Adoption and use of Web 2.0 technologies: a comparison of four adoption models as a case study of a state government eExtension project

by

David John James
BHortSc, DipHortSc (Massey), MAgrSt (UQ)

A thesis submitted to the
Faculty of Business, Education, Law and Arts
University of Southern Queensland
in fulfilment of the requirements for the degree of

Doctor of Philosophy

2015

Abstract

The adoption and use of three Web 2.0 technologies (web conferencing, eSurveys, and YouTube videos) were studied using the following four adoption models: the Diffusion of Innovations, the Unified Theory of Acceptance and Use of Technology, the Adoption and Diffusion Outcome Prediction Tool (ADOPT), and Switch: How to change things when change is hard. It is believed that this research study comparing four quite divergent models is the first of its kind attempted, and similarly its focus on the adoption of Web 2.0 technologies.

The study was conducted within an organisational context of a state government agriculture department. Unlike previous studies which focused on individuals in an organisational setting with attitude factors such as perceived use, this study considered the actual usage of the technologies by government staff.

A case study approach with mixed methods consisting of quantitative and qualitative techniques utilised the results from six data sets – five surveys and one set of observational data – all collected as part of the Queensland Government's eExtension project. Staff actively using the eTechnologies were surveyed for the eExtension project baseline survey (n=119), the Impact of web conferencing survey (n=56), the Impact of eSurveys survey (n=47), the YouTube video training workshop survey (n=39) and finally, the Motivation to adopt an innovation survey (n=94). In that final survey, organisational users of the Web 2.0 technologies selected one of the three technologies – eSurveys, webinars, or YouTube videos – and rated their degree of use of the technology, nominated the factors that encouraged and discouraged adoption of the technology, and then responded to questions from the four adoption models.

The quantitative data was analysed using R (including ANOVA, Principal Components Analysis and Hierarchical Cluster Analysis) and the qualitative data was analysed using content analysis (predominantly undertaken manually but also electronically using Leximancer and Wordle).

While it was not possible to determine whether one of the four models was any more effective than the others at predicting adoption, the Hierarchical Cluster Analysis confirmed that the Diffusion of Innovations and ADOPT models were robust with minimal overlapping questions within them.

Unlike any previous study reviewed, an analysis was undertaken to determine whether there was a difference between human or technology related questions. An analysis across all the questions indicated that questions categorised as relating to technological factors were slightly better at predicting adoption that those categorised as human factors.

This study also identified the factors that encouraged the adoption and use of new technologies, which for eSurveys were the increased efficiency of creating, distributing and analysing surveys; the ease of use for the survey creator and respondent; saving time and money; accessibility of reaching people; and the ease of distribution. These factors for webinars were that they provided more opportunities

to interact; reduced travel and were cost effective; provided visual aids in seeing each other and documents, were easy to use or to get support and assistance. The factors that encouraged adoption of YouTube style videos were their use as a visual tool for training and/or conveying information; lower costs associated with making video as opposed to other options; greater acceptance and/or demand by the target audience; and having received training to make the videos. The overall themes that emerged regarding the factors that encouraged adoption of the new technologies were that they needed to be easy to use, save time and money, and they required the provision of support.

The research study also identified the factors that discouraged adoption of the new technologies. For eSurveys these were learning how to use the technology and the lack of acceptance of the technology by end-users. For webinars they were the lack of training for organisers and/or participants; lack of Departmental support; potential participants not accepting the technology and/or not having access to equipment; the preference for face-to-face interaction and the cost. Finally, for YouTube the factors were lack of training, lack of Departmental support, lack of access to equipment, and lack of time. The overall themes that emerged regarding the factors that discouraged adoption of the new technologies were lack of training on how to use the new technology, end-users not being receptive to it, lack of departmental support and/or policy, and lack of access to equipment.

The benefits derived from the use of these modern technologies were also identified, and for web conferencing these were saving travel time, saving travel money, better engaging with clients and/or colleagues, being more innovative and being more responsive to the needs of clients and/or colleagues. The benefits derived from the use of eSurveys were being more efficient by saving time and effort when gathering feedback from clients, being more responsive to the needs of clients, being more innovative, making better informed decisions, and more efficiently gathering feedback after an event. The main benefit derived from YouTube videos was an efficient means of communication without the use of paper.

A new model for the adoption and use of Web 2.0 technologies, the User benefits model, was developed for an organisational setting. It comprises four factors related to user benefits: contagious benefits, supporting benefits, working smarter benefits and noticeable, trialable benefits.

Certification of Thesis

This is to certify that the ideas, experimental work, results, analysis, conclusion, and recommendations reported in this dissertation are entirely of my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

Signature of candidate

John James	Date

Endorsement
Signature of supervisors

Professor Raj Gururajan (Principal supervisor)	Date

Dr Jeff Coutts (Associate supervisor)	Date

Acknowledgments

In the time-old children's book, *Through the looking glass*, Carroll (1871, p. 64) writes:

> "The time has come," the Walrus said,
> "To talk of many things:
> Of shoes–and ships–and sealing-wax–
> Of cabbages–and kings–
> And why the sea is boiling hot–
> And whether pigs have wings."

And so the time has come to give a heartfelt vote of thanks to my two PhD supervisors, Raj Gururajan and Jeff Coutts for the countless hours they devoted to helping me with my PhD journey. At times it seemed to me that the elements of my research were as diverse as cabbages and kings, with little sense to be made from them. At other times it seemed as though I was asking unanswerable questions, like "Why is the sea boiling hot?", but they helped me to journey on further and dig deeper to find the real meaning in the data and the stories it was whispering. Special thanks go to Kerry Bell for her wonderful assistance with biometrical issues.

I am especially grateful to my family for their understanding and patience when many a night and weekend I was tapping away at the keyboard instead of spending time with them. Thank you Julie, Matthew, Luke and Katie for your generosity.

The author has also appreciated the access to numerous resources provided through his workplace and most importantly the time to focus on these studies as part of his work program, albeit part-time over 10 years. Thanks Peter, Bob and Krista for enabling this to happen. The author is also grateful for the technology that in recent years made the arduous task of seeking and recording bibliographic references so much easier – thanks Google Scholar and EndNote!

Publications produced during this research study

James, J 2010a, 'Save Time and Money with Web Conferencing', *APEN ExtensionNet*, vol. 17, no. 4, p. 1.

---- 2010b, 'Using eExtension to better engage with clients and enable change', in J Jennings, W Packham & D Woodside (eds), *Shaping Change: Natural Resource Management, Agriculture and the Role of Extension*, Australasia-Pacific Extension Network (APEN), Australia, pp. 155-61.

---- 2010c, 'Using Web 2.0 technologies to enable practice change in Australian agriculture', Extension Farming Systems, vol. 5, no. 1, pp. 167-72.

---- 2011, *The road less travelled: a balanced approach to eExtension*, Paper presented at the APEN National Forum: Hitting a Moving Target – Sustaining landscapes livelihoods and lifestyles in a changing world, Armidale, NSW, pp. 86-9.

James, J, McIntosh, F & Bath, G 2013, 'Powering adoption by using eExtension wisely', poster presentation at Northern Beef Research Update Conference, Cairns, Australia.

Table of contents

List of figures

List of tables

List of abbreviations and definitions

ABS	Australian Bureau of Statistics
ABARES	Australian Bureau of Agriculture and Resources Economics and Sciences
ADOPT	Adoption and Diffusion Outcome Prediction Tool
ANOVA	Analysis of Variance
DAFF	Department of Agriculture, Fisheries and Forestry *Note: While Department of Primary Industries and Fisheries (DPI&F) was the name of the department at the commencement of this study, it subsequently changed to DEEDI (Department of Employment, Economic Development and Innovation) in 2009 and then to DAFF (Department of Agriculture, Fisheries and Forestry)in 2012. For reading continuity, all references to the Department have been changed to DAFF, irrespective of the timing of the reference.*
EVAO	Estimated Value of Agricultural Operations
ICT	Information and Communication Technologies
IT	Information Technology
LSD	Least Significant Differences
NBN	National Broadband Network
OGP	Open Government Partnership
PCA	Principal Components Analysis
R&D	Research and Development
RD&E	Research Development and Extension
TAM	Technology Acceptance Model
TAM2	An extension of TAM
TAM3	A further extension of TAM
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UK	United Kingdom
UTAUT	Unified Theory of Acceptance and Use of Technology

Note: the terms Web 2.0 and ‘new communication technologies’ are used interchangeably in this thesis.

1. Introduction

This chapter provides an introduction to the research study by covering the background situation of new communication technologies, use of the Internet, Australian agriculture and agricultural extension. It subsequently provides background about the eExtension project and then proceeds to outline the research problem, including the research setting and research question (as shown in Figure 1).

The primary research question that will be addressed in this research study is: 'What factors influence the adoption and use of new communication technologies, and what are the implications for organisations in supporting this change?'. This is set within the context of the Australian rural Research, Development and Extension (RD&E) system, and uses a case study of a state government eExtension project.

Adoption in this context refers to the process where an individual chooses whether or not to use a particular innovation. Whereas diffusion refers to 'the cumulative spread of such adoption decisions over time and through space' (Lindner 1987, p. 144), and is 'a kind of social change' (Rogers 2003, p. 6).

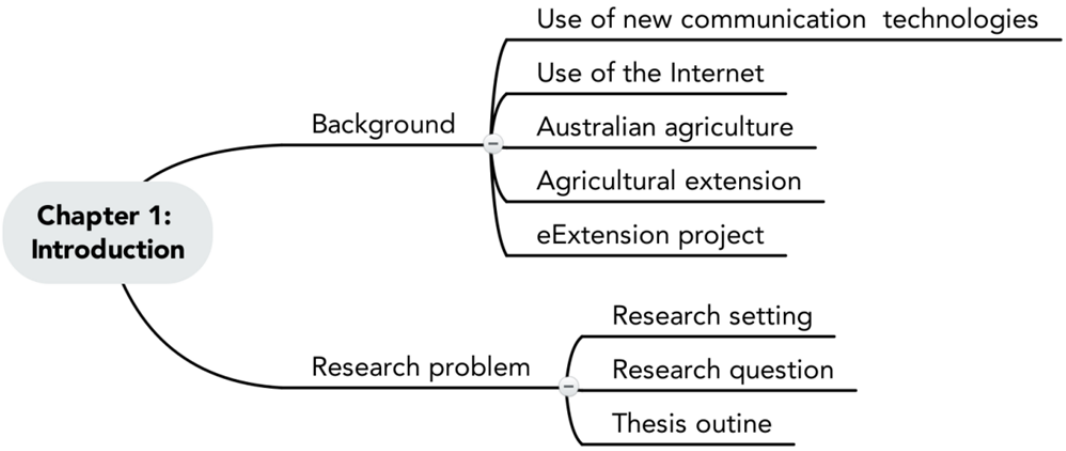


Figure 1. The structure of Chapter 1.

