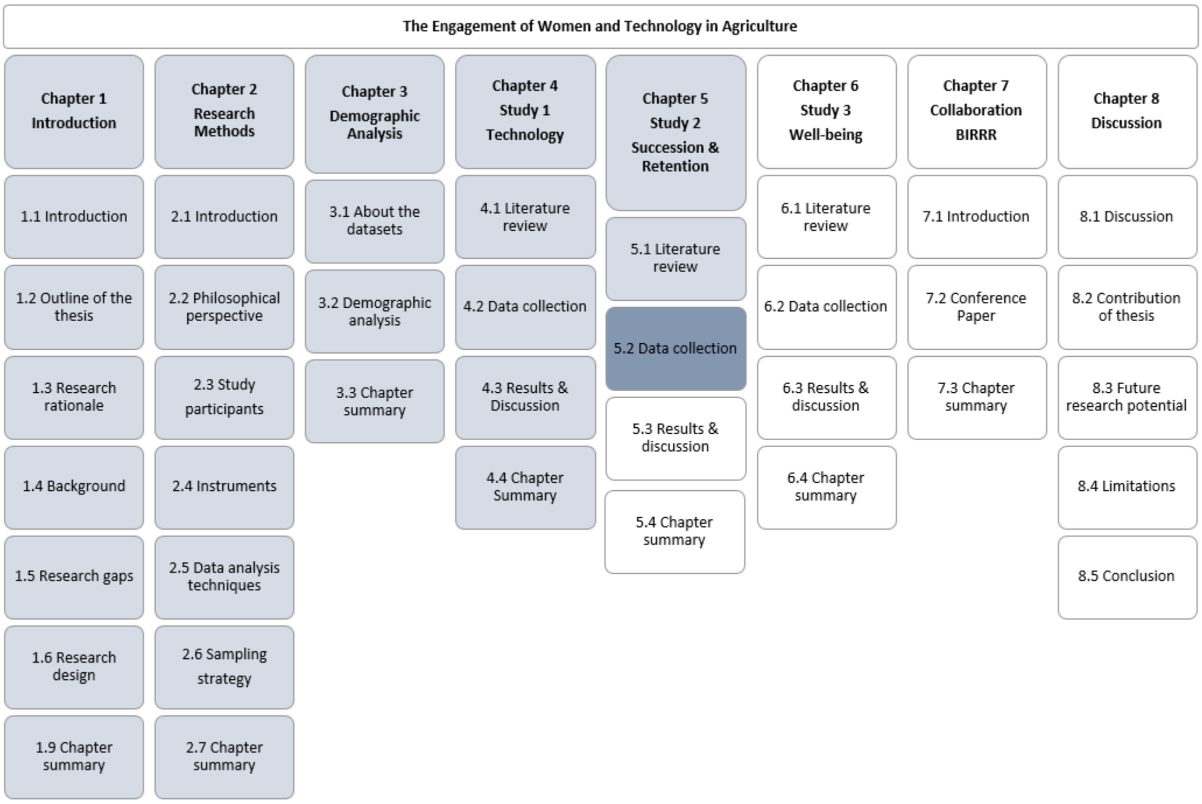
The reflection of the agricultural industry as a place for hard work, uneducated workers or that it is male dominated is harming the reputation of working in farming production (Watts & Harrison, 2017). This reputation adds to the trend of workers seeking employment in other industries, whether they are seasonal workers or children from agriculture. The lure of 'big money' from mining and other sectors is attracting workers away from agriculture (Downey et al., 2017; Watts & Harrison, 2017). Failure of family farms and in turn, failure of farming communities as well as participation in education also contributes to children moving away, leaving ageing parents to continue running the farming enterprise on their own (Downey, Threlkeld, & Warburton, 2016; Falkiner & Steen, 2016). The farming lifestyle is often perceived as isolating and less rewarding by young people who are more reliant on social connection than their predecessors, which may also contribute to the lack of workers in the agriculture sector (Falkiner & Steen, 2016). More recently the lack of connectivity to the internet and to mobile services contributes to the shortage of skilled agricultural workers (Submission 57 & 56, "Smart farming: Inquiry into agricultural innovation," 2016). Attraction of rural and remote regional workers in Australia is made more difficult by policy that states that *"service and infrastructure provision are based on efficiency rather than equity"* (Haslm McKenzie, 2007, p. 75). This means that services, such as training, housing, health, and community are limited in these areas preventing companies and communities from attracting and retaining skilled workers.

Providing internet and technology access to staff may help to overcome a shortage of workers, it may help to keep workers more satisfied and to feel less isolated while working in regional and remote areas. To ensure production increases to meet demand it is important that technology is adopted on farm and learned by skilled and unskilled workers. To open a discussion about the relationship between technology use and workers, a series of questions was asked to beef producing families in Queensland Australia about access to the internet and technology used on their property and whether technology will benefit their workers.

The next section discusses data collection and contains the demographic analysis followed by the results and discussion section, which analyses the online survey and focus group outcomes. Section 5.4 follows and provides a summary and conclusions to *Chapter 5*.

5.2 Data Collection

Thesis Structure Overview: Chapter 5 – Data Collection



Chapter Five Study 2 focusses on the succession and workers data collected in 2016 and describes how the respondents perceive having technology on their property, which may be used to enhance farming practices and communication, affects children's decisions about whether to return to the farm as a career, and the attractiveness of technological properties to workers. A single survey was used to ask questions about the topics in each of the three studies (*Study 1: Technology*, *Study 2: Succession and Workers, and Study 3: Well-being*). Elected questions drawn from the single survey were attributed to the topics in in each of the studies. A summary of the sampling strategy and the participants is included in this section. For a more in depth view, for the sampling strategy see Section 2.6. For information about the data set see Section 3.1 and for the demographic analysis see Section 3.2. Data from the focus group outcomes is in Section 5.3.3. Data in Section 5.3.2 was analysed using descriptive analysis including frequencies and a Chi-square test for independence with Yates' Correction for Continuity. Yates' Correction for Continuity is designed to compensate for an overestimation of the chi-square value when using dichotomous data in 2 x 2 tables (Pallant, 2016).

5.2.1 Sample

As in Section 4.2.1, cluster sampling divided the population into groups and drew a simple random sample, which was used to distribute the survey via Qualtrics (2013) to the membership database from the Queensland Isolated Children's and Parents' Association (ICPA) (approximately 1200 members). The online survey was also distributed to the Better Internet for Rural Regional and Remote Australia (BIRRR) group, which had approximately 6000 members at the time of the survey, see Section 4.2.1 for more details the sample.

5.2.2 Online Survey

As stated in *Chapter 4*, a single survey was used to ask questions about the topics in each of the three studies. Selected questions drawn from the single survey were attributed to the topics in each of the three studies. Twenty-two questions about succession and workers were extracted and then analysed are presented in Section 0. The online survey was open to women and men over the age of 18. Participants were advised that technology should be defined as including personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, National Livestock Identification Systems (NLIS), remote cameras, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology and other livestock management systems, see Figure 5.2 for examples of on farm technology.

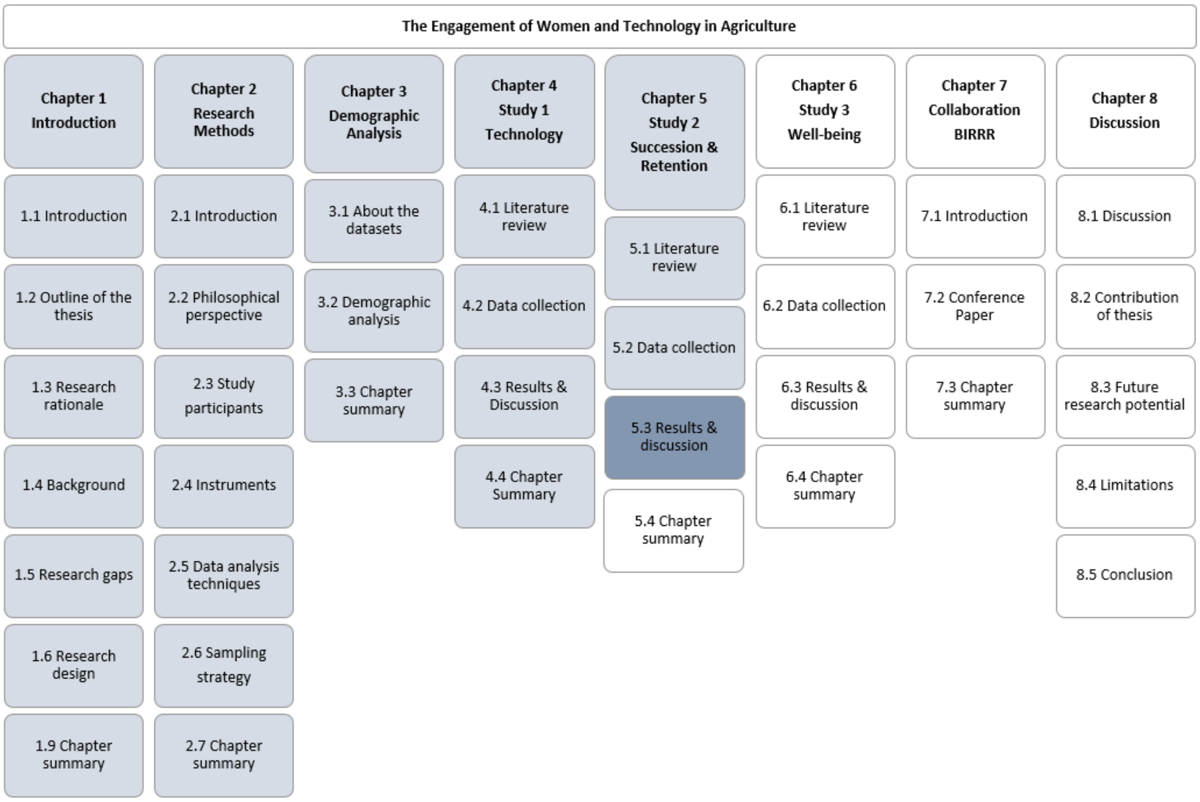
Figure 5.2: Examples of on farm technology provided to participants

A frequency analysis was used to compare partial data to completed data which confirmed the suitability of 100% completed surveys to be used in the analysis (N=200), see Section 4.3.2 for a further breakdown of the survey responses. Unlike in *Chapter 4*, the questions in *Chapter 5* had not been asked before, therefore no comparison is made to 2013 data in *Chapter 5*.

5.2.1 Focus Group

The focus group data used in *Chapter 5* was collected at the Queensland Rural, Regional and Remote Women's Network annual conference as discussed in Section 2.3.5. Data collected from the focus group supports the findings from the online survey. Results are used within the online survey analysis where appropriate and are summarised in Section 5.3.4. The data collected was coded into explanatory concepts, which were used to develop the theory surrounding technology adoption by rural women, see Section 5.2.1 for more details on how the data was collected and processed.

5.3 Results and Discussion



5.3.1 Demographics - Succession and Workers Survey

Two hundred respondents completed the survey in 2016, of which 8.5% were male and 91.5% were female. Men were aged between 18 and 35 years (1%) and older than 36 years of age (7%). Twelve percent of the women were aged between 18 and 35 years, and 79.5% were older than 36 years of age, see Table 5.1 for a summary of responses.

Table 5.1: Gender breakdown of sample (N=200)

				2016 (N=200)
		Percent		
	N	Male	N	Female
17 or younger	1	0.5	0	0.0
18 - 35	2	1.0	24	12.0
36+	14	7.0	159	79.5
Total	17	8.5	183	91.5

One hundred and ninety five respondents indicated the location of their property, the majority were from Queensland, Australia, with respondents in all other States, and Territories, except for the Australian Capital Territory and Tasmania, see Table 5.2 for a summary of responses.

Table 5.2: Distribution of sample between States of Australia

	2016 (N=200)	
State/Territory	N	Percent
Queensland	176	88.0
New South Wales	8	4.0
South Australia	2	1.0
Victoria	2	1.0
Western Australia	5	2.5
Northern Territory	2	1.0
Australian Capital Territory	0	0.0
Tasmania	0	0.0
Missing	5	2.5
Total	200	100

Note: there were no responses from the Australian Capital Territory or Tasmania

The next section presents the results and discussion, which analyses the online survey and focus group outcomes. Section 5.4 follows and provides a summary and conclusions to *Chapter 5*.

5.3.2 Online Survey

Land Manager/Ownership Profile

Seventy-four percent of respondents were both owner and manager of their property. Eleven percent manage the property they are on and 15% had some other land management capacity. Of the 15% that said they had some other capacity, 38% identified as “invisible farmers” (Brandth, 2002; Bryant & Pini, 2006) labelling themselves as wives, spouses, or daughters of the property. Thirty-one percent said that the property was family owned and that they were involved at a management level with other family members. A further 10% said that they were joint owners with their spouse (see Figure 5.3). The term ‘invisible farmer’ is increasingly being used to define women who work in agriculture where their role is difficult to describe (Brandth, 2002). Women’s position in farming is often tied to their marital contract, seen as the farmer’s wife without independent status (Brandth, 2002, p. 184). The farm work that women do often is overlooked, unnoticed, and invisible to others (Brandth, 2002; Little, 1987; Whatmore, 1991), hence the term ‘invisible farmer’.

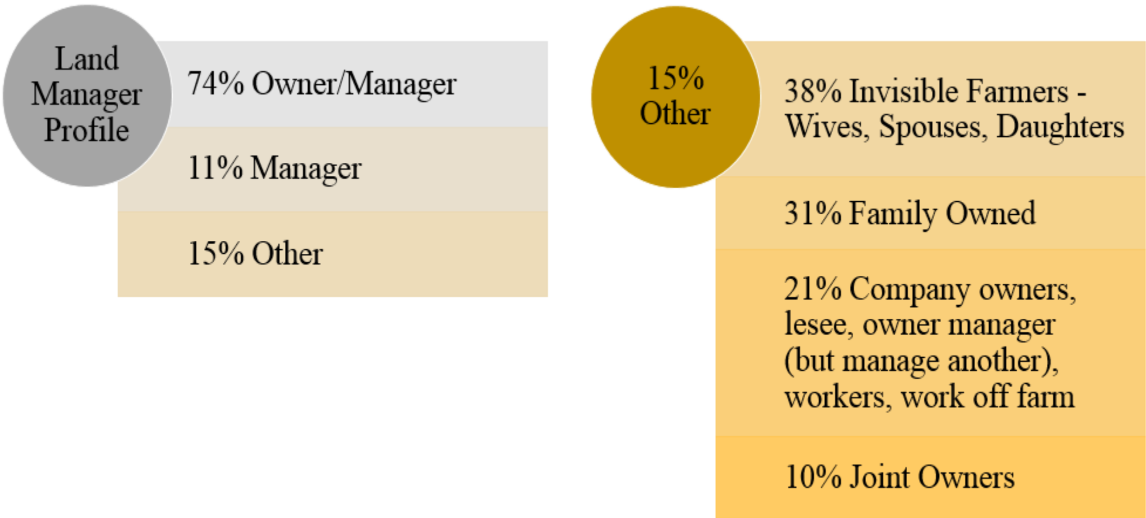


Figure 5.3 Land manager ownership profile

The land manager profiles are consistent with much of the extant literature. However, place identity, where people’s engagement with the farm informs a sense of belonging to the farm, may play a part in the ownership profile. For example, those farms that are family owned with participants being involved at a management level, may be in that position because their parents may have a strong attachment to the farm and the lifestyle (Downey et al., 2017). On the other hand, it may be that the farm does not generate enough income to support both retirement and succession. Therefore, both retired parents and active farmer families stay on farm (Falkiner & Steen, 2016; Pitts et al., 2009; Schulze et al., 2003).

When asked how they acquired their property, 12.5% of respondents indicated that they had inherited their property. Thirty-two percent of respondents answered, *"No, I did not inherit the property"* implying that they had acquired their property some other way and 20.0% had *"taken over from mum and dad"*. These respondents identified in their comments that their parents were still on the property, and the respondent is running the business, that no ownership changes were formalised. Parents residing on the property with family members as management may support previous research where ownership may not be being transferred due to heavy tax burdens or possibly because of place attachment by the previous generation (Falkiner & Steen, 2016). Place attachment should not be seen as a negative consequence because 'familiness' can enhance the business and create a competitive advantage for the farming family (Suess-Reyes & Fuetsch, 2016). Fifteen percent of respondents work on a property that someone else owns. Nearly 13% of respondents are *"working for mum and dad"* on their property. Eight and a half percent of respondents did not answer this question see Table 5.3.

Table 5.3 Frequency analysis of responses to the question "Did you inherit or take over the property?"

		2016 (N=200)
Ownership profile	n	Percent
No, I did not inherit the property (purchased)	63	31.5
I have taken over from mum and dad (they are still on farm, but I run it)	40	20.0
I work on the property (someone else owns it)	30	15.0
I inherited the property	25	12.5
Mum and Dad own the property and I work their	25	12.5
Missing	17	8.5
Total	200	100

Of the properties that someone else owns (17%), 26% responded that their in-laws owned the property, 17% said their spouse owned the property and 13% said that a grazier or a grazing company owned the property. Another 13% said they were in partnership with their parents and nearly 9% had joint ownership with someone else. Nine percent of respondents had some form of succession planning agreement in place. Four percent said that they owned the business but not the land, 4.3% said that the property was owned by extended family such as an aunty or grandmother. The remaining 4.3% said that the family company owned the property.

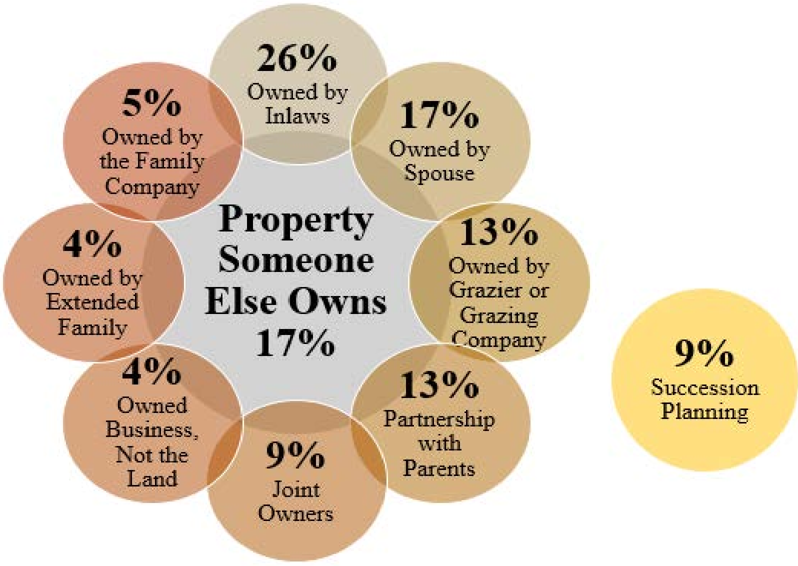


Figure 5.4: Responses for "I work on the property, someone else owns it. Who?" (N=200)

Fifty-one percent of respondents have only ever worked in agriculture. Of the remaining 49% of respondents, the majority (23.7%) previously worked as teachers or in education, 11% worked in administration, 10% worked in nursing and 9% worked in banking, finance, or commerce. A further 16% worked as professionals i.e. geologists, pilot, engineering, accountants or in medicine (5.3% of participants each). Ten percent of participants previously worked in pharmacy, media, law, hospitality, and extension (2% of participants each). A further 10% worked in retail (4.1%), mining (3.1%) or marketing (3.1%) and 7% of participants previously worked in tourism, recreation, local government, human resources, customer service or childcare. When asked if the participants would rather work somewhere else, 82% said no, indicating a strong sentiment of place reminiscent of farmer's scripts, supporting findings from Cassidy and McGrath (2014, 2015); Downey et al. (2017).

Some of the other jobs listed as alternatives that respondents would like to do or are already doing include administration, retail, banking/business (2), events (2), working in the gas industry, health (2), mediation, photography and writing/publishing. Some respondents just wanted to work "away from isolation (2)" or earn an "off-farm income (7)" others wanted to work in "paid" teaching positions (3). The remaining participants listed retirement (2) or working from home as other occupations they would like to do.

The survey asked participants to indicate how many children they had in various age groups and whether they lived at home, were at boarding school, or were not living at home. Twenty percent of respondents had two children under 16 living at home, 17% had one child aged under 16, 10.5% had three children and 5% had four children aged under 16 living at home. Nineteen percent had one child over 16 at boarding school, 14.5% had two children over 16 living out of home, 12.5% had one child over 16 at boarding school and 11.5% had one child over 16 not living at home. A further breakdown of the number of children per participant is in Table 5.4.

Table 5.4: Number of children (participants could select more than one group)

	2016 (N=200)				
	1 Child	**2 Children**	**3 Children**	**4 Children**	**5 Children**
Under 16 at home	17.0	20.0	10.5	5.0	-
Under 16 at boarding school	19.0	6.0	0.5		-
Over 16 at home	9.0	4.5	0.5	-	-
Over 16 at boarding school	12.5	1.0		-	-
Over 16 not living at home	11.5	14.5	6.0	3.5	1.5

Family Farming History and Succession issues

The survey asked participants how many generations had owned the property, 8.5% of respondents said that they were the fifth or more generation to have owned the property, 12% were fourth generation, and 24.6% responded that they were third generation owners. Twenty-four percent responded that they were second-generation owners and 31.2% responded that they were first generation owners. When asked if they intended to hand down the property, 61% of respondents answered "yes" they intended to hand the property on to future generations and 8% responded "no" they did not want to pass the property on. Nearly 31% chose the response "maybe" they would want to pass the property on to the children. The subtle difference in answers may be due to a generational response, where the longer the property has been in possession of the family, the more desire there is for it to succeed to the next generation (Cassidy & McGrath, 2014). On the other hand, it may be that the respondent is conditioned to the response that succession is the norm, but is uncertain about conditions upon which succession will occur (Cassidy & McGrath, 2014, p. 401). Some examples of potential hurdles are contained in Table 5.6 to Table 5.10. These respondents were asked why they were undecided.

A cross tabulation was performed between the question "How many generations of your family has owned this property?" and "Do you hope/intend to hand the property on to future generations to test if the generation was the driver of the "yes" and "maybe" responses the results are shown in Table 5.5.

Table 5.5: Cross tabulation, showing which generation of property owner intends to hand their property onto future generations (N=200)

Number of generations	2016 (N=200)		
	Percent		
	Yes	No	Maybe (Why is that?)
One Generation	14.6	5.1	11.1
Two Generations	14.6	1.0	8.1
Three Generations	18.7	1.5	4.5
Fourth Generation	8.6	0.5	3.0
Fifth Generation or more	4.5	0.0	4.0

An independent t-test was conducted to compare the generation responses for "yes" and "maybe" to test if one response was more significant than the other was. There is no significant difference between the "yes" (M=2.57; SD=1.21) and "maybe" responses (M=2.38; SD=1.40; t=(180)=.963, p=.337, two tailed). From these results, we can infer that there is no significant difference between those generations who definitely want to pass their property on (i.e. those who strongly chose "yes") and those who hesitated for some reason (i.e. those who chose "maybe"). Regardless, there is a still a strong tendency toward succession by participants within the generations as can be seen in Table 5.5.

To investigate the motivation behind the response "maybe" a second cross tabulation was performed on the question "How many generations of your family has owned this property?" and the "Maybe, why is that?" responses. The majority of responses noted that the decision depended on what the children wanted to do, what their interests were and if they wanted to come back to the property (25 comments). Furthermore, respondents showed concern that it was their own choice to work in agriculture, therefore, the decision to take over the property "should not be pushed" onto the children. A selection of anecdotal comments is contained in Table 5.6.

Table 5.6: Anecdotal comments about handing the property to future generations – depends on what the children want

Property Owner	***Anecdotal Comments***
First generation	*"This was my husband and my dream to own a property; it will depend on our children's dreams"* *"Depends on what they want to do. We do what we do for our sake not our children"*
Second generation	*"It will be our children's choice, not something we want to push them into because this is what we do"* *"I don't want the kids to think they have to return to the property if their interests/passions lie in other areas. It is their choice and we respect that"*
Third generation	*"Depends on the next generations interest, and if they want to continue on the farm"* *"If they choose to be on the land"*
Fourth generation	*"Depends if they are wanting to be farmers as well"*
Fifth generation	*"Our belief is our children should live their own lives, not one they perceive to have inherited."* *"Depends if they are interested, if not, no"*

Similarly, survey participants commented that their children have other careers to pursue, that they may not choose to take over the property or that they may choose to manage the property remotely (nine comments). Samples of anecdotal comments are contained in Table 5.7.

Table 5.7: Anecdotal comments about handing the property to future generations - depends on what the children pursue

Property Owner	***Anecdotal Comments***
First generation	*"Children have other careers that are not related to Agriculture."*
Second generation	*"If they want to take over or can manage it remotely."*
Third generation	*"Children well-educated with their own professions so may not be interested and have comfortable city lives with city partners."* *"Depends on the individual child's aspirations"*
Fourth generation	No comments
Fifth generation	*"If that is the future that they most desire then I am happy for them to be in Ag"*

A further ten comments were about the agricultural industry being unpredictable or whether or not the farm is viable or that the farm was not big enough to share between the children. A sample of anecdotal comments is contained in Table 5.8. Survey participant comments about farm viability support Calus, Van Huylenbroeck, and Van Lierde (2008) who suggest that lower total farm assets result in farm discontinuation (p. 38) and that if the farm has optimised its viability then it will be transferred within the family. If not, the family will exit and liquidation will be optimised (Calus et al., 2008, p. 42).

Table 5.8: Anecdotal comments about handing the property to future generations – unpredictable industry or non-viable farm

Property Owner	***Anecdotal Comments***
First generation	*"Agriculture is unpredictable, especially with government frivolity."* *"Depends how the agricultural is fairing over all."* *"See how cattle prices remain"* *"This farm is not big enough to sustain a family unless they work off farm."* *"Must be equal for all children"*
Second generation	*"It won't be able to be handed on to 4 children"* *"Not sure how to share it 5 ways!"*
Third generation	No comments
Fourth generation	*"We are concerned about the future of agriculture because of vegetation management laws, foreign ownership and droughts. It is a really tough life at times but we would like to see at least one of our sons interested in the property."*
Fifth generation	*"Depends what they want to do and if it is viable"*

Interestingly, the fifth generation comment *"depends on what they want to do and if it's viable"* clearly reflects Block's (2012) views that older generations are less innovative and therefore rely on the younger generations to show interest before succession is developed.

The next set of five comments were about affordability, about being unsure if the property owners wanted their children to take over and about failure of succession planning. These comments are supported by Falkiner and Steen (2016) who posit that most succession planning fails because of a lack of communication… for fear that *"in doing so [planning] will open a can of worms and disrupt family harmony"…* and for fear that *"they will not be able to develop a working plan"* or through *"mistrust of daughters/siblings in law"* or *"the reluctance to face the reality of dying"* (pp. 1-19). Comments by respondents to succession planning failure are vague, with respondents only citing that succession planning had failed. Comments about being unsure if the respondents wanted the children to take over and comments about the children needing to purchase the property are stated clearly. A sample of supporting anecdotal comments is contained in Table 5.9.

Table 5.9: Anecdotal comments about handing the property to future generations – affordability, being unsure and failure of succession planning

Property Owner	***Anecdotal Comments***
First generation	"*There are times when I wouldn't wish this life on our kids. But not often."*
Second generation	"*One child would like to come home - to me this is akin to a slow death sentence"* "*First succession plan failed"*
Third generation	"*They will need to purchase it from us so that we can retire"*
Fourth generation	"*Affordability*
Fifth generation	No comments

The remaining comments were associated with the participant either not having children or their children being too young, so decisions about succession are too far into the future, see Table 5.10.

Table 5.10: Anecdotal comments about handing the property to future generations – decisions too far away, do not have children or who knows?

Property Owner	***Anecdotal Comments***
First generation	No comments
Second generation	*"Depends on what my daughters want to do as a profession. They are currently 5 and 4 years old, so there is a lot of time..."* *"Who knows???"*
Third generation	No comments
Fourth generation	No comments
Fifth generation	*"Hope to have children but still waiting..."*

The survey asked if the respondents hoped that their children would return to farming. Just over 80% of the men and 87% of the women agreed or strongly agreed that they hoped their children would return to farming. The data was recoded so that the responses for agree and strongly agree were equal to "yes" and that disagree and strongly disagree were equal to "no" to see if the was a difference between men and women's responses. A chi-square test for independence (with Yates' Continuity Correction to compensate for an over estimate pf the Chi-squares value in 2 x 2 tables (Pallant, 2016)) confirmed there was no significant difference between gender and succession preferences X^2 (1, n=200) = 0.10, p=.75, phi = -0.50, (Table 11). The large effect size indicates a strong association between gender and succession, highlighting an underlying and profound hope by both males and females for children to return to farming, giving an indication of respondent's attitude, see Table 5.11. However, caution is advised in terms of reliability and generalisation due to the small number of men who answered the survey as noted by the minimum expected count.

Table 5.11: Chi-square test for independence: Gender and 'I hope my children return to run the farm'

Chi-Square Tests (N=200)

	Continuity Correction[b] Value	**df**	**Asymptotic Significance (2-sided)**	**Phi**	**Expected count**
I hope my children return to run the farm	.100	1	.751	-.50	2.09

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.09.

b. Computed only for a 2x2 table

The survey also asked about technology and its role in succession and retaining workers. As noted earlier, technology on farms can be beneficial to families, children, and workers, by providing access to information, education and business management tools, as well as health care and for communication with family, friends, colleagues, and markets. The next set of questions introduces the topic of technology and the role it plays in succession and with workers.

Technology and its role in succession and with workers

Participants were asked to agree or disagree with the statement *"Using technology will help with production into the future"*. Nearly 97% of women and 100% of men agreed or strongly agreed with the statement. The data was recoded so that the responses for agree and strongly agree were equal to "yes" and that disagree and strongly disagree were equal to "no". A chi-squares test was completed to test the difference between gender and technology/production preferences. The minimum expected cell count (.48) has been violated by 1 cell (25.0%) due to the small number of male responses. While this limitation is acknowledged, the overall findings remain important as it is historically hard to get producer men to complete this questionnaire (Hay, 2013).

The chi-square test for independence (with Yates' Continuity Correction) confirmed there was no significant difference between gender and technology/production preferences X^2 (1, n=200) = .000, p=1.0, phi=0.05 (see Table 5.12). The large effect size indicates a strong association between gender and the use of technology to increase production. While acknowledging the small number of male responses, this finding is interesting from the male point of view as previous research identifies cattle producer men as technology averse (Adrian et al., 2005; Hay, 2013).

Table 5.12: Chi-square test for independence: Gender and Using Technology will help with production into the future

Chi-Square Tests (N=200)

	Continuity Correction[b] Value	df	Asymptotic Significance (2-sided)	Phi	Expected count
Using Technology will help with production into the future	.000	1	1.000	.052	.48

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is .48.
b. Computed only for a 2x2 table

Similarly, participants were asked to agree or disagree that *"farming with new technology would help the grazing industry to remain productive"*. Sixty-seven percent of participants strongly agreed and nearly 30% somewhat agreed that technology would help with productivity. Interestingly, since previous research identified men as limited users of technology, male respondents 100% agree with the statement, while around 3% of females disagreed that technology will help the grazing industry to remain productive, see Table 5.13.

Table 5.13: Frequency analysis of the question "Farming with new technology would help the grazing industry to remain productive"

	2016 (N=200)			
	Percent			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
Farming with new technology will help the grazing industry to remain productive	67.3	29.6	2.0	1.0

The next question asked the participant how they mainly use their internet. Participants were also asked to rank their usage on a scale of 1= most used to 4 = not used. A means analysis highlights that participants mostly use their internet for business (M=1.23; SD=0.479), followed by research and development (M=1.73; SD=0.631), education (M=1.81; SD=0.779), then for social tasks such as social media, email and communications (M=1.82; SD=0.687). The final mean score (M=3.03; SD=0.997) indicates that the internet is least or not used for staff, see Table 5.14. This may be due to data restrictions in rural, regional, and remote areas of Australia who are currently experiencing a #datadrought (BIRRR Regional Internet Access Survey Results, 2016; BIRRR Skymuster Survey Results, 2017). The hashtag #datadrought is used by BIRRR when engaging with the topic of having limited data on social media so that the topic remains searchable through mobile applications such as Twitter. When asked how long the participant has had access to the internet 94% answered that they have had internet for more than five years. Three percent has had access for two to five years, 1% has had access for one to two years, and 2% of respondents have had access to the internet for less than one year.

Table 5.14: Means analysis for the question "What do you mainly use the internet for and how much do you use it?

	2016 (N=200)		
		Percent	
	Mean	N	Std. Deviation
Business	1.23	199	0.479
Research & Development	1.73	199	0.631
Education	1.81	199	0.779
Social	1.82	199	0.687
For staff	3.03	199	0.997

Staff not having access to the internet was debated in the focus groups held at the QRRRWN Annual Conference where producers discussed both internet access being a ‘basic human right’ (Australian Human Rights Commission, 2013; United Nations, 2016) and about who’s responsibility it is to provide internet. The producers questioned the provision of internet access to staff heavily during the focus group. Three producers did not consider it their responsibility to provide internet access, while the remaining two producers argued that they should provide it [internet] to their staff. There was further debate about who was responsible for payment of the internet as well as discussion about the staff not being able to access the hardware to connect and whose responsibility it was to provide the appropriate equipment (Participants of Queensland Rural Regional and Remote Women's Network Annual Conference, 2017). The final conclusion from the respondents was that it was too hard to work out and therefore it may be perceived as a ‘wicked problem’ that requires further consideration (Patterson et al., 2015), see Figure 5.5 for a definition of wicked problems.

Wicked Problems Defined:

"'Wicked' involving multiple actors, scales, and levels; diverse policies, goals, and interests; and uncertain, contested, and evolving situations. Wicked problems are resistant to traditional policy interventions applied at a single level or over short timeframe" (Patterson, Smith, & Bellamy, 2015, p. 479).