1.1 Background

In 2012 the Queensland government drastically reduced staff numbers in its agriculture department in an effort to balance the state budget (Moore 2012). Yet it then released a discussion paper (DAFF 2012) with a vision to double the value of Queensland's agricultural production by 2040.

The state's primary producers are spread across more than 1.7 million square kilometres, which is seven times larger than the UK and more than twice the size of Texas, USA (Encyclopaedia Britannica Online, 2014) . This is an extremely large area of land to provide services across, so with even fewer staff, the tyranny of distance will become an even greater obstacle to effective industry engagement.

This is where the effective use of new communication technologies could benefit primary producers and the state budget – but only if it is possible to overcome the barriers that are preventing greater adoption of these technologies by staff at the Department of Agriculture, Fisheries and Forestry (DAFF).

The use and uptake of new communication technologies in the broader community is described in this section and an exploration of the use of Web 2.0 technologies in the workplace for agriculture is provided as a context for this study.

1.1.1. Use of new communication technologies

The concept of what has become the World Wide Web was published by Sir Tim Berners-Lee on 12 March 1989 and is now used by 'hundreds of millions around the world' (Pew Research Center 2014, p. 4) and has become 'the most significant technology of the 21st century' (Murugesan 2010, p. 1). Within America, the number of adults using the internet has steadily grown, as shown in Figure 2. It is estimated that 87% of American adults are using the Internet in 2014, and 99% of American adults living in households earning $75,000 or more are using it (Pew Research Center 2014, p. 5).

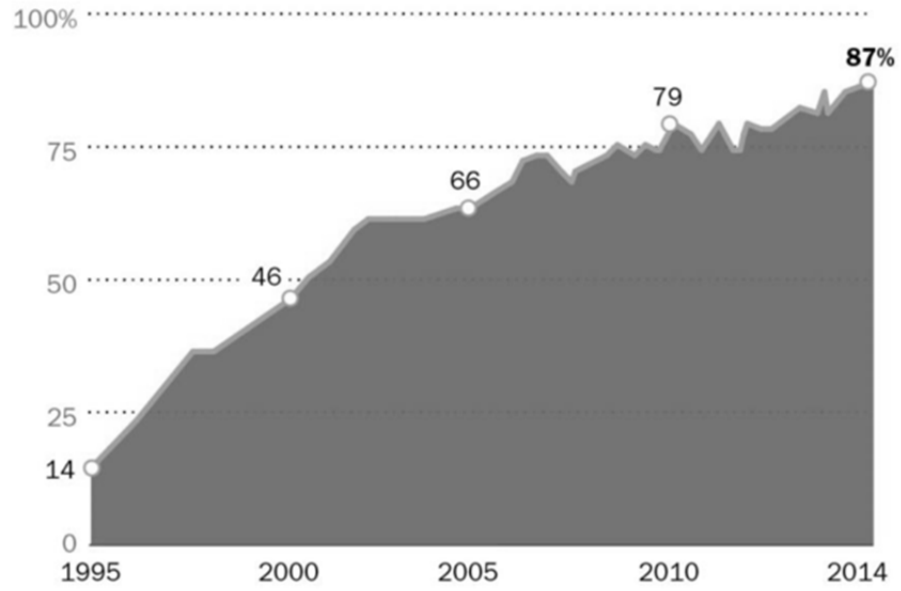


Figure 2. Percentage of American adults who use the Internet, 1995 to 2014.

Source: Pew Research Center (2014, p. 17).

While the traditional Internet allowed the static connection of multiple web pages, Web 2.0 allows online collaboration and interaction (Anderson 2007). The term Web 2.0 was coined by Dale Dougherty in 2004 (Madden & Fox 2006) and thanks to the popularisation by O'Reilly Media and MediaLive International, within 18 months the term received more than 9.5 million citations in Google (O'Reilly 2007). These Web 2.0 technologies are enabling people to connect, communicate and create knowledge faster than ever before (Jimoyiannis et al. 2013; Tapscott & Williams 2006).

It is difficult to give a precise definition of Web 2.0 as it is a 'set of principles and practices' and does not have a 'hard boundary, but rather, a gravitational core' (O'Reilly 2007, p. 18). Indeed, it is 'an evolving conceptual idea that controls the technological standard of the services that interact with it' (Kim et al. 2009, p. 658). Others describe it as 'an umbrella term encompassing several new Web technologies' (Murugesan 2007, p. 35). It has been described as the 'read/ write Web' (Ajjan & Hartshorne 2008, p. 71), the 'social web' (Wickramasinghe, Davey & Tatnall 2013, p. 318) and the 'participatory web' (Madden & Fox 2006), as it allows users to interact with material on the Internet, whether adding new content or editing someone else's. The six key features of Web 2.0 are said to be: participation, collaboration, social networking, rich user experience, semantics and interactivity responsiveness (Kim et al. 2009).

The paradigm has changed from an individual user accessing content to communities creating and sharing their ideas (Pence 2007). As an example, Wikipedia, the online encyclopedia, enables registered users to add new material or edit existing content. This online collaboration is sometimes referred to as harnessing 'collective intelligence' (O'Reilly 2007, p. 22), 'mass collaboration' (Tapscott & Williams 2006), 'web-based collaborationware' (Boulos, Maramba & Wheeler 2006)and 'crowdsourcing' (Howe 2006). For this reason other authors refer to Web 2.0 as an attitude, not a technology, and therefore refer to it not as a technological revolution, but a social revolution (Downes 2005). Examples of Web 2.0 technologies include blogs, wikis, instant messaging, internet telephony, social bookmarking, RSS feeds, mashups, tags and social networking (Dearstyne 2007; Hartshorne & Ajjan 2009; Information Victoria 2009; Murugesan 2007), and those particularly relevant to this study: web conferencing (Charles & Dickens 2012), YouTube (Chou et al. 2013) and eSurveys (Justiss 2011).

For *digital natives* (those who interacted with digital technology from an early age), the use of these technologies is second nature, whereas for *digital immigrants* it involves an often long and difficult learning curve (Prensky 2001). These digital natives actively participate in Web 2.0 activities such as social networking and blogging on a regular basis (Pence 2007). Due to the emphasis placed on these networking activities, it has been suggested that the Internet is becoming 'less about content and more about individual social connections' (Pence 2007, p. 348).

The term Web 3.0 is beginning to be used intermittently, though once again there is no agreed definition. Generally it is being used to describe machine-to-machine communication on the Internet, using a semantic web to provide personalised information (Agarwal 2009). If Web 2.0 is about users manually collaborating with each other, then it has been suggested that Web 3.0 is about software applications

collaborating, based on previous user interaction. It will evaluate the usefulness of the content on web pages, and will then search on behalf of the user for other information that has a high probability of being of interest (Berners-Lee, Hendler & Lassila 2001; Opsahl 2011). Web 4.0 is about 'harnessing the power of human and machine intelligence on a ubiquitous Web, where both people and computers not only interact, but also reason and assist each other in smart ways' (Murugesan 2010, p. 2).

In this research study, the terms Web 2.0 and 'new communication technologies' are used interchangeably.

Worldwide use of new communication technologies

The first decade of the new millennium (2000–2009) has seen the unparalleled uptake of new technologies, in particular, social networking. To reach 50 million users, it took radio 38 years, television 13 years, the Internet four years, Facebook 3.7 years (Wired 2007), the iPod 3.0 years (United Nations 2001) and LinkedIn just 1.3 years (LinkedIn 2009). Incredibly, in 2009 Facebook added 50 million users in just three months (Mashable 2009). This dramatic reduction in time to adopt new technologies is illustrated in Figure 3. This illustrates the point that the adoption of new technologies is generally occurring at an increasingly faster pace.

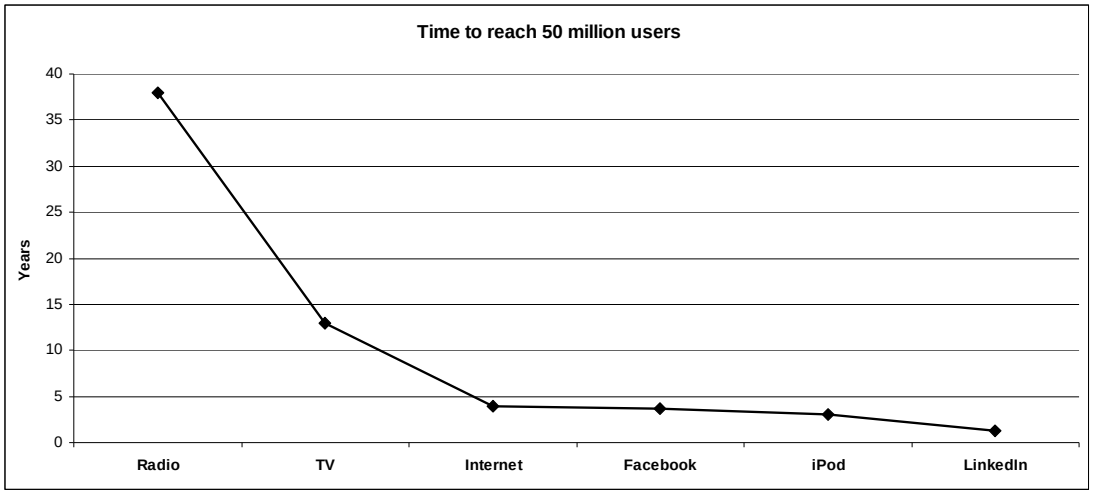


Figure 3. Time taken for technologies to reach 50 million users.

Source: Compiled by author using data extracted from LinkedIn (2009), United Nations (2001) and Wired (2007).

The following snapshots reinforce the dramatic increase in the adoption and use of a range of popular social networking technologies.

Facebook (www.facebook.com), a social network site, was launched in 2004 and now has more than one billion active users, and is used by more than half of the world's online population (Richter 2013). There have been over 140 billion connections and over 219 billion photos uploaded (9to5Mac 2012). Facebook CEO Mark Zuckerberg was named Time's Person of the Year for 2010 for 'connecting more than half a billion people and mapping the social relations among them, for creating a new system of exchanging information and for changing how we live our lives' (Time 2010). The growth of Facebook active users (a user who has visited the website in the last 30 days) is shown in Figure 4.