Figure 5.5: Definition of wicked problems

Survey participants were also asked to select 'Other' if they were using their internet connection for other tasks. Eleven respondents chose 'Other' with tasks such as accounting, banking, cloud computing, community organisation, distance education, Wi-Fi access to mobile data, mental health and outside employment listed as most used, see Table 5.15. One respondent sometimes uses the internet for community development and another respondent said that the internet is never used for staff or kids, as there is not enough data (BIRRR, 2016a, 2017a).

Table 5.15: Anecdotal responses for other in terms of how participant internet is used

	2016 (N=200)				
	Most used	**Sometimes used**	**Least used**	**Not used**	**Total**
Accounting	2	0	0	0	2
Banking	1	0	0	0	1
Cloud	1	0	0	0	1
Community organisations	1	0	0	0	1
Distance education for primary school children	1	0	0	0	1
Mobile phones (Wi-Fi)	1	0	0	0	1
My mental health	1	0	0	0	1
Outside employment	1	0	0	0	1
Community development	0	1	0	0	1
Not enough data to allow staff or kids to use our internet connection.	0	0	0	1	1
Total Count	**9**	**1**	**0**	**1**	**11**

When asked whether having technology available on working properties might increase succession in terms of children returning to work the property, 92.5% of respondents agreed. The survey also asked if the internet would benefit the children and the family on the property, 99.5%

agreed that the internet would benefit them. Only one respondent strongly disagreed with the statement. This disagreement is supported by some responses to the focus group question “How does having technology available make the family property more attractive to children and workers?” While participants were overall positive about technology, they also noted that “technology can be mind-numbing, repetitive and lead to a loss of productivity”, “technology can be overwhelming” and “technology can isolate older people” (Participants of Queensland Rural Regional and Remote Women's Network Annual Conference, 2017). Ninety eight percent of survey respondents agreed that having internet access would benefit their children, if that/those child/ren were to return to work on the property, see Table 5.16.

Table 5.16: Responses to questions about technology, succession, and children returning to the property (N=200)

	2016 (N=200)			
	Percent			
	Strongly agree	**Somewhat agree**	**Somewhat disagree**	**Strongly disagree**
Having technology available on working properties may increase/encourage succession, in terms of children returning to work the property	55.3	37.2	6.5	1.0
Having the internet at my property will benefit my children and my family	84.4	15.1	0.0	0.5
I believe that having internet access will benefit my children if they to return to work on the property	79.4	18.6	1.0	1.0

The respondents were also asked if having internet available for staff to use would make the property more attractive to staff and if it would keep them at the property longer. Nearly 86% of respondents strongly agreed or somewhat agreed that having the internet available would make staff stay longer, see Table 5.17. The result supports statements from focus groups held at the Queensland Rural, Regional and Remote Women’s Network conference that include *“without the internet workers would be socially isolated”*, and *“it would be more fun at work”* and *that it “gives them [employees] a better social life, which equals happier employees”* (2017) confirming the results from the survey participants.

Table 5.17: Responses about having internet connectivity for staff (N=200)

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
	Percent			
Having access to the internet at my property will be attractive to staff as well as help to keep them longer	61.3	24.1	9.5	5.0

When asked how important the internet was, 95.5% of survey respondents answered that it was extremely important, four (2%) respondents answered that it was extremely unimportant and five (2.5%) responded that it was slightly important. The importance of the internet to rural, remote, and regional people and that, farmers recognise the benefits of technology, particularly internet connection, reveal new insights into connectivity for staff retention. However, connectivity is still challenging in rural communities (Freeman & Park, 2015).

The next section discusses results from the focus groups held at the Queensland Rural, Regional and Remote Women's Network Annual conference held in Emerald from the 19th to the 21st of October 2017, this will be followed by a Chapter Summary.

5.3.3 Focus Groups

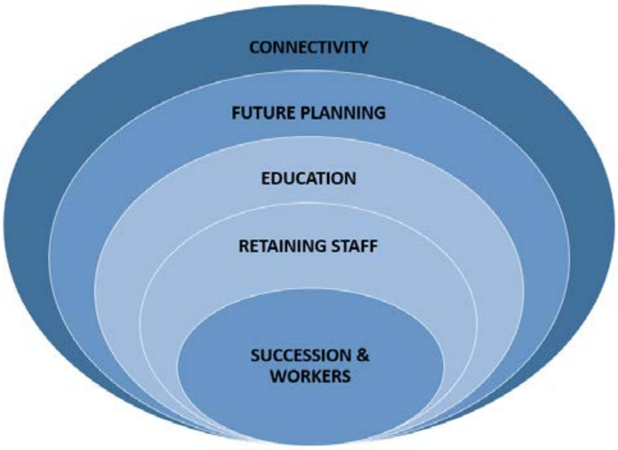
Succession Focus Group held at the Queensland Rural Regional and Remote Women's Network Annual Conference

The roving ideas storm for Section 5.3.3 considered 'technologies role in succession and for workers'. Respondents were asked to consider the semi structured question "How does having technology available make the family property more attractive to children and workers?" to allow the participants to share their understanding of the research problem (Gubrium & Holstein, 2001). Two different groups of rural women with complimentary occupations participated in the roving ideas storm, which allowed the responses to be viewed from an emic or insider's perspective from a practical and 'lived' point of view and from an etic or observers perspective, see Section 0 for an extended outline of the method. The material from the focus groups was coded, categorised, and re-categorised to identify explanatory concepts. These concepts are important to developing the theory surrounding technology adoption by rural women. Focus group results on technology adoption are discussed in *Chapter 4* and well-being are discussed in *Chapter 6*.

5.3.3.1 Succession Group 1 – Producers

The first group of participants identified four themes surrounding the question “How does having technology available make the family property more attractive to children and workers?” Themes include retaining staff, education, future planning, and connectivity.

Figure 5.6: Group 1, themes relating to thoughts that technological properties are more attractive to staff and children



Group 1 Succession themes

Group 1 Retaining Staff: Group 1 participants agreed that having access to the internet was a basic human right (Australian Human Rights Commission, 2013; United Nations, 2016) and without it, the participants stated that they *“can’t get workers without internet connectivity”* and that *“access to employee options would be limited”*. The also agreed that workers would have more fun at work and that internet access gives them a *“better social life”* and therefore *“internet access helps to retain workers”*. Group 1 also agreed that having connectivity in their community *“helped to attract more people to rural areas”*, giving them a larger pool of potential employees.

Group1 Education: The second theme to emerge from the focus group was education. Participants felt that they *“must have technology to teach children these days”* and that technology made it *“easier to educate”* and allowed for *“personal and professional development”*. Group 1 stated that *“technology allows for further education and experiences for bush kids”* and that it is *“vital to keep up with emerging technologies”*. Technology helps the *“kids to feel more connected* *with outside"* [of the rural community] and allows for *"opportunity"*. Group 1 participants recognised that *"having an internet connection allows for staff education and training"*.

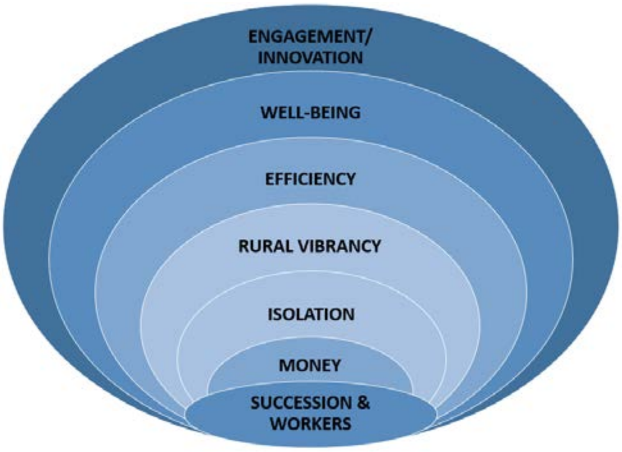
Group 1 Future Planning: More associated to succession, participants highlighted future planning as a way to encourage children and workers to continue farming. In terms of succession the participants highlighted that *"it is easier to connect with relevant people"* to discuss and plan for succession. They stated that technology is an *"easier transition"* to succession and that it can *"bridge the generational gap"*. Technology *"plays a huge role in involving youth [into farming]"* and *"encourages kids and employees to stay on the land"*. Technology allows for an *"off-farm income, [which can] assist in the succession process"* and it *"allows [for] more productivity due to increased efficiency"*.

Group 1 Connectivity: The fourth theme to emerge was connectivity. Participants recognised that is "vital to family business workers" and that "properties must provide some sort of connectivity or you [they] socially isolate [occupants]", there is a "need to be socially connected". Participants agreed, "Connectivity is the key to children returning to rural areas" and that "communities cannot grow without connectivity".

5.3.3.2 Succession Group 2 – Agricultural extension officers or other service providers

The second group of participants identified six themes surrounding the question "How does having technology available make the family property more attractive to children and workers?" Themes include money, isolation, rural vibrancy, efficiency, well-being, and engagement and innovation.

Figure 5.7: Group 2, themes relating to thoughts that technological properties are more attractive to staff and children



Group 2 Succession themes

Group 2 Money: A minor theme to emerge from Group 2 discussions was the topic of money. The group felt that technology was *"money saving"* and that technology *"keeps the grower in contact with prices"*. However, included in discussion for Question 1 "What are the women producer's motives, actions, and intensions in terms of technology use and management?" Group 1 has highlighted that technology is *"expensive to replace"*. In addition, there was concern that providing technology could be costly for the producer.

Group 2 Isolation: Group 2 also highlighted that having access to technology can help workers and families "feel less isolated" and that having "connectivity to the outside world makes farming more attractive".

Group 2 Rural Vibrancy: Group 2 highlighted "rural vibrancy" important to succession, stating, "rural vibrancy can make the agriculture sector more competitive with other industries by making more diverse 'techy' jobs". Group 2 also stated that technology "helps to make rural businesses progressive and positive about the future", giving "more job options for the kids".

Group 2 Efficiency: Group 2 stated that technology would make "succession easier as data about farming is recorded over time" giving an "accurate history of the business". In terms of workers, technology means that there will be "less repetitive tasks and an opportunity for creativity in roles for workers". However, "workers skills would need to be different"

Group 2 Well-being: In terms of making the family property more attractive to children and workers, Group 2 discussed the happiness and well-being of the staff and children. They felt that having technology *"would improve conditions for workers"* and as such, *"they would suffer less boredom"* and be more attracted to the property. On the other hand Group 2 noted that, *"automation may reduce the number of staff, and having less workers on the property might make returning (succession) less attractive"*.

Group 2 Engagement / Innovation: Group 2 discussed that technology may "create new roles or different work to do on the farm" keeping workers engaged, but that there would have to be "improved and up to date technology [that would be] more attractive for recruitment". Technology would provide "better engagement with other workers within the industry", "more access to assistance, help, or innovative ideas"

Summary

The most confounding factor for both succession and workers, non-adoption of technology is the lack of connectivity to the internet and mobile services in rural, regional, and remote Australia ("Smart farming: Inquiry into agricultural innovation," 2016). However, overall Group 1 themes include that having access to technology assisted with future planning and education. In terms of workers, Group 1 participants discussed that technology may assist in retaining staff and that connectivity is a driver of adoption of technology. Group 2 questioned if technology "actually affected/influenced succession" adding that they thought that it was attitudinal and about gender equality "who gets the station – women can do technology".

5.3.4 Summary of data analysis

Study 2 explores whether technological properties are more attractive to children and to staff and how this effects succession and staff retention in rural, regional, and remote areas of Queensland, Australia. While the study's primary focus is on women's use of technology, the survey and focus groups were open to both women and men. However, very few men responded to the survey and none participated in the focus groups. A cross tabulation was applied to all questions to test if the male responded to each questions or not. Where there are no responses from men, the text has only referred to women as the responders.

Land managers profiles in the study are consistent with much of the extant literature. The vast majority are both owners and managers of their farms. While a larger proportion of farms are identifying as family owned, a small proportion of women are identifying as 'invisible farmers' (Brandth, 2002; Bryant & Pini, 2006). Only 12.5% of respondents inherited their property and approximately one third of land managers acquired their property in another way other than succession. Another third of participants either had taken over from their parents (but they still live and work on the farm) or was working for their parents. Supporting literature highlights heavy tax burdens, the farm being too small to generate an income for more than one family or place attachment as reasons of non-succession (Downey et al., 2017; Falkiner & Steen, 2016; Pitts et al., 2009; Schilling & Schulze-Cleven, 2009). The downturn in the economy also highlights that single owner farms may not be able to sell their property for a high enough price to afford to retire and therefore choose to stay on the farm (Downey et al., 2017; Falkiner & Steen, 2016; O'Callaghan & Warburton, 2015). Only 9% of land managers in the study had some form of succession planning agreement in place supporting extensive literature (see, for example Brandth & Overrein, 2012; Downey et al., 2017; Falkiner & Steen, 2016; Gill, 2013; Grubbström et al., 2014; Hicks et al., 2012; Massis et al., 2008; Tunkkari-Eskelinen, 2016) about a lack of succession planning in farming families, although there is still a strong sentiment for staying in farming from the participants of this study.

Two thirds of the respondents of the study had children and therefore would need to consider succession planning. Two thirds were also second, third, fourth or fifth generation farmers increasing the prospect of succession (Cassidy & McGrath, 2014). While 61% of respondents were certain they wanted to hand down their property to the next generation, there was consternation from the others about succession. There is evidence that the patriarchal tendencies typical in succession are no longer strictly limiting succession to male members of the family (Luhrs, 2016; Price & Evans, 2009; Whatmore, 1991) with most participants stating that the decision was dependent on what the child/children wanted and what careers they want to pursue. Elaborating further, the participants were concerned that they would be pushing their own farming scripts onto children by making them take over the farm, especially if the adult's chose to farm (for example in families who purchased farms) rather than inherited the farm.

There are continuing concerns about the cattle industry being unpredictable, particularly in terms of *"Government frivolity, prices, vegetation management laws, foreign ownership, and drought"* (respondent comment) and therefore viable for succession i.e. if the participants are handing over a failing enterprise or a thriving one. In addition, some families have up to five children and therefore worry that the farm will not support all of the children in succession resulting in farm discontinuation (Calus et al., 2008). Other participants thought that concerns about succession were too far into the future because their children were too young. However, Falkiner and Steen (2016) advise that farmers should be pro-active and start conversations about succession early. Regardless, even though few men responded to this survey, the results show that there is a strong sentiment from both males and females that the children return to farming.

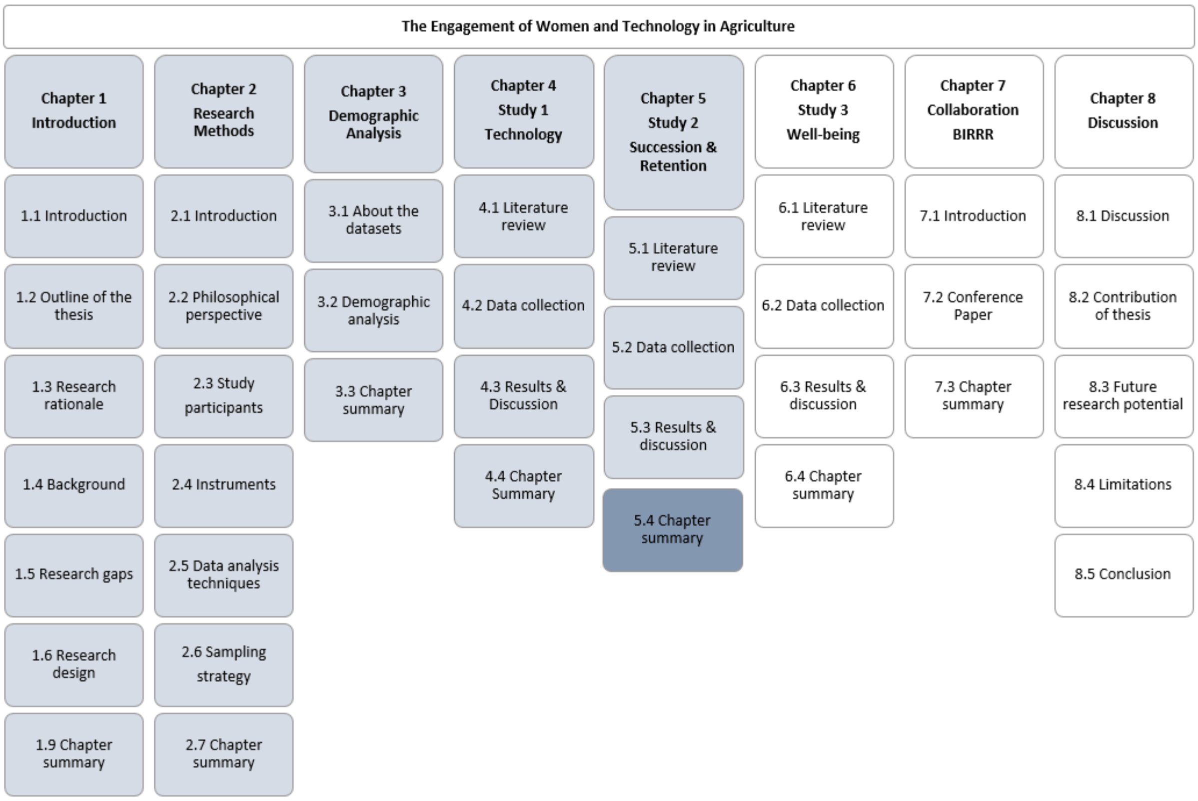
An interesting finding is that men more than women agreed that technology would help with production into the future. This finding is interesting from the male point of view as previous research identifies cattle producer men as technology averse (Adrian et al., 2005; Hay, 2013), although, as seen in *Chapter 4*, the use of the smart phone is encouraging men to adopt technology more readily. However, when the internet is being used it is mostly used for business, research and development, education, socially and then lastly for staff. The findings show that there are two major arguments surrounding internet connection for staff. Firstly, that having connection to the internet is acknowledged as a basic human right (Australian Human Rights Commission, 2013; United Nations, 2016) and secondly, while producers agreed that workers should have access to the internet, they were confused about whose responsibility it was to provide internet access and maintenance. While the problem was set aside as a wicked problem, the results from the study highlight good reasons to give workers access to the internet and other technology. Key issues of data / bandwidth availability and internet reliability remain unresolved.

Focus Groups

Overall themes relating to succession from Group 1 in the focus groups included retaining staff, education, future planning, and connectivity. Participants' agreed that giving staff access to the internet into the future was important to retaining staff. While the participants discussed education as an important reason to be connected to the internet, they also acknowledged that connectivity was important to self-development, and that connectivity allowed for experience and opportunity for *"bush kids"*. In terms of future planning, participants discussed that technology made it easier to connect with people, that transition was made easier and that technology helped to bridge the generational gap. More importantly having technology on-farm *"plays a huge role in involving youth [into farming]"* and *"encourages kids and employees to stay on the land"*. Overall, participants recognised that is *"vital to family business workers"* and that *"properties must provide some sort of connectivity or you [they] socially isolate [occupants]"*, there is a *"need to be socially connected"*. Participants agreed, *"Connectivity is the key to children returning to rural areas"* and that *"communities cannot grow without connectivity"*. The second group identified money, isolation, rural vibrancy, efficiency, well-being, and engagement/innovation as important to making properties more attractive to children and workers. The theme of money on one hand supported technology adoption because of increase production and reduced costs. On the other hand, money implied that technology is expensive to replace. Technology is recognised as creating rural vibrancy and as being able to reduce the feeling of isolation, increasing well-being and making properties more attractive to both children and workers. Group 2 recognised that while technology would make farm work more efficient, children and workers would need a different skill set. New roles may need to be created, which may lead to a need for more access to assistance for workers and children to better engage with the industry. The next section provides a summary and conclusions to *Chapter 5*.

5.4 Chapter 5 Summary

Thesis Structure Overview: Chapter 5 – Summary



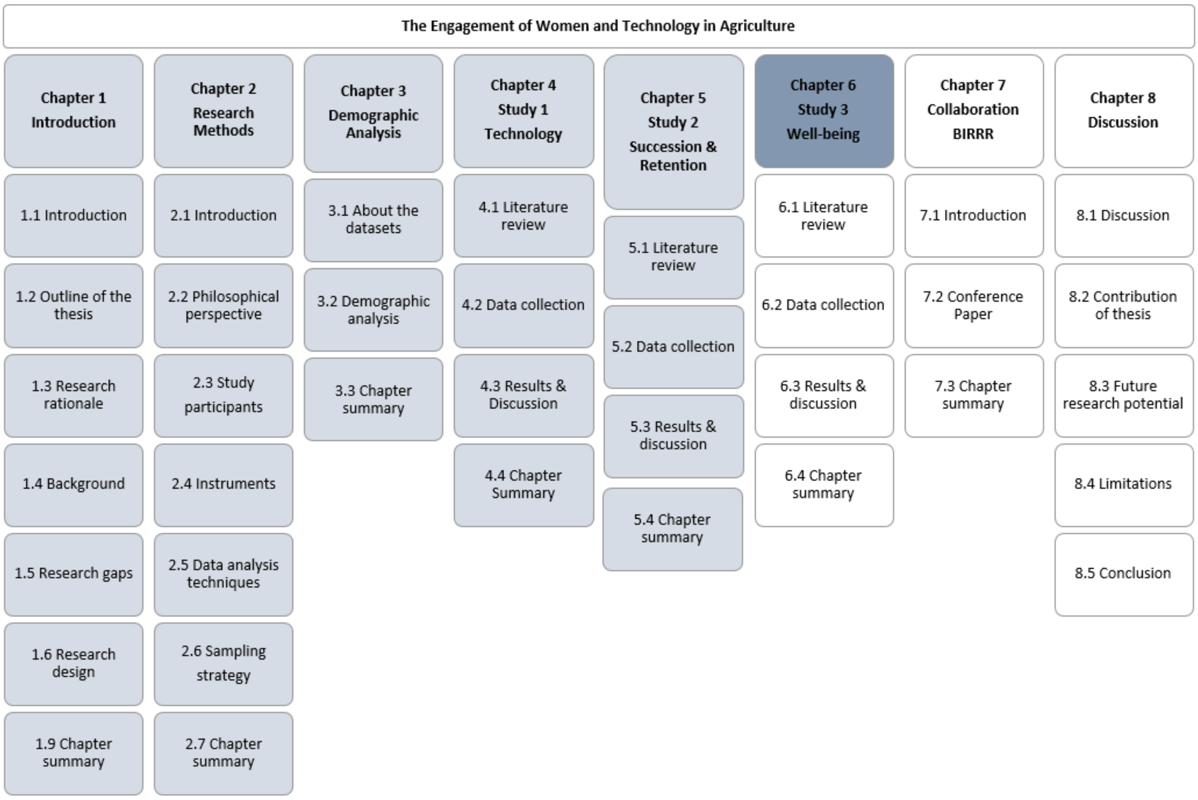
The online survey and focus group results demonstrate a variety of factors that either drive or inhibit farmers to engage in the use of technology. There are both inhibiting enabling factors to achieve technology adoption amongst famers and to encourage workers. Several factors such as social, environmental and economic changes, longevity of the farm and negative tax implications (Falkiner & Steen, 2016) have been emphasised as inhibiting factors to succession and as such, these factors may also be inhibiting factors to technology adoption. However, other aspects such as the impact of one party’s actions on another and differing knowledge between generations (agency and dialectics) and the size, commitments of the business (lone and family farms and altruism), influences of the past present, future of, and place attachment to the family farm (temporality and place identity) also influence technology adoption in succession. A lack of technology education resources, failure to connect with agricultural innovation, and negative perceptions of the agricultural industry ("Smart farming: Inquiry into agricultural innovation," 2016; Watts & Harrison, 2017) are confounding factors for workers' expectations. In addition, a lack of internet access is confounding to both succession and to workers.

While there are still challenges surrounding connectivity in rural, regional, and remote Australia (BIRRR, 2016a, 2017a), having access to technology may be able to assist in a healthy future for family farming. Having access to technology allows for future planning, it allows for increased productivity of small farms and it allows for an off-farm income, which can assist the process of succession. Technology has been able to bridge the gap between generations, which makes for an easier transition in succession. Technology plays a *"huge role"* in involving youth in farming and encourages kids to stay on the land. The study found that properties that provided internet to workers were perceived as more attractive to work for than those that did not provide it. The results concluded that with internet, workers would be more connected, less socially isolated, have more fun and therefore be happier. The survey respondents answered that having access to the internet was extremely important, so therefore, it must also be extremely important to staff as well. Therefore, technological properties may be more attractive to both children in terms of succession and workers in terms of connectivity and may be a solution to issues surrounding an ageing rural workforce and a shortage of rural workers

This section of the thesis aimed to investigate whether technological properties were more attractive to children and to staff and how this effected succession and staff retention. This Chapter explored the relationship between succession, workers, and the adoption of technology, and while there are pro's and con's for both succession and workers supplied in the results, the evidence towards technology adoptions effect on succession and workers is inconclusive and warrants further investigation.

Chapter 6 Study 3 Well-being of producers and producer families

Thesis structure Overview: Chapter 6: Study 3 Technologies effect on well-being of producers and producer families



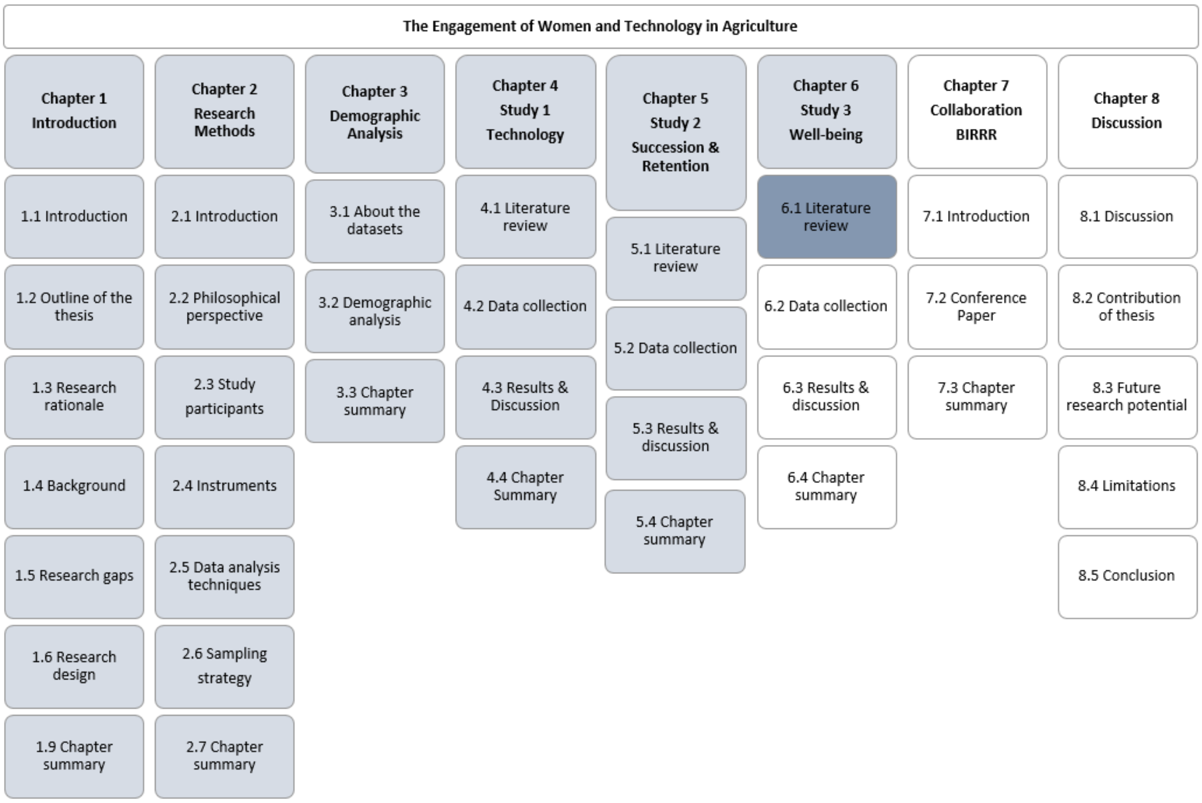
Chapter Six presents Study Three and responds to Research Gap 3, which identifies that "The relationship between technology and well-being is not clear and a key question remains about the extent to which technology can reduce isolation and increase well-being". The mental health and well-being of people in rural areas of Queensland is suffering under the strain of the effects of prolonged drought and other external factors (such as the interruption to the live meat export trade). As noted earlier, live meat export was suspended in June 2011 the value of $1.4 billion over 6 months due to cases of animal cruelty being exposed in Indonesian abattoirs. Ramifications from the 6 month halt in trade continue to devastate farmers and regional economies (McDonald et al., 2011; Wagstaff, 2016). Extending resources and access to health and community services as well as increasing training for health workers can improve mental health and well-being (Allan, 2010). Women's contact with male family members and workers has been identified as an entry point for improving male-related mental health (Congues, 2014). Women can use their contact with the men in their family, whether they be husbands, fathers, sons or workers, to encourage them to access health and well-being programs online (Powell et al., 2012) and ultimately improve men's mental health.

Women in Hay and Pearce's (2014) study identified that having technology and being able to use it at night made them available in the day time to work alongside their partners. This in turn made the men happier, resulting in increased feelings of well-being. No studies were located that investigated if technology plays a role in increasing well-being and mental health in beef producers. This gap has been identified and is important to the wellbeing of rural women, men, and families, leading the researcher to propose that female producers who use technology are able to spend more time with their husbands, potentially increasing the well-being of the male producer. Therefore, research question 2 asks, *"In the producer partnership, how does a female producer using technology affect the well-being of the male producer?"* This chapter is designed to provide exploratory evidence of technology's effect on isolation and its contribution to well-being. The findings suggest that technology's relationship to well-being is important, but deficiencies in the data prevent in depth testing of the proposition and therefore identifies that more research on the topic is required.

The chapter provides an overview of topics related to well-being (Section 6.1) in the agricultural sector. It also provides a summary of how the data was collected (Section 6.2). Emerging themes fed into the questions in the online survey and are matched to the research gaps as shown in Appendix 6: Online Survey. Results and discussions are contained in Section 6.3 and Study Three's conclusions are reported in Section 6.4. *Chapter 8* will draw the three studies together and highlight future research potential.

6.1 Literature Review

Thesis Structure Overview: Chapter 6 – Literature review



Chapter Six discusses the determinants of the relationship between women using technology and the effect it has on men's well-being. While well-being is not the primary focus of the study, and the questions asked are not aimed at measuring overall well-being, but rather exploring the relationship between technology use and how it affects well-being, which is potentially important and therefore warrant inclusion in the thesis.

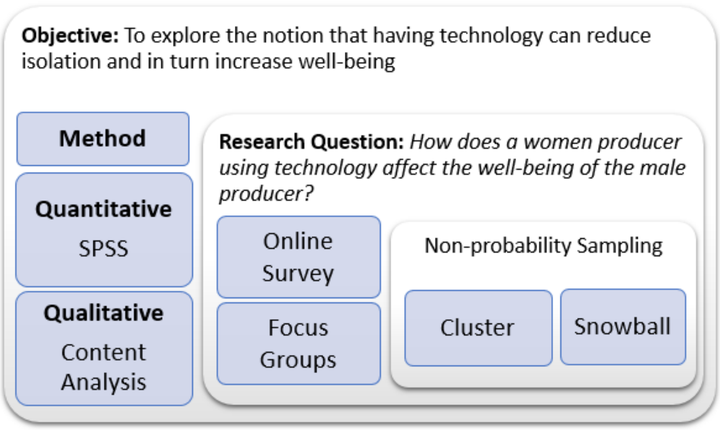


Figure 6.1: Overview of Study 3 Research Design

Producers who are rich in social capital (or connectedness) tend to experience good mental health and well-being (Berry & Welsh, 2010). Interventions to promote well-being can bring benefits to both the individual, to family members and workers and to communities. Interventions that promote positive mental health using internet platforms are available (Powell et al., 2012). However, rural men's lack of confidence in using technology, noted in the earlier chapters, is an inhibiting factor for men trying to access the services. In such circumstances, using informal networks, *"social support and a sense of community may be a better buffer for stress and promote well-being within rural men"* (Kutek, Turnbull, & Fairweather-Schmidt, 2011).

6.1.1 Well-being

Well-being is made up of five essential elements: career, social, financial, physical and community well-being (Berry & Welsh, 2010; Kruger, 2011) and can be defined as "*the dynamic process that gives people a sense of how their lives are going, through the interaction between their circumstances, activities and psychological resources or 'mental capital*" (National Accounts of Well-being, 2015). Berry et al., (2011b) state that *"a great deal rests on the success and well-being of Australian farmers and there are clear and credible signs that their health and well-being may be compromised by drought, outmigration of children, and amongst other things, the altered social structure of their rural community"* (p. 128S).

Kutek et al. (2011) in a study of 185 rural men aged between 18 and 89, found that *"social support and a sense of community benefit subjective well-being, and that stress is detrimental to well-being for rural men"* (p. 21). During the data collection period of this study, Australia, especially Queensland was experiencing (as at 2017) an extended period of drought (Queensland Government, 2017). The drought has seen cash-poor producers lay off paid staff resulting in producers completing work alone, which in turn reduced their social connectedness typically found in communities (Berry et al., 2011b). Reduced social connectedness may lead to increased suicide in rural areas. Suicide rates in rural areas are 33% higher than in major cities (McGlaughlin, 2010). Patterson-Kane and Quirk (2014), completed a study of cattle producers in Western Queensland about rural men's experience with depression. Their results showed that rural women had higher rates of depression than men did.

Upon further investigation, it was established that “the gender difference was more in the level of reporting, with men tending to under report” (Patterson-Kane & Quirk, 2014, p. 162), confirming men in rural areas as being more inclined to depression (and potentially suicide). Patterson-Kane and Quirk (2014) identified that people in rural areas use their own language to acknowledge depression and that the language used was akin to acceptance of help surrounding depression. For example terms like ‘avoiding it’ (trying really hard not to think about it), ‘dulling it’ (by working hard), ‘fixing it’ (by trying to fix depression on their own, not asking for help), ‘blowing up’ (getting angry) and ‘nearing or going over the edge’ (nearing suicide) (p. 164).