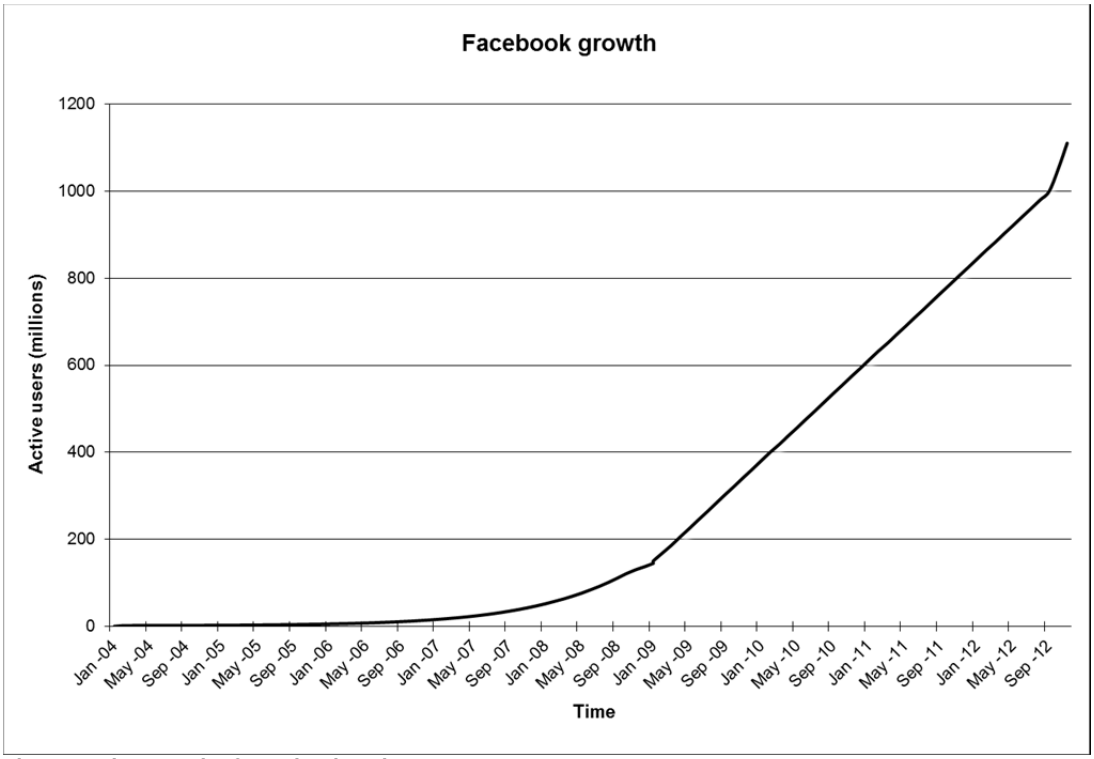


Figure 4. The growth of Facebook active users.

Source: Compiled by author using data extracted from Wikipedia (2013d).

Twitter (www.twitter.com), a social network and micro-blogging service, was launched in 2006 and now has over 500 million users (Lunden 2012), generating over 400 million tweets each day (Moore 2013), up from just 2.5 million in 2009 (Twitter 2010). The monthly growth rate of Twitter users in the 12 months from February 2008 to February 2009 was 1382% (Nielsen 2009). This strong rate of growth is shown in Figure 5.

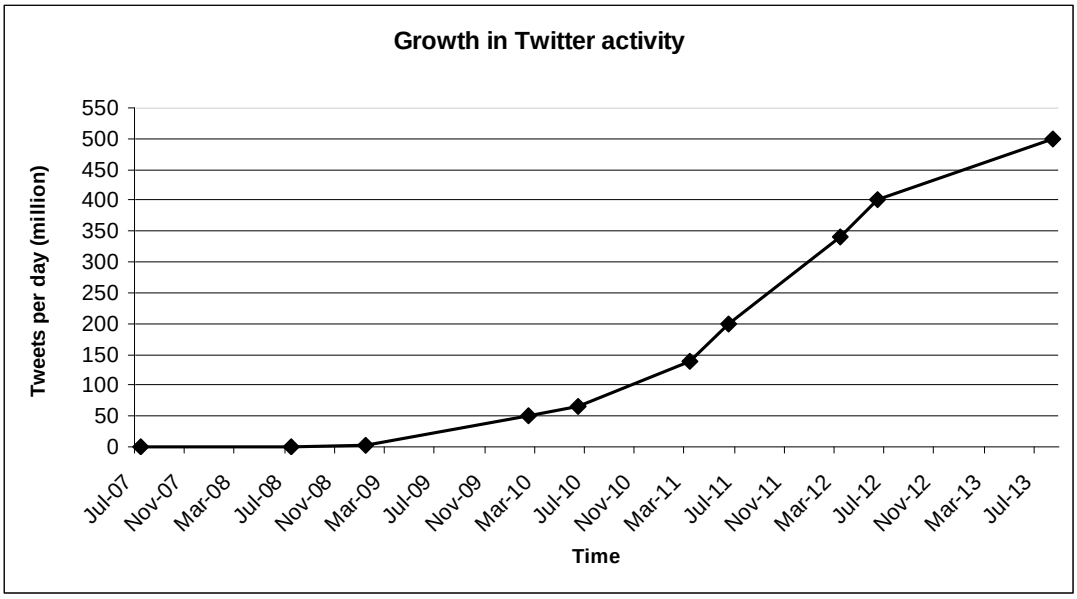


Figure 5. The growth of Twitter activity.

Source: Compiled by author using data extracted from Wikipedia (2013e).

LinkedIn (www.linkedin.com), a business-oriented social networking site, commenced in 2003 and now has over 225 million professionals in over 200 countries, with approximately another two joining every second (LinkedIn 2014). Another example is Foursquare (www.foursquare.com), a location-based social networking website for mobile devices, commenced in 2009 (Wikipedia 2013k) and experienced 3400% growth in 2010 and now has over 20 million users (Wikipedia 2013k). Finally, YouTube (www.youtube.com), a video-sharing website that was created in February 2005, now has 800 million unique users a month and over six billion hours of video are watched each month. YouTube streams four billion videos per day and 100 hours of new videos are uploaded to the site every minute (YouTube 2013).

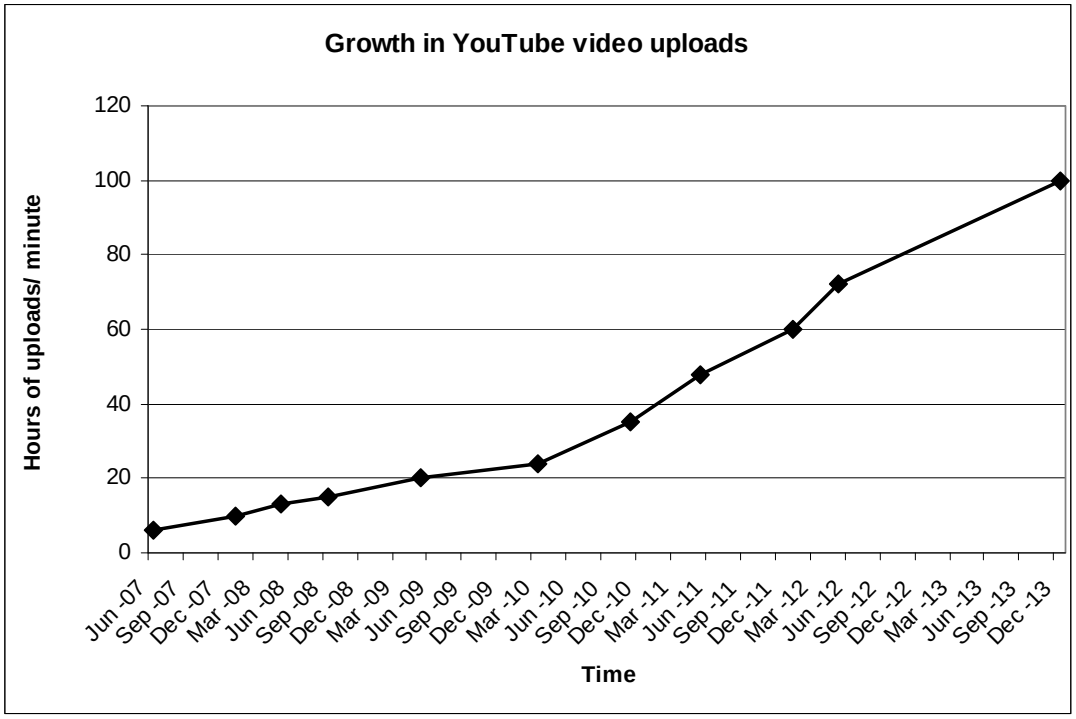


Figure 6. The growth of YouTube uploads showing hours of uploads per minute.

Source: Compiled by author using data extracted from YouTube (2013).

These snapshots have demonstrated the phenomenal increase in the adoption and use of new technologies across the world, many at exponential rates. This research project focuses on the adoption of new communication technologies by a government organisation, so the next section will focus on government use of new communication technologies.

Government use of new communication technologies

There have been significant changes in the way governments have been using the new communication technologies to better engage with their constituents. This follows a move to Government 2.0, the integration of new communication technologies into government structure and operations (Davies & Lithwick 2010). This approach seeks to put the 'citizen at the center' (Eggers 2005, p. 16) so that government services are less paternalistic and more responsive to the needs of the residents. Web 2.0 technologies are at the core of enabling these changes to occur, as demonstrated by the following examples drawn from around the world.

United States of America
The most notable change occurred in America in the lead up to the 2008 presidential election when Barack Obama used social media for gaining support, fundraising and volunteer coordination. Using no less than 16 social networks, Obama and his team engaged with voters in a way that no presidential candidate had ever done before (Harfoush 2009).

After his election, Barack Obama in a memorandum to his Heads of Executive Departments and Agencies on 21 January 2009 President Obama (2009) stated:

> *'My Administration is committed to creating an unprecedented level of openness in Government. We will work together to ensure the public trust and establish a system of transparency, public participation, and collaboration. Openness will strengthen our democracy and promote efficiency and effectiveness in Government.'*

This exemplifies the need to effectively utilise the new communication technologies, for without them it is difficult to deliver the participation and collaboration on a large scale. While America has made good progress, it is not alone as exemplified by work being undertaken in the UK.

United Kingdom
The United Kingdom (UK) Cabinet Office appointed a new Director of Digital Engagement in May 2009 to oversee the Government's online communications strategy. This new role was to work across all government departments to help them transition from communicating to citizens via the Internet to conversing and collaborating with them through digital technology, including blogs and social networking sites (Robinson 2009).

The UK is one of eight founding members of the Open Government Partnership (OGP) which was launched in September 2011 as a global effort to 'make governments better'. The other founding partners are Brazil, Indonesia, Mexico, Norway, Philippines, South Africa and the United States. By 2013 there were 59 governments in the OGP. To become a member, participating countries must: embrace a high-level Open Government Declaration, deliver a country action plan developed with public consultation, and commit to independent reporting on their progress going forward (*Open Government Partnership* 2013).

In June 2013 the Cabinet Office released its second draft *National Action Plan: From Open Data to Open Government*, as it seeks to be 'the most open and transparent government in the world' (Cabinet Office 2013).

The British Prime Minister, David Cameron, sent his first tweet in October 2012 and received 100,000 Twitter followers within a matter of days (Press Association 2012). Unfortunately in July it was revealed that more than 3,000 messages sent to his Twitter feed every month are deleted without being read. The reason provided was that most of the messages contain 'no real substantive content' and that 'the limitations of Twitter's format mean we wouldn't be able to give a full and useful reply' (Mason 2013).