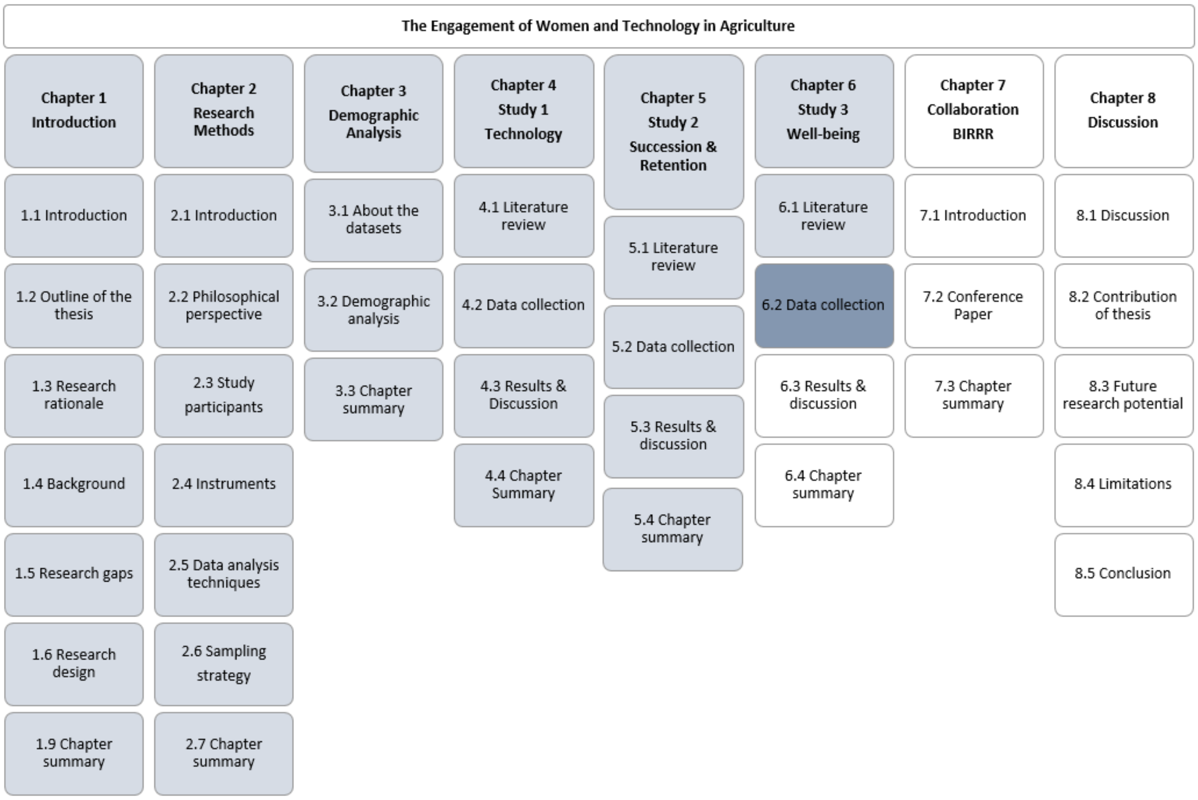
Allan (2010) states that mental health and well-being can be improved in rural areas by extending resources and access to appropriate and timely services, as well as increasing mental health training in suicide and crisis prevention for health workers (p. 4). Kutek, Turnbull, and Fairweather-Schmidt (2011) support Allan (2010), adding that social support was the most important predictor of subjective well-being” (p. 24). Congues (2014), adds another dimension where she states that women may be the key to well-being, especially in men… *“Women are the key to accessing men because women are crucial to keeping families together”* (p. 237). Because women have direct contact with men, they were inadvertently made responsible for their welfare (Congues, 2014).

Often family members take work off-farm as a risk management strategy (Chang & Mishra, 2008). In farming families, family members work on-farm and off-farm to both increase and stabilise their total household income. However, this leads to increased working hours as family farm workers are required to complete work off-farm and then return home to farming duties. In addition, family expenditure increases, as the worker becomes more time poor (Chang & Mishra, 2008). In 1993, McCoy and Filson (1996) noted that *“women employed off-farm reported more areas of lower satisfaction than their male counterparts and men and women working solely on-farm”* (McCoy & Filson, 1996, p. 149). Van den Broeck and Maertens (2017) using a subjective self-reporting survey with similar findings, i.e. that women working off-farm experience less satisfaction from non-income effects i.e., farm work or housework. Women using technology during the evenings and working outside has been highlighted as beneficial to men working on the family property, as spending time with a spouse can provide the social support needed in times of stress.

There may be a link between well-being, the mental health of rural men and women using technology. As previously noted, in Hay and Pearce's (2014) study, respondents observed that the rural women being able to complete technology related duties at night meant that they were available to work in the paddock during the day, reducing the isolation felt by the producer men from working in the paddock alone. Working together may increase social connectedness and in turn well-being, which is motive towards investigating technology adoption by women in agriculture.

6.2 Data Collection

Thesis Structure Overview: Chapter 6 – Data Collection



6.2.1 Sample

As in Section 4.3.1, cluster sampling divided the population into groups and draw a simple random sample, which was used to distribute the survey via Qualtrics (2013) to the membership database from the Queensland Isolated Children's and Parents' Association (ICPA) (approximately 1200 members). The online survey was also distributed to the Better Internet for Rural Regional and Remote Australia (BIRRR) group, which had approximately 6000 members at the time of the survey, see Section 4.3.1 for more details the sample.

6.2.2 Online Survey

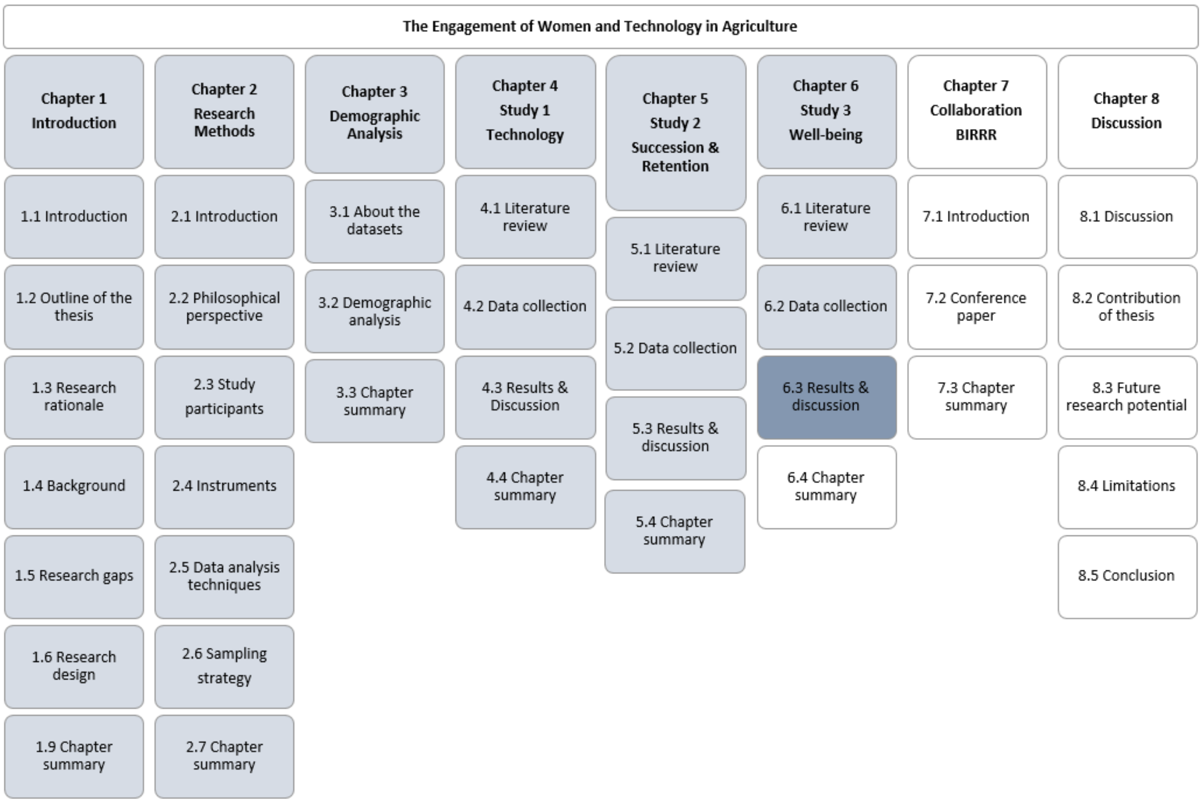
A single survey was used to ask questions about the topics in each of the three studies (as stated in *Chapter 4*). Selected questions drawn from the single survey were attributed to the topics in each of the three studies. Twenty-six questions about well-being were extracted and then analysed are presented in Section 6.3. The online survey was open to women and men over the age of 18. Participants were advised that technology should be defined as including personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, National Livestock Identification Systems (NLIS), remote cameras, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology and other livestock management systems. A frequency analysis was used to compare partial data to completed data which confirmed the suitability of 100% completed surveys to be used in the analysis (N=200), see Section 4.3.2 for a further breakdown of the survey responses. Unlike in *Chapter 4*, the questions in *Chapter 6* had not been asked before, therefore no comparison is made to 2013 data in *Chapter 6*.

6.2.3 Focus Group

The data from focus groups used in *Chapter 6* was collected at the Queensland Rural, Regional and Remote Women's Network annual conference as discussed in Section 4.3.3. Data collected from the focus groups supports the findings from the online survey. The results from the focus groups are used within the online survey analysis where appropriate and are summarised in Section 6.3.2. The data collected was coded into explanatory concepts, which were used to develop the theory surrounding technology adoption by rural women, see *Chapter 2* for more details on how the data was collected and processed.

6.3 Results and Discussion

Thesis Structure Overview: Chapter 6 – Results and Discussion



6.3.1 Demographics

Two hundred participants responded to the survey in 2016. Eight and a half percent of respondents were men and 91.5% were women. One male under 17 responded to the survey, but was opted out, as he did not meet the criteria of being aged 18 or over. Of the remaining participants, 1.5% of men and 12.6% of women were aged 18-35 and 7.3% of men and 78.2% of women were aged 36 years old or over. Approximately half of all respondents had only ever worked in agriculture, while others had worked as teachers or in education, administration, nursing or banking and finance (54.6%) or in another professional position (15.6%). Nearly 17% had worked in retail, mining, marketing, pharmacy, media or in law and mediation. The remaining participants had worked in varying positions related to agriculture, or were married to someone involved agriculture (13.3%), see Table 6.1

Table 6.1: Anecdotal responses to the question 'Have you always worked in agriculture' answered 'No, what did you do before' (N=200)

2016			
Employment Type	**Percent**	**Employment Type**	**Percent**
Teaching/Education	23.7	Law/Mediation	2.1
Administration	11.3	Jack of all trades	2.1
Nursing	10.3	Hospitality	2.1
Banking/Finance/Commerce	9.3	Extension	2.1
Professional	5.2	Tourism	1.0
Accounting	5.2	Recreation	1.0
Medicine	5.2	Married to someone who works in ag	1.0
Retail	4.1	Local government	1.0
Mining	3.1	Human Resources	1.0
Marketing	3.1	Customer Service	1.0
Pharmacy	2.1	Childcare	1.0
Media	2.1	**Total**	**100**

Note: Not included in 2013 survey

Participants were asked if they would like to work somewhere else, 82% answered 'No" and 18% answered yes. The responses, coded to reflect seven themes including other are listed in Table 6.2. The majority of responses indicate that when not working in agriculture, the participants would like to work in business (4%) or that they would like to work in agriculture as well as something else (2.5%). While some participants indicated that they wanted to work "away from isolation (1.5%)", others indicated that they would like to work as a health related practitioner (1.5%), in teaching (1.5%), or they wanted to retire (1.0%), or do something after their current commitments or in another industry (2.5%).

Table 6.2: Anecdotal responses to the question 'Would you like to work somewhere else?" answered 'Yes, what would you like to do'

2016 (N=200)	
Where else would you like to work	**Percent**
In Business	**4.0**
Administration	
Banking/Business	
Event Coordinator/ Organisation	
Office/computing job/publishing	
Retail	
Small services business	
Photography rural based	
I do or would like to work in both agriculture and something else	**2.5**
I am a flight nurse, and contract musterer and in partnership on the property	
I work 140km off farm nursing	
I do work off farm	
I am interested in doing other things (e.g. writing) as well as continuing in agriculture	
I would love to earn money from home	
Away from isolation	**1.5**
Anywhere in a city that is not isolated and has access to services etc.	
On a farm closer to my family	
I just need to earn an income, but I can't get out of the property as the road is too bad	
As a practitioner	**1.5**
Alternative therapist animals/humans	
Mediation	
Health	
Teaching	**1.5**
Teach in schools and get paid	
Teaching	
Teaching	
Retirement	**1.0**
Retire	
Unsure/Retire	
Other	**2.5**
Once I have finished educating the children	
In the gas industry	
Study history	
We need the outside income	
Somewhere where it rains	

Participants of the study were asked what they produced. The majority (96.5%) produced cattle, 20% produced sheep, 21% were involved in cropping and 8% produced something else, see Table 6.3 for anecdotal comments from participants on their production.

Table 6.3: Frequency analysis of the question "What do you mainly produce?"

	2016 (n=200)
	Percent
Cattle	96.5
Sheep	20.0
Cropping	21.0
Other	8.0
2016: Leaucaena, camels, goats, potatoes, farm tourism, sugar cane, agistment, carbon, hay, horticulture , timber, contract farming, earthmoving, and horses	

More than half of the respondents (62.3%) were situated on properties larger than 20,000 acres, 14% indicated that they were situated on properties between 10,000 and 20,000 acres and 35.5% had less than 10,000 acres.

Table 6.4: Cross tabulation of responses to the questions "What size is your property?" and "Where is your property located"

	2016 (N=200)					
	Acres					
	< 1000	1001 - 5000	5001 - 10,000	10,001 - 20,000	20,000 +	Total
QLD	11	7	18	26	114	176
NSW	3	3	1	1	0	8
SA	1	0	0	0	1	2
VIC	2	0	0	0	0	2
WA	0	1	0	1	3	5
NT	0	0	0	0	2	2
	17	11	19	28	*120	195

* 4 cases missing property location, 1 case did not enter size nor location

The first question asked participants to nominate 0=no or 1=yes to a list of technology products that respondents might be using on their property. A preliminary means analysis was performed to determine if there was any change in use of technology on the survey participant's property between 2013 and 2016. The analysis shows that participants were using all of the technologies listed below more in 2016 than they were in 2013, with the exception of walk over scales, satellite phones and feedlot technology.

Table 6.5: Means analysis to determine which technology is being used in 2016

	2013 (N=138)			2016 N=200)		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**
Smart/Mobile Phone	0.73	138	0.445	0.87	200	0.343
NLIS (with or without wand accessory)	0.80	138	0.404	0.85	200	0.363
Laptop	0.82	138	0.387	0.83	200	0.377
Home PC	0.78	138	0.419	0.74	200	0.440
Tablet	0.48	138	0.501	0.70	200	0.459
Satellite Imagery	0.32	138	0.468	0.48	200	0.501
Walk Over Scales	0.54	138	0.500	0.48	200	0.501
Remote Cameras	0.15	138	0.360	0.19	200	0.389
Satellite Phone	0.18	138	0.387	0.17	200	0.372
Remote Weather Stations	0.07	138	0.248	0.11	200	0.314
GPS Collars	0.06	138	0.235	0.09	200	0.287
Bore or Remote Water Trough Cameras	0.07	138	0.248	0.09	200	0.280
IVF Technology	0.04	138	0.205	0.05	200	0.208
Drones				0.05	200	0.208
Feedlot Technology	0.04	138	0.205	0.03	200	0.171
Other -	0.08	138	0.272	0.12	200	0.320

2013: GPS auto steer(3), GPS cropping (1), GPS property management (1), GPS not collars (1), 2Way radio (1), water monitoring (1), embryo transfer (1)

2016: Water monitoring (11), GPS auto steer (4), pregnancy testing (2) and video conferencing, GoPro camera, DNA performance monitoring, and remote monitoring for liquid additives mixing (4)

The next section presents the results and discussion section, which analyses the online survey and focus group outcomes. Section 6.4 follows and provides a summary and conclusions to *Chapter 6*.

6.3.2 Online Survey

The first question establishes the position the respondent holds in the farming business. Participants were asked if they owned and/or managed the property. The data indicates that less people are identifying as both owner and manager in 2016 than in 2013. Similarly, less are also identifying as property managers between the years. However, there was an increase in those that selected other in 2013 compared to 2016 (see Table 6.6). Of those that identified as 'Other', 2.2% in 2013 and 5.5% of respondents in 2016 identified as invisible farmers (Brandth, 2002; Bryant & Pini, 2006) labelling themselves as wives, spouses, or daughters of the property.

Table 6.6: Responses to the question 'Are you the owner and/or the manager of this property?

	2013 (N=138)		**2016 (N=200)**	
	n	**Percent**	**n**	**Percent**
Both owner and manager	110	79.7	148	74.4
Owner only	0	0.0	22	11.0
I manage the property	18	13.0	29	14.5
Other				
Invisible farmer	3	2.2	11	5.5
Family owned	3	2.2	9	4.5
Other worker (e.g. caretaker, fix trucks)	2	1.4	2	1.0
Company owner	1	0.7	1	0.5
Lessee	1	0.7	1	0.5
Joint owners			3	1.5
Owner manager (owner of all, manager of some, owner/assistant manager)			2	1.0

Respondents who identified as family owned properties have increased since 2013 from 2.2% to 4.5% and 'other workers' has decreased since 2013. Other workers identified in 2013 as "renting with minor caretaking duties" and in 2016 as "I work on the property" indicating somewhat transient positions supporting the reduction in responses. Company owners and lessees have also reduced, which could be indicative of the downturn in the agricultural markets during the period of this study

(Australian Bureau of Statistics, 2016; Cranston, 2013; Institute for European Environmental Policy, 2009). In 2016, respondents added that they were joint owners (1.5%) or that they were owner manager's (1%). These results may support families moving back to the farm to support the family business in tough times.

When asked about off-farm work, 49% of the participants from this survey indicated that they do not participate in off-farm work. Of those that do work off-farm, 24.5% work more than 20 hours off-farm and 18% work less than 20 hours off-farm. The survey also asked who primarily works off farm. A cross tabulation showed that only females answered the question, where 13% said that they work off-farm and 3.5% said that their partner works off-farm. One and a half percent selected that someone else primarily works off farm and those were identified as the agent, the son "who manages the property" and both "partners in the business who run an online business and have shared responsibilities".

Table 6.7: Responses to the question 'Do you or your partner (if relevant) have an off farm business or work off farm'

	2016 (N=200)	
Work off farm or off farm business	**N**	**Percent**
No	98	49.0
Yes, I/we work more than 20 hours per off-farm	49	24.5
Yes, I/we work less than 20 hours per week off-farm	36	18.0
Who primarily works off farm		
Me (Females)	26	13.0
My Partner	7	3.5
Other (tell us who): Agent, Both, Son	3	1.5
** Not included in 2013 survey*		

The participants were asked if they could rate their emotional health on a 5-point scale from excellent to extremely poor. Emotional health was defined as "the degree to which you feel emotionally secure and relaxed in everyday life" (Schirmer, Yabsley, Mylek, & Peel, 2016). A cross tabulation of emotional health and male/female (N=200) showed that 42.7% of women and 6.0% of men rated themselves as above average or excellent and 6.0% of females and 0.5% of males thought that their emotional health was poor or extremely poor. Just over 43% of women and 1.5% of men rated their emotional health as moderate.

Table 6.8: Cross tabulation of the question "How would you rate your mental health and gender

	Male		Female	
	n	**Percent**	**n**	**Percent**
Extremely poor	0	0.0	1	0.5
Poor	1	0.5	11	5.5
Moderate	3	1.5	86	43.2
Above average	4	2.0	26	13.1
Excellent	8	4.0	59	29.6
Total	16	8.0	183	92.0
**Not asked in 2013*				

A second cross tabulation was performed that included the question 'who primarily works off farm'. Respondents that answered "Me" were identified in a cross tabulation as female, where 38.9% indicated that they rated their emotional health as moderate. This result may support Schirmer et al. (2016), Chang and Mishra (2008); McCoy and Filson (1996) and Van den Broeck and Maertens (2017) findings that women who work off-farm may be less satisfied than those who only work on farm or do not work at all.

Table 6.9: Cross tabulation of emotional health with "Who primarily works off farm"

Emotional Health	**Who primarily works off farm 2016 (n=36)**					
	Me (n)	Percent	My partner (n)	Percent	Other (n)	Percent
Poor	1	2.8	1	2.8	0	0.0
Moderate	14	38.9	5	13.9	1	2.8
Above average	2	5.6	0	0.0	1	2.8
Excellent	9	25.0	1	2.8	1	2.8
Total	26	72.2	7	19.4	3	8.3

When asked if participants did any volunteer work, only female respondents answered the question. More than half (58.5%) of farming women volunteer their services when they are needed, 22.5% do not volunteer at all. Eight percent of female respondents volunteer a set number of hours per week and 2.5% run a not for profit business.

Table 6.10: Frequency analysis of the question "Do you do any volunteer work?"

	2016 (N=200)	
	n	**Percent**
Yes, I volunteer casual hours when I am needed	117	58.5
No, I don't volunteer	45	22.5
Yes, I volunteer a set number of hours per week	16	8.0
How many? 1 - 10 hours (8), 11-30 hours (2), > 30 hours (6)		
I run a not for profit business	5	2.5
How many hours do you spend doing this per week? 1 - 10 hours (4), 25 hours (1)		

Ninety seven percent of 2016 respondents agreed that "farming with new technology will help the grazing industry to remain productive (this question was not asked in 2013). To help us understand their position, participants were asked to write comments about how they thought technology had changed farming on their land. The responses were recorded and coded into themes in Section 4.3.2. Anecdotal comments about well-being extracted from Table 4.22 to Table 4.33 indicate that women are responsible for technology use and are sometimes frustrated being the person responsible for using it, for example:

> "[using technology] *Adds to my frustration as husband just not interested in learning so all up to me and does not allow time for Tru-test extra info entry - just wants weights, NLIS pain in butt with non-reading tags and poor transfers at sale yards. I need to be better at adopting & upgrading tech but expensive and when upgrade find for example new laptop not compatible with Tru-test cord (pins), update in software not compatible etc.*
>
> *"Yes, it [technology] has helped big time, but it is left up to the female to making that big transition and when it fails, you take the blame."*
>
> *"Life is more frustrating. Speed, expectations of others, and poor sport makes their use very draining"*

While women are frustrated, men are grateful that they are using technology, which is evident in comments such as *"By her keeping up with technology allows us to make decisions on what technology we will take up, helps with joint decision making"* and *"My spouse and daughters are an incredibly valuable part of my team, having access to technology to do the job and do it well is a bonus"* and *"Getting things done faster frees them [women] up to spend more time doing things as a* *family - people really have no idea how important this is to people in remote Australia"* and *"[technology] allows her to have a sense of ownership of the business"*. When men were asked how they thought technology had affected the female in their partnership, they agreed that women gained valuable skills that using technology gave them more confidence and that it has been empowering. Men also agreed that technology helped to maintain their budget, and gave the female more control over the business, while recognising that half of their partners would rather someone else was responsible for technology. One comment justifies women's use of technology stating that *"she has the time to wait for fixes to problems"*, but ignores that women are considering their competing priorities, which asks them to decide between other duties that they perform and fixing technology, see Table 6.11.

Table 6.11: Frequency analysis of the question "How has adopting technology affected the female in the partnership"

	2013 & 2016 (N=19)			
	Percent			
	n	**Agree**	**n**	**Disagree**
She has gained new and valuable skills	19	100.0	0	0
She has more confidence to complete business tasks	15	93.8	1	6.3
Learning how to use technology has been empowering for her	17	89.5	2	10.5
It has helped to maintain our budget	17	89.5	2	10.5
She has more control over the business	16	84.2	3	15.8
She would rather someone else did it	9	47.4	10	52.6

Other

Allows her to have a sense of ownership of the business (1), she has the time to wait for fixes to problems (1)

*This question was only asked to men in the 2016 survey

Overall, the comments and responses provided indicate that men in the survey value the contributions of women to the farming business. While the sample size is too small to generalise across the cattle producing industry, the results give an idea of men's thoughts on women using technology.

Nearly 92% of respondents answered that they hoped or intended to hand their property on to future generations, indicating that staying on the land was important to cattle producers, that their business was successful and at the same time adding pressure to succeed. While most of the accompanying anecdotal comments (from the response Maybe (why is that?) in Table 6.12) surrounded the decision for children to return, being dependent on the children's interest to return, 11% were concerned with the viability of the family business, which also adds pressure to farming families.

Table 6.12: Frequency analysis for the question "Do you hope/intend to hand the property on to future generations?"

	2016 (N=200)	
	n	**Percent**
Yes	121	61.1
Maybe (Why is that?)	61	30.8
No	16	8.1

The next set of questions asks about the participants' use of the internet and how using the internet affects their lifestyle in rural, regional, and remote areas. Firstly, the participants were asked how long they have had access to the internet, where the majority 94% responded that they had had access to the internet for more than five years. Two percent have had access for less than one year, 1% for one to two years and 3% have had access for two to five years.

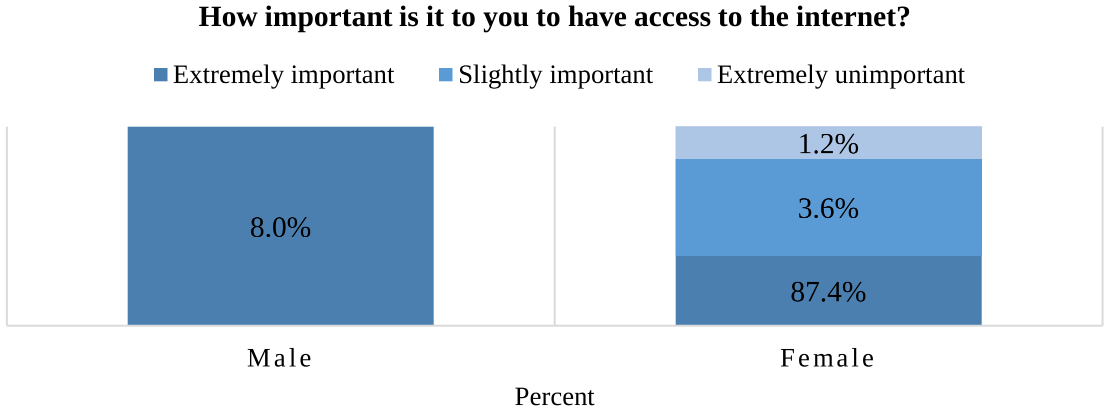
Table 6.13: Frequency analysis of the question "How long have you had access to the internet"

	2016 (N=200)	
	n	**Percent**
Less than one year	4	2.0
One to two years	2	1.0
Two to five years	6	3.0
More than 5 years	187	94.0

A four point scale 1=extremely important to 4=extremely unimportant was used to ask respondents how important it was to have access to the internet. A cross tabulation between the question and male/female indicated that 87.4% of female respondents (n=183) selected that it was extremely important to have access to the internet and 3.6% said it was slightly important. Only 1.2%

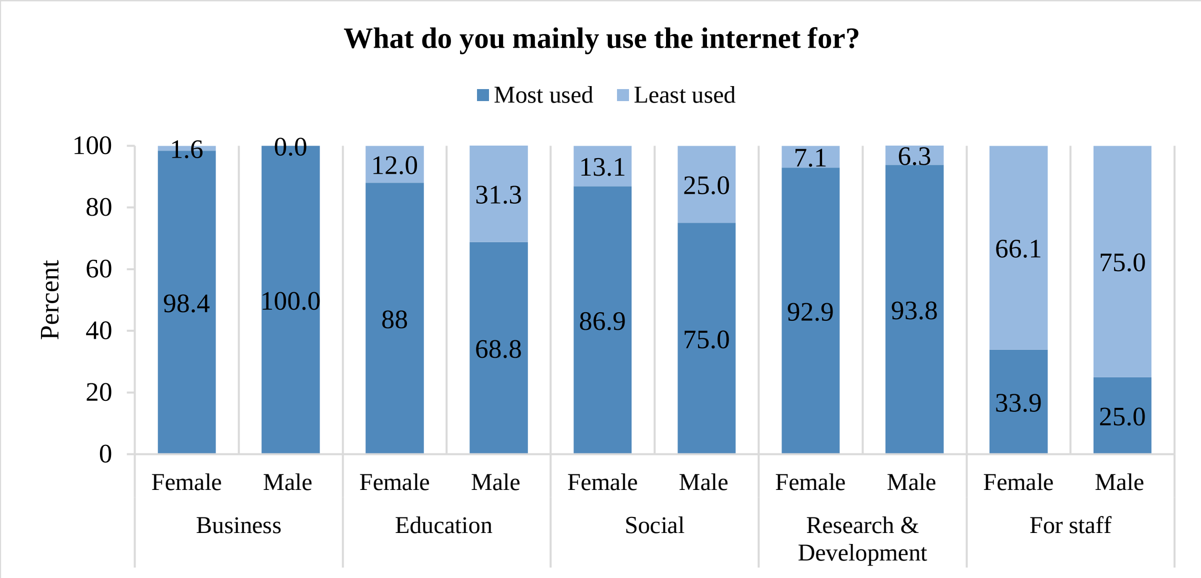
selected that having access was extremely unimportant. All of the men that responded to the question (n=16) selected it was extremely important to have internet access. None of the respondents selected the option of slightly unimportant.

Table 6.14: Frequency analysis of the question "How important is it to you to have internet access?"



Participants were asked what they mainly use the internet for. The responses were re-coded from 1= most used, 2=sometimes used, 3=least used and 4=not used (see *Chapter 4*, Table 4.39 for results) to 1=most used and 2=least used to establish the difference between use of the internet between males and females. The results show that women and men are mostly using the internet for business and research and development. Women are using the internet more for education, socially and for staff than men are. Overall, the results show that women are using the internet more than men are which supports findings from *Chapter 4* and *Chapter 5*.

Table 6.15: Cross tabulation for the question "What do you mainly use the internet for?"



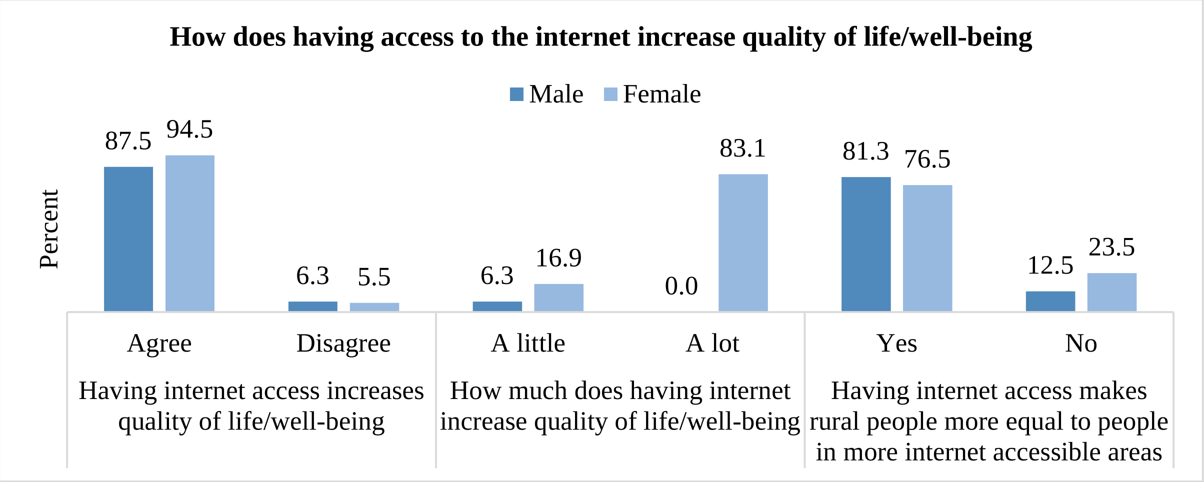
When asked what the top three reasons most important reasons to have access to the internet, participants responded communication (n=133), accounting and banking (n=106) and business administration (n=96). Respondents were asked to submit their top three reasons the internet was important to them, the comments were coded and themed and are discussed in *Chapter 4*. Table 6.16 below contains the top 14 themes overall that participants indicated about why the internet is important to them.

Table 6.16: Top 14 Most important reason to have access to the internet

Top Three Reasons		**Other Reasons**			
Communication	133	Information	84	Online Business/Off-farm work	9
Accounting/Banking	106	Education	63	Water Monitoring	5
Business Administration	96	Personal use/Social	38	Online Shopping	3
		Weather	17	Community Groups	2
		Health & Well-being	14	Staff Satisfaction	1
		Cloud Computing	9		

Participants were asked if having access to the internet increased their quality of life/well-being. Participants both male (87.5%) and female (94.5%) agreed overwhelmingly that internet increased their quality of life and or well-being and that it increased it by “a lot”. Male (81.3%) and female (76.5%) participants also responded that having access to the internet made them feel more equal to people in more internet accessible areas.

Table 6.17: Cross tabulation of responses between male and female and the importance of having access to the internet



Participants were asked to comment on why they thought internet access made them feel more equal to people in more internet accessible areas. The use of the word ‘equal’ caused some consternation in the respondents. For example *“Equal to me is not really the word to use as it does not relate to people being equal as such BUT it means we are equal in the advantages we have in being able to access the Internet although ours is do much slower than in towns”* and *“In a way - but not entirely! It allows us to share our message more easily into other areas, but it’s a long way off from creating any sort of 'equality'. More like allows us to keep our chins above water with what access we are able to get”*. To clarify, equal is used as an adjective in this question and is defined as *“(of people) having the same status, rights or opportunities”* rather than a noun where the definition slightly differs as *“the state of being equal, especially in status, rights or opportunities”* (Oxford Dictionary, 2017). While most of the participants understood the question as intended, careful attention of the question’s wording should be considered in future research.