Canada
The Government of Canada launched its Open Government strategy in March 2011, which included the following two principles that utilise Web 2.0 technologies. *Citizen participation* which utilised online consultations to engage citizens in public dialogue that informs policy and contributes to a more responsive, innovative and effective government. Secondly, *New technologies for openness and accountability* which used Web 2.0 technologies to enhance accessibility and transparency by enabling greater information sharing, public dialogue and collaboration (Government of Canada 2011).

To enhance internal collaboration and knowledge sharing, the Government of Canada in 2008 created an internal wiki, *GCpedia* which uses the slogan 'People & Knowledge' (Eaves 2009; Wikipedia 2013b). In August 2011 one of the wiki administrators reported that this wiki had over 22,000 registered users and approximately 11,000 pages of content. It had received 6.5 million pageviews and each week it received about 2,000 visitors and 15,000 pageviews (Eaves 2011). By May 2012, it was reported that the wiki had over 32,000 registered users, over 18,000 pages of content and had received almost 15 million pageviews (Wikipedia 2013b).

China
Microblogs, the Chinese equivalent of Twitter, were the third-largest information source of public opinion on the Internet in China in 2011. They were the third-favourite online source of information, after news portals and online forums (China Daily 2011). They are being used as a tool for democracy, increasing government engagement and accountability. Government officials there have been using the short messages to reconnect with the public since 2009. The popularity of this Web 2.0 communication tool has grown extremely quickly, so that in 2011 there were more than 195 million users of the leading microblogging services. This is almost ten times the population of Australia and represents approximately 15 percent of the Chinese population. Interestingly, about 15 percent of Australians also use Twitter (Thomler 2011).

A 2011 study found that 71 percent of Chinese web users attributed their increasing interest in politics to microblogging. Of the respondents, 59 percent indicated they had become more inclined to express their political views on microblogs and 23 percent chose politics as their favourite topic of discussion via microblog. The respondents indicated that they were highly in favour of politicians using microblogs, with 72 percent supporting the concept (Shanshan 2011).

Australia
In July 2010, the Australian Government made its declaration of Open Government (Department of Finance and Deregulation 2010) which stated:

> *'Collaboration with citizens is to be enabled and encouraged. Agencies are to reduce barriers to online engagement, undertake social networking, crowd sourcing and online collaboration projects and support online engagement by employees'.*

This was a strong message from the Federal government that it intended to collaborate and engage with the Australian public, and to use electronic methods for

doing so. It specifically mentioned supporting staff to undertake this online engagement, for without building their capacity, change would be unlikely. The Australian Government has made a commitment to join the Open Government Partnership in April 2014 (*Open Government Partnership* 2013).
As this research project is focusing on the use of Web 2.0 technologies by a Queensland government agency, the following sheds light on the use of these communication technologies within this part of Australia.

Queensland
A survey of Queensland public authorities in 2010 indicated that just over half (51%) of the 135 responding agencies were already using Web 2.0 tools as part of their business processes (Queensland State Archives 2010). A diverse range of Web 2.0 tools were reported being used, or intended to be used, as shown in Figure 7.

Respondents indicated that 'Web 2.0 tools were often specifically suited for particular uses, such as targeted engagement with specific social age groups or monitoring industry issues and opportunities' (Queensland State Archives 2010, p. 10). This demonstrates the ability of the new communication technologies to help governments deliver services to their constituents.

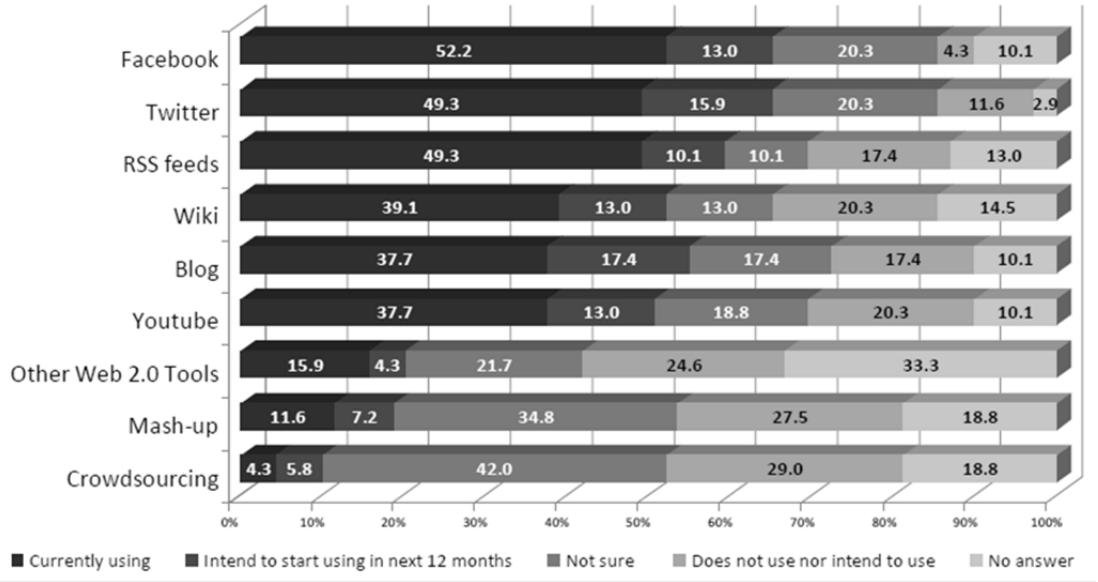


Figure 7. Web 2.0 tools used in the course of conducting business.

These Web 2.0 tools are being used for information provision, promotion of services and products, and a range of other business uses detailed in Figure 8.

Figure 8. Purpose of Web 2.0 tools used by Queensland public authorities.

Source: Queensland State Archives (2010)

This demonstrates that even at the state level, agencies are starting to make extensive use of the new communication technologies in a wide range of business practices. The next section will consider the use of the Internet in the Australian context.

1.1.2. Use of the Internet

Internet usage within Australia

In December 2012 the estimated population of Australia was 22.8 million (ABS 2012b) and the number of Internet subscribers was 12.2 million, which represented a 5% increase over the previous year (ABS 2013). This increase exceeds the population growth rate for Australia, which is only 1.7 per cent (ABS 2012a). More than 550,000 TB of data were downloaded in the December quarter of 2012, a 33 per cent increase in comparison to the June 2012 quarter (ABS 2013). These figures indicate the phenomenal rate of growth in the use of the Internet in Australia.

Reducing the digital divide (inequitable access to high speed Internet) between the metropolitan and the rural and remote areas in Australia was one of the key promised benefits of the National Broadband Network (NBN) program (Bowles & Wilson 2011). The Australian Government promised that 'every Australian, no matter where they live, has access to affordable high-speed broadband' (Senator Conroy, cited in Hansard 2010, p. 19). Currently the location where an Australian lives (capital city versus regional centre or a rural location) heavily influences the quality and type of their access to the Internet (Bowles 2011), with a general decrease the further away the user is located from a capital city.

Internet usage in Australian agriculture

Some 99.1% of all businesses in Australia use broadband as their main Internet connection, including 98.3% of agriculture, fisheries and forestry businesses (ABS 2013). In 2007-08, when the ABS last collected data regarding the use of the Internet on farms, it was estimated that 90% of all farms with an estimated value of

agricultural operations (EVAO) of $1,000,000 or more, used the Internet for business operations.

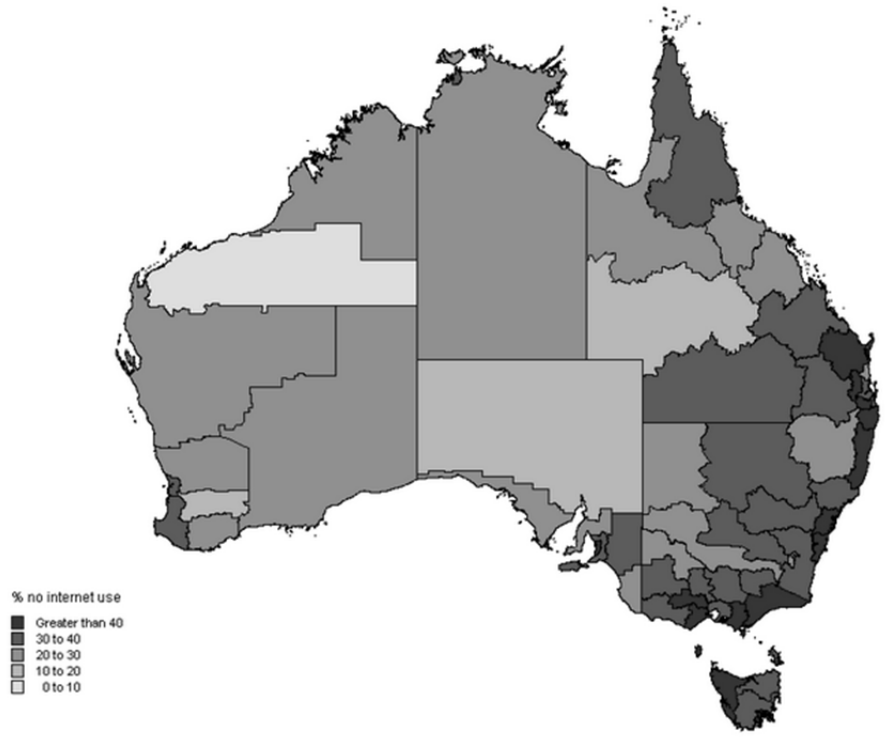


Figure 9. Farms not using the Internet for business operations (2007-08).

Source: ABS (2009).

The results (displayed in Figure 9) indicated a higher proportion of farms in remote areas use the Internet for business operations. It was mostly smaller farms located around urban areas that were less likely to use the Internet for business operations. This highlights the strong relationship between farm size (as measured by EVAO), and the use of the Internet for business operations (ABS 2009). This demonstrates that the more remotely located agricultural properties are able to utilise the modern communication technologies which are the subject of this research study.

Using the Australian beef industry as an example, it utilises 332 million hectares (43 per cent) of the country's land mass and has the largest geographical footprint of all broad acre industries (Primary Industries Standing Committee – R&D Sub-Committee 2010). Figure 10 illustrates the large geographic spread of this industry across Australia and emphasises the importance of using electronic media to efficiently engage with this geographically dispersed audience.

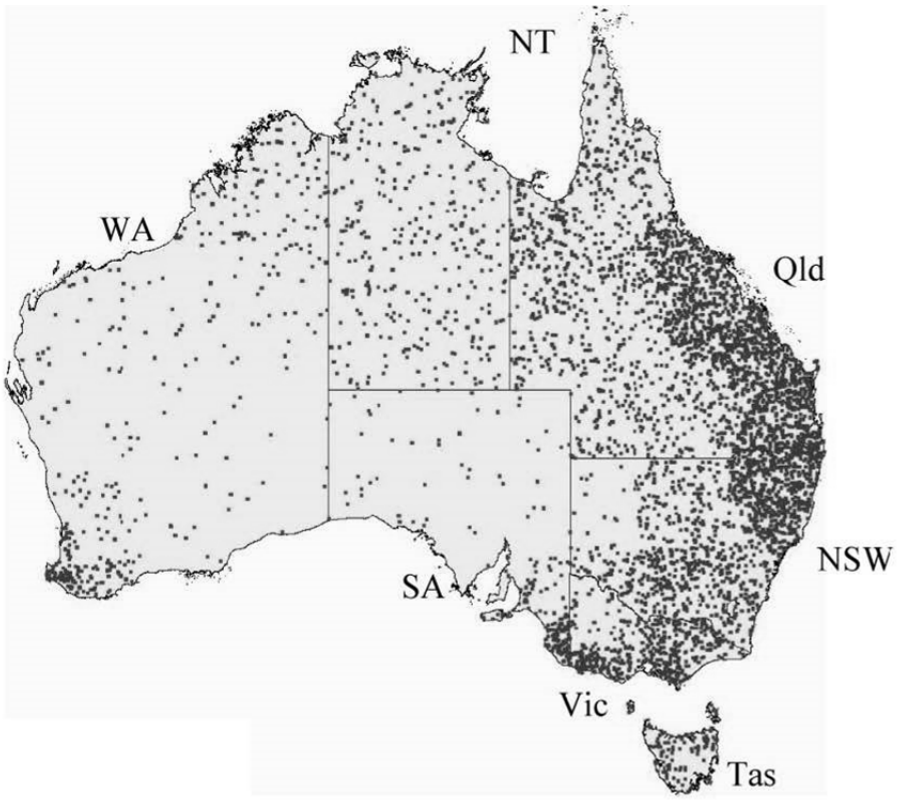


Figure 10. Distribution of beef cattle across Australia.

Source: Australian Bureau of Statistics.

1.1.3. Australian agriculture

The gross value of Australian agricultural production in 2012-13 was $48.0 billion, representing a 3 percent increase from 2011-12 (ABS 2014). Agriculture has historically played an important role in the Australian economy. In the first half of the 20th century, it accounted for around a quarter of the nation's output and approximately three quarters of Australia's exports. Hence the saying that the Australian economy used to 'ride on the sheep's back' (ABS 2012c).

However since then, agriculture's relative importance within the economy has been in steady decline. Its contribution to the GDP has fallen from approximately 14 per cent in the 1960s to now being approximately 5 per cent. This decrease isn't due to agriculture being any less productive, but rather other industries (such as tourism and mining) have significantly increased their contribution, so in relative terms agriculture has decreased. In contrast, in absolute terms actual output from Australian agriculture has more than doubled over the last 40 years, and exports have almost tripled since the mid-1970s (Productivity Commission 2005).

The funding for rural R&D and related extension activity in Australia is estimated to be $1.5 billion per annum, of which three-quarters is provided by the Australian and State and Territory Governments (Productivity Commission 2011). Research by the Australian Bureau of Agriculture and Resources Economics and Sciences (ABARES) estimates that for each dollar the government invests in agricultural R&D, farmers generate $12 within 10 years (Department of Agriculture 2014).

Five enablers of productivity growth for Australian agriculture have been identified, namely: R&D development of new knowledge and technology; innovation adoption

through facilitating innovation and improving incentives and the industry's capability to adopt new knowledge; removal of policy regulations or other impediments that stifle innovation; improvements to market access; and finally, addressing environmental pressures that pose a threat to productivity growth (Marslen 2014; Nossal & Gooday 2009).

Australian agriculture has over 135,000 businesses (with an EVAO of $5,000 or more), directly employing 306,700 people and utilising over 409 million hectares of land or 53% of the total land mass (ABS 2012d). If the whole agricultural supply chain is considered (including affiliated food and fibre industries), then agriculture employs over 1.6 million people (National Farmers' Federation 2012).

Approximately 99 percent of farm businesses are family owned and operated. Each farmer produces sufficient food to feed approximately 600 people – 150 at home and 450 overseas. In fact, Australian farmers produce over 90 percent of Australia's daily domestic food supply (National Farmers' Federation 2012).

Agriculture is still a very significant contributor to Australia's economy and way of life. As a testimony to this, the Year of the Farmer was celebrated in 2012, giving Australians an opportunity to acknowledge the pivotal role that agriculture and farmers play in our economy and society. This event aimed to reduce the divide between Australia's rural and urban communities, and highlight the important role that agriculture has in delivering national and global food security (ABS 2012c).

Queensland agriculture

Of all the Australian states, Queensland has the highest percentage of land area being used for agriculture (83 per cent). In 2010–11, the gross value of production for agriculture, fisheries and forestry was $11.2 billion (which represented 21 per cent of Australia's total gross value of production). In the same year, Queensland exported $6.3 billion worth of agriculture and food products. As Queensland's seasons occur slightly differently to the rest of Australia, it has a competitive advantage enabling it to send produce to the large southern markets (Department of Agriculture Fisheries and Forestry 2013).

In 2010–11, Queensland's largest agricultural commodities by value were beef cattle (worth $3.4 billion), fruit and vegetables ($1.9 billion), sugarcane ($910.3 million), cotton ($776.1 million), wheat ($378.4 million) and poultry ($395.5 million) (ABS 2012e).

DAFF and its role

Like most state government departments of primary industry, the role of the Queensland Department of Agriculture, Fisheries and Forestry (DAFF) is to foster the growth and development of primary industries, resulting in greater food security, employment and exports. This is undertaken within the agricultural RD&E system. Extension is defined as 'the process of enabling change in individuals, communities and industries involved in the primary industry sector and with natural resource management' (State Extension Leaders Network 2006, p. 2). While more formally known as agricultural extension, it uses similar processes to health promotion to engage with people so as to change their knowledge, attitudes, skills and aspirations.

The department's extension staff are located within various DAFF business groups, and are geographically located in or near the major production centres. Table 1 and Table 2 indicate the relevant business groups and regions in which the extension officers were located in 2007, when the last audit was undertaken.

Table 1. Distribution of extension staff across DAFF business groups.

Business Group	Officers
Animal Science	32
Biosecurity Queensland	43
Emerging Technologies	1
Fisheries	25
Hort & Forestry Science	14
Industry Devt - Metro	15
Plant Science	25
Regional Delivery - Central	26
Regional Delivery - Metro	18
Regional Delivery - North	46
Regional Delivery - South	30
Regional Delivery - South East	45
Regional Delivery - West	11
Total	331

Table 2. Distribution of extension staff across DAFF regions.

Region	Officers
Central	43
Metro	39
North	78
South	72
South East	78
West	21
Total	331

These 331 staff are based in over 50 locations across Queensland, many in fairly remote locations, as shown in Figure 11.

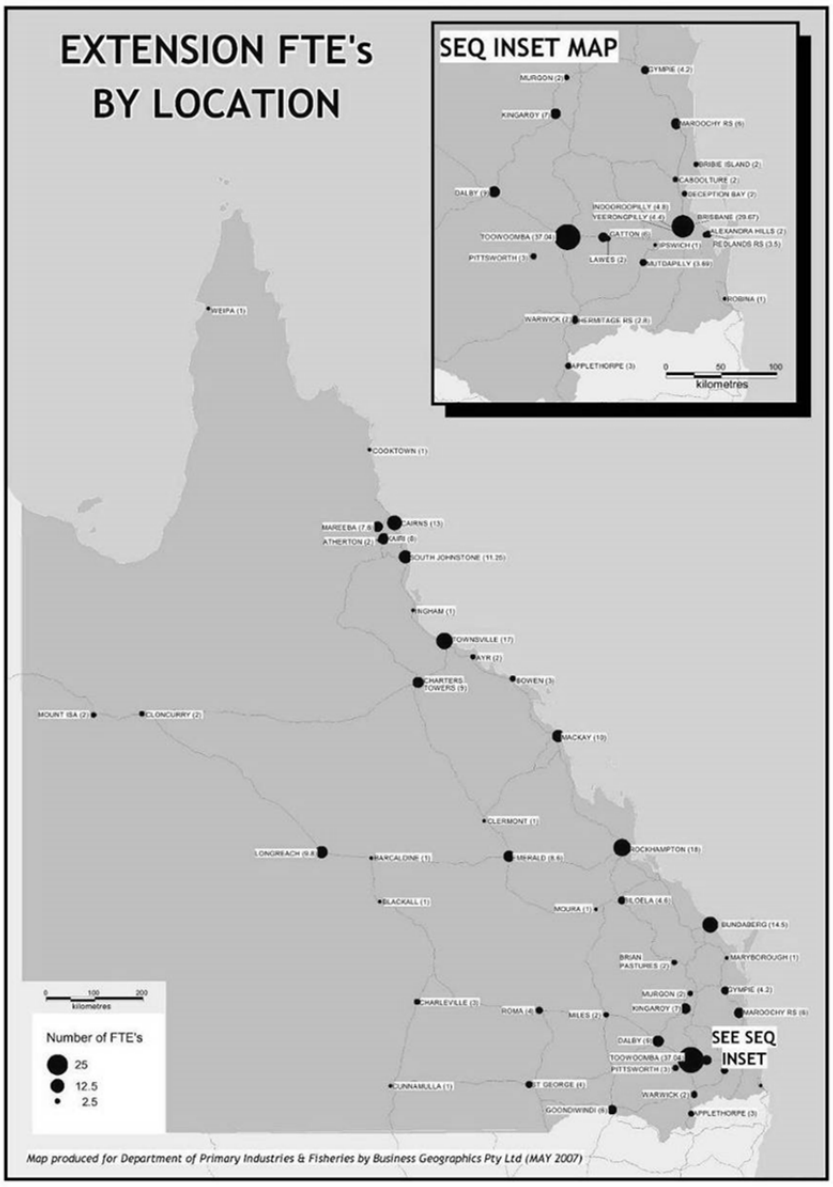


Figure 11. Geographic distribution of DAFF extension staff.

An implication of this wide geographic dispersion for DAFF is that it needs to have robust internal communication mechanisms, especially two-way, which are often time consuming and expensive if face-to-face communication is to be used. It is almost prohibitively expensive to bring all 330 staff together for a briefing or workshop, due to the large travel time and costs involved in such an exercise.

Similarly, external communication between staff and producers can be cost and time consuming due to the large distances involved. It is not uncommon for producers to travel eight hours to attend a workshop delivered by DAFF staff. These workshops often involve staff from other regions attending, and they too need to travel long distances to attend.

1.1.4. Agricultural extension

The concept of extension can be traced back to the adult education programs delivered at Oxford and Cambridge universities from 1867 (Jones & Garforth 1997). These programs aimed to extend the reach of the universities beyond their physical

campuses into the neighbouring communities (Swanson & Rajalahti 2010). They quickly spread to other institutions in Britain and the United States. In 1889 a successful 'mobile' dairy program was being run in Queensland, using trains to transport staff and materials (Maunder 1972).

While agricultural extension was initially described as a system of out-of-school education for rural people (Savile 1965), it has more recently been defined as 'the process of enabling change in individuals, communities and industries involved with primary industries and natural resource management' (State Extension Leaders Network 2006). It has also been described as 'the oil that makes things happen' (Coutts 2000, p. 6). The translations of some non-English words for extension include the Dutch 'voorlichting' (lighting the path), the German 'beratung' (to counsel or deliberate) and the French 'vulgarisation'(to render popular) (Ison & Russell 2000).