To analyse the responses, a cross tabulation was performed using "gender" and "can you tell me why having access makes rural people more equal to those who have internet connection". Nine male participant's offer that having access to internet connection means that they can keep up to date with the latest information, participate in training or run their business competitively. That they can communicate and enjoy connectivity with family and friends, and that connectivity helps with mental health. One male respondent adds, "*Without access to the internet we are second class citizens to those that have access*". Supporting comments are recorded in Table 6.18.

Table 6.18: Anecdotal comments from men about "Why having access to internet makes rural people more equal to those who have internet connection"

"Access to information"
"Access to data, communication"
"Although slower I can access training that I otherwise couldn't attend"
"Connectivity"
"Equal"
"Having access to information decreases social isolation, access to family and friends via skype is good for my mental health, being able to shop online and of course being able to manage all aspects of my business from accounting to buying and selling of stock in real time make us competitive in a 21st century market"
"If not we would be in the dark"
"It's too far to town to just duck in and grab something or look at something compared to people in less remote/isolated areas"
"Most businesses and institutions are using the internet as a prime point of communication. Without access to the internet we are second class citizens to those that have access"

Women provided 105 comments that were coded and themed into seven different themes. Women participants offer that having access to the internet means that they can be competitive in their business, participate in education, remain informed, and communicate. The women responded that their internet connection removed the tyranny of distance, that it made them feel less isolated and that having access to the internet closed the social gap between rural, regional and remote people and city people. Supporting comments from female participants are summarised in Table 6.19 to Table 6.25.

The most prominent theme from women's comments about having internet connection was "access", having equal access to information, services and research means that rural women in this study had *"equal opportunity, regardless of location"*, that they could be *"informed"* and be *"kept up to date with current events and have purchasing power"*. The responses imply that having access to opportunity makes rural women more equal to people in more internet accessible areas.

Table 6.19: Anecdotal comments from female participants regarding equal access to internet connection - Access

"*Access to information and opportunity"*
"*Access to information in a timely manner"*
"*Can access same information"*
"*Can talk on similar topics"*
"*Equitable access to information"*
"*I feel that I have access to the same information"*
"*Now have access to information that wasn't available to us before"*
"*Access the same information and social media groups/conversations, educate ourselves in the same way"*
"*We can access things that city people can access"*
"*Equal opportunity available regardless of location"*
"*Opportunity and connection and access"*
"*Access to services, education & shopping"*
"*Have access to same things: services; products"*
"*More access to information and services via the internet"*
"*We should be able to access whatever information is available to anyone else"*
"*Being able to keep up with current events, purchasing power, information"*
"*Easier research"*
"*Research, social, shopping!"*
"*The ability to research products, services, etc. that we don't have immediate access to"*
"*Information and communication"*
"*Informed"*

Communication was the next prominent theme. Women's comments highlight that communication is important to *"connect to the global economy to reduce business risk"*, that communication allows women to *"represent their communities"* and that *"having access to communication in isolation is vital"*. Women also highlight that it is important to be able to keep in touch and that having access to the internet means that information is immediate and it gives them the opportunity to *"relate to the same things"* as others, see Table 6.20 for supporting comments.

Table 6.20: Anecdotal comments from female participants regarding equal access to internet connection - Communication

"Because everyone communicates this way now and it is important to remain up to date with technology in remote areas"
"Communication and access to information is vital"
"Communication in an isolated lifestyle: Accounting : Health"
"Communication is everything"
"Communication, access to information in a timely manner, connection to global economy reduces business risk"
"Equal access to immediate news and information, ability to communicate and represent our communities"
"I can see what is going on and keep in touch with people that are in my outside business"
"I don't have to go to town for banking or shopping. Also can email rather than call. Be research capable. It should be a basic right for all"
"Instant communication"
"Social media access"
"Most communication now days is by email"
"Most common form of communication and information sharing now"
"Much faster than Snail Mail"
"Timely responses / presence"
"We can communicate with each other with understanding"
"We can have the same access to information and be in touch with changes in the world around us. Our business can be more efficient. Communication can be more efficient"
"We can relate to the same things"

While 76.5% of participants (rural men and women) selected "yes" re the statement that having access to the internet makes you more equal to people in more internet accessible areas, quality of access remains an issue. Rural women have highlighted connectivity as a barrier to being more equal to those with better access, leading to frustration by rural women using the internet. The following statement extracted from Table 6.21 sums up women's comments: *"We are all part of the same nation/world and deserve access to the same level of service at a fair price. The expectation from community and government agencies is that many services and applications be completed online.*

Frustratingly, this is not often possible at the level experienced by our more urban counterparts". Other barriers such as cost, speed, and reliability have also been highlighted, see Table 6.21 for women's comments.

Table 6.21: Anecdotal comments from female participants regarding equal access to internet connection - Connectivity

"Being only able to have limited amount of data on a slow speed does not take us up to the same as in town areas. Very expensive"
"Yes, but only if the internet is fast as download takes for ever if slow"
"Can keep up with the times but speeds are embarrassingly slow"
"Depends on the speed and about we have access to"
"Gives us access to the same information through technology if we can be bothered to persist with our much slower compromised speeds"
"It brings equity with urban counterparts - although still costs way more that it should if truly equitable"
"We are all part of the same nation/world and deserve access to the same level of service at a fair price. The expectation from community and government agencies is that many services and applications be completed online. Frustratingly, this is not often possible at the level experienced by our more urban counterparts"
"It seems to be a given in the cities that everyone has access internet"
"It would, but we do not have anywhere equal access"
"Just part of life for everyone else-though our use is very expensive, slow and not equal"
"Yes, only partly as our service is pretty crappy compared to ADSL etc"
"Personally not unequal. Yes internet is great if and when it works and we may be more happy to use it more if it were not so slow and time consuming"
"We can see some limited things like city people can. Speed & cost are awful though".

Women's responses indicate that having access to internet connection narrows the gap between rural residents and people in more internet accessible areas. Women offer that internet access "helps them to keep up with social change", that they "have the world at their fingertips" and that they "have better access to everything" and are "not being left behind". One woman commented "*Having continuous quality access to the internet would make me feel equal to the city people at the moment I feel we are the forgotten population of Australia"* which is supported by another who indicated, *"[rural people] are quite often forgotten about in the country"*. Women commented that having internet connection meant that internet connection *"ensures that we [rural people] are not as isolated* *as in the past"* and that the *"tyranny of distance is abolished"*, see Table 6.22 for supporting comments.

Table 6.22: Anecdotal comments from female participants regarding equal access to internet connection – Narrows the Gap

"Narrow's the social gap"
"The world is at our finger tips"
"The world is small"
"There shouldn't be a divide"
"We are not denied anything"
"We feel we can keep up with social change"
"We have access to everything they do. You don't feel like a hillbilly"
"Without, we would be left behind in usage of all technology"
"It ensures that we are not as isolated as in the past"
"Reduces isolation"
"So many services (including government) are now internet based and without the internet you can feel isolated and not connected to the mainstream world"
"Because we are quite often forgotten about in the country"
"Having continuous quality access to the internet would make me feel equal to the city people at the moment I feel we are the forgotten population of Australia"
"Tyranny of distance is abolished"

Women noted that having internet connection helped them to be better informed, that *"it keeps them in touch with changes occurring in the business world"*, and it keeps them *"better informed of city [their target market] interests"*, see Table 6.23 for supporting comments.

Table 6.23: Anecdotal comments from female participants regarding equal access to internet connection - Better informed

"*Connected to up to date information"*
"*Better informed of city interests"*
"*Enables me to keep up better with current attitudes and thought"*
"*Enables one to be in touch with changes occurring in the business world"*
"*I keep up to date through internet"*
"*I know what they are talking about!"*
"*It allows you to keep up to date with policies, news & weather"*
"*Keeping up and current"*
"*Keeps us up to date"*
"*Make us feel like we are not so backwards and that we too know what is happening in the world"*
"*Papers are a week old and don't always catch the news and market reports"*
"*We can be up to date with information"*
"*Yes, we share the same news"*

Women's comments themed towards business indicate that having internet connection allows them to "conduct business in a more professional way", it gives them "the same access to business opportunities" as their more internet active counterparts. Having internet access allows rural people to remain competitive in the global market, which makes them feel more equal to those other who have ready access to the internet, see Table 6.24 for supporting comments.

Table 6.24: Anecdotal comments from female participants regarding equal access to internet connection - Business

"Access to business"
"Can conduct business in a more professional way"
"It has become a necessity in business and personal life"
"It is mandatory to run your business"
"Provides us with a tool to be able to complete business in remote locations"
"It is very difficult to operate a business in this world today without internet access and often the only way of communicating/trading with many business as they don't realise that some of us struggle to have internet access"
"Majority of people operate business online so without access you get left behind"
"Business access, knowledge, access to information"
"Same access to business opportunities"
"We are competing on the global market so need to keep up to date with all things effecting us"
"Able to do business on-line and connect with family/friends far away"

The final theme from women's comments is education. Women state that internet connection *"Allows us [them] to engage with a higher level of learning and keeping up to date with national and global issues"*, it also allows them to study in formal education and internet connection allows rural women to education their children, see Table 6.25 for supporting comments.

Table 6.25: Anecdotal comments from female participants regarding equal access to internet connection - Education

"Allows us to engage with a higher level of learning and keeping up to date with national and global issues"
"I can study uni online"
"It has been made a necessity for schooling, so we should have it"
"It is a right in this day and age and it's unfair just because you live remotely that you have to put up with second rate internet especially when you rely on it to educate your children"

The next question extends the findings from the 2013 survey where several respondents from face-to-face interviews indicated that completing computer based work at night allowed the women to work alongside their partners during the day, which made the partner happier (less suicidal) and as such, made their life happier. The question was only asked to women, where only 9.8% of respondents strongly agreed with the statement, which is reflective of the number of respondents from face-to-face interviews, a further 54% somewhat agreed with the statement indicating some belief in the statement. Twenty-six percent of respondents somewhat disagreed and 9.3% strongly disagree with the statement. Given that more than half of the respondents agreed with the concept, this study concludes that further investigation is required to fully understand the relationship between technology and life satisfaction.

Table 6.26: Frequency analysis of the question "Do you agree or disagree that being able to work on the computer inside at night (or other times), means you can work outside with your partner during the day would result in making him happier, and your life is more enjoyable"

	2016 (N=200)	
	n	**Percent**
Strongly agree	18	9.8
Somewhat agree	99	54.1
Somewhat disagree	49	26.8
Strongly disagree	17	9.3

The participants were also asked if they agreed that women being to work outside during the day and inside on the computer at other times contributed to others sense of well-being. While few participants strongly agreed or disagreed with the statement. More than 50% somewhat agreed that partners, children (both at boarding school and on the property) and workers benefited from having the woman working outside during the day and working on computers at other times. While the responses to this question are by no means conclusive, they open a discussion about how women supporting their partners by working alongside them on the property can positively affect the well-being of not only their partner but of others in the family and working relationships. Further investigation is required.

Table 6.27: Frequency analysis of the question "Do you agree or disagree that women being able to work outside during the day and inside on the computer at other times contributes to the well-being of the others"

								2016 (N=200)
		Strongly agree		**Somewhat agree**		**Somewhat disagree**	**Strongly disagree**	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**	**n**	**Percent**
Husband/Wife/Partner	34	18.6	97	53.0	45	24.6	7	3.8
Children (boarding school)	26	14.2	98	53.6	45	24.6	14	7.7
Children on the property	25	13.7	92	50.3	50	27.3	16	8.7
Workers	19	10.4	93	50.8	53	29.0	18	9.8
Extended Family	17	9.3	91	49.7	61	33.3	14	7.7
Neighbours	13	7.1	74	40.4	68	37.2	28	15.3
No, I don't think it contributes to the well-being of others	30	16.4	48	26.2	63	34.4	42	23.0

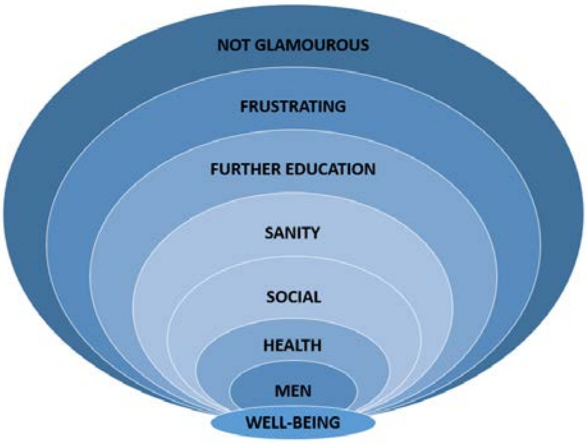
The next section discusses results from the focus groups held at the Queensland Rural, Regional, and Remote Women's Network Annual conference held in Emerald from the 19th to the 21st of October 2017, and is followed by a Chapter Summary.

6.3.3 Focus Groups

6.3.3.1 Well-being Group 1 – Producers

The first group of participants identified seven themes surrounding the question "How does a woman producer using technology affect the well-being of the male producer/family?" Themes include that technology is used by men (to assist with daily activities and learning, but there lack of confidence to use technology may make them feel more disconnected), health, social, sanity, further education, frustrating and that it is not glamourous. Each of the themes is expanded in the next section.

Figure.6.2: Group 1, themes relating to women use of technology and its effect on well-being



Group 1 Well-being themes

Group 1 Men: In terms of men and technology, most of the participant's husbands/partners were using some form of technology, mostly smart phones. However, one participant's husband was not using technology, she stated, *"he does not even know how to turn on the computer, he still can't text"*. The group agreed that sometimes technology could make *"men feel more disconnected because they did not understand it"*. Conversely, another participant's husband is using technology to improve his literacy through an online reading and typing tutorial. The respondent said, *"He [her husband] is gaining more confidence from learning how to spell, he has dyslexia"*.

Group 1 Health: In terms of health, the participants of the focus group said they used technology to *"improve their health by researching nutritional value of foods for family meals"*. They also are more comfortable with healthcare services as *"getting access to health assistance is easier"*.

Group 1 Social: Socially, connectivity is similar to the technology theme in Question 1. Participants recorded that they like technology *"because it helps them to keep up to date with the kids, who are away from home"*. Similarly, the respondents responded that children are also not socially isolated when they are at home on the farm because *"they have access to their friends through social media, such as Facebook or Snapchat, which makes the participants happier"*. The participants discussed that technology *"allows them to keep in touch with extended family and friends increasing connectedness and reducing loneliness"*. Finally, the respondents said that *"having access to technology and the internet gives them a voice with which they can share stories about life in rural, regional and remote areas or lobby for changes to their industry"*.

Group 1 Sanity: The respondents elaborated on *"sanity"* in the well-being session of the focus group. They stated that having access to technology *"allows them to have 'screen time', which allows the women some piece and quietness"*. The participants are able to do the grocery shopping online, which they cite as *"the best invention ever"*. However, the women also commented on *"being addicted to shopping, games, and movies"*. In terms of productivity, the participants agreed, *"having technology attached to water tank monitors saves them time and reduces the workload"*.

Group 1 Further education: In addition to the participant's husband using the internet to improve his reading, the participants are using the internet to *"search for new business ideas and information"* with the aim of investing in their farm (Block, 2012).

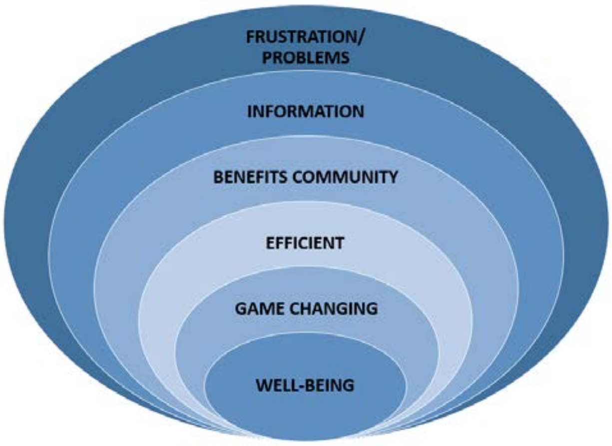
Group 1 Frustrating: While there were plenty of positive effects from technology discussed during the focus groups, there were some negative aspects as well. In terms of frustration, the participants were mainly *"frustrated with the demands of family members, who are reliant on the participant to purchase, troubleshoot, and train others"*. They sometimes find *"searching on the internet overwhelming, with so many sites to go to for information, that often has conflicting information"*. The participants discussed technology *"being the cause of family disconnection"*, reporting that *"other family members are all over engaged with their technology products"*.

Group 1 Not glamourous: Participants highlight that there are *"safety issues within social media"* and that *"seeing perfect lives on social media"* may be harmful. While the participants were happy that they and their kids had *"increased social interaction"*, they discussed that the *"kids are* *using too much social media"*, both adults and kids are *"too dependent on it"*, they are *"not always living in the real world"* and that it can *"lead to social isolation and disconnectedness"*. Participants recognise that the internet *"can be overused"* by both kids and adults and they wondered, *"What did I do with my time before social media?"*

6.3.3.2 Well-being Group 2 – Agricultural extension officers and other service providers

The second group of participants identified five themes surrounding the question "How does having technology available make the family property more attractive to workers and returning children?" Themes include that technology is game-changing, efficient, it benefits community, provides information, but it causes frustration/problems. Each of the themes is expanded in the next section.

Figure 6.3: Group 2, themes relating to women use of technology and its effect on well-being



Group 2 Well-being themes

Group 2 Game Changing: Group 2 participants found technology to be game changing citing that *"technology allows remote control, thereby saving out of home time / money employing extra staff"* and that while *"some technologies i.e., updated RFID are incredibly expensive"*, they *"improve life exponentially"*.

Group 2 Efficient: On farm technology: *"improved the efficiency of farm administration and can mean more time together at night"*, *"more family/partner time"*, it *"brings couples together"*. Technology *"eases some of the work burden"* as *"less time is spent on paperwork for example"*.

Group 2 Benefits Community: There was extensive discussion surrounding the theme that technology benefits the wider community. That it *"advances the bush"*. Technology has *"improved efficiency of farm administration (using digital tools / technology) means more time for working on the business rather than in it"*, *"improved networks and connections (virtual)"* and *"improved communication"*. While participants cited that technology *"can perform roles that may previously have been outsourced"*, they also highlighted that *"improved technology is attracting people to the rural sector"*. Technology can provide a *"potential income to supplement farm"* and *"women can build their confidence to bring new ideas/ opportunities to the business / drive innovation"*. The participants also thought that technology provided a *"better use of time and less out of hours work e.g. irrigation sensors replace the need to get out of bed at 1am"*.

Group 2 Information: Group 2 identified technology as giving increased information to improve well-being. The group highlighted that access to the internet *"can give better access to info on mental health (to help support/manage family members and or staff"* and that there was *"better access to telehealth"*, technology *"can reduce isolation [it can] help you see there are others grappling with similar challenges"*. and that technology was *"reducing isolation"*. Likewise technology gives better access to information and education and improves skills, it *"improves distance education for children"*, gives *"potential for skills development and then work on farm in enhanced roles"* and allows *"access to more information and resources"*, *"access to help/ training/ research online"* and *"better access to market/ weather/ information, peace of mind"*. Technology *"simplifies banking"* and *"while it works it gives a sense of achievement"*. The participants in group two, also highlighted that technology is important in property management *"everyone in modern property management must use and understand technology"* and that *"women are all good facilitators, therefor they can lead access to, plus train the family on use of technology"*. *"A woman can draw the family together (subjectively) better than a male"*.

Group 2 Frustration / Problems: On the other hand participants agreed that having technology lead to *"extra responsibility - just another bloody thing to take care of or manage"* and *"if the husband is not technology savvy there is a lot of reliance on the partner – frustrating"*. They found it *"exhausting/addictive"* and that it was time wasting *"can get side tracked on the computer (loose time)"*. Technology is seen as *"time consuming when updating or changing technology e.g. accounting program" and participants "can feel frustrated in getting stuck indoors on the computer"*, they find it *"difficult to access help to fix problems – frustrating"*, and that *"limited support for IT can be isolating"*. On a positive note, they found technology to give *"a sense of shared enterprise via different means"*.

Summary

The first group of participants identified seven themes. *"Sanity"* and "*Social"* appeared in the responses from the focus group participants in terms of how technology affected their well-being, as did education, but for different reasons to technology. Other themes include health, and men. Negatively, two themes emerged as frustrating and not glamourous, both themes having an effect on well-being. The second group of participants identified five themes. Themes include that technology is game changing, efficient and that it benefits the community. While technology gives participants of the focus group increased access to information, it also creates frustration and problems. The next section provides a summary of the data analysis.

6.3.4 Summary of data analysis

Study 3 explores the notion that having technology can reduce isolation and in turn increase well-being in family members and workers on rural, regional, and remote areas of Queensland, Australia. While the studies focus is on women's use of technology, the survey and focus groups were open to both women and men. However, very few men responded to the survey and none responded to the focus group. A cross tabulation was applied to all questions to test if the male responded to each questions or not. Where there is no response from men, the text has only referred to women as the responders.

Half of all respondents had only ever worked in agriculture, while others had worked as teachers or in education, administration, nursing, banking and finance or other professional positions. The remaining respondents worked in retail, mining, marketing, pharmacy, or media or were working in positions related to agriculture (extension officer) or were married to someone involved in agriculture. When asked if they would like to stay working in agriculture 82% answered "yes" indicating that most survey participants were satisfied with their working environment. The majority of respondents produced cattle and lived on large properties (20,000acres +) in Queensland, Australia.

The data confirms that participants are using technology more in 2016, than they were in 2013. While the majority of survey participants identified as owner/managers, 13% also identified the female in the partnership as working off-farm as well. Nearly half of the respondents rated their emotional health as above average or excellent. However, the women who indicated that they work off-farm rated their emotional health as moderate highlighting that they might be less satisfied than those women who work only on-farm or do not work at all (Chang & Mishra, 2008; McCoy & Filson, 1996; Schirmer et al., 2016; Van den Broeck & Maertens, 2017). Nearly all participants agreed that farming with new technology would help the grazing industry to remain productive. The data shows that women are primarily responsible for technology use. However, they indicated through anecdotal comments that they are sometimes frustrated being responsible for using technology and then getting the blame when something goes wrong, adding to their frustration. By contrast, men included the study, identified women as having more control over the business. Men are grateful that women are using technology. They agreed that by using technology, women were gaining valuable skills and feeling more confident and that using technology was empowering for women. Overall, the comments and responses provided indicate that men in the survey value the contributions of women to the faming business. While the sample size is too small to generalise across the cattle producing industry, the results give an idea of men's thoughts on women using technology.

The study results indicated that participants hoped or intended to hand their property on to future generations, indicating that staying on the land was important to cattle producers, as was ensuring that their business was successful, which added pressure to farming families to succeed in business. The majority of survey participants that have had access to the internet for more than five years also responded that having access to the internet is extremely important. Participants mostly use the internet for business, research and development, education, socially, with only a few respondents using internet for staff. The top three reasons for having internet access was communication, accounting and banking and business administration. The majority of female and male participants agreed that having access to the internet increase their quality of life/well-being and that by having access to the internet they feel more equal to people in more internet accessible areas. Participants agreed that completing computer based work at night allowed the women to work alongside their partners during the day, which made their partner happier (less suicidal) and as such, made their life happier. They also agreed that being able to work alongside others during the day contributed to their sense of well-being. Female respondents agree that partners, children, and workers were positively affected by the woman working outside during the day and on the computer at other times. While the responses to this question are by no means conclusive, they open a discussion about how women supporting their partners by working alongside them on the property can positively affect the well-being of not only their partner but of others in the family and working relationships.

Focus groups

Originally the question "How does having technology available make the family property more attractive to workers and returning children?" was asked because it was indicated in Hay and Pearce's (2014) study that technology may allow farming women to spend more time with their husbands/partners, making them happier and less depressed or suicidal. Kunde, Kairi, Kelly, Reddy, and De Leo (2017) cite suicidal characteristics in farmers to include experiencing financial difficulties, work and financial concern, difficulties linked to stress, low rates of treatment for mental illness and access to firearms (p. 11). In addition and of importance to this study, a lack of confiding relationships is noted as a contributor to suicide (Kunde et al., 2017). However, the responses from the focus groups have not reflected this.

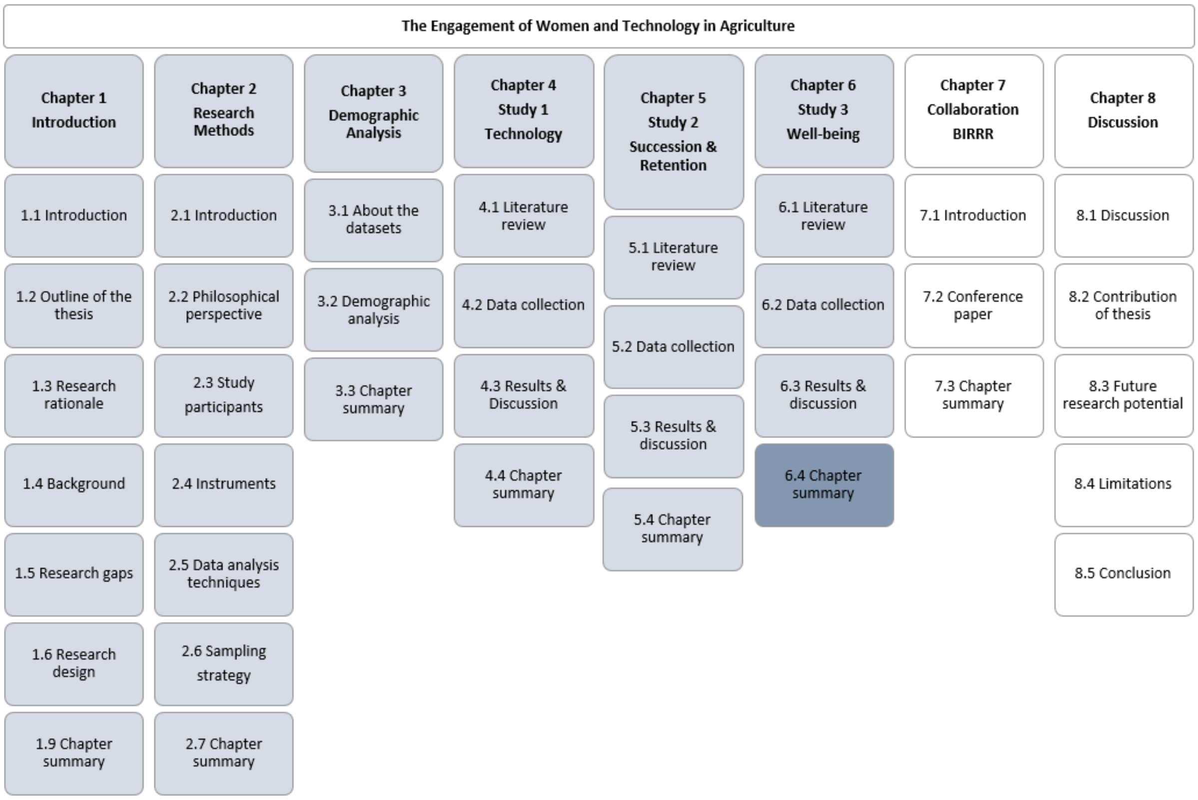
One participant commented on her husband's literacy challenges and how her husband was using technology to overcome dyslexia. The participant's husband falls into the 40% of developed countries population that has literacy problems of which half (20% of the population) have severe literacy problems (Adkins & Ozanne, 2005b; Office for National Statistics, 2000). Typically *"adult* *learners combine a range of social skills and resources and an ability to manage the shame of the low-literacy stigma to get their needs met…"* (Adkins & Ozanne, 2005a, p. 153). As consumers, they may become alienated and view social and business contact as threatening, leaving them powerless to challenge, lacking agency and empowerment (Adkins & Ozanne, 2005a). Being able to study online allows the participant's husband to avoid being stereotyped as an adult learner and by contrast, the online learning environment adds to his empowerment.

Participants are also keeping up to date with children that are away from home, which has a different connotation to keeping up with friends socially as stated in Question 1. As such, the well-being of the focus group participants is increased by using technology to keep in touch when the children are away from the farm.

When asked if having internet access would increase the participant's quality of life/well-being, 94.4% of respondents agreed that it would, 3.5% somewhat disagreed and 2% strongly disagreed. Responses from the focus groups supported the positive responses on the survey with statements such as *"it [technology] breaks down the training barrier*s", *"it builds on peoples strengths"*, "*it connects family quicker"*, and it provides "*connectedness"*. By contrast, the same focus group participants found using technology frustrating, with supporting comments such as they are *"frustrated by the demands of family users reliant on them"* and that there is a *"family disconnect… a generational divide"*. Importantly these negative responses have implications for quality of life/well-being.

6.4 Chapter 6 Summary

Thesis Structure Overview: Chapter 6 - Summary



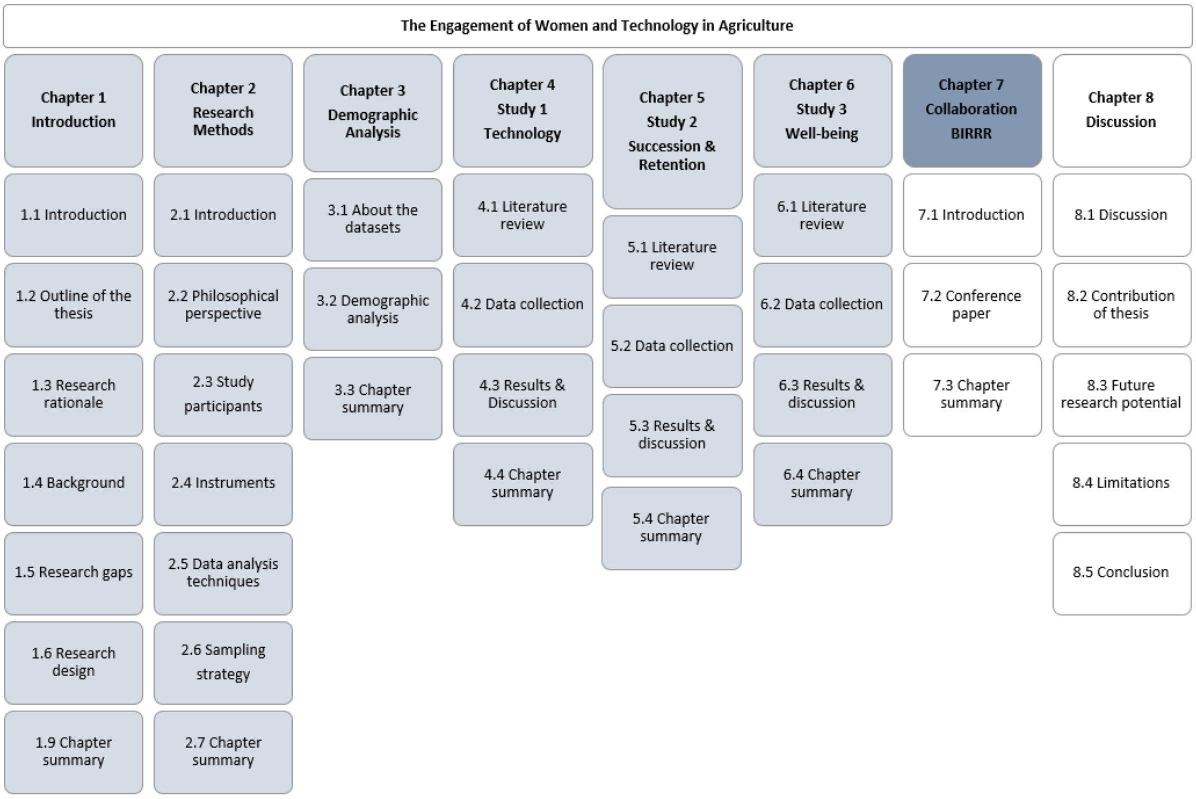
Chapter Six Well-being of producers and producer families proposes that female producers who use technology are able to spend more time with their husbands, potentially increasing the well-being of the male producer. Women in Hay and Pearce's (2014) study identified that having technology and being able to use it at night made them available in the day time to work alongside their partners. This in turn made the men happier, resulting in increased feelings of well-being. However, technologies role in increasing well-being has not yet been clarified. This chapter provides initial exploratory research to begin to address a gap in scholarly understanding of why and how women's use of technology affects the level of well-being of the farming family. The associated study used an online survey and focus groups to establish "In the producer partnership, how does a female producer using technology affect the well-being of the male producer?" Summaries of the study including the literature review and the results are discussed below.

A short review of the literature identifies social capital as a pre-cursor to good mental health and well-being (Berry & Welsh, 2010). Challenges such as drought, outmigration of children and altered social structures amongst others are prominent causes of stressors for rural men (Berry et al., 2011b). Stressors, poor social support and a lack of community are identified as barriers to good mental health (Kutek et al., 2011). Online interventions to prevent suicide are available (Allan, 2010; Powell et al., 2012), but are inhibited by men's lack of confidence in using technology. Women affected by pressures of off-farm work report more areas of lower satisfaction than those working solely on farm (McCoy & Filson, 1996), from farm work or from house work (Van den Broeck & Maertens, 2017). Women using technology during the evenings and working outside has been highlighted as beneficial to men working on the family property. Working together may increase social connectedness and in turn well-being, which gives motive to investigating technology adoption in this study.