Criticisms have been made of the traditional top-down, linear model (Black 2000; Ison & Russell 2000; Leeuwis 2008; Rivera & Rasheed Sulaiman 2009; Russell et al. 1989; Ruttan 1996; Stephenson 2003; Vanclay & Lawrence 1995), leading to newer approaches such as the farmer first model (Chambers 1988; Chambers & Ghildyal 1985; Chambers & Thrupp 1994; Scoones & Thompson 1994, 2009) and the agricultural innovation systems approach (Brunori et al. 2013; Hall, Dijkman & Sulaiman 2010; Klerkx & Nettle 2013; Klerkx et al. 2012; Klerkx, van Mierlo & Leeuwis 2012; Leeuwis 2008; Nettle, Brightling & Hope 2013; Röling 2009; Veldkamp et al. 2009; Woiceshyn & Eriksson 2014).

Agricultural extension in Australia can be traced back to activities of several agricultural societies operating in the late nineteenth century (Jones & Garforth 1997). It has been hypothesised that growth of extension in Australia has followed a four phase cycle of crisis, high, awakening and unravelling (Hunt et al. 2012), and that we are currently in the unravelling phase. Extension has been identified as contributing to the capacity and resilience of Australia's rural industries (Hunt et al. 2011) and that it helps achieve 'the adoption of beneficial changed practices and innovations' (Marsh, Pannell & Lewellyn 2007, p. 11). It also contributes to capacity building, which is defined as 'increasing the abilities or resources of individuals, organisations and communities to manage change' (Coutts et al. 2005, p. 4). Five models of extension were described by Coutts and Roberts (2003), namely Empowerment and facilitation, Programmed learning, Technological development, Information access, and Consultant/ mentor. A 'partnership model' has been proposed which placed empowered farmer groups at the centre of a process to determine research needs and priorities, so that appropriate research and development was undertaken and the results communicated to farmers (Murray-Prior 2005).

It has been proposed that the 'New extensionist' take on a more global view of extension and advisory services to incorporate an agricultural innovation systems approach. While this will require the development of new capacities, the focus is on expanding interactions to include the wide range of actors critical for innovation, with the aim of increasing the productivity and effectiveness of agricultural systems (Sulaiman & Davis 2012).

1.1.5. eExtension project

The DAFF eExtension project commenced in 2008 as a statewide whole-of-department project aimed to introduce online collaboration technologies into the Department over a four year period. At this time DAFF staff were only just becoming aware of Web 2.0 technologies. The results of a baseline survey at the commencement of the project indicated that the level of awareness of Web 2.0 by the DAFF staff surveyed was only on average 3.8 on a seven point scale, where 1 was *Not at all* and 7 was *Very much*.

The term eExtension was first coined by the author in 2007 (Power 2008) and has since become common terminology. eExtension is defined as 'the use of electronic technologies, especially information and communication technologies (ICT) to enhance face-to-face and paper-based interactions that enable change' (James 2010a, p. 156). If extension is all about change, then eExtension is all about better involving people to enable the change.

The objective of the eExtension project was to introduce the new communication technologies and build the capacity of DAFF extension staff to better utilise them. The project's rationale was that the department needed to better utilise electronic communication technologies so as to better engage with its clients. Better engagement leads to greater levels of adoption in a shorter timeframe, as clients are better supported before, during and after their change (or adoption of innovation) journey. This then maximises the return on investment in research, development and extension. During the project it was always emphasised that ICT approaches should never completely replace face-to-face approaches, but rather complement them. It was maintained that the benefits of eExtension included better engagement and follow up with clients, lower transactional cost (doing more with less) and most importantly, greater likelihood of successful long-term change through better engagement.

As the eExtension project was a whole of department initiative, it targeted staff who worked in the extension service delivery arena from the following business groups: Industry Development, Delivery, Fisheries and Biosecurity. Since extension had moved from being a profession (a job for which one is employed) to a discipline (a body of knowledge that is applied as part of one's work e.g. project management), it was difficult to identify exactly how many people were involved with delivering extension services. Consequently a broad brush approach was used where communication messages went to more than just extension staff, with the expectation that this then included most extension staff.

1.2 The research problem

Despite the worldwide surge in the adoption and use of new technologies as described in the previous section, it is not always a simple matter to introduce a new technology into the workplace. Often a new technology such as web conferencing can be well accepted by the innovators within an organisation, but then very few others adopt the innovation (Moore 2002).

By better understanding the factors that influence the adoption and use of new communication technologies, those working in the Australian agricultural RD&E arena will be better able to utilise these technologies to design and conduct activities

that result in greater adoption of innovations by the farming community. This will then lead to greater efficiencies and profitability for the Australian agricultural sector.

1.2.1. Research setting

Considering the significance of agriculture to the national economy, it is of national importance to explore how the new communication technologies could further improve the Australian agricultural industries. This more flexible and engaging mode of communication could allow greater and quicker levels of adoption and practice change within the Australian agricultural industries, leading to greater economic benefits for the nation.

While Australian agriculture is an important contributor to Australia's economy, it is being pressured by shifting consumer demand, government policy changes, technological advances, environmental concerns and 'an unrelenting decline in the sector's terms of trade' (Productivity Commission 2005, p. 16). These conditions are driving out the less competitive enterprises not able to compete in this demanding environment.

Agricultural productivity has demonstrated strong growth over the last 30 years and was on average more than double that achieved in other sectors. This productivity growth was responsible for the entire increase in output by the agriculture sector over the last 30 years (Productivity Commission 2005). To achieve this, farmers need to continually adopt innovations to ensure their farming practices more profitable and sustainable in the long-term.

Australian government agencies undertake RD&E programs that provide technologies and innovations for farmers to adopt into their farming practices. The latest estimate is that $1.5 billion was invested in 2008/09 by various government agencies in rural research and development in Australia (Productivity Commission 2011).

However, this amount of investment is potentially wasted if the resulting R&D is not appropriately communicated to the wider community and ultimately adopted by farmers. As the Productivity Commission report into the Rural Research and Development Corporations commented, 'No matter how intrinsically valuable a piece of rural R&D, if its outcomes do not result in changed practices, then beyond the knowledge generated, there will be no benefit from that research for the community' (Productivity Commission 2011, p. 104). As it more bluntly points out later in the report when talking about the adoption and dissemination of research outcomes, 'There is no point in undertaking R&D if it is not adopted' (Productivity Commission 2011, p. 186). There is a general frustration by researchers and extension officers in the 'slower than expected adoption levels for agricultural innovations' (Llewellyn 2007, p. 148).

With reducing government budgets, there has been a move away from one-to-one advisory services to the use of mass media and group-based activities. This is especially so in remote communities where the opportunity for face-to-face interaction between producers and government specialists is limited due to the large distances that often need to be travelled and the associated costs involved.

Web 2.0 technologies (such as wikis, blogs and podcasts) are becoming increasingly popular, enabling greater collaboration, engagement and networking (Tapscott & Williams 2006). There has been a dramatic rise in the use of the Internet and social networking in popular culture, so that by the end of 2012, there were a reported 634 million websites (up from 255 million in 2010) and 2.4 billion Internet users (up from 1.97 billion in 2010). On average each day there were 63.8 billion tweets on Twitter (up from 25 billion in 2010) and 1.2 trillion searches on Google (Pingdom 2013). However, these enabling technologies are only just starting to be used in the agricultural arena (Liao, Marshall & Swatman 2012; Thysen 2000), so there is an opportunity for the benefits accrues elsewhere to flow into the Australian RD&E

1.2.2. Research question

This research study focuses on the factors that both positively and negatively influence the adoption of new communication technologies. It builds on the existing research pertaining to barriers to adoption in an agricultural context and explores the application of them in the new domain of Web 2.0 technologies. The boundary of the research is within the Australian rural RD&E system, using Department of Agriculture, Fisheries and Forestry (DAFF) extension officers as a case study. It considers both the internal use within the department and also the external use with those in the farming community.

While the areas of diffusion of innovation and the acceptance of technology by individuals with regards to physical products are reasonably well understood, little work has focused on identifying the key influences that inhibit or promote adoption and use of these new communication technologies. The exceptions include early work by Sonnenwald, Maglaughlin and Whitton (2001) which utilised the Diffusion of innovations theory, the study by Murphrey and Coppernoll (2006) which looked at the adoption of online conferencing, and Hightower et al. (2011) which examined the adoption of the Moodle online course platform. Indeed Peng and Mu (2011, p. 133) stated that 'technology adoption in online social networks remains relatively under-explored'.

The primary research question that will be addressed in this research study is: ***'What factors influence the adoption and use of new communication technologies, and what are the implications for organisations in supporting this change?'***. This will be addressed within the context of the Australian agricultural RD&E system.

1.2.3. Thesis outline

The structure of this thesis is based upon the approach of Perry (1998) and is graphically represented in Figure 12. This first chapter, the introduction, sets the scene of the research, providing the background and outlining the research problem. It introduces the new communication technologies and their rapid and extensive adoption by the general population. An overview of Australian agriculture and agricultural extension is presented to provide the context for this research study. It concludes with presenting the research setting and the key research question to be answered by this study.