The online survey and focus group results indicate that participants are motivated to work in agriculture and to pass the tradition on to their family. While women are contributing technology adoption to beef production they are still identifying as "invisible farmers", labelling themselves wives, spouses or daughters of the property. The term 'invisible farmer' is increasingly being used to define women who work in agriculture, whose role is difficult to describe (Brandth, 2002). The farm work that women do often is overlooked, unnoticed, an invisible to others (Brandth, 2002; Little, 1987; Whatmore, 1991). In addition, women's position in farming is often tied to their marital contract, women have previously been viewed as the farmer's wife without independent status (Brandth, 2002, p. 184), rendering farming women as less valuable than farming men. More participants identified as property owners in 2016 than in 2013, which may indicate that families are moving back to the farm during tough times. The downturn in the agricultural markets during the period of this study (Australian Bureau of Statistics, 2016; Cranston, 2013; Institute for European Environmental Policy, 2009) may also contribute to stressors affecting the well-being of faming families. Furthermore, just over half of the female participants are working off farm, increasing their workload, potentially adding more stress to the farming family (Chang & Mishra, 2008). While participants indicated that, at the time of the survey, the majority felt emotionally healthy, a lack of social connection and spending less time in the community coupled with additional stressors may be detrimental to their well-being. Internet connection was identified by participants as both extremely important to have access and for communication, accounting and banking and business administration and for increased levels of well-being. While women were sometimes frustrated with being responsible for technology purchase, use and training, their partners were grateful that the women were responsible for managing the technology. Participants (63%) agreed that working with their partners in the paddock during the day (and on the computer at night) made him (only females answered the question) happier and their life more enjoyable. More than half of the participants responded that partners, children (both at boarding school and on the property) and workers benefited from having the woman working outside during the day and working on computers at other times. While the responses to this study are by no means conclusive, they open a discussion about how women supporting their partners by working alongside them on the property can positively affect the well-being of not only their partner but of others in the family and working relationships. Further investigation is required.

Chapter 7 Additional Collaborative Project with Better Internet for Rural, Regional and Remote Australia

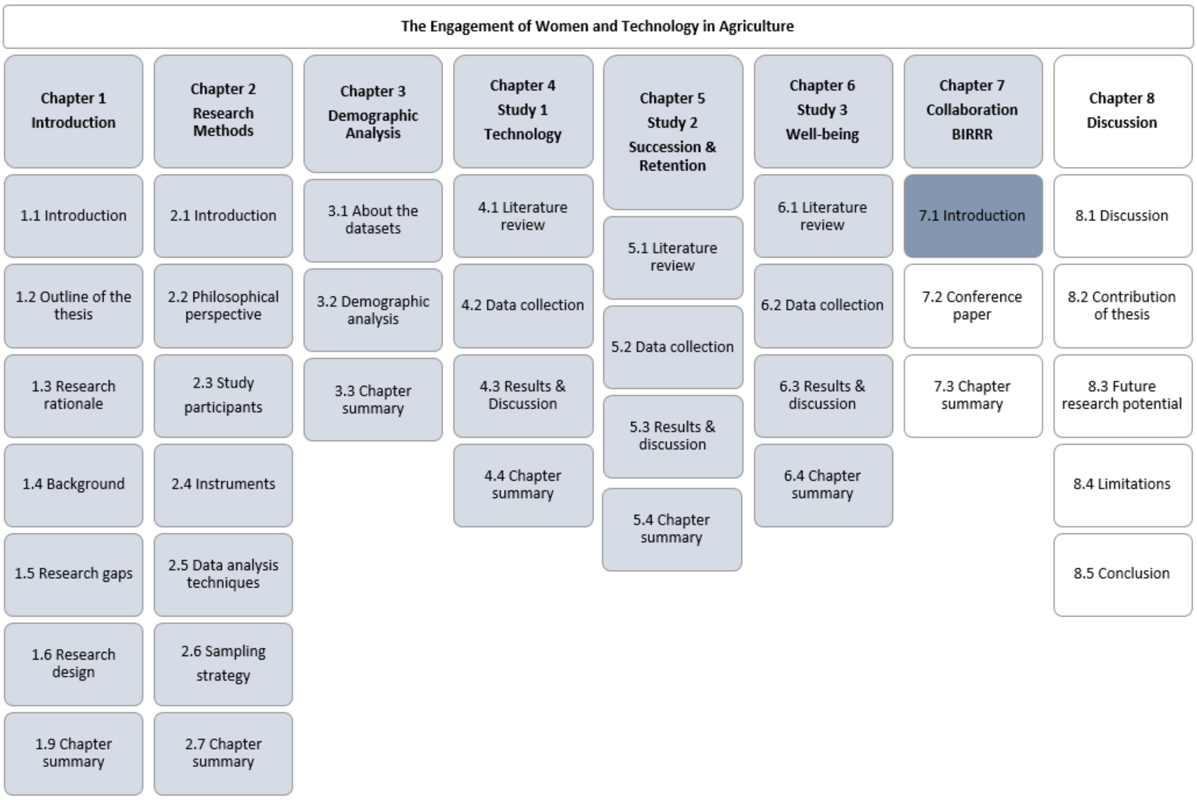
Thesis Structure Overview: Chapter 7 – Collaboration with BIRRR: Marketing Social Change in Rural, Regional and Remote Australia



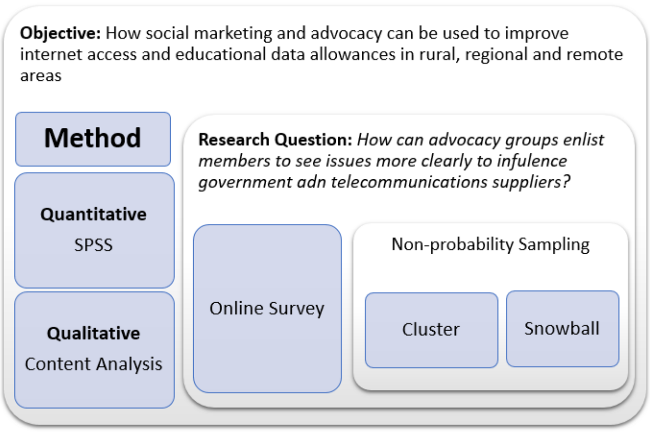
Chapter Seven presents a collaboration between the researcher and the Better Internet for Rural, Regional and remote Australia (BIRRR), (see the Case Study in Section 7.2.3 for an outline of the BIRRR membership group). The BIRRR group offer solutions to rural, regional and remotely (RRR) located people about problems with internet connectivity. The researcher's role in the collaboration was as a volunteer data analysist for the group and her task was to write plain language reports on the results of two surveys and three lobbying submissions, which are published in the BIRRR website here https://birrraus.com/press-releases/.

7.1 Introduction to Collaboration

Thesis Structure Overview: Chapter 7 – Introduction to Collaboration



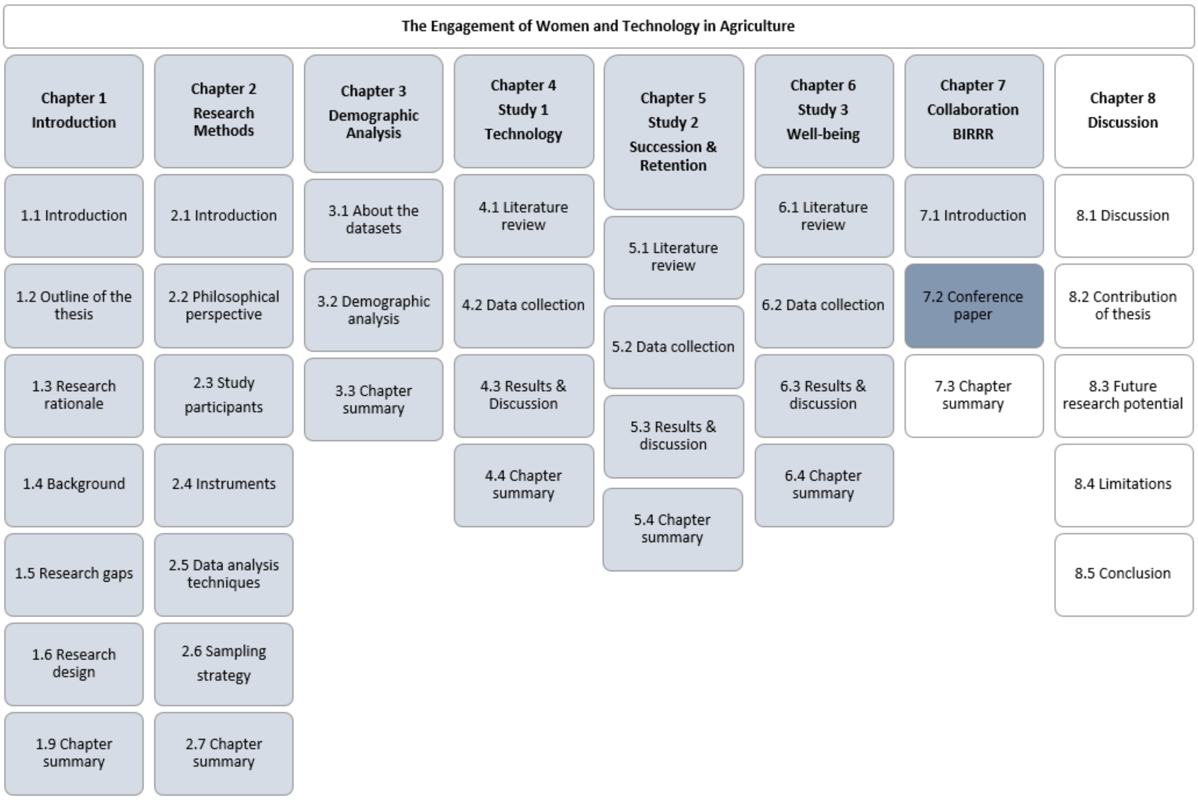
Chapter Seven presents the paper associated to the research that was accepted and presented by the researcher at the 2017 Academy of Marketing Conference at Hull University on the 4th of July 2017. The paper, which acknowledges the link between advocacy groups and social change is published in the conference proceedings. The chapter provides an overview of the data collection (Section 7.1.1), which is followed by the paper as submitted to the Academy of Marketing Conference 2017. Section 7.3 provides a summary of *Chapter 7*.



7.1.1 Data Collection

The data for the study was extracted from the BIRRR Facebook page, from posts and comments and includes secondary data extracted from the "BIRRR Internet Access Survey, 2016" and the "BIRRR SkyMuster Survey, 2017" and from other activities completed by BIRRR. The BIRRR Internet Access Survey, which was distributed to approximately 6000 BIRRR members, sought to collect information about internet use in rural, regional, and remote Australia. The survey consisted of 50 questions about either mobile broadband or about satellite, or if participants were using both mobile broadband and satellite, they were to respond to all of the questions. The BIRRR Sky Muster Survey, distributed to approximately 8600 members, aimed to establish the then current state of Sky Muster connections of people in rural, regional, and remote areas of Australia, by collecting information about satellite internet user experience in rural, regional, and remote Australia. Both sets of survey results were used to both work with and lobby stakeholders, government, and industry to improve access to and usability of bush internet communications.

7.2 Paper in Proceedings of the 2017 Academy of Marketing Conference: Marketing Social Change: Fixing Bush Internet in Rural Regional and Remote Australia



7.2.1 Abstract

Cattle producers in Australia have turned to social media to highlight deficits in internet access in rural, regional, and remote Australia. This paper provides a case study of how a group of Australian cattle producer women used social marketing and advocacy to improve internet access and educational data allowances in rural, regional, and remote Australia. Facebook posts and comments from the Better Internet for Rural, Regional, and Remote Australia (BIRRR) were analysed using content analysis. The results show evidence of a connection between advocacy and the principles of marketing. Of which, the results lead to a change in policy giving rural, regional, and remote school children a dedicated education portal to complete their studies and which highlighted deficits in access to internet connectivity.

Keywords: rural women, social marketing, policy, advocacy, agriculture, technology

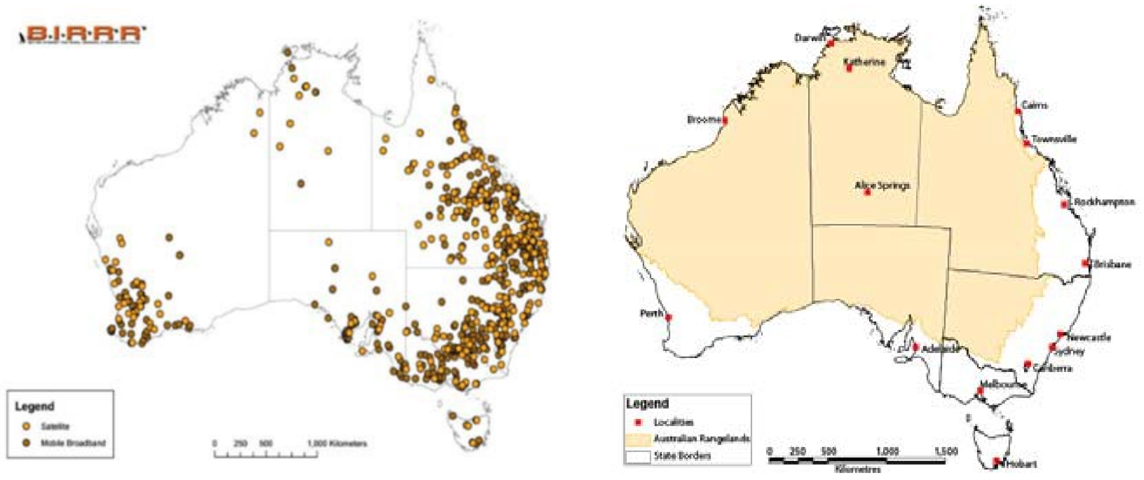
7.2.2 Introduction

Australia covers approximately 7.692 million square kilometres (Dept. of Environment and Energy, 2005). Around 81% of this is broadly defined as encompassing rural, regional and remote areas of Australia. Rangelands are characterised by "eucalypt savanna and native grasslands, small areas of cleared land and scattered settlements, and rivers and wetlands that sustain ecosystems" (Dept. of Environment and Energy, 2005, p. 1). The rangelands are the home of Australian beef cattle production, where the industry produces around 27 million head of cattle to the value of $17.87 billion (2014/15) (Meat and Livestock Australia, 2016a).

Agricultural products from Australia are highly regarded, as such, the beef industry looks to Information Communication Technology (ICT) to help boost production to meet projected global food demand goals (Linehan et al., 2012).

ICTs have the potential to transform how people live in rural, regional, and remote areas. New internet and mobile phone technology is allowing producers to keep in contact, not only with friends and relatives, but also with markets, suppliers, telehealth services, weather, flood and fire services and banking as well as remote education. However, access to networks in Australian Rangelands is challenging (BIRRR, 2016a; Curtin, 2001). ICT connectivity across the Rangelands is limited. For example, Figure 1 demonstrates a lack of overlap between the Australian rangelands and internet responsiveness to a national survey of internet usage (BIRRR, 2016a). In many sparsely populated pastoral regions, download speeds can be as low as 0.7 Mbps (BIRRR Regional Internet Access Survey Results, 2016). Expensive and unattainable access to either mobile or internet connectivity is adding to the digital divide currently experienced by those on the Rangelands (Curtin, 2001). However, a small group of cattle producing women are using social marketing to advocate for change.

(A) (B)



Note: not all addresses could be mapped, and (B) location of Australia

Figure 7.1: (A) Responses mapped from the Better Internet for Rural Regional and Remote Australia (BIRRR) Regional Internet Access Survey showing access to internet in Australia (BIRRR, 2016a).

7.2.3 Case Study

Two remote-area cattle producing women who were experiencing unexplained excessive usage on their mobile broadband data and were struggling to educate their children through distance education and run their businesses with very limited access to the internet, have taken action to change policy-surrounding Rural, Regional, and Remote (RRR) internet connectivity. Together they founded the Better Internet for Rural Regional and Remote Australia (BIRRR) action group. The women set up a Facebook page in 2014 and a website and a Twitter (#DataDrought; #fixbushinternet) account in 2015 and started to respond to media interest about the #DataDrought. BIRRR is a not for profit group, which has five administrators, several provider and technical volunteers and more than 8500 members. BIRRR provides information and support about telecommunications services and delivers it via their website and Facebook group to people in RRR areas of Australia. BIRRR uses survey data collected from their Facebook members, their website and from media coverage, to lobby for better internet for RRR Australia and regularly engages with community, government and other stakeholders to highlight the deficits in internet access in RRR Australia (BIRRR, 2016a). The team employs social marketing practices and advocacy (Novelli, 2011) and uses community connectedness through their social networks (Lefebvre, 2013) to focus on fixing bush internet and putting an end to the data drought experienced by RRR communities in Australia. BIRRRs target audience is the members of RRR Australia. The sample, segments BIRRR group members into broadband and satellite users as each offering has both similar and unique issues. The program goal was to get members in RRR areas to recognise common issues with internet access so that they would then join the campaign, elevating rural internet access as a priority. The behavioural objective was to get those affected by the deficits to make informed decisions based on their knowledge and to have BIRRR recognised as a not-for-profit organisation working for change on behalf of RRR communities. The primary objective was to get members to see the issues more clearly, so that as a community the members could influence government and telecommunications suppliers to table the issues. This paper aims to analyse how BIRRR uses social marketing and advocacy to create change that benefits children, families, and businesses in rural, regional, and remote Australia.

7.2.4 Literature Review

Social Marketing: Social marketing is designed to benefit the target audience and is defined by Andreasen (1995) as "the application of commercial marketing technologies to the analysis, planning, execution, and evaluation of programs designed to influence the voluntary behaviour of target audiences in order to improve their personal welfare and that of their society" (p. 7). More recently social marketing has been defined as "seeking to develop and integrate marketing concepts with other approaches to influence behaviours that benefit individuals and communities for the greater social good" (iSMA, ESMA, & AASM, 2013, p. 1). 'Social Marketing is about making the world a better place for everyone…' (Andreasen, 2006). This paper discusses the integration of advocacy into behaviour change theory (Lefebvre, 2013) to elicit change in internet access for RRR communities. Text from BIRRR's Facebook page will be measured using content analysis against five principles of social marketing (Lee & Kotler, 2011), firstly, that the program must benefit both individual and society. Secondly, that it must influence behaviour. Thirdly, that the audience must play a role and fourth, the program considers the four P's and lastly that there is evidence and evaluation.

Community Engagement in Change: The BIRRR team gathers information for its online community across the often-confusing landscape of “bush” broadband. The online community activates the information requests via the BIRRR Facebook page. Responses (or activation) are operationalised by volunteers, both self-selected and recruited (Roncarati, Lefebvre, & Carleton, 1989). Through social media, the advocacy group has built a “natural helper network” (Lefebvre, 2013, p. 388) of internet providers and technical experts. Natural helper networks are a volunteer delivery system, whereby volunteers are recruited, trained and supervised to provide a volunteer service (Israel, 1985; Lefebvre, 2013). BIRRR admin respond to 150 – 200 enquiries per week. Without the help of “natural helper networks” (Lefebvre, 2013, p. 388) the group could not keep up with demand and positive change would not occur. By assisting customers/members of their group in topics such as dropouts, lagging, outages, unexplained data use, high costs and poor connectivity (BIRRR, 2016a, 2017a) BIRRR have become customer advocates. Customer advocacy is a powerful tool that involves the provision of information including advantages and disadvantages of a product to a customer with the view of representing them (Urban, 2005, p. 11). The role of the advocate is to “adopt a stance, advance a cause and attempt to produce a result on behalf of an interest of a person, group or cause” (Cohen, 2004, p. 9). The goal of BIRRRs advocacy is to provide RRR people with open, honest, transparent and complete information (Urban, 2005). BIRRR uses trust and advocacy within their network to engage public participation (Carpini, Cook, & Jacobs, 2004) in research on RRR internet access (Regional Access Survey Results, 2016a) and Sky MusterTM services (Sky Muster Survey Results, BIRRR, 2017a). Public participation included peer support, surveys, providing supporting evidence of issues with “bush” internet to submissions, lobbying and attending meetings, public hearings, and conferences. These tools were used to shift from engagement to action (Lefebvre, 2013), which was motivated both by the group members need for support for issues with the internet and it was motivated by the BIRRR administrators being their own customers (Grimm, 2006). The type of motivation is important to action, for without motivation the audience will not have the will to act (Urban, 2005). Therefore, BIRRR being its own customer created an internal motivation to act.

The data collected were used to create reports and government submissions that provided transparent and relevant information to inform policy makers about “bush” internet (Sparrow, 2015; Sparrow & Gowen, 2017). Technical information from experts, providers and users was given in an open forum, which ensured that interested parties could discuss or challenge the information to provide solutions to issues raised by members creating transparent two way communication and in turn inducing trust (Urban, 2005). These actions were supported heavily by targeted media campaigns to highlight issues and to reinforce recommendations made by BIRRR. By embracing advocacy on behalf of RRR internet consumers BIRRR has become a powerful and supported representative for RRR people, gaining strong public and political support and commitment (Lefebvre, 2013, p. 113; Urban, 2005, p. 11). The BIRRR team is successful because they have a customer centred mind set, this is partly because they are their own customer. However, sometimes the group to slips into the wrong mind set of being organisation centred as they charge on to satisfy the BIRRR group goals. For example seeing their mission as inherently good, where the primary goal of fixing bush internet and stopping the data drought is intertwined with both being customer centred and organisation centred (Andreasen, 1995, pp. 39-43). The group is ethical in its conduct with a focus on both the good of the individual and RRR society as a whole (Eagle et al., 2013, p. 99).

7.2.5 Theory Development

This paper aims to increase the literature on advocacy used in social marketing. Urban (2005), states that customer advocacy “does not speak at people”, rather that it is a “mutual discussion that assumes that if you advocate for your customer they will advocate for you”. Figure 7.2 gives an example of customer advocacy using the BIRRR group.

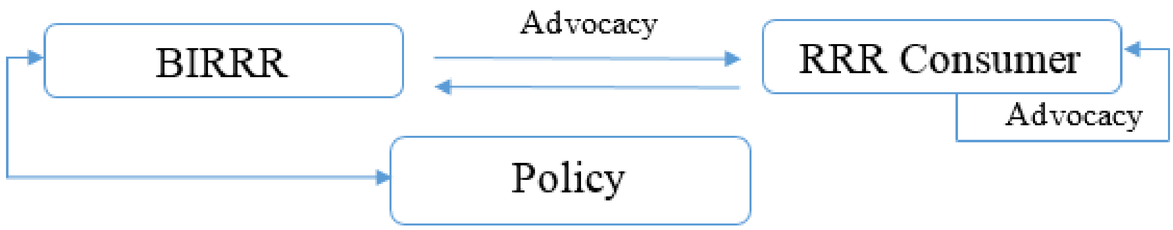


Figure 7.2: Advocacy: BIRRR advocates for consumers, consumers advocate to consumers, consumers advocate for BIRRR, which then feeds into policy

BIRRR follows the principles of the Advocacy Pyramid (Urban, 2005) (Figure 7.3). Prior to BIRRR, there was no one-stop shop for information about "bush" internet. The information that BIRRR provides is of high quality, is supported by technical experts, and is bounded by Total Quality Management (TQM) and customer satisfaction, which in turn increased the trustworthiness of the group's advocacy. BIRRR's relationship management saw their Facebook administrators manage member contributions with strict and sensible rules, which exclude political statements and abuse of members, administrators, or providers, but allows open discussion of issues encountered by members.

Figure 7.3: The Advocacy Pyramid (Urban, 2005)

Customer relationship management allows BIRRR to personalize their advocacy with each customer/member, forming relationships and creating trust. CRM extends to build relationships with relevant stakeholders such as technical experts, media, other advocacy groups, and policy makers to maximize interest in the issues surrounding "bush" internet.

7.2.6 Methodology

The BIRRR Facebook page and website was chosen for content analysis for a case study of advocacy marketing (Novelli, 2011). The data was gathered by accessing BIRRR Facebook posts using www.gritics.com. The data set included 445posts and 6578 comments from 22/10/2014 to 2/02/2017. The researcher, with permission, notified BIRRR group members to alert them of the study prior to collecting data. Content analysis (Krippendorff, 2013) allowed the researcher to uncover conceptual insights in detail by moving the level of analysis from the posts and their comments to the actual text used by the group members. This facilitates the systematic discovery of key themes and concepts surrounding internet issues in RRR Australia.

7.2.7 Data Analysis

Leximancer 4.5 (see http://info.leximancer.com/) was used to explore the conceptual layout of unstructured social media text generated from the BIRRR Facebook page. For this paper, text extracts were mined to show a connection between the advocate Kristy Sparrow (Founder of BIRRR) and the Principles of Social Marketing (PSM). In Figure 7.4 (Appendix 7), the advocate is directly linked to nearly all of the concepts, which shows the relevance of the advocate to the social marketing campaign despite only being represented in 9% of the text extracts. The full conceptual analysis of the Facebook data will be explored in more detail at a later stage. Instead, groups of concepts that meet each PSM engaged by BIRRR during the advocacy campaign are visually portrayed in Figure 7.5 (Appendix 8). Furthermore, Appendix 9, Figure 7.6 provides the frequency chart for Figure 7.5 which demonstrates the strength of occurrence between each concept and 'service' (the idea most central to the conversation). As shown in Figure 7.5 (Appendix 8), BIRRR had a stronger role in influencing behaviour (PSM2), addressing the four P's (PSM4) and providing evidence (PSM5) compared to allowing the audience to play a role (PSM3) and benefitting both the individual and society (PSM1). The role of BIRRR in meeting each of these five PSMs is further explained in the next section.

7.2.8 Discussion/Conclusion

BIRRR uses five of the social marketing principles in their social marketing advocacy campaign. A graphic is contained in Appendix 8 that provides a visual of the Leximancer Gaussian map, which shows

PSM1: It benefits the both individuals and society in rural, regional and remote areas – BIRRR focusses on improving accessibility and in turn well-being of rural, regional and remote people. The campaign uses accurate, relevant, and clear messages based on research to communicate in creative and impactful ways. Concepts revealed in the Leximancer analysis that relate to PSM 1 include that the group is Australian, and that the text discusses government, copper (runs all AU land based phone lines), fibre and tower, which both relate to new nbn^{TM} products (Figure 7.5, Appendix 8). Lobbying for change focusses on these concepts.

PSM2: Influencing behaviour – Concepts identified in the analysis includes discussion by members about signal, the area in which they live, and what service is available in their area (fixed wireless, nbn^{TM}, or satellite), service providers, and the systems in place (Figure 5). BIRRR encourages people with little knowledge about internet connectivity to engage in the conversation, to search for solutions and to speak up about their unique connectivity problems. Rather than remain information takers, they are encouraging them to become information makers, to tell the own story from an emic perspective. The data produced then feeds into evidence used to communicate the broader problem of poor or no access to the internet and expensive and inadequate data allowances, to the intended audience.

PSM 3: BIRRRs audience plays a principle role in the social marketing process – the BIRRR administrators understand their customer because as a customer of their own group they live and breathe the same issues that the campaign is addressing. Members relate to identified issues and play an active role using BIRRRs social media and other platforms (Figure 7.5: Facebook, Twitter, email and the website, Appendix 8) to tell their story, to ask for help, and to find support in their individual circumstances.

PSM 4: The four P's – BIRRR is immersed in the standard marketing four P's as it addresses each element (Figure 7.5: PSM 4, Appendix 8):

Product – comparisons of product between providers and of what is available in non-rural areas Vs rural areas in terms of plans, data, speed, phone, and mobile vs satellite and rural access (Figure 7.5, Appendix 8). BIRRR investigates the offerings between broadband and satellite and reports on the inequity of those offerings. For example, customers located in cities have access to fast, reliable, large cheap and always-available internet plans. Whereas those in rural, regional and remote areas pay more for less data, have unreliable connections, shaped accounts and peak and off peak data (shaped is where the speed of your internet connection is lowered when the planned data allowance has been used. Peak data is the allocation used in peak times (typically small allowances) and Off-peak data has a larger allowance that can only be used at inconvenient times (for more information see the BIRRR, 2016 Regional Access Survey results)).

Price – while data plans cannot be directly compared between city and rural areas, it is clear that city folk are getting more 'bang for their buck' compared to rural regions. The price of internet connection not only affects the purse of rural, regional, and remote people in Australia, it also affects access to education, business tools, tele-health, emergency information, and communication. This has an increased cost on time, effort, and overall well-being of people in rural, regional, and remote areas.

Place – government and communication providers often quote that a core product is available in RRR areas or they may quote what their policy says that the core product should be supplying. For example, the nbn™ Sky Muster™ Fair Use Policy limits end users to 75GB of peak data (nbn™ Sky Muster™ is the service provider for broadband connectivity to regional and remote Australia). However, in reality the average peak data available to users across all providers is 55GB (BIRRR, 2016). BIRRR lobbies government, relevant industry bodies and telecommunications providers to highlight shortfalls in service provision. These shortfalls would have previously gone unnoticed. BIRRR's main aim is to ensure that people in RRR areas have equitable access to telecommunications.

Promotion – Prior to the BIRRR group, there was no single way to seek and find information about internet connectivity. Information came from a large number of diverse sources. Many people were experiencing problems and they knew that others were experiencing the same problems, but they did not have a contact point or a united voice. The BIRRR group calls on community participation to send messages through social media, their website, news media, public speaking, word of mouth and by lobbying about the deficits of internet in the bush.

PSM 5: Evidence and evaluation – BIRRR conducts regular surveys, polls, and participates in community engagement to gather evidence required to lobby government and communication providers to implement change for the broadband needs of RRR people in Australia. Government ranks last in the frequency of terms because, compared to troubleshooting members problems, lobbying for change takes up a small proportion of the advocates time. Typically policy change is addressed in the beginning months of each year. The group celebrate their achievements through social media, awards nominations, and news media (https://birrraus.com/press- releases/). The group is recognised by telecommunications providers and government departments as an expert in their field and a force to be reckoned with. Evidence on their return on investment include:

- Un-metering of education specific sites for Telstra (Australia's leading telecommunications company (Telstra™, 2017)) mobile broadband distance education. Previously distance education would use the entire data allowance purchased prior to business or communication needs being met.

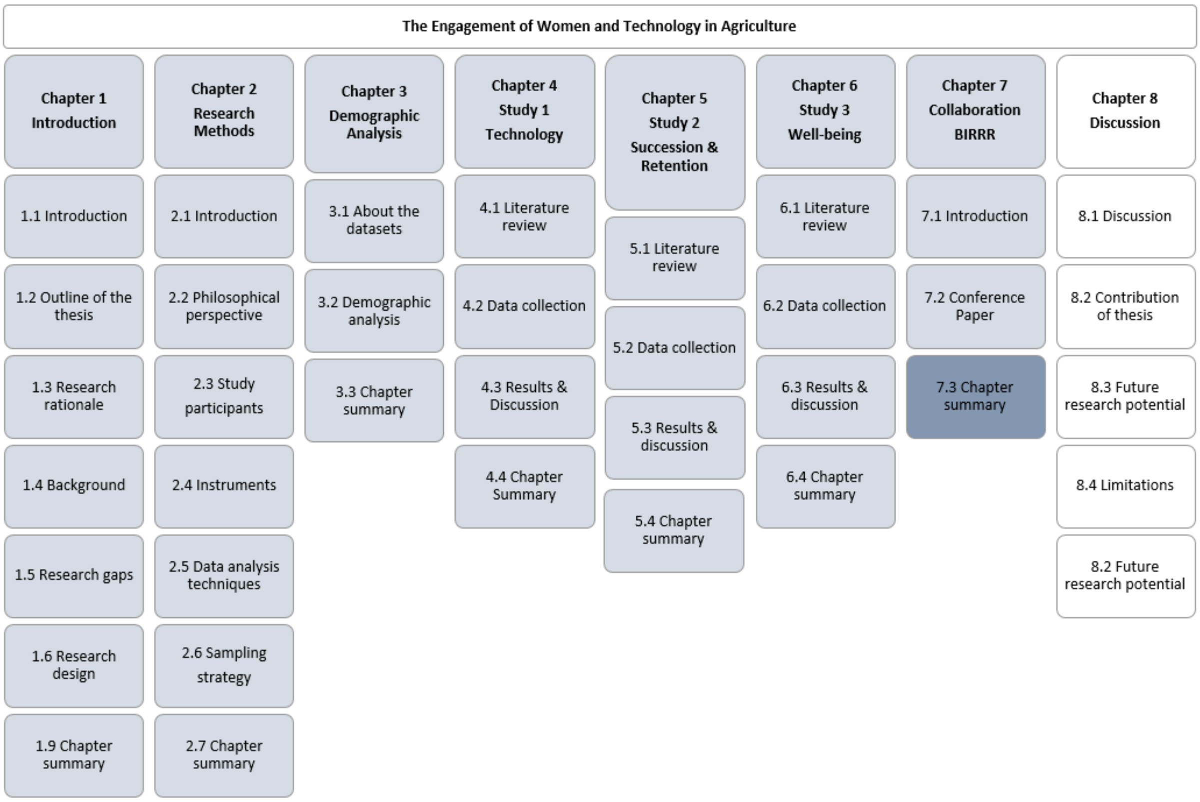
- Education ports for distance education and home schoolers using nbn™ Sky Muster™ ("nbn™," 2017) – dedicated education ports that allocated 50gb per student (up to 3 students) in addition to standard data allowances.

- Establishment of an nbn contact team for RRR users – dedicated service providers trained in rural technology and are aware of the challenges felt by RRR people.

- Widespread survey of bush telecommunications – produced base line data on actual usage and issues affecting RRR people.

This analysis has demonstrated the Better Internet for Rural, Regional and Remote Australia groups' use of five social marketing principles to advocate for equity in internet provision, for people in rural regional and remote Australia. The analysis has highlighted that there is more work to be done in terms of identifying the extent of social marketing practices in the BIRRR group. Research identifying the significance of overall conversations and exploring the role of SMP in BIRRR chats and further investigation of the role of the advocate are in progress.