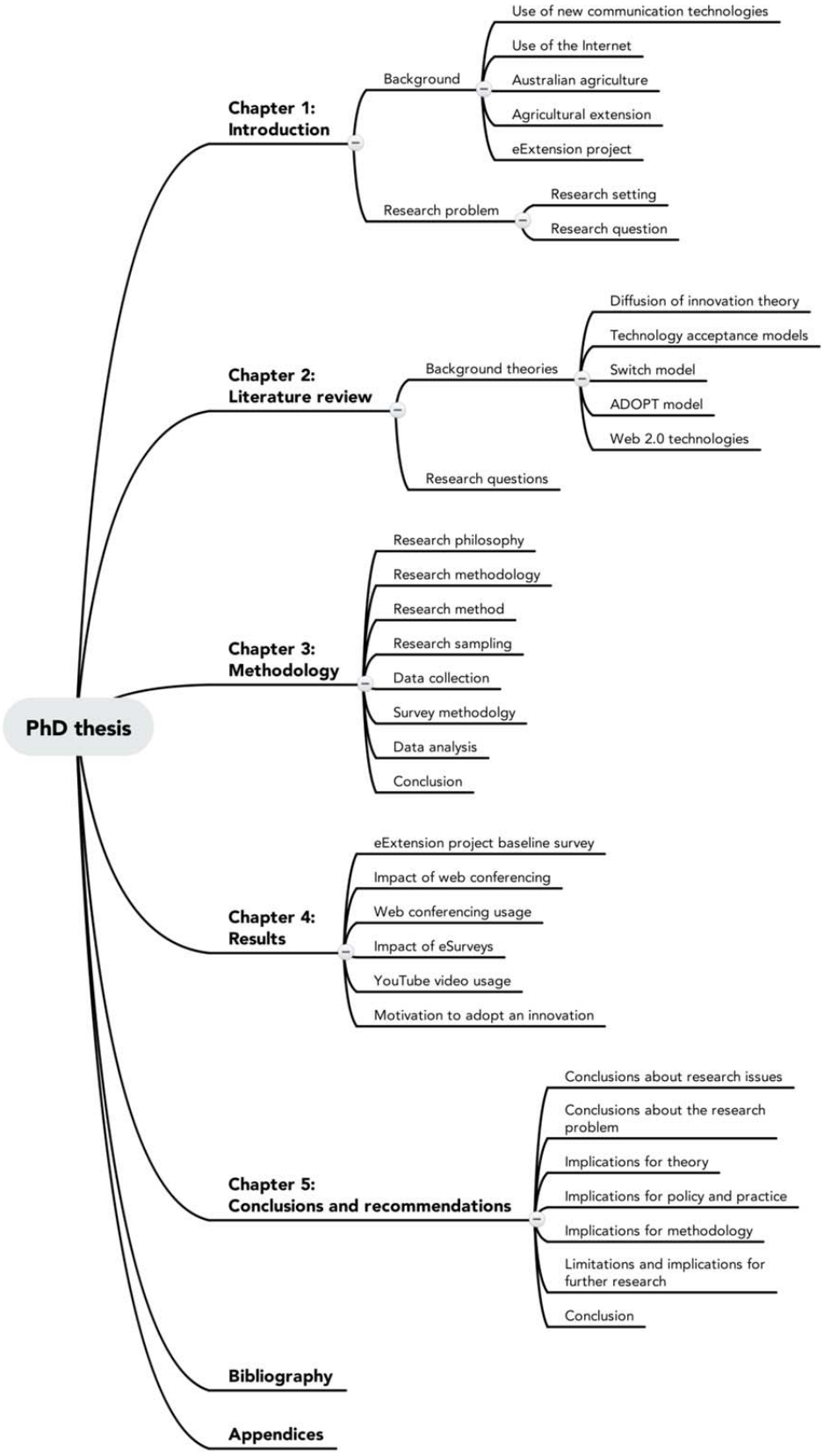


Figure 12. The overall structure of this PhD thesis.

Chapter two provides a review of the literature, exploring the background theories and developing the research questions for this study. The background theories include Diffusion of innovation, Technology acceptance models, the ADOPT model, the Switch model and Web 2.0 technologies. The chapter concludes with the research questions to be explored by this study.

The third chapter outlines the methodology used for the research study. It includes the research philosophy, methodology and methods. It also covers the research sampling, data collection and analysis methods.

Chapter four provides the analysis of the six data sets used in this study. The first data set comes from a baseline study used for the eExtension project, while the next four data sets relate to the use of four communication technologies. The sixth data set refers to a questionnaire designed to ascertain the motivation for adopting an innovation.

The fifth and final chapter considers the conclusions and recommendations arising from this research, including a new model representing the factors that affect the adoption and use of new communication technologies.

The following chapter provides a review of the literature, exploring the background theories and developing the research questions for this study. Unlike other reviews of the literate which often take a singular discipline focus, this one provides an exploration of the published literature regarding adoption theory from four disciplines of knowledge. The background theories include Diffusion of innovation, Technology acceptance models, the Switch model, the ADOPT model and Web 2.0 technologies. The chapter concludes with the research questions to be explored by this study.

This page was deliberately left blank.

2. Literature review

The previous chapter introduced the research study by outlining the new communication technologies, Australian agriculture and agricultural extension. It then introduced the research problem, including the research setting and research question.

One of the criticisms of previous adoption literature reviews has been the 'disciplinary fragmentation' (Pannell & Vanclay 2011, p. 12) where the focus was only on a narrow disciplinary area, such as economics or sociology. This chapter breaks from that tradition and provides an exploration of the published literature surrounding the adoption theory from four disciplines of knowledge and embodies decision-making values. A visual representation of the structure of this chapter is provided in Figure 13. This will prepare a pathway to the subsequent chapter which details the research methodology.

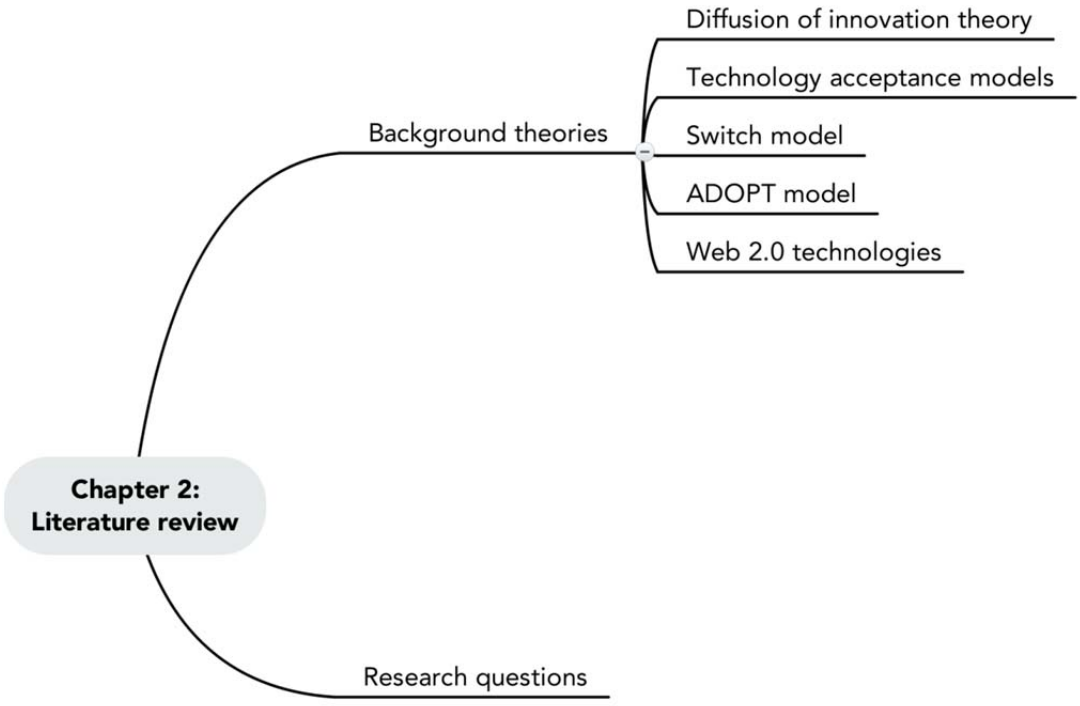


Figure 13. The structure of Chapter 2.

2.1 Background theories

The seminal research that sparked much of the study of adoption behaviour was based upon the rapid adoption of hybrid corn in the early twentieth century. This literature review will start with that study which later developed into the Diffusion of Innovation theory in the rural sociology discipline. It will then explore the Technology Acceptance Models from the information systems discipline, the ADOPT model from the agricultural extension/ economics discipline, and the Switch model from organisational behaviour discipline. The literature review will finish by exploring the Web 2.0 technologies which are the focus of this research project.

2.1.1. Diffusion of Innovation theory

Hybrid corn was released by the Iowa State Agricultural Experiment Station in 1928 and produced a 15 to 20 percent yield advantage over the traditional open-pollinated corn. Other advantages included the stalks being sturdier and therefore more suited to mechanical harvesting which was also becoming popular at that time, and the plants were hardier and more able to tolerate the droughts that affected Iowa in 1934 and 1936 (Rogers 2004). Seed companies initially distributed free packets of seed to farmers in the area (Valente & Rogers 1995). It was so quickly adopted by farmers that by 1940 it was grown by most farmers (Ruttan 1996). The Station funded a rural sociology study to better understand the diffusion process. It involved interviews with 259 farmers from two small communities in Iowa and revealed that the adoption process started with a small number of farmers and then spread to others (Ryan & Gross 1943). The study identified neighbours as the most influential source of information, so that when farmers observed and interacted with those farmers who had already adopted growing hybrid corn, they too started growing it.

Various researchers turned their attention to this interesting phenomenon, but the best known is Everett Rogers. Rogers proposed that there are four elements that influence the spread of a new innovation, namely: the innovation, communication channels, time and the social system, as shown in Figure 14. The innovation, defined as ‘an idea, practice, or object that is perceived as new by an individual or other unit of adoption’ (Rogers 1995, p. 12), has five attributes which affect its rate of adoption (Rogers 1962, 1983, 1995, 2003). The *relative advantage* is the degree to which the potential user perceived the innovation to be better than what it is replacing. The *compatibility* is the degree to which the innovation fits in with the previous values, practices and needs of the potential adopter. The *complexity* is the degree to which the potential adopter perceives the innovation to be difficult to understand and then use. *Trialability* is the degree to which the innovation may be tested or experimented with before full scale use. The *observability* is the degree to which others can easily see the results of the innovation. Rogers contends that innovations that are perceived to have low levels of complexity and high levels of relative advantage, compatibility, trialability and observability, will be more quickly adopted than those that do not.

Rogers (2003) described the following five stages of the innovation-decision process: knowledge, persuasion, decision, implementation and confirmation, as shown in Figure 15. Knowledge occurs when a person becomes aware of an innovation and information about it. Persuasion then occurs when the person forms an attitude (favourable or unfavourable) towards the innovation, as a result of experience and discussion with others. Decision occurs when the choice to accept or reject the innovation is made. Implementation then follows when the innovation is acquired and utilised. The last step, confirmation, occurs when the person obtains positive reinforcement of their decision. This was an advancement on the earlier model by Beal, Rogers and Bohlen (1957), which proposed a five stage sequence to the adoption process: awareness of the existence of the innovation, information seeking, evaluation of the information, trial of the innovation on a small-scale, and adoption of the innovation on a full-scale basis.