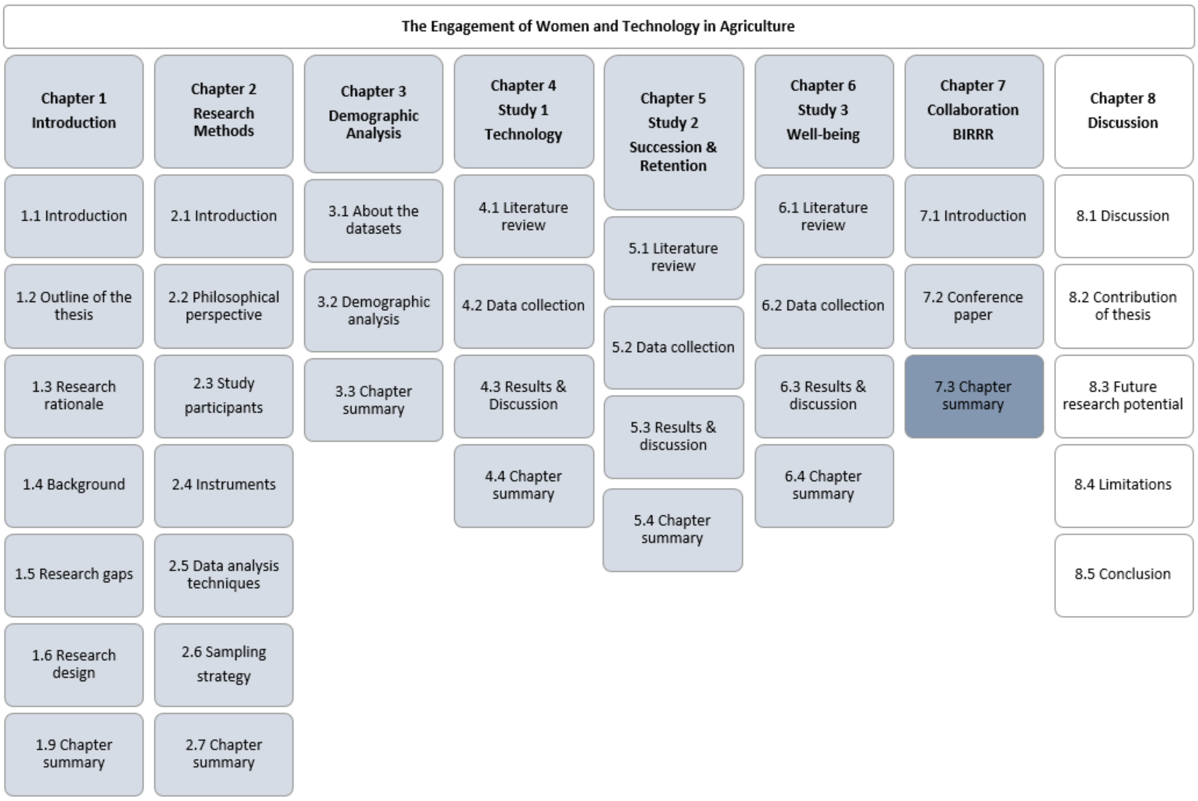
7.3 Chapter Summary



The paper was well received at the conference and generated much conversation about internet connectivity and its role in communication, safety and well-being of remotely situated people. The paper informed the BIRRR volunteer staff of their previously unrealised use of theory to perform their advocacy. The volunteers found value from the information and felt empowered that their work was recognised academically, boosting confidence for the team members and the BIRRR group. The data collected in the surveys was used to produce three separate parliamentary submissions, which were heard and responded to in public hearings. The first submission about regional access to internet connection resulted in increases in data limits presented to the consumers, and it alerted policy makers and government to issues relating to connectivity in rural, regional and remote areas of Australia. For example, computer mapping programs used by internet providers and government to supply services was offset by approximately 150 kilometres, which meant that providers and government were misinformed about boundaries for service provision i.e., providers were wrongly informing consumers that they could guarantee specific service to a consumer that did not have any access to the internet. The second submission about access to Skymuster Satellite Internet, similarly informed stakeholders, policy makers and government of the then current state of the connectivity. This information resulted in increased data plans, installation services and transparency of issues with the rollout of the new satellite technology. The third submission concerned the removal of copper telecommunication lines from all users across Australia, which meant that consumers had to rely on very poor quality Voice over Internet Protocol (VoIP) (a set of rules that makes it possible to use the telephone or videophone communication) for their telephone services. Because the VoIP system was unreliable, it meant that consumers would not be able to use their telephone to reach emergency services, manage their business or have any form of basic communication. The results from the parliamentary enquiry resulted in the copper telephone line being re-instated. The researcher's role in this project included attending and responding to parliamentary enquiry public hearings, presenting a selected telecommunications conferences on behalf of the BIRRR team and providing statistical data analysis and submission writing support to the volunteer team.

Internet connectivity is widely recognised as the principal barrier to technology adoption (Australian Medical Association, 2017; Curtain, 2001; Fan, 2002). As the services provided by BIRRR and other advocacy groups (such as the ICPA) continue to improve connectivity issues, diffusion of agricultural technology will continue to increase in in RRR areas of Australia as they become more connected, which ultimately is the focus of this study.

Chapter 8 Discussion and Conclusions



8.1 Discussion

This final chapter discusses the overall findings from each of the three studies and the conclusions that can be drawn from them in relation to the original research questions. Section 8.1.1 presents an introduction, Section 8.1.2 responds to the rationale and Section 8.1.3 responds to the literature review. This is followed by the findings for Study 1 in Section 8.1.4, Study 2 in Section 8.1.5 and the findings for Study 3 in Section 8.1.6. The chapter then presents the contribution to research (Section 8.2) and future research potential (Section 8.3), finishing off with limitations to the study in Section 8.4 and conclusions in Section 8.5. The findings have important implications for stakeholders, government and policy makers, as well as technology and communication suppliers.

8.1.1 Introduction

The study supports the research rationale (see Section 1.3) by confirming that women adopting technology is modifying gender divisions away from traditional separate roles towards productive partnerships. Information and communication technology extends into almost every aspect of life, transforming how consumers do things: rural consumers are no different, but face a unique set of challenges in maximising the benefits of technology, both in terms of farm operation and personal lives. Technology is reducing geographic isolation and isolation between partners, in turn increasing the well-being of rural women and men. Although technology use by children and workers is restricted by limited data allowances, an increase in well-being is realised when children and workers are able to access technology online, which has important implications for government, policy makers and other health industry stakeholders. Therefore, the thesis confirms that technological properties may be more attractive to both children in terms of succession and to workers in terms of connectivity and may be a solution to issues surrounding an ageing rural workforce and a shortage of rural workers.

8.1.2 Response to rationale

The mixed methods data collection strategy (Dillman et al., 2009; Krueger & Casey, 2015; Saunders et al., 2009) is confirmed as a good fit for research involving farmers, who are challenging in terms of communication and information sharing (Shrapnel & Davie, 2001). Naturalistic enquiry through conversational interviews and media relations developed a subject reality that supported the research and formed trust between the researcher as an instrument and the participants (Yardley & Bishop, 2015), resulting in rich and meaningful data collection from focus groups and the online survey. The realist perspective, used objective and precise inquiry to interpret the research problem and mixed methods (quantitative and qualitative) allowed for triangulation through interviews, questionnaires, observation and data analysis (content analysis, discourse analysis, descriptive and/or inferential methods and statistics, among others), which generated a deep understanding of the subject reality of the participants and to reach conclusions based on evidence and reasoning (Abdalla, Oliveira, Azevedo, & Gonzalez, 2018; Saunders, Lewis, & Thornhill, 2009).

8.1.3 Response to literature review

Connectivity

Key findings from the study both support and extend literature cited in the thesis. Reviewed literature supports the Queensland Beef industry as playing an important role in providing food security and meeting current and future demand for Australian beef products (Meat and Livestock Australia, 2016b; Queensland Government, 2016; Stoutjesdijk & ten Have, 2013). To meet demands for increased production, to reduce costs and to improve the welfare of their animals (Department of Agriculture Fisheries and Forestry, 2014; Lawrence et al., 2011), beef producers need to adopt agricultural technology as stated in Section 1.4.3. Importantly the findings show that, while people in rural, regional and remote Australia (where most cattle production takes place) are disheartened by problems with connectivity, they are keen to adopt new agricultural, communication and social technologies where benefits outweigh disadvantages.

Value

The study confirms that technology used in agriculture reduces money and time spent accessing and exchanging information as cited by Deichmann et al. (2016, p. 4). However, while technology improves production and using it creates value, respondents to the study reported replacing equipment to keep up with technological advances is expensive and counterintuitive to any additional value gained, creating a genuine barrier to adoption, extending the findings of Cavallo et al. (2014), Deichmann et al. (2016, p. 4) and Lamb et al., (2008). Traditional barriers still exist but are confounded by a disconnect between user (the user's ability for using the technology), the advertised product (how marketing says it performs) and the actual product (how it actually performs) (BIRRR, 2016a, 2017a; Lamb et al., 2008; Solomon et al., 2013)

Women

An important finding for the study confirms women as important decision makers and users of technology, particularly personal computers, tablets, smart phones, accounting programs, social media, cattle management programs, the internet, NLIS, remote camera's and weather stations, water sensing technology, and satellite technology (mapping). Women are contributing to maintaining the farm financially by working off-farm and taking a larger role in technology management importantly refuting literature that focusses on rural women's role as being focussed on duties related to the homestead (Alston & Wilkinson, 1998; Bryant & Pini, 2006; Little, 2009; Whatmore, 1991). While the study highlights, men using technology more in 2016, it is important to them that women were keeping up with new technology, which in turn allows both women and men to make decisions on which technologies to adopt.

8.1.4 Findings Study 1 Producer adoption of rural digital technology

"What are the women producer's motives, actions and intentions in terms of technology use and management?"

Key findings of Study One clarify how rural women use technology and women's role in the diffusion of technology into the beef industry. The study confirms that women are using technology more than men are. Specifically technology used by women relates to both management practices and social connection. Both management practices and social connection are leading to less isolation in terms of having better access to business management and communication tools. Women are using technology to research and improve production, manage accounting practices, and to improve communication to create opportunity for and within their family business.

Technology use and management

While the study highlights that men are using technology more than in 2013, they are using the technology-based tools, often installed by women, more practically for example by checking market pricing, weather, remote sensing technology and remote cameras saving time by streamlining farming systems and increasing productivity rather than seeking decision making information.

Women and men are making decisions about technology together, whereas in the past this was reported as being the men's role. Although some women are frustrated by having extra duties involving technology, they are motivated to continue to manage technology. Significantly, the findings confirmed that women are gaining valuable skills over time and that they feel a sense of achievement, empowerment, and self-worth by managing technology. Importantly, key findings show that having technology on the property has improved management practices, decision making, record-keeping and planning and it has given access to information that rural residents would otherwise not be able to gather whilst situated at their property.

Tyranny of distance

Technology can be intrusive, however, it can also save time, money and allow for broader communication with peers, industry, and customers, increasing competitiveness in their industry. The study supports earlier research that reduced isolation and the depletion of the tyranny of distance (Blainey, 1983) is encouraging women to adopt technology in rural, regional and remote areas of Australia. Therefore, a strong focus on increasing internet connectivity by government and other stakeholders is required.

Technology adoption

The Technology Acceptance Model (TAM) (Davis, 1989) is supported by this study as a practical application that suits the personality styles of producers, namely that it uses both perceived ease of use and perceived usefulness to determine a person's attitude towards adoption. Adoption is determined by each producer's individual environment, which will be affected by other factors for example technological, socio-economic, agro-economic, institutional, informational and behavioural factors and by producer's perceptions (Tey & Brindal, 2012). Producer decisions about adoption will be driven by the problem at hand (Öhlmér et al., 1998), by cognitive and normative influences (Bearden & Etzel, 1982; Miller et al., 2011) as well as by family and individual motivation, suitability and opportunities available (Farmar-Bowers, 2010) and by a producers level of adaptive capacity (Berry et al., 2011a). However, while a person's adaptive capacity can give them the ability to change and take advantages of opportunities or cope with stress, ongoing challenges with internet connection for rural, regional, and remote Australia, still presents as the biggest barrier to technology adoption.

The findings, brought together, create a model of technology adoption for beef producers that fits with several existing theories and models, see Figure 8.1. Overarching is the Technology Adoption Model (Davis, 1989) where each of its elements are extended by concepts and models proposed by others for example see Berry et al., 2011a; Farmar-Bowers, 2010; Öhlmér et al., 1998; Tey & Brindal, 2012. The model illustrates that perceived usefulness and perceived ease of use are directly influenced by the producers' environment and that their attitude towards use is influenced by the decision making process. These factors bring together a producers' decision to adopt, but are ultimately driven by challenges with internet connection. Each of the factors leads to producers' behavioural intention to use technology and only when they are satisfied will the producer adopt the technology.

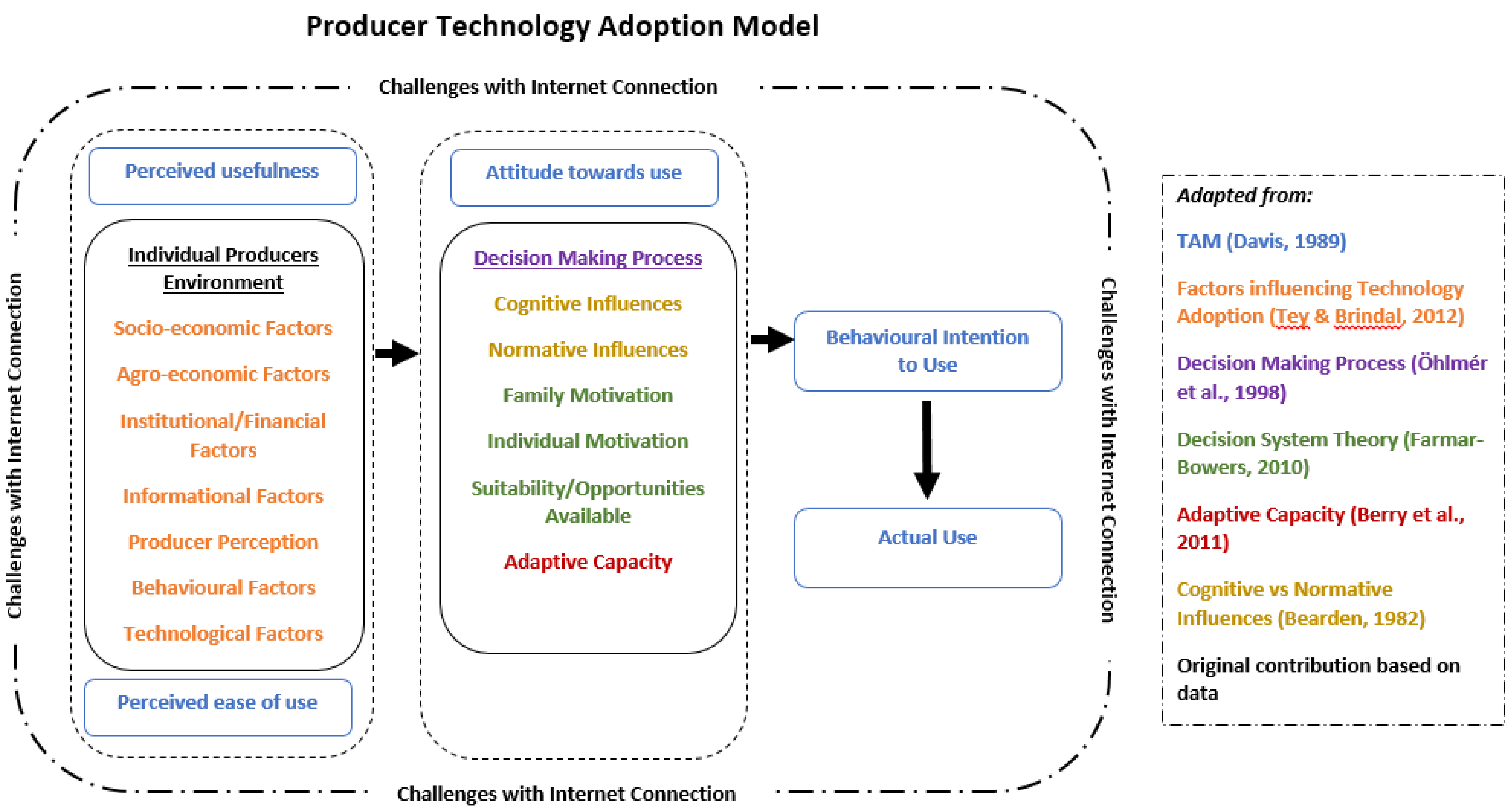


Figure 8.1: Producer Technology Adoption Model (Hay, 2018)

8.1.5 Findings Study 2 Technology, farming families, and workers: It's all about succession and retention

"How does having technology available make the family property more attractive to workers and returning children?"

Key findings for Study Two indicate that there is evidence that technological properties are more attractive to staff and children and that adopting technology may assist with the ageing workforce and a shortage of rural workers.

Succession

Parents are neither encouraging or discouraging their children to return to the family farm, contradicting current literature (Hicks et al., 2012) with many participants stating that it is the child's decision whether to return to the farm or not. The findings of the study show that a larger proportion of farms were family owned by second, third, fourth or fifth generation farmers increasing the prospect of succession (Cassidy & McGrath, 2014). One third of respondents had taken over the farm or were working for their parents, while their parents still lived on farm, confirming literature that cites a downturn in the economy, heavy tax burdens, farm size and place attachment as reasons for non-succession (Downey et al., 2017; Falkiner & Steen, 2016; O'Callaghan & Warburton, 2015; Pitts et al., 2009; Schilling & Schulze-Cleven, 2009). A small percentage of women are identifying as "invisible farmers", wives, spouses or daughters (Brandth, 2002). However, the findings contradict patriarchal tendencies that are typical in succession, which strictly limit succession to male members of the family, to include female members of the family in succession planning (Luhrs, 2016; Price & Evans, 2009; Whatmore, 1991). Farming families having access to technology may provide the producer with a competitive edge, not only in terms of production, but also in terms of longevity.

Workers

Giving staff access to the internet was found to be important to self-development, communication and retention of workers. However, the findings show that there are three major arguments surrounding internet connection for staff. Firstly, that having connection to the internet is acknowledged as a basic human right (Australian Human Rights Commission, 2013; United Nations, 2016). Secondly, while producers agreed that workers should have access to the internet, they were confused about whose responsibility it was to provide and pay for internet access and maintenance and third, while technology would make farming more efficient, workers may need a different skill set to engage with the industry. Confirming, properties that provided internet to workers were perceived as more attractive to work for, than those that did not provide it. The findings concluded that with internet, workers would be more connected, less socially isolated, have more fun and therefore be happier.

The recognition of the importance of the internet to rural, remote, and regional people, and that farmers recognise the benefits of technology, particularly internet connection, reveal new insights into connectivity for staff retention. However, connectivity is still challenging in rural communities (Freeman & Park, 2015). Key findings from this study should be used as grounding for further investigation into children's perception of technology adoption and its effect on their decision regarding whether or not to return to farming. In addition, the study of workers perceptions surrounding technology-connected properties should be investigated as a separate study. Implications for the research reach beyond the farming community to benefit the wider community by providing food security, jobs, tourism opportunities and a future for farming children and industry workers.

8.1.6 Findings Study 3 Well-being of producers and producer families

"In the producer partnership, how does a female producer using technology affect the well-being of the male producer?"

The relationship between technology and well-being is not clear and a key question remains about the extent to which technology can reduce isolation and increase well-being. The findings from Study Three are exploratory in nature and should be used as the basis of further investigation.

How technology is used

Participants confirm that they are using the internet for communication, accounting, business administration, to search for information and for education and personal use. They are using the internet for practical farm related activities such as, cloud computing, online business or off-farm work, water monitoring, online shopping for community groups and for staff satisfaction, to track the weather and for personal and social interaction. In addition, they are also using it to research a range of health and well-being topics.

The importance of connectivity

Key findings show that internet connection and access to technology was identified as extremely important. Well-being at the time of the survey was fragile in rural, regional and remote Australia with less than half of male and female respondents rating their emotional health as average or excellent. Internet access has increased rural residents quality of life and by having access to the internet rural residents feel more "equal" to their city counterparts.

Benefits of women using technology

While women were sometimes frustrated with being responsible for technology purchases, use and training, their partners were grateful that the women were responsible for managing the technology. Importantly responses to the study indicate, women working outside with their partner during the day and working on technology based tasks at other times made the men happier and their life more enjoyable. In addition, women managing technology has also benefited children (away from and on the property) and workers. Men cited that having access to the internet means they can communicate and enjoy activities with family and friends and that connectivity helps with mental health. The women cited that their internet connection removed the tyranny of distance, that it made them feel less isolated and that having access to the internet closed the social gap between rural, regional and remote people and city people.

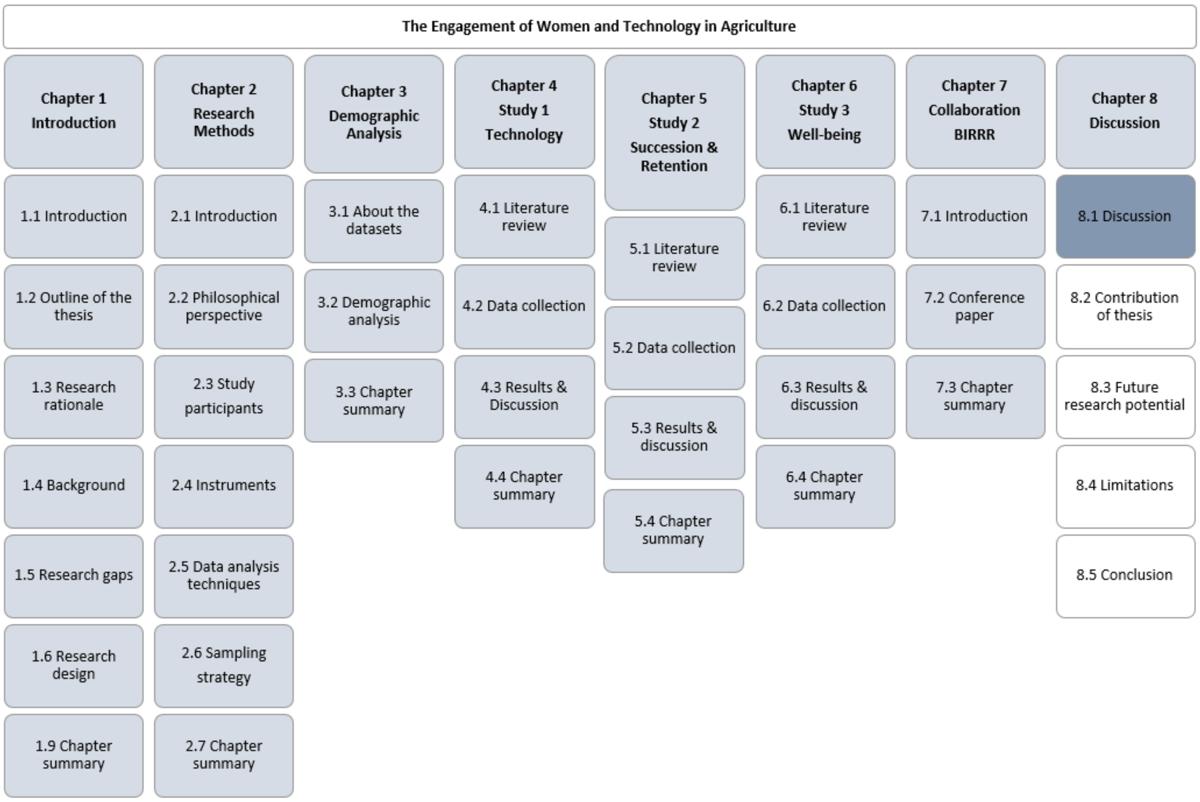
Off-farm work

Women who worked off farm indicated less satisfaction than those who did not work off farm. The findings confirm research by Schirmer et al. (2016), Chang and Mishra (2008); McCoy and Filson (1996) and Van den Broeck and Maertens (2017) who cite that women who work off-farm may be less satisfied than those who only work on farm or do not work at all.

While the responses to this study are by no means conclusive, they open a discussion about how women supporting their partners by working alongside them on the property can positively affect the well-being of not only their partner but of others in the family and working relationships. Further investigation is required.

8.2 Contribution of the thesis

Thesis Structure Overview: Chapter 8 – Contribution of the thesis



This thesis contributes to existing knowledge about diffusion of rural digital technology into beef producing families. It informs stakeholders, government, policy makers and other stakeholders include the media, and communications and technology service providers about factors that influence technology adoption and women's key role in adoption decisions and thus how to enable rural women to support their farming business and their lifestyle as well as increase productivity in the beef industry. It highlights women's role in decision making in beef production practices, identifying how digital technology affects the beef production business, personal career path and family aspirations from a women's perspective. The thesis helps to identify gaps in training, gaps in information sharing and it recognises the importance of the women's role in decision making in beef production practices, increasing self-worth and importance. Recognition of women as producers may help to shift their roles from representatives of the beef industry to participants in decision making about the beef industry, allowing rural women to build networks and contribute to the beef producing community. However, the implications for the research reach beyond the beef producing community to benefit the wider community by providing food security, jobs, tourism opportunities, and a future for beef producer's children.

In addition, identifying reasons surrounding producer men's own perceptions of an inability to use rural technology (as found in Hay & Pearce (2014)) may assist in diffusion of rural technology across Northern Australian beef producing properties. Enabling technology adoption by men may encourage better management practices and increase the longevity of the business. Adopting technology and increasing business longevity may increase the attractiveness of succession, and ultimately secure the future of the Northern Beef Industry (Vanclay, 2004).

Theoretically, the thesis makes a contribution to literature surrounding information systems and it develops a technology adoption model that individually targets beef producing women and men as adopters by specifically looking at producer typology. The final contribution of this thesis addresses succession and investigates how technology may become an enabler for both children to return to the family business and to attract and retain staff.

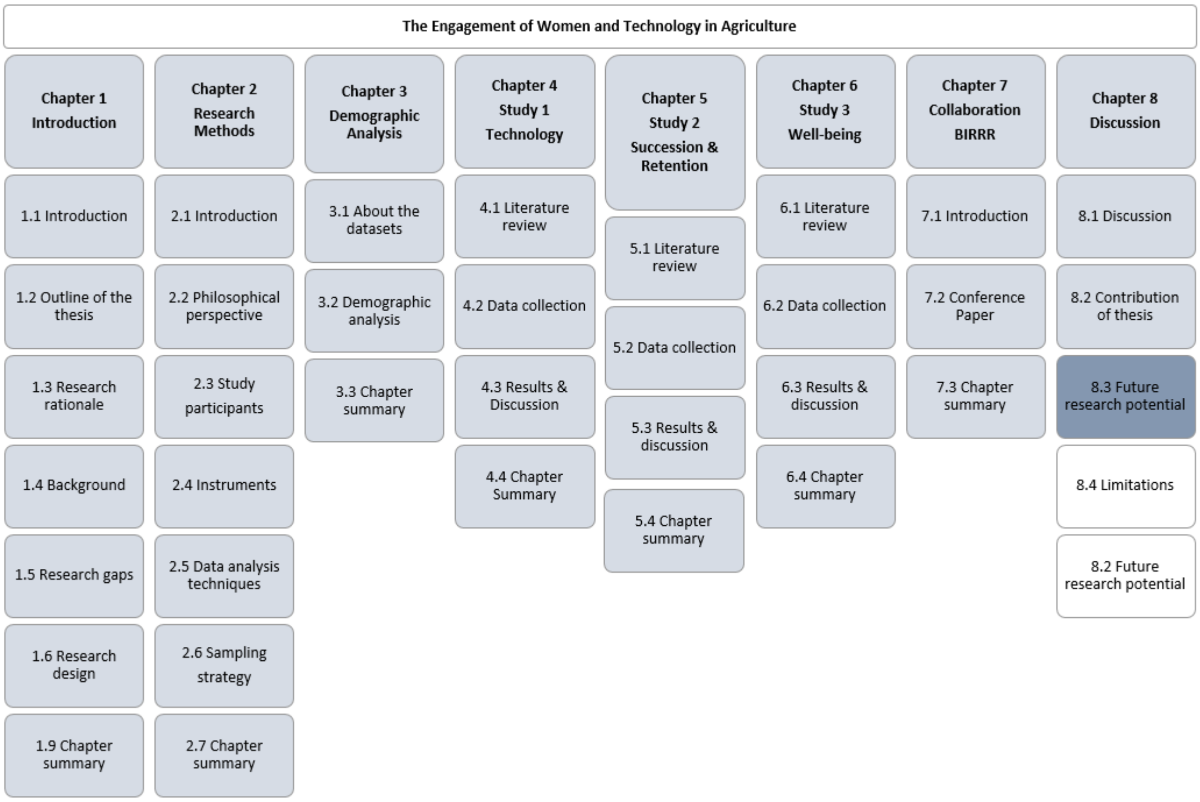
Methodologically, the thesis has confirmed the value of using the mixed method approach, highlighting the compatibility between quantitative and qualitative methodologies using the strength of grounded theory to engage those living the phenomenon under study (Kevin, 2015; Norman, 2012). The inductive research method allowed for iteration between theory and data. Initially from prior research as addressed in Chapters 4, 5 and 6 then from responses to conversational interviews, which fed into the development of the online survey, then iteratively into the development of questions used in focus groups, leading to a model of Producer Technology Adoption. Having established the value of the approach used there is now a basis for replication and extension in the wider research area.

Table 8.1 contains a summary of the major contributions of this study together with an indication of whether the findings advance or contribute to the thesis topic.

Table 8.1: Overview of thesis and its contribution

Thesis and its contribution					
Practical Problem	**Research Gap**	**Research Question**	**Key Findings Contribution/Advance**	**Theoretical Contribution/Advance**	**Practical Contribution/Advance**
Study 1: Rural digital technology adoption lagging in the beef industry	Women's role in the diffusion of technology into the beef industry has not yet been clarified, so it is not obvious how technology has been used by rural women	What are the women producer's motives, actions, and intentions in terms of technology use and management?	- Role of women not addressed - focus is predominantly on males Contribution To knowledge specifically of women's role in technology adoption	- No single model/ theory offers complete explanation of factors influencing technology uptake Advance - Findings enable synthesis of several models (see Figure 8.1)	Contribution -Inform Policy about enabling rural women to increase productivity - Identify gaps in training, information sharing - Highlight women's role in decision making in farming practices
Study 2: On farm technology may increase the attractiveness of the beef producing property to children and staff	There is no evidence that technological properties are more attractive to staff and children or how this effects staff retention and succession	How does having technology available make the family property more attractive to workers and returning children?	- Lack of evidence in the literature regarding attractiveness for any rural groups Contribution Succession: properties providing internet/technology are perceived as more attractve to children Retention: Technology plays a part in involving youth in farming and encourages kids to stay on the land	Contribution - findings advance literature on succesion and workers - advance literature on information systems	Contribution - Understand the motivators for children and staff to return to farm
Study 3: Technology use may reduce isolation and increase well being	The relationship between technology and well-being is not clear and a key question remains about the extent to which technology can reduce isolation and increase well-being	How does a women producer using technology affect the well-being of the male producer?	Contribution - Women supporting their partners, workers and children can positvily affect well-being of not only their partner, but of others in the family and working relationships	Contribution - findings contribute to a paucity of literature that links well-being with technology adoption	Contribution - Identify barriers and enablers of technology adoption by rural men

8.3 Future research potential



In terms of future research, as a priority the online survey instrument needs to be repeated in a face-to-face format with male graziers' to obtain data on their views on adopting emerging livestock management tools. This can be achieved by conducting focus groups at selected agricultural field days or by piggy backing others' research programs, thereby reducing overall costs of data collection.

Secondly, it would be valuable to expand the research to other States in Australia and to other countries to establish the extent to which rural women are using technology and to establish their views on their role in managing emerging livestock management tools and, if those views match the views of respondents in Queensland. Survey questions could more directly focus on obtaining the views of women in how they manage technology, views on training for technology's use, to ascertain what women need into the future to continue with adoption.

Thirdly, male participants' views on technology use are changing as are the technologies themselves. Future researchers should focus on men's changing perceptions about how they use technology and the perceived barriers versus enablers of technology adoption across a range of technologies. Considering the findings of current and future research may help those who advocate rural technology to assist in the diffusion of emerging livestock management tools.

A fourth study could investigate how the adoption of emerging technology might encourage succession of younger generation farmers. Young people having access to technology may make working in agriculture and living in rural, regional and remote locations more attractive. Without technology, as history demonstrates, agricultural work is less profitable. Making agriculture more attractive to young people by intensifying the level of access to technology may be crucial to the development of Australia's beef industry and crucial to succession.

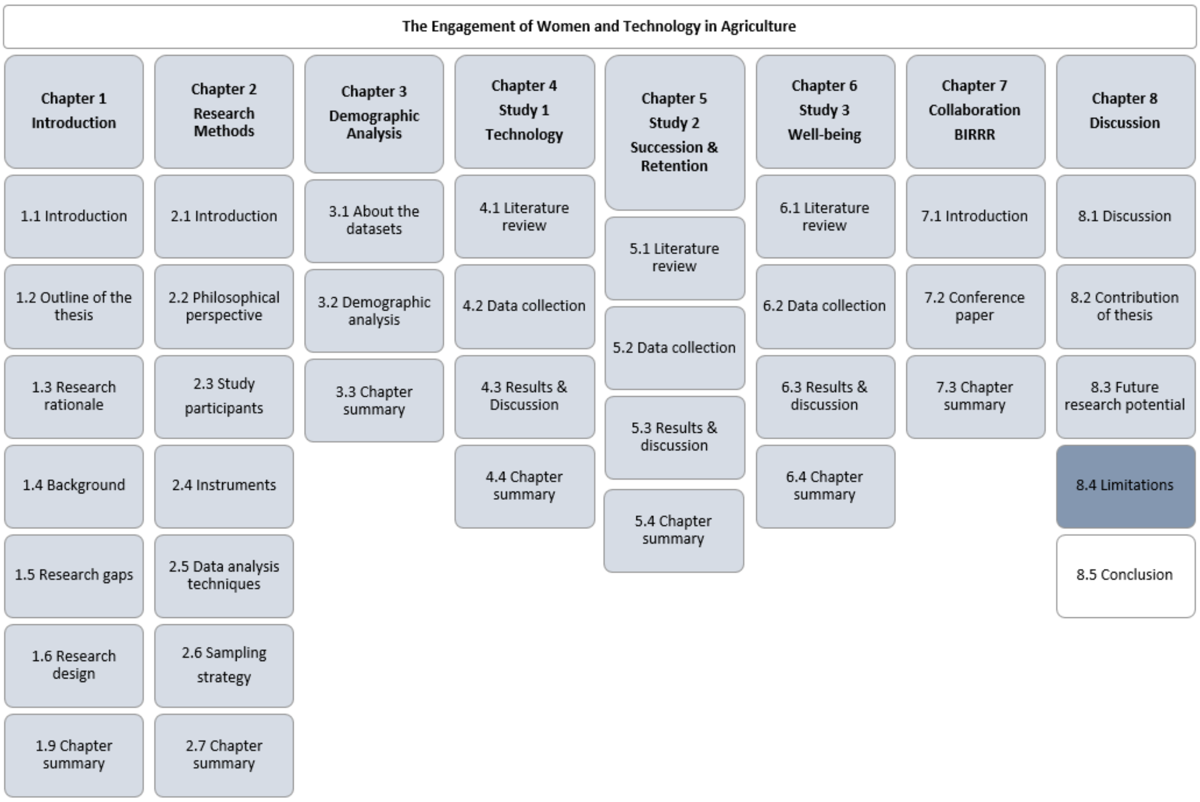
A limitation to the studies reported here (see next section) is the focus on the beef industry. It would be useful to compare and contrast the views of farmers across a range of different agricultural sectors.

Finally, further research is required into the determinants of productivity and profitability through technology use, and its ability to elevate women to undertake senior management roles in cattle producing businesses, and what effect that will have on the overall lives of men and women in rural Australia.

There is a considerable amount of research focussing on technology adoption by men. Very little focuses on technology adoption by rural women. In terms of future research, any additional studies that complement the current study would be valuable. As such, any research stimulated by the current study would be commended for exploring the views of rural women of their roles in managing emerging livestock management tools.

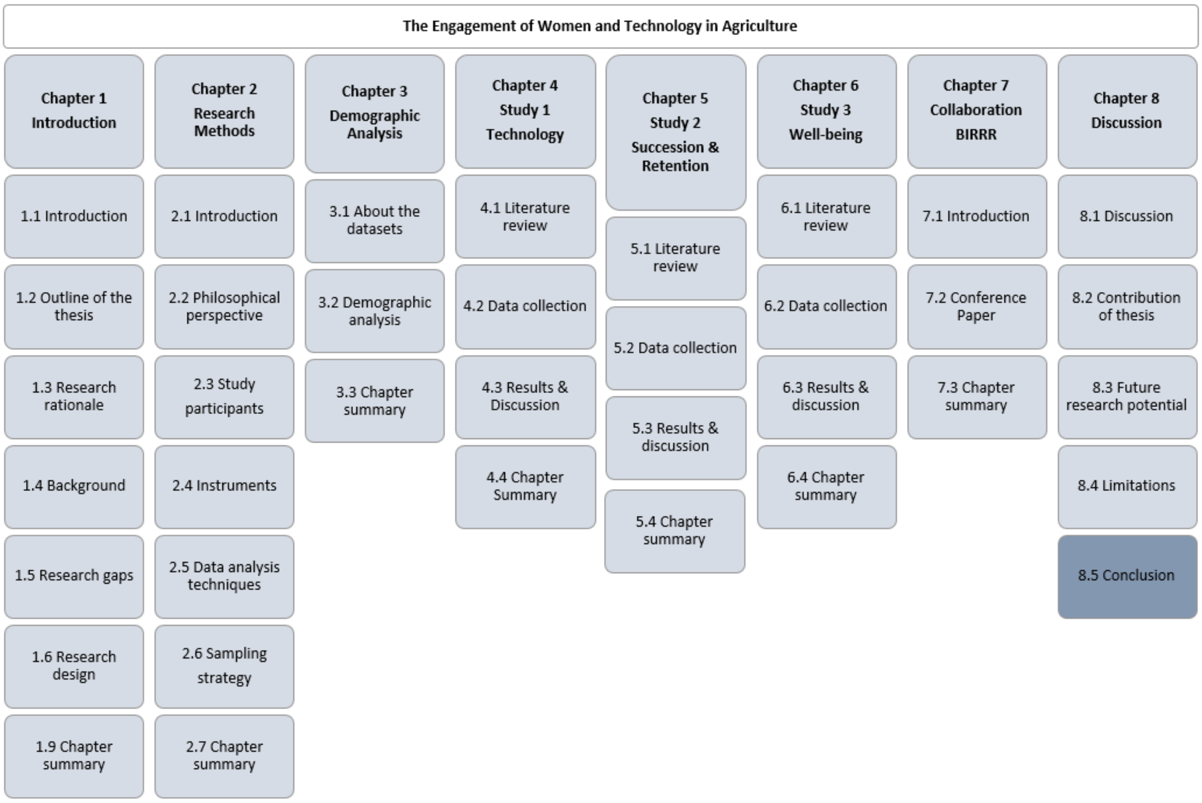
8.4 Limitations

Thesis Structure Overview: Chapter 8 – Limitations to the study



Limitations include that the study was only open to Queensland beef producers, reducing the generalisability of the findings to other agricultural sectors. In addition, while the survey was open to both male and female participants, far fewer men than women replied to the online survey that was used in all three studies as identified in Figure 1.8, which produces a limitation of not knowing the views of the men who did not respond. This may be managed in future studies by including telephone or face-to-face interviews in the data collection, as discussed in the previous section. In addition, some respondents noted that the questionnaire was aimed at heterosexual partnerships or families and did not allow for single women or women in homosexual relationships to respond to the study. Future studies should consider including suitable questions for this purpose.

8.5 Conclusion



This thesis explored the benefits to, and importance of, rural women's use of and role in managing technology and the valuable skills and attributes that rural women bring to decision-making in agricultural management and leadership. Its findings have important implications for stakeholders, government, and policy makers in terms of diffusion of technology into rural, regional, and remote areas of Australia. The thesis highlights that advocacy groups need to be supported by independent research and administrational funding to continue their important role in advocacy for better internet connection in rural, regional, and remote Australia. It also highlights that the development of new technologies needs to be funded by the makers of the technology (supported by investment) to ensure that development costs are not passed on to end users of the technologies to such an extent that it makes acquiring the technology unattractive or financially unattainable. Doing so will remove an important and genuine barrier to rural, regional and remote people adopting technology. Developers of technology need to be transparent about the use and performance of their product. Marketing material should be written in plain language with easy to access 'help desk' assistance. Marketers of technology should recognize women as decision makers in the adoption of rural technology products rather than exclusively focusing on men. While men in this study identified as using technology more than in the previous study (Hay, 2013), they also championed women as decision makers and users of technology in farming families. Agricultural technology marketers and change agents should also target women as technology managers, users and decision makers.

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Appendix

Appendix 1: Ethics Approval Notice

This administrative form
has been removed

Appendix 2: Information Sheet

JAMES COOK UNIVERSITY
AUSTRALIA

PhD Candidate, JCU,
Rachel Hay

INFORMATION SHEET– Agricultural Field Day

PROJECT TITLE:**The engagement of women and technology in agriculture**

You are invited to take part in a research project about technology adoption by rural women. The study is being conducted by **Rachel Hay** and will contribute to her **PhD** at James Cook University.

If you agree to be involved in the study, you will be invited to participate in a conversational interview. The conversational interview, with your consent, should only take approximately 5 - 10 minutes of your time. The conversational interview will be conducted during thisagricultural field day. Theconversational interview in which you participate, **asks you about your experiences with technology and the role you play in the decision to adopt and manage technology.**

Taking part in this study is completely voluntary and you can stop taking part in the study at any time without explanation or prejudice.

If you know of others that might be interested in this study, can you please pass on this information sheet to them so they may contact me to volunteer for the study.

Your responses and contact details will be strictly confidential. The data from the study will be used in research publications and reports. You will not be identified in any way in these publications.

If you have any questions about the study, please contact –**Rachel Hay or Professor Lynne Eagle**

Principal Investigator:
Rachel Hay
College of Business, Law & Governance
James Cook University
Phone:
Email: rachel.hay@jcu.edu.au

Supervisor:
Lynne Eagle, Professor of Marketing; Associate Dean, Research
College of Business, Law & Governance
James Cook University
Phone:
Email: lynne.eagle@jcu.edu.au

If you have any concerns regarding the ethical conduct of the study, please contact:
Human Ethics, Research Office
James Cook University, Townsville, Qld, 4811
Phone: (07) 4781 5011 (ethics@jcu.edu.au)

Appendix 3: Informed Consent

This administrative form has been removed

Appendix 4: Field Day Research Questions

- Will technology use improve the business for the family unit?
- Is the technology useful at a personal level where the user engages with technology solely for personal contact or a practical level, where technology is used in business or both?
- What value or benefits does technology afford the women producer?
- What value or benefits does technology afford the male producer?
- Will the use of technology, falling to the women producer, cause resentment of having to take on another job? Is this balanced by the technology use improving the family or the family business unit?
- Will the opportunity to introduce the new technology to the farm outweigh the burden of extra work?
- Are the skills that the women producer already has useful in using new technologies?
- Why do male producers feel they cannot use technology – what are the barriers?

Appendix 5: Tick and Flick Sheet from Conversational interviews

Age

□ 18-35

□ 36+

Sex

□ Male

□ Female

Produce

□ Cattle

□ Sheep

□ Other

Property Size

□ 1000 – 5000

□50001 – 10000

□10001 – 20000

□ 20000+

Position

□ Work

□ Own

□ Other

Technology

□ Home PC

□ Tablet

□ Laptop

□ Mobile Phone

□ Satellite Phone

□ NLIS

□ Remote Cameras

□Remote Weather

□ Satellite Imagery

□GPS Collars

□Walk over scales

□ Bore sensors

□ Drones

□ other

Role in Tech

□ Checking personal

□ email

□ Checking business email

□ Searching the internet

□ Online news

□ Social media

□ GST/Accounting

□ Managing stock numbers

□ Managing feed supplies

□ NILS Management

□ Remote livestock management (go to next question)

Succession

□Children

□Workers

Value

□ Time Saving

#

□ spend more time with family

□Gets the work done quicker

□ Gain new skills

□Better standing in community

Contribution

□ Allows time for other jobs

□ Saves money

□ Allows time for the male grazier to spend with family

□ Makes the rural woman more valuable at home

Role

□ Major

□ Supporting

□ Input Development

□Not consulted

□Initial discussion

□ Used my ideas

□Ideas not considered

□ Involved in whole process

Well Being

□ Husband

□ Wife

□ Family

Appendix 6: Online Survey/Questionnaire

The questionnaire is designed using Qualtrics Survey Software and uses skip logic tools to enable both male and female respondent to complete the questionnaire.

Qualtrics Q1 - Questionnaire Introduction

Thank you for agreeing to participate in this important study that James Cook University (JCU) is conducting about Technology Adoption by Women in Agriculture.

By completing this online survey, you are consenting to participate in the "Technology Adoption by Women in Agriculture" study.

Taking part in this study is completely voluntary and you can stop taking part in the study at any time.

We are asking you about your experiences with technology* adoption and the role women play in the decision to adopt and manage technology.

**Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera's, remote weather stations, bore cameras, satellite technology, walk over weighing, IVF technology, feedlot technology, drones and other livestock farming systems.*

Who should complete this survey? Women and Men over the age of 18, who live and/or work on remote properties who primarily produce cattle

If you need to, you can complete this survey later by returning via the link in the original email. However, after one week, your responses are no longer saved and you will be required to start the survey again. This survey should take 10 - 15 minutes to complete.

Survey closes 30th September 2016

.

<table>
<tr><td colspan="4">Research Aim: to establish how rural women view and make decisions with regard to adopting technology in agriculture.</td></tr>
<tr><td colspan="4">- Female Questions -</td></tr>
<tr><td colspan="4">Reflects conversational interview questions from honours study:

What is your role (the woman) in the grazing family in terms of technology?

Was your role in the decision to adopt technology a major or supporting role?

In what way do you find that technology is helpful?

How do you feel about having to manage technology? Has your opinion changed over time?

Would you prefer that someone else was responsible for technology use?</td></tr>
<tr><td colspan="4">Research Gap 1: To establish the rural women’s role in the diffusion of digital technology to beef production

RQ1: What are the women producer’s motives, actions and intentions in terms of technology use and management?

Research Gap 2: To explore the notion that having technology can reduce isolation and in turn increase well-being

RQ2: How does a women producer using technology affect the well-being of the male producer?

Research Gap 3: To establish whether technological properties are more attractive to staff and children and how this effects staff retention and succession

RQ3: How does having technology available make the family property more attractive to workers and returning children?</td></tr>
<tr><td>Objective</td><td>Investigative Question</td><td>To establish</td><td>Measurement</td></tr>
<tr><td>Demographics</td><td>Q2 Are you male or female?

Male (1)

Female (2)</td><td>Allows the online survey to be taken by both sexes. Qualtrics skip logic is used to direct men to a brief</td><td>Select One</td></tr>
</table>

	If Male Is Selected, Then Skip To End of BlockIf Female Is Selected, Then Skip To How old are you?	questionnaire about how he values her contribution	
	Q3 How old are you? 17 or younger (1) 18 - 35 (2) 36+ (3) If 17 or younger Is Selected, Then Skip To Thank you, for participating in th...If 18 - 35 Is Selected, Then Skip To From the list below select the types ...If 36+ Is Selected, Then Skip To From the list below select the types ...	Establishes if the participant is over 18 and sends those under 18 to the end of the survey	Select One
	Q4 Thank you, for participating in this survey. Unfortunately you are not eligible to participate due to your age. However, if you know someone who is over 18, who lives and/or works on a cattle producing property that would like to participate in this survey: Please forward the original email invitation to them, so they can participate in the "Technology Adoption by Women in Agriculture" study. If Thank you, for participa... Is Displayed, Then Skip To End of Survey	Completes the survey for those who are under the age of 18	NIL

Research Gap 1: To establish rural women's role in the diffusion of digital technology to beef production **Is the technology useful at a personal or a practical level or both?**	Q5 From the list below select the types of technology used on your property? (Select all that apply) Home PC (1) Tablet (2) Laptop (3) Smart/Mobile Phone (4) Satellite Phone (5) NLIS (with or without wand accessory) (6) Remote Cameras (7) Remote Weather Stations (8) Satellite Imagery (9) GPS Collars (10) Walk Over Scales (11) Bore or Remote Water Trough Cameras (12) IVF Technology (13) Feedlot Technology (14) Drones (15) Other (Please Specify) (16) ____________________	Identifies technology used at a practical level by women, which requires management from the homestead. Identifies target more closely related to the study	Select all that apply

Research Gap 1: To establish rural women's role in the diffusion of digital technology to beef production

Is the technology useful at a personal or a practical level or both?

Q6 When using technology, who mainly completes the following tasks on your property? (Select 'male' or 'female' as the primary user or 'both' if you do the task equally. Select 'not applicable' if you do not use this technology at all on your property)

	Male (1)	Female (2)	Both Separately (3)	Both Together (5)	Not Applicable (4)
To check personal email (1)					
To check business email (2)					
To search the Internet (3)					
To complete online banking (4)					
To check the online weather (5)					
To check the online news (6)					
For social media (7)					
To complete GST / Accounting (8)					
To Manage feed supplies (9)					
To communicate with friends and neighbours (10)					
To manage the business web page (11)					

Identifies who is using technology more on the property and what they use it for

Select one for each line

To manage IVF technology (12)					
To check remote bore cameras (13)					
To check remote weather cameras (14)					
To check remote cameras (wild animal control, anti-theft) (15)					
To track GPS Collars (16)					
For satellite technology (e.g. paddock / stock management (17)					
For GPS cropping systems (18)					
For cattle management software (iHerd, Stockbook) (19)					
For NLIS Management (20)					
Running my online business (21)					
Other (make a selection and complete the text or select not applicable to proceed) (22)					

Research Gap 1: To establish rural women's role in the diffusion of digital technology to beef production **Is the technology useful at a personal or a practical level or both?**	Answer If From the list below select the types of technology you use on your property? (Select all that apply) Smart/Mobile Phone Is Selected Q7 When you use your Smart Phone, what tasks do you use it for on your property? (Select all that apply) To check personal email (1) To check business email (2) To search the Internet (3) To complete online banking (4) To check the online weather (5) To check the online news (6) For social media (7) For cattle management software (iHerd, Stockbook) (8) To Manage feed supplies (9) To communicate with friends and neighbours (10) To manage the business web page (11) For NLIS Management (12) To check remote bore cameras (13) To check remote weather cameras (14) To check remote cameras (wild animal control, anti-theft) (15) To track GPS Collars (16)	Identifies individual use of smart phone Particularly important for male questions (see below)	Select all that apply

<table>
<tr><td></td><td>For satellite technology (e.g. paddock / stock management (17)

For GPS cropping systems (18)

Other (19) ____________________</td><td></td><td></td></tr>
<tr><td></td><td>Q8 How easy do you find it to use the technology? (Select One)

<table><tr><th></th><th>Always (1)</th><th>Sometimes (2)</th><th>Never (3)</th></tr><tr><td>I find it really easy to use, I enjoy it (1)</td><td></td><td></td><td></td></tr><tr><td>I struggled at the beginning, but now I find it easy to use (2)</td><td></td><td></td><td></td></tr><tr><td>I simply can't get the hang of it (3)</td><td></td><td></td><td></td></tr></table></td><td>Technology ease of use</td><td>Select one</td></tr>
<tr><td></td><td>Answer If How easy do you find it to use the technology? (Select One) I simply can't get the hang of it Is Contains always

Q9 When you can't get the hang of it, how do you complete the work?

I do it manually (1)

Someone else does it (can you tell us who?) (2) _______________</td><td>Identifies how the work is completed when technology is not used</td><td>Select one</td></tr>
<tr><td>Research Gap 1: To establish rural women's role in the diffusion of digital technology</td><td>Q10 Consider any technology* managed by you from within the homestead on your property. Select the statement below, that most applies to you. * Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera's, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology, drones and other livestock farming systems.</td><td>Identifies how the technology came to be used by the female.</td><td>Select One</td></tr>
</table>

	Technology management naturally fell to me as the woman in the homestead (1) I chose to manage the technology (2) We have technology products, but I do not use any of them (3) I had no choice, it needed to be done, and it was up to me (4) I used to be the only person responsible, but now other's use it too (5)	Identifies the extent to which the woman is responsible for management of the technology.	
	Answer If Consider any technology* managed by you from within the homestead on your property. Select the s... I used to be the only person responsible, but now other's use it too Is Selected Q11 Who uses it now that didn't use it before? Husband/Partner (1) Workers (male) (2) Workers (female) (3) Children (female) (4) Children (male) (5)	Identifies changes in technology use	Select all that apply
	Answer If Who uses it now that didn't use it before? q://QID79/ChoiceDisplayed Is Displayed Q12 What technolgoy does that person use (Select all that apply) Home PC (1)	Identifies what the new user is using	Select all that apply

	Tablet (2) Laptop (3) Smart/Mobile Phone (4) Satellite Phone (5) NLIS (with or without wand accessory) (6) Remote Cameras (7) Remote Weather Stations (8) Satellite Imagery (9) GPS Collars (10) Walk Over Scales (11) Bore or Remote Water Trough Cameras (12) IVF Technology (13) Feedlot Technology (14) Drones (15) Other (Please Specify) (16) ____________________		
Research Gap 1: To establish rural women's role in the diffusion of	Q13 Whose decision was it to bring technology* onto the property? (Select agree or disagree) * Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera's, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology, drones and other livestock farming systems.	Identifies whose decision it was to adopt technology.	4 point agree/disagree Likert

<table>
<tr><td></td><td>

	Strongly agree (1)	Somewhat agree (2)	Somewhat disagree (3)	Strongly disagree (4)
The female producer (1)				
The male producer (2)				
We do not use technology on our property (3)				
Both male and female producer decided together (4)				
An external decision maker (e.g. the accountant, please specify) (5)				

</td><td></td><td></td></tr>
<tr><td>Research Gap 1: To establish rural women’s role in the diffusion of digital technology to beef production</td><td>Answer If Who's decision was it to bring technology onto the proper... An external decision maker (e.g. the accountant) - Agree Is Selected

Q14 Do you agree that adopting new technology such as an accounting program has made adopting other farming technology easier?

Yes (1)

No (2)</td><td>Identifies if tech is helpful or not. If yes we can assume that tech adoption was a good thing</td><td>Yes / No</td></tr>
</table>

<table>
<tr>
<td></td>
<td>Q15 * Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera’s, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology, drones and other livestock farming systems.

How has adopting new technology* affected you? (Select 'Agree' or 'Disagree')

<table>
<tr><th></th><th>Strongly Agree (1)</th><th>Somewhat Agree (3)</th><th>Somewhat Disagree (2)</th><th>Strongly Disagree (4)</th></tr>
<tr><td>I like to have control over the accounting and/or cattle management programs (1)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Managing the technology gives me a feeling of achievement (2)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Learning how to use technology is empowering and improves my self-worth (3)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>I would rather someone else did it (4)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>I have gained new skills (5)</td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Gauges the effect of tech adopt on the woman personally</td>
<td>4 point agree/disagree Likert</td>
</tr>
<tr>
<td>Research Gap 1: To establish rural women’s role in the diffusion of digital technology to beef production</td>
<td>Q16 How has having access to technology changed your lifestyle? (Select 'Agree' or 'Disagree')

<table>
<tr><th></th><th>Strongly agree (1)</th><th>Somewhat agree (2)</th><th>Somewhat disagree (3)</th><th>Strongly disagree (4)</th></tr>
<tr><td>It has improved my communication with friends and neighbours (1)</td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Gauges the effect of tech adopt on the woman’s lifestyle</td>
<td>4 point agree/disagree Likert</td>
</tr>
</table>

	Access to the internet saves time because I no longer have to travel to town to pay bills (2) Technology has removed my feeling of isolation (3) It allows me to spend more time with family (4) It allows the male in the partnership to spend more time with the family (5) I find technology a big waste of time, I would rather not have it (6) It has increased my workload because I work outside on the property during the day and inside at other times (7) Managing the technology keeps me involved with production practices (e.g. NLIS management, Stockbook, IVF programs) on the property (8) Technology takes me away from outside duties that I would rather be doing (9) It has allowed me to start up an online business (10)						

	Q17 Does being able to work outside during the day, and inside at other times suit you? (Select one)	1 Most of the time 2 Always 3 Never	
Research Gap 2: To explore the notion that having technology can reduce isolation and in turn increase well-being	Q18 In a previous survey, some respondents said: “by being able to work on the computer inside at night (other times), means I can work outside with my partner during the day, this makes him happier, and then our life is more enjoyable” How much do you, agree or disagree with this statement (Select 'Agree' or 'Disagree') ❍ Strongly agree (1) ❍ Somewhat agree (2) ❍ Somewhat disagree (3) ❍ Strongly disagree (4)	Technology’s effect on well being Establishes the propensity for computer work at night to contribute positively to well being	4 point agree/disagree Likert
Research Gap 2: To explore the notion that having technology can reduce isolation and in turn increase well-being **Will technology improve the business for**	Answer If In a previous survey, some respondents sai: “by being able to work on the computer inside at night (other times), means I can work outside with my partner during the day, this makes him h... Strongly agree Is Selected And In a previous survey, some respondents sai: “by being able to work on the computer inside at night (other times), means I can work outside with my partner during the day, this makes him h... Somewhat agree Is Selected Q19 You agreed with the statement “by being able to work on the computer inside at night (other times), means I can work outside with my partner during the day, this makes him happier, and then our life is more enjoyable” How important is your partner's happiness to you? ❍ Extremely important (17) ❍ Very important (18) ❍ Slightly important (20) ❍ Not at all important (21)	Technology’s effect on well being The importance or working together and well being	4 point agree/disagree Likert

<table>
<tr>
<td></td>
<td>Q20 Do you think women being able to work outside during the day and inside on the computer at other times contributes to the well-being of the others, for example: (Select 'Agree' or 'Disagree')
<table>
<tr><th></th><th>Strongly agree (1)</th><th>Somewhat agree (3)</th><th>Somewhat disagree (4)</th><th>Strongly disagree (5)</th></tr>
<tr><td>Husband/Wife/Partner (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Children on the property (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Extended Family (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Workers (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Neighbours (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Children at boarding school (6)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>No, I don't think it contributes to the well-being of others (7)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td>Technology’s effect on well being</td>
<td>4 point agree/disagree Likert</td>
</tr>
<tr>
<td></td>
<td>Q21 Is your partner...?

❍ Male (1)
❍ Female (2)</td>
<td>Establishes technology’s effect on the well being of the male in the relationship</td>
<td>Select one</td>
</tr>
<tr>
<td></td>
<td>Q22 Do you have any comments to make about the relationship between positive well-being and technology use. (If you have any comments, write them in the box below, if not click next to continue) * Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera’s, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology, drones and other livestock farming systems.TEXT BOX</td>
<td>Establishes technology’s effect on the well being</td>
<td>Text</td>
</tr>
</table>

<table>
<tr>
<td rowspan="2">Research Gap 3: To establish whether technological properties are more attractive to staff and children and how this effects staff retention and succession

Will technology improve the business for the family unit?</td>
<td>Q23 In what way do you think that technology is useful on your property? (Select 'Agree' or 'Disagree')

<table>
<tr><th></th><th>Strongly Agree (1)</th><th>Somewhat Agree (2)</th><th>Somewhat Disagree (3)</th><th>Strongly Disagree (4)</th></tr>
<tr><td>It has helped to increase productivity (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>It has streamlined farming systems (e.g. walk over weighing, NLIS tracking) (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Saves time, allowing male and female property managers/owners to do other jobs (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Allows me to work outside during the day, and inside during the other times (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Technology takes the woman away from outside duties, which means we need to employ someone else (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Because of technology, we are able to run the farm more efficiently using only family members or less workers (6)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Having access to the internet means that workers (including adult children) are happier on the property and will most likely stay longer (7)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table></td>
<td>Identifies how technology is useful.

Perceived ease of use leads to adoption</td>
<td>4 point agree/disagree Likert</td>
</tr>
<tr>
<td>Q24 How has technology* changed farming on your land? If you have any comments, write them in the box below, if not click next to continue. * Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera's, remote weather</td>
<td>Identifies how technology has changed farming practices.</td>
<td>Text</td>
</tr>
</table>

	stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology, drones and other livestock farming systems. TEXT BOX	Perceived ease of use leads to adoption	

Research Gap 1: To establish rural women's role in the diffusion of digital technology to beef production

What value does the technology afford the woman grazier?

Q25 In terms of value from technology do you 'agree or disagree' with the following statements (Select 'Agree' or 'Disagree')

	Strongly Agree (1)	Somewhat Agree (2)	Somewhat Disagree (3)	Strongly Disagree (4)
I enjoy learning new skills, so find technology personally valuable (1)	❍	❍	❍	❍
Being tech savvy gives me a better standing in the community (2)	❍	❍	❍	❍
I think knowing how to use and manage technology on the property makes women more valuable in the rural partnership (3)	❍	❍	❍	❍
Using technology allows time for other jobs (4)	❍	❍	❍	❍

Identifies value of technology use towards the female

4 point agree/disagree Likert

Research Gap 1: To establish rural women's role in the diffusion of digital technology to beef production

Is the technology useful at a personal or a practical level or both?

Q26 When purchasing new technology products for the property, where do you look for information? How important is that source? (Select the level of importance)

	Very important (1)	Somewhat important (2)	Somewhat unimportant (3)	Not important at all (4)
Online Information (1)	❍	❍	❍	❍
Rural Newspapers (Queensland Country Life, The Land etc) (2)	❍	❍	❍	❍
Major Newspaper (The Australian, Courier Mail etc) (3)	❍	❍	❍	❍

Identifies where producers find information and the value placed on the source

4 point agree/disagree Likert

<table>
<tr>
<td></td>
<td>
<table>
<tr><td>Trade and Farming Publications (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Field Days (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Extension Officers (6)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Friends and Family (7)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Word of Mouth (8)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Other (make an importance selection and then complete the text or select not important at all to proceed) (9)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research Gap 1: To establish rural women's role in the diffusion of digital technology to beef production
What value does the technology afford the woman grazier</td>
<td>Q27 Who mainly makes the decision to purchase when buying new technology products for the property. (Select 'Agree' or Disagree')
<table>
<tr><th></th><th>Strongly Agree (1)</th><th>Somewhat Agree (2)</th><th>Somewhat Disagree (3)</th><th>Strongly Disagree (4)</th></tr>
<tr><td>The female, if the technology is to be used for inside the homestead (e.g. a new computer, accounting, cattle management or education program etc) (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>The male, if the technology is to be used outside of the homestead (e.g. walk over scales, remote weather stations etc) (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>We both do, depending on the size of the purchase (i.e. if the purchase is a high cost</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td>Identifies the decision maker in farming families

(synergistic decision making – clarifying, listening, reinforcing – reciprocity?)</td>
<td>4 point agree/disagree Likert</td>
</tr>
</table>

		purchase, we will discuss it together and then decide) (3) Other (make an agreeance selection and then complete the text or select strongly disagree to proceed) (4)	❍	❍	❍	❍		
Research Gap 2: To explore the notion that having technology can reduce isolation and in turn increase well-being	**Will technology improve the business for the**	Q28 How long have you had access to the internet? ❍ Less than one year (1) ❍ One to two years (2) ❍ Two to five years (3) ❍ More than 5 years (4) ❍ I don't have internet at home I am doing this on my mobile (5)					Identifies respondent's access to the internet and potentially other rural digital technology	Select one
		Q29 How important is it to you to have access to the internet. ❍ Extremely important (1) ❍ Slightly important (2) ❍ Slightly unimportant (3) ❍ Extremely unimportant (4)					Identifies personal connection to internet access	4 point agree/disagree Likert
		Q30 What are the top three reasons that having access to the internet is important to you? Internet access is important - Reason 1 (1) Internet access is important - Reason 2 (2) Internet access is important - Reason 3 (3)					Identifies most important uses of internet access	Text

<table>
<tr>
<td rowspan="4">Research Gap 2: To explore the notion that having technology can reduce isolation and in turn increase well-being</td>
<td rowspan="4">Will technology improve the business for the family unit?</td>
<td>Q31 What do you mainly use the internet for? (please select how important the use is)
<table>
<tr><th></th><th>Most used (1)</th><th>Sometimes used (2)</th><th>Least used (3)</th><th>Not used (4)</th></tr>
<tr><td>Education (of both students and self-learning. e.g. learning about agricultural or other practices) (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Business (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Social (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Research & Development (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>For staff (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Other (make a selection and complete the text or select NOT USED to proceed) (6)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td>Identifies the uses of the internet – supports importance of access</td>
<td>4 point agree/disagree Likert</td>
</tr>
<tr>
<td>Q32 Do you agree or disagree that having access to the internet increases your quality of life/well-being?

❍ Strongly agree (1)
❍ Somewhat agree (2)
❍ Somewhat disagree (3)
❍ Strongly disagree (4)</td>
<td>Technology's effect on well being</td>
<td>4 point agree/disagree Likert</td>
</tr>
<tr>
<td>Q33 How much does having access to the internet increase your quality of life/well-being.

❍ Very much (1)
❍ A lot (2)
❍ A little (3)
❍ Not very much (4)</td>
<td>Internet access' effect on well being</td>
<td>Select one</td>
</tr>
<tr>
<td>Q34 Do you feel that having internet access makes you more equal to people in more internet accessible areas (for example in cities)?