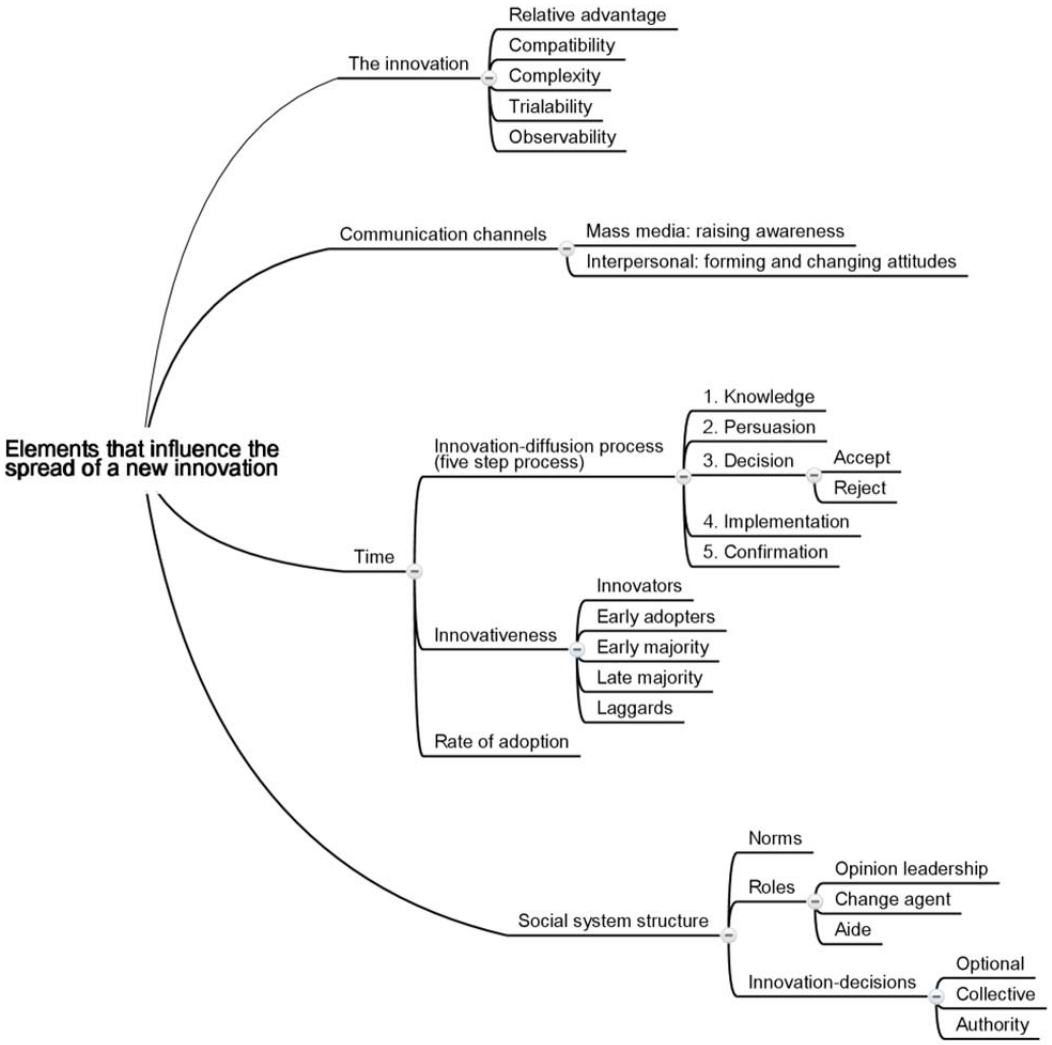


Figure 14. Elements that influence the spread of a new innovation.

Source: Author's summary of Rogers (2003) model.

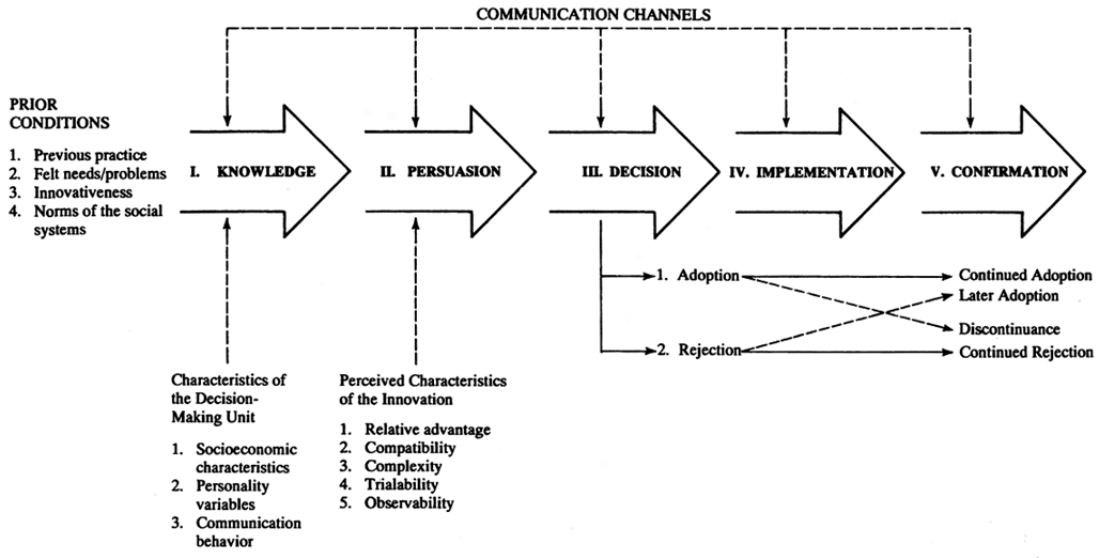


Figure 15. The elements of the Diffusion of Innovations model.

Source: Rogers (1995, p. 170).

As a result of his early research, Rogers postulated that there were five types of people involved in the adoption of innovations and that the population was normally distributed (Rogers 1958). The *Innovators* (comprising 2.5% of the population) are on the cutting edge – looking for new ways of undertaking their work. They generally not only know the latest trend but are actively developing and trialling it. The *Early adopters* (13.5%) are the opinion leaders or visionaries (Moore 2002) who help bridge the gap between the innovators (who are generally not good communicators) and the early majority. The *Early majority* (34%) are those who are generally more careful in making choices than the early adopters, though are still open to change. They focus on the pragmatic reasons for practice change (Moore 2002). The *Late majority* (34%) tend to be quite sceptical of new ideas. They only adopt an innovation when they can see it is already being used successfully by many others. Finally, the *Laggards* (16%) strongly resist the change and may not ever fully adopt the proposed innovation. The distribution of these groups is indicated in Figure 16, where a small number of innovators adopt the innovation, followed by increasing numbers of early adopters and early/ late majority adopters, and finally a small number of laggards.

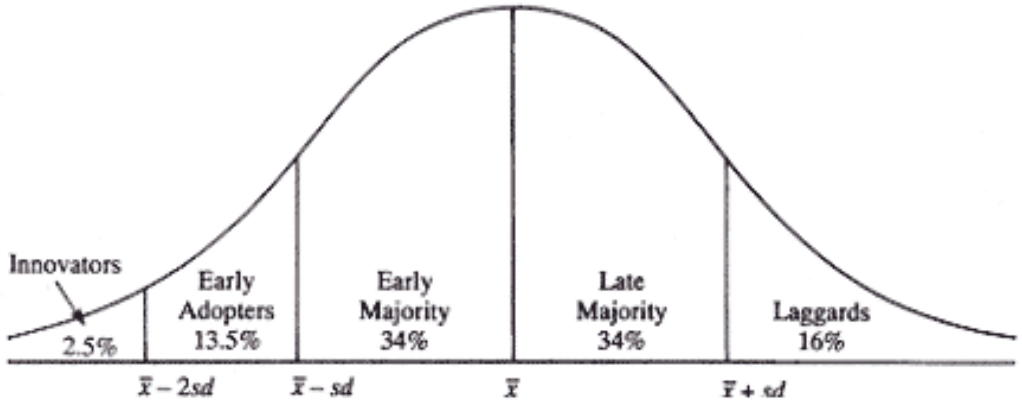


Figure 16. Adopter categorization on the basis of innovativeness.

Source: Rogers 2003, p. 281.

Innovators are characterised as being technology enthusiasts (Moore 2002), younger and having higher incomes (Lionberger 1960), and being more cosmopolitan and having larger operations (Coleman 1957). They rely upon primary sources of information whereas later adopters rely on word of mouth (Ryan & Gross 1943). Over time, the cumulative market share increases to 100%, as each successive adopter category adopts the new innovation. Lionberger (1960) determined that this followed an S or growth curve as shown in Figure 17. The S curve was actually studied back in 1903 by the French sociologist Gabriel Tarde (Rogers 1995, p. 41), though he referred to adoption as ‘imitation’.

Moore and Benbasat (1991) have built on the work of Rogers (1962) and identified the following seven core constructs that can be used to predict the acceptance of information technology by individuals: relative advantage, ease of use, image, visibility, compatibility, results demonstrability and voluntariness of use.

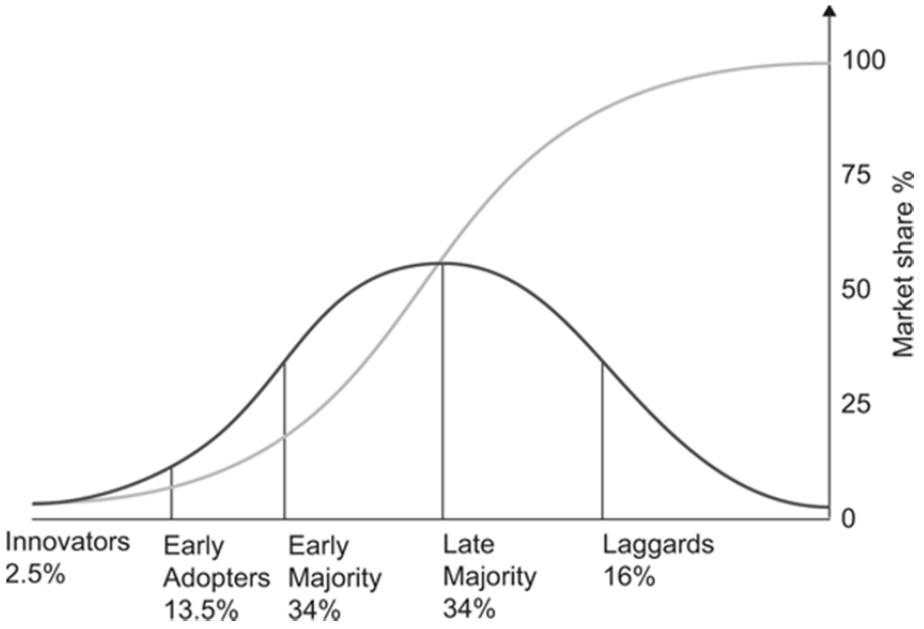


Figure 17. Increase in market share of new adoption.

Source: Based on Rogers (1962) and sourced from Wikipedia (2013c).

Much research has been undertaken to determine the factors that affect the adoption of new practices and this has been covered in extensive reviews (Black 2000; Feder, Just & Zilberman 1985; Feder & Umali 1993; Maunder 1972; Pannell et al. 2006; Vanclay 2004; Vanclay & Lawrence 1995), with most of the research using the Diffusion of innovations theory as a basis. Vanclay (1992) distilled it further and listed the following 10 barriers to adoption: complexity, divisibility, congruence, economics, risk and uncertainty, conflicting information, implementation cost (capital outlay), implementation cost (intellectual outlay), loss of flexibility and physical and social infrastructure.

An Australian study (Guerin & Guerin 1994) identified the following constraints with respect to the adoption of innovations: the extent to which the farmer finds the new technology complex and difficult to understand; how readily observable the outcomes of an adoption are; its financial cost; the farmer's beliefs and opinions towards the technology; the farmer's level of motivation; the farmer's perception of the relevance of the new technology; and the farmer's attitudes towards risk and change. The importance of cost effectiveness was highlighted in a study undertaken in the Philippines, where it was identified as the key factor influencing the adoption decision (Lamban et al. 2011).

An Australian agricultural study by Llewellyn