❍ Yes (can you tell us why?) (1) ____________________
❍ No (2)</td>
<td>Equality measure – effect on well being</td>
<td>Select one</td>
</tr>
</table>

	Q35 How would you rate your emotional health? (Emotional health is defined by "the degree to which you feel emotionally secure and relaxed in everyday life") ❍ Excellent (1) ❍ Moderate (2) ❍ Above average (3) ❍ Poor (4) ❍ Extremely poor (5)	Response state – links to well being	Select one

<table>
<tr>
<td>Research Gap 3: To establish whether technological properties are more attractive to staff and children and how this effects staff retention and succession

Will technology improve the business for the family unit?</td>
<td>Q36 Please select how much you agree or disagree with the following statements:
<table>
<tr><th></th><th>Strongly agree (1)</th><th>Somewhat agree (2)</th><th>Somewhat disagree (3)</th><th>Strongly disagree (4)</th></tr>
<tr><td>Having the internet at my property will benefit my children and my family (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Having access to the internet at my property will be attractive to staff as well as help to keep them longer (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>I believe that having internet access will benefit my children if they to return to work on the property (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Using technology will help with production into the future (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>I hope my children return to run the farm (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>I hope my children never return to farming (6)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td>Indicator for succession</td>
<td>4 point agree/disagree Likert</td>
</tr>
</table>

Research Gap 1: To establish rural women's role in the diffusion of digital technology to beef production **What value does the technology afford the woman grazier**	Q37 Do you agree or disagree that farming with new technology will help the grazing industry to remain productive? ❍ Strongly Agree (1) ❍ Somewhat agree (2) ❍ Somewhat disagree (3) ❍ Strongly disagree (4)	Technologies effect on production	4 point agree/disagree Likert
Demographic	Q38 How many children do you have... ______ ... under 16 at home (1) ______ ... under 16 at boarding school (2) ______ ... over 16 at home (3) ______ ... over 16 at boarding school (4) ______ ... over 16 not living at home (5)	Links to importance of having internet access at home and hence well being	Place a number in the box associated
Research Gap 3: To establish whether technological properties are more attractive to staff and children and how this effects staff retention and	Q39 Do you agree or disagree that having technology available on working properties may increase/encourage succession, in terms of children returning to work the property? ❍ Strongly Agree (1) ❍ Somewhat agree (2) ❍ Somewhat disagree (3) ❍ Strongly disagree (4)	Establishes technology's effect on succession	4 point agree/disagree Likert
Demograp hic	Q40 Have you always worked in agriculture? ❍ Yes (1) ❍ No (what did you do before) (2) ______________________	Attachment to place	Select one

	Q41 Would you want to work somewhere else? ❍ Yes (what would you like to do?) (1) ____________________ ❍ No (2)	Attachment to place	Select one
	Q42 How many generations of your family has owned this property (including children)? ❍ One Generation (1) ❍ Two Generations (2) ❍ Three Generations (3) ❍ Fourth Generation (4) ❍ Fifth Generation or more (5)	Attachment to place	Select one
	Q43 Do you hope/intend to hand the property on to future generations? ❍ Yes (1) ❍ No (2) ❍ Maybe (Why is that?) (3) ____________________	Attachment to place	Select one
	Q44 What do you mainly produce? (Select all that apply, and the percent of production) ❑ Cattle (%) (1) ____________________ ❑ Sheep (%) (2) ____________________ ❑ Cropping (%) (3) ____________________ ❑ Other, what do you produce? (%) (4) ____________________	Confirms that the participant is within the scope of the study – that they are beef producers	Select all that apply
Demographics	Q45 What size is your property? (If more than one property, please specify approximate total size) ❍ Less than 1000 acres (1) ❍ 1001 - 5000 acres (2) ❍ 5001 - 10,000 acres (3) ❍ 10,000 - 20,000 acres (4) ❍ 20,000 + acres (5)	Identifies what scale of production the property has. Technology is typically adopted by larger properties – identifies changes to adoption practices	Select one

	Q46 Where is your property located? ❍ QLD (4) ❍ NSW (5) ❍ ACT (6) ❍ SA (7) ❍ VIC (8) ❍ WA (9) ❍ TAS (10)	Confirms that the participant is within the scope of the study	Select one
	Q47 Are you the owner and/or the manager of this property? (Select One) ❍ Both owner and manager (1) ❍ Owner only (5) ❍ Manager only (2) ❍ Other (Please Specify) (3) ____________________	Identifies decision maker Larger properties are more likely to have staff that may run the technology; hence, the woman may be doing it as her paid job, which will bias the study. Property size helps to identify family run business	
	Answer If Are you the owner and/or the manager of this property? (Select One) Both owner and manager Is Selected And Are you the owner and/or the manager of this property? (Select One) Owner only Is Selected Q48 How many years and months have you owned this property? ❍ Years (1) ____________________ ❍ Months (2) ____________________	Attachment to place	Select one
	Q49 Did you inherit or take over the property? ❍ I inherited the property (1) ❍ I have taken over from mum and dad (2) ❍ No, I did not inherit the property (3) ❍ Mum and Dad own the property and I work there (5) ❍ I work on the property, someone else owns it (Can you tell us who?) (4) ____________________	Attachment to place	Select one

Demographics	Q50 Do you or your partner (if relevant) have an off farm business or work off farm? ❍ Yes, I/we work less than 20 hours per week off-farm (1) ❍ Yes, I/we work more than 20 hours per off-farm (3) ❍ No (2)	Identifies source of other income	Select one
	Answer If Do you or your partner have an off farm business or work off farm? Yes Is Selected Q51 Who primarily works in the off farm business? ❍ Me (1) ❍ My partner (2) ❍ Other (select and fill in the text box) (3) ____________________	Identifies other income/work pressures	Select one
	Q52 Do you do any volunteer work? ❍ No, I don't volunteer (4) ❍ Yes, I volunteer casual hours when I am needed (1) ❍ Yes, I volunteer a set number of hours per week (how many?) (2) ____________________ ❍ I run a not for profit business (how many hours do you spend doing this per week?) (3) ____________________ If No, I don't volunteer Is Selected, Then Skip To End of SurveyIf Yes, I volunteer casual hou... Is Selected, Then Skip To End of SurveyIf Yes, I volunteer a set numb... Is Selected, Then Skip To End of SurveyIf Yes, I volunteer a set numb... Is Not Empty, Then Skip To End of SurveyIf I run a not for profit busi... Is Selected, Then Skip To End of SurveyIf I run a not for profit busi... Is Not Empty, Then Skip To End of Survey	Identifies other income/work pressures	Select one

-End Female Survey-

Male Survey Begins			
Objective	Investigative Question	To Establish	Measurement
To establish sex of participant and eligibility to participate in the survey	Q53 How old are you? ❍ 17 or younger (1) ❍ 18 - 35 (2) ❍ 36+ (3) If 17 or younger Is Selected, Then Skip To End of BlockIf 18 - 35 Is Selected, Then Skip To Previous research has shown that tech...If 36+ Is Selected, Then Skip To Previous research has shown that tech...	Having selected male in Q2. Q53 confirms age to be eligible for survey. Under 18 are redirected to the end of the survey	Select one
	Q54 Previous research has shown that technology use on rural properties may fall to the women in pastoral partnerships, leaving the men to complete outside farming duties. * Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera's, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology, drones and other livestock farming systems. The following questions aim to determine your thoughts on the value of women in agriculture in terms of technology use.	Directive – male introduction to survey	None

<table>
<tr>
<td>Is technology useful at a personal or practical level or both?</td>
<td>Q55 From the list below select the types of technology used on your property? (Select all that apply)

❑ Home PC (1)
❑ Tablet (2)
❑ Laptop (3)
❑ Smart/Mobile Phone (4)
❑ Satellite Phone (5)
❑ NLIS (with or without the wand) (6)
❑ Remote Cameras (7)
❑ Remote Weather Stations (8)
❑ Satellite Imagery (9)
❑ GPS Collars (10)
❑ Walk Over Scales (11)
❑ Bore or Remote Water Trough Cameras (12)
❑ IVF Technology (13)
❑ Feedlot Technology (14)
❑ Other (15) ____________________</td>
<td>Identifies technology used at a practical level by men</td>
<td>Select all that apply</td>
</tr>
<tr>
<td>Is technology useful at a personal or practical level or both?</td>
<td>Q56 Who mainly uses the technology to do the following tasks on your property? (Select 'male' or 'female' as the main user or 'both' if you use it together or separately. Select not applicable if you do not use this technology at all on your property)

<table>
<tr><th></th><th>Male (1)</th><th>Female (2)</th><th>Both separately (3)</th><th>Both together (5)</th><th>Not Applicapble (4)</th></tr>
<tr><td>To Check Personal Email (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>To Check Business Email (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Searching the Internet (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Online Banking (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Online Weather (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table></td>
<td>Identifies who is using technology more on the property and what they use is for</td>
<td>Select one for each line</td>
</tr>
</table>

	Online News (6)	❍	❍	❍	❍	❍		
	Social Media (7)	❍	❍	❍	❍	❍		
	GST / Accounting (8)	❍	❍	❍	❍	❍		
	Managing Feed Supplies (9)	❍	❍	❍	❍	❍		
	Communicate with Friends and Neighbours (10)	❍	❍	❍	❍	❍		
	Manage the Business Web Page (11)	❍	❍	❍	❍	❍		
	Manage IVF Technology (12)	❍	❍	❍	❍	❍		
	Check Remote Bore Cameras (13)	❍	❍	❍	❍	❍		
	Drones (22)	❍	❍	❍	❍	❍		
	Remote Weather Cameras (14)	❍	❍	❍	❍	❍		
	Remote Cameras (wild animal control, anti-theft) (15)	❍	❍	❍	❍	❍		
	GPS Collars (16)	❍	❍	❍	❍	❍		
	Satellite Technology (17)	❍	❍	❍	❍	❍		
	GPS Cropping Systems (18)	❍	❍	❍	❍	❍		

	Cattle Management Software (iHerd, Stockbook) (19)	❍	❍	❍	❍	❍		
	NLIS Management (20)	❍	❍	❍	❍	❍		
	Other (make a selection and complete the text or select not applicable to proceed) (21)	❍	❍	❍	❍	❍		
Is technology useful at a personal or practical level or both?	Answer If From the list below select they types of technology used on your property? (Select all that apply) Smart/Mobile Phone Is Selected Q57 When you use your Smart Phone, what tasks do you use it for on your property? (Select all that apply) ❑ To check personal email (1) ❑ To check business email (2) ❑ To search the Internet (3) ❑ To complete online banking (4) ❑ To check the online weather (5) ❑ To check the online news (6) ❑ For social media (7) ❑ To Manage feed supplies (9) ❑ To communicate with friends and neighbours (10) ❑ To manage the business web page (11) ❑ To check remote bore cameras (13) ❑ To check remote weather cameras (14) ❑ To check remote cameras (wild animal control, anti-theft) (15) ❑ To track GPS Collars (16) ❑ For satellite technology (e.g. paddock / stock management (17) ❑ For GPS cropping systems (18) ❑ For cattle management software (iHerd, Stockbook) (19) ❑ For NLIS Management (20) ❑ Other (21) ____________________						Establishes men’s use of smart phone	Select all that apply

<table>
<tr>
<td>Will technology use improve the business for the family unit?</td>
<td>Q58 Assuming the female of the partnership completes the GST/accounting or other homestead based work (inside technology e.g. managing Stockbook, iHerd), would you consider completing this work if she was unable to do so? (Select One)

❍ Yes (1)
❍ Probably with some training (3)
❍ No, I would employ someone to do it (4)</td>
<td>Identifies men’s level of technology use</td>
<td>Select one</td>
</tr>
<tr>
<td>Will technology use improve the business for the family unit?</td>
<td>Answer If With regard to GST/accounting or other homestead based wo... No, I would employ someone to do it Is Selected

Q59 You selected 'no, that you would employ someone to do it' is that because...

<table>
<tr><th></th><th>Strongly agree (1)</th><th>Somewhat agree (2)</th><th>Somewhat disagree (4)</th><th>Strongly disagree (5)</th></tr>
<tr><td>I don't know how to use the technology (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>I don't want to learn how to use the technology (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>I can use the technology, I just don't have time to do it (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>I don't think I can learn to use technology based programs (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Other (make a selection and complete the text or select STRONGLY DISAGREE to proceed) (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table></td>
<td>Identifies why men’s are not using technology</td>
<td>4 point agree/disagree Likert</td>
</tr>
<tr>
<td>What value does technology afford the women producer?</td>
<td>Q60 When the female needs to complete accounting or other homestead based work urgently, do you help with inside duties such as looking after the children or housework? Select how often you help.

<table>
<tr><th></th><th>Most of the time (3)</th><th>Sometimes (5)</th><th>Rarely (7)</th><th>Never (9)</th></tr>
</table></td>
<td>Measures the men’s propensity to support the women in technology use</td>
<td>4 point agree/disagree Likert</td>
</tr>
</table>

	I look after the children (1)	❍	❍	❍	❍		
	I help with the meals (2)	❍	❍	❍	❍		
	I help with the housework (3)	❍	❍	❍	❍		
	Someone else come to help (Who?) (5)	❍	❍	❍	❍		
	Other (make a selection and complete the text or select NEVER to proceed) (4)	❍	❍	❍	❍		

<table>
<tr>
<td>What value does technology afford the women producer?</td>
<td>
Q61 *Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera's, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology and other livestock farming systems.
Whose decision was it to bring technology* onto the property? (Select agree or disagree)
<table>
<tr><th></th><th>Strongly agree (1)</th><th>Somewhat agree (2)</th><th>Somewhat disagree (3)</th><th>Strongly disagree (4)</th></tr>
<tr><td>We do not use technology on our property (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>The female producer (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>The male producer (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>An external decision maker (e.g. the accountant) (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Both male and female producers decided together (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td>Identifies who's decision it was to adopt technology</td>
<td>4 point agree/disagree Likert</td>
</tr>
<tr>
<td>Will technology use improve the business for the family unit?</td>
<td>
Q62 Do you think adopting new technology has made farming practices easier/more efficient?
❍ Strongly agree (12)
❍ Somewhat agree (13)
❍ Somewhat disagree (15)
❍ Strongly disagree (16)
</td>
<td>Technologies effect on farming practices</td>
<td>4 point agree/disagree Likert</td>
</tr>
</table>

<table>
<tr><td></td><td></td><td>Identifies opinion about the effects of tech adoption on the man personally</td><td></td></tr>
<tr><td>What value does technology afford the women producer?</td><td>Q63 What is it that you like about the female of the partnership managing technology? (Select 'Agree' or 'Disagree')

<table>
<tr><th></th><th>Strongly agree (1)</th><th>Somewhat agree (2)</th><th>Somewhat disagree (3)</th><th>Strongly disagree (4)</th></tr>
<tr><td>It allows me time to do other work (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>It allows me to spend more time with the family (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Because she manages it, I know it is done right (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>It helps us both to keep a better eye on the business (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Other (make a selection and complete the text or select STRONGLY DISAGREE to proceed) (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table></td><td>Gauges the effect of technology adoption on the man personally</td><td>4 point agree/disagree Likert</td></tr>
<tr><td>What value does technology afford the women producer?</td><td>Q64 *Technology includes personal computers, tablets, smart phones, accounting programs, cattle management programs, the internet, NLIS, remote camera’s, remote weather stations, bore cameras, satellite technology, walk over scales, IVF technology, feedlot technology and other livestock farming systems.

In your view, how has adopting technology affected the female in the partnership? (Select 'Agree' or 'Disagree)

<table>
<tr><th></th><th>Strongly agree (2)</th><th>Somewhat agree (3)</th><th>Somewhat disagree (4)</th><th>Strongly disagree (5)</th></tr>
<tr><td>She has more control over the business (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>It has helped to maintain our budget (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table></td><td>Identifies men’s opinion of how having technology has affected the women</td><td>4 point agree/disagree Likert</td></tr>
</table>

	Learning how to use technology has been empowering for her (3)	❍	❍	❍	❍		
	She would rather someone else did it (4)	❍	❍	❍	❍		
	She has gained new and valuable skills (5)	❍	❍	❍	❍		
	She has more confidence to complete business tasks (7)	❍	❍	❍	❍		
	Other (make a selection and complete the text or select STRONGLY DISAGREE to proceed) (6)	❍	❍	❍	❍		
Will technology use improve the business for the family unit?	Q65 In what way do you think that technology is useful on your property? (Select 'Agree' or 'Disagree)					Identifies how technology is useful for the business	4 point agree/disagree Likert
		Strongly agree (1)	Somewhat agree (2)	Somewhat disagree (3)	Strongly disagree (4)		
	It has helped to increase productivity (1)	❍	❍	❍	❍	Ease of use	
	It has streamlined farming systems (e.g. walk over weighting, NLIS tracking) (2)	❍	❍	❍	❍		
	Saves time, allowing male and female property managers to do other jobs (3)	❍	❍	❍	❍		
	Technology takes the woman away from outside duties, which means we need to employ someone else (4)	❍	❍	❍	❍		
	Because of technology, we are able to run the farm more efficiently using only family members (5)	❍	❍	❍	❍		

<table>
<tr>
<td></td>
<td>
<table>
<tr><td>Having access to the internet means that workers (including adult children) are happier on the property and will most likely stay longer (6)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What value does technology afford the women producer?</td>
<td>Q66 When thinking about how valuable the female in the partnership is, in terms of work she does using technology. How do her duties add value to the business? (Select 'Agree' or 'Disagree')
<table>
<tr><th></th><th>Strongly agree (1)</th><th>Somewhat agree (3)</th><th>Somewhat disagree (2)</th><th>Strongly disagree (4)</th></tr>
<tr><td>The females contribution to GST/Accounting and other duties saves the business time and money (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>I think women learn about technology more quickly than men, therefore their contribution to technology is very valuable (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Women learning and managing technology allows the business to keep moving forward (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>I don't think her using technology on the property adds any value at all (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Other (make a selection and complete the text or select not applicable to proceed) (6)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td>Identifies men’s thoughts on the value of women’s inputs to the property via technology</td>
<td>4 point agree/disagree Likert</td>
</tr>
<tr>
<td>Is the technology useful at a personal or a practical level or both</td>
<td>Q67 When purchasing new technology products for the property, where do you look for information. How important is that source?
<table>
<tr><th></th><th>Very important (1)</th><th>Somewhat important (2)</th><th>Somewhat unimportant (3)</th><th>Not important at all (4)</th><th>Not applicable (5)</th></tr>
<tr><td>Online Information (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td>Identifies if the producer is looking to technology for information</td>
<td>4 point agree/disagree Likert</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr><td>Rural Newspapers (Queensland Country Life, The Land etc) (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Major Newspaper (The Australian, Courier Mail etc) (3)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Trade and Farming Publications (4)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Field Days (5)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Extension Officers (8)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Friends and Family (9)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Word of Mouth (6)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>Other (make a selection and complete the text or select NOT APPLICABLE to proceed) (7)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What value does technology afford the women producer?</td>
<td>
Q68 Who mainly makes the decision to purchase when buying new technology products for the property? (Select 'Agree' or 'Disagree')
<table>
<tr><th></th><th>Strongly agree (1)</th><th>Somewhat agree (2)</th><th>Somewhat disagree (3)</th><th>Strongly disagree (4)</th></tr>
<tr><td>The female, if they are to be used for inside the homestead (e.g. a new computer, accounting, cattle management or education program etc) (1)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
<tr><td>The male, if the technology is to be used outside of the homestead (e.g. walk over scales, remote weather stations etc) (2)</td><td>❍</td><td>❍</td><td>❍</td><td>❍</td></tr>
</table>
</td>
<td>Identifies the main decision maker

Identifies the women's / men's decision level / purchasing power / value</td>
<td>4 point agree/disagree Likert</td>
</tr>
</table>

	We both do, depending on the size of the purchase (i.e. if the purchase is a high cost purchase, we will discuss it together and then decide) (3) ❍ ❍ ❍ ❍ Other (make a selection and complete the text or select STRONGLY DISAGREE to proceed) (4) ❍ ❍ ❍ ❍		
What value does technology afford the women producer?	Q69 Do you use a smart phone or tablet? ❍ Yes (1) ❍ No (2) If No Is Selected, Then Skip To How long have you had access to the i...	Identifies men's use of technology	Select one
	Q70 Who purchased your smart phone or tablet? ❍ I did (1) ❍ My wife/partner did (2) ❍ Someone else did (who was this)? (3) ____________________	Identifies level of engagement with technology	Select one
	Q71 Who set up your smart phone or tablet? ❍ I did (4) ❍ My wife/partner did (5) ❍ Someone else did (who was this)? (6) ____________________	Identifies level of engagement with technology	Select one
	Q72 Who taught you how to use the smart phone or tablet? ❍ I did (4) ❍ My wife/partner did (5) ❍ Someone else did (who was this)? (6) ____________________	Identifies level of engagement with technology	Select one
	Q73 How do you use your smart phone or tablet? (Select all that apply) ❑ I use it to look up new product information on the internet (1) ❑ I use it just to make telephone calls (2) ❑ I use it to make telephone calls and text (3) ❑ I use apps, such as the weather on my smart phone (4) ❑ What else do you use it for? (Please Specify) (5) ____________________	Identifies level of engagement with technology	Select all that apply

	Q74 What are the benefits of having a smart phone or tablet? ❑ I can learn it myself (4) ❑ I can search for things and research stuff e.g., parts, stock prices etc (5) ❑ I can check the weather (6) ❑ I don't have to ask someone to do it for me (7) ❑ I don't have to go back to the homestead to find out the information I need (8) ❑ Other (9) ____________________	Identifies benefits of technology use	Select all that apply
Will technology use improve the business for the family unit?	Q75 How long have you had access to the internet? ❍ Less than one year (1) ❍ One to two years (3) ❍ Two to five years (4) ❍ More than 5 years (5) ❍ I don't have internet at home I am doing this on my mobile (2)	Identifies respondents access to the internet and potentially other rural digital technology	Select one
	Q76 How important is it to you to have access to the internet? ❍ Extremely important (11) ❍ Slightly important (12) ❍ Slightly unimportant (14) ❍ Extremely unimportant (15)	Identifies personal connection to the internet	4 point agree/disagree Likert
	Q77 What are the top three reasons that having access to the internet is important to you? Internet access is important - Reason 1 (1) Internet access is important - Reason 2 (2) Internet access is important - Reason 3 (3)	Identifies the most important use of internet access	Text
Will technology use improve the business for the family unit?	Q78 What do you mainly use the internet for? (please select how important the use is)	Identifies the uses of the internet – supports importance of access	4 point agree/disagree Likert

	Most used (1)	Sometimes used (2)	Least used (3)	Not used (4)
Education (of both students and self-learning. e.g. learning about agricultural or other practices) (4)	❍	❍	❍	❍
Business (5)	❍	❍	❍	❍

	Social (6) ❍ ❍ ❍ ❍ Research & Development (7) ❍ ❍ ❍ ❍ For staff (9) ❍ ❍ ❍ ❍ Other (make a selection and complete the text or select NOT USED to proceed) (8) ❍ ❍ ❍ ❍		
	Q79 Please select how much you agree or disagree with the following statements:	Indicator for succession	4 point agree/disagree Likert

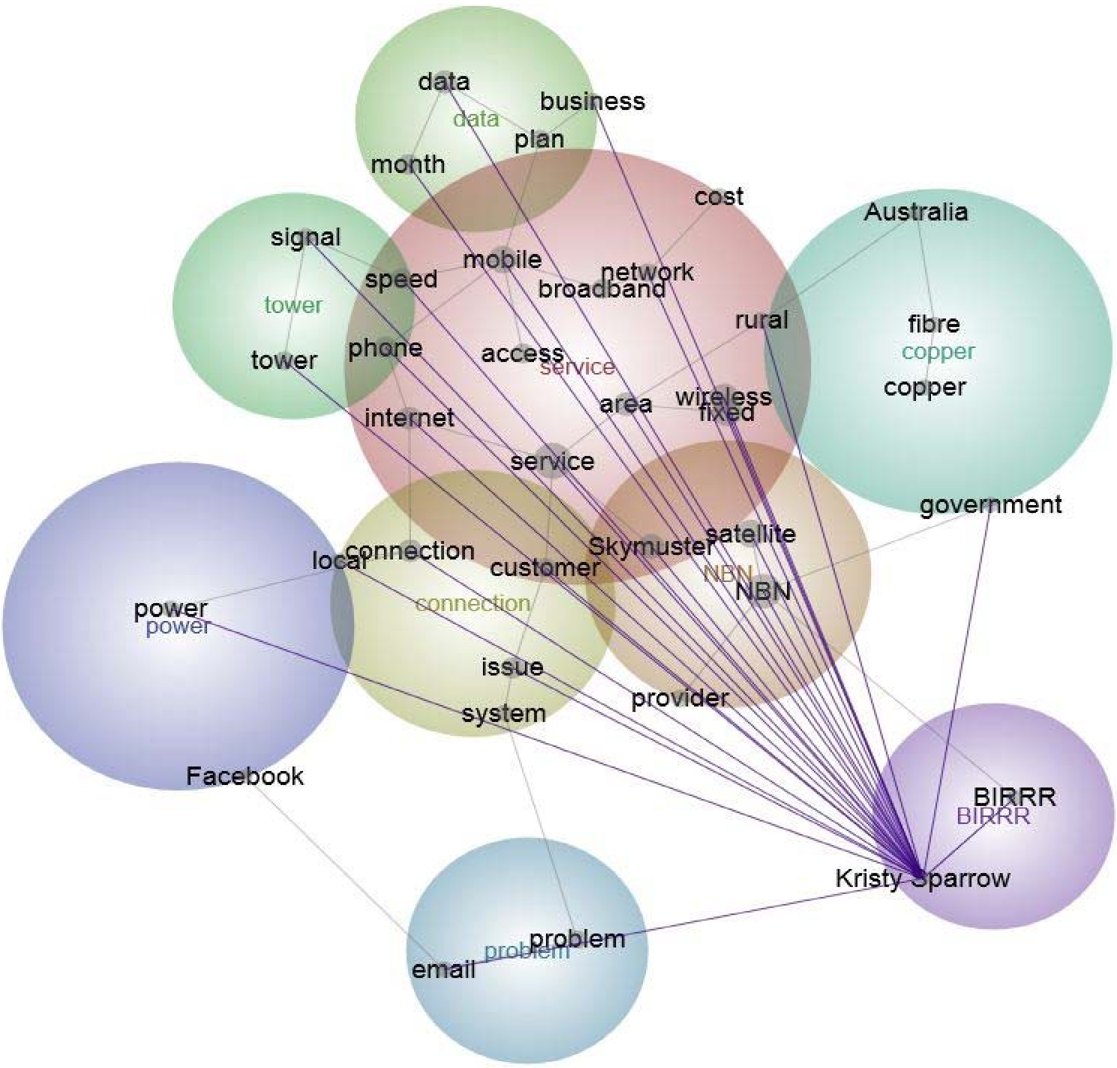
	Strongly agree (1)	Somewhat agree (2)	Somewhat disagree (3)	Strongly disagree (4)
Having the internet at my property will benefit my children and my family (4)	❍	❍	❍	❍
Having access to the internet at my property will be attractive to staff as well as help to keep them longer (5)	❍	❍	❍	❍
I believe that having internet access will benefit my children if they to return to work on the property (6)	❍	❍	❍	❍
Using technology will help with production into the future (7)	❍	❍	❍	❍
I hope my children return to run the farm (8)	❍	❍	❍	❍
I hope my children never return to farming (9)	❍	❍	❍	❍

	Q80 Do you agree or disagree that farming with new technology will help the grazing industry to remain productive? ❍ Strongly Agree (1) ❍ Somewhat agree (2) ❍ Somewhat disagree (3) ❍ Strongly disagree (4)	Technologies effect on production	4 point agree/disagree Likert
Will technology use improve the business for the family unit?	Q81 Do you agree or disagree that having technology available on working properties may increase/encourage succession, in terms of children returning to work the property? ❍ Strongly Agree (4) ❍ Somewhat agree (5) ❍ Somewhat disagree (6) ❍ Strongly disagree (7)	Technologies effect on succession	4 point agree/disagree Likert
Succession	Q82 Do you hope/intend to hand the property on to future generations? ❍ Yes (1) ❍ No (2) ❍ Maybe (Why is that?) (3) ____________________	Propensity for succession	4 point agree/disagree Likert
	Q83 How many generations of your family have owned this property (including children)? ❍ One Generation (1) ❍ Two Generations (2) ❍ Three Generations (3) ❍ Fourth Generation (4) ❍ Fifth Generation or more(5)	Attachment to place	Select one
Well Being	Q84 Do you agree or disagree that having access to the internet increases your quality of life/well-being? ❍ Strongly agree (14) ❍ Somewhat agree (15) ❍ Somewhat disagree (17) ❍ Strongly disagree (18)	Technologies effect on well being	4 point agree/disagree Likert

	Answer If Do you agree or disagree that having access to the internet increases your quality of life/well-b... Strongly agree Is Selected And Do you agree or disagree that having access to the internet increases your quality of life/well-b... Somewhat agree Is Selected Q85 How much does having access to the internet increase your quality of life/well-being? ❍ Very much (4) ❍ A lot (5) ❍ A little (6) ❍ Not very much (3)	Internet access' effect on well being	Select one
	Q86 Do you feel that having internet access makes you more equal to people in more internet accessible areas (for example in cities)? ❍ Yes (can you tell us why?) (4) ____________________ ❍ No (5)	Equality measure – effect on well being	Select one
	Q87 How would you rate your emotional health? (Emotional health is defined by "the degree to which you feel emotionally secure and relaxed in everyday life") ❍ Excellent (8) ❍ Moderate (6) ❍ Above average (7) ❍ Poor (5) ❍ Extremely poor (4)	Response state – links to well being	Select one
Demographic	Q88 Have you always worked in agriculture? ❍ Yes (1) ❍ No (what did you do before) (2) ____________________	Attachment to place	Select one
	Q89 Would you want to work somewhere else? ❍ Yes (what would you like to do?) (1) ____________________ ❍ No (2)	Attachment to place	Select one
	Q90 What do you mainly produce? (Select all that apply) ❑ Cattle (%) (1) ____________________ ❑ Sheep (%) (2) ____________________ ❑ Cropping (%) (3) ____________________ ❑ Other (Please Specify plus % of production) (4) ____________________	Confirms participant is within the scope of the study – that they are beef producers	Select all that apply

	Q91 What size is your property? (Select One) ❍ Less than 1000 acres (1) ❍ 1001 - 5000 acres (2) ❍ 5001 - 10,000 acres (3) ❍ 10,000 - 20,000 acres (4) ❍ 20,000 + acres (5)	Identifies the scale of production the property has See note in Female Q's	Select one
	Q92 Do you work on the property or are you the property owner? (Select One) ❍ I work on the property (1) ❍ Property owner (2) ❍ I manage the property (4) ❍ It's my parents property and I work there (5) ❍ Other (Please Specify) (3) ____________________ If I work on the property Is Selected, Then Skip To End of SurveyIf Property owner Is Selected, Then Skip To End of SurveyIf Other (Please Specify) Is Selected, Then Skip To End of SurveyIf Other (Please Specify) Is Not Empty, Then Skip To End of Survey	Attachment to place	Select one
Demographic	Answer If How old are you? 17 or younger Is Selected Q93 Thank you, for participating in this survey. Unfortunately you are not eligible to participate in this study due to your age. However, if you know someone who is over 18, who lives and/or works on a cattle producing property that would like to participate in this survey: Please forward the original email invitation to them, so they can participate in the "Technology Adoption by Rural Women" study. Once again, thank you for your interest in this topic. If Thank you, for participa... Is Displayed, Then Skip To End of Survey	Directive	None

Appendix 7: Figure 7.4: Leximancer map showing the elements of connection between BIRRR and the principles of social marketing



Concepts List from Leximancer showing name-like concept rankings			
Name-Like	Count	Relevance	
NBN	938	100%	
Skymuster	457	49%	
BIRRR	179	19%	
Australia	101	11%	
Kristy Sparrow	88	09%	
Facebook	25	03%	

Figure 4: Leximancer map showing the elements of connection between BIRRR and the principles of social marketing

Appendix 8: Figure 7.5: Leximancer concept map showing concepts relevant the Principles of Social Marketing

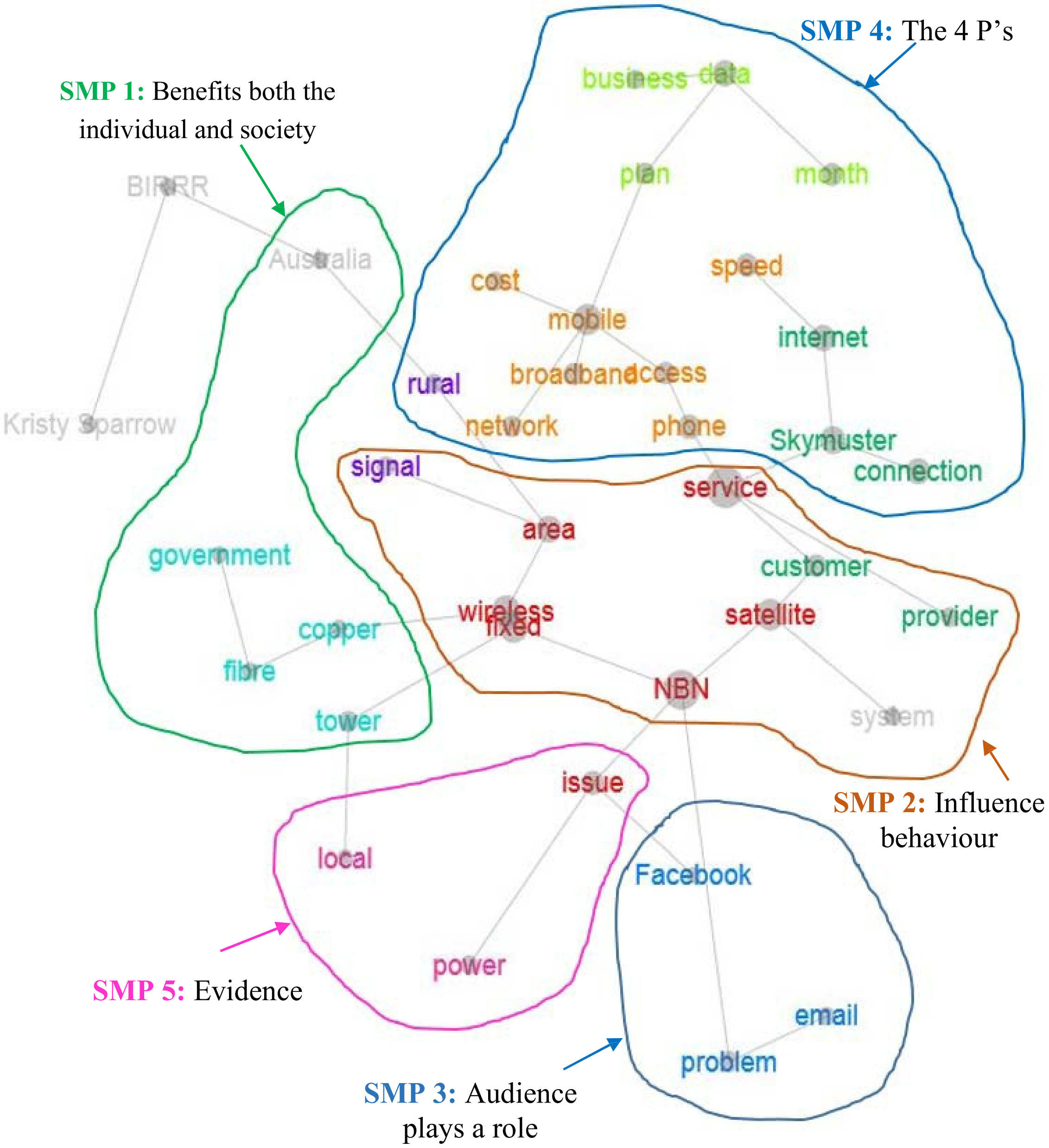


Figure 5: Leximancer concept map showing concepts relevant to the Principles of Social Marketing

Appendix 9: Figure 7.6: Frequency Chart, Concepts List from Leximancer showing word-like concept rankings

Word-Like	Count	Relevance
service	887	95%
satellite	593	63%
data	461	49%
mobile	431	46%
connection	419	45%
fixed	397	42%
internet	382	41%
issue	377	40%
area	365	39%
wireless	355	38%
phone	326	35%
month	317	34%
speed	309	33%
problem	298	32%
customer	251	27%
tower	238	25%
power	220	23%
plan	207	22%
network	200	21%
access	198	21%
provider	184	20%
email	176	19%
business	169	18%
signal	166	18%
broadband	160	17%
rural	131	14%
cost	124	13%
system	123	13%
copper	116	12%
local	103	11%
fibre	95	10%
government	88	09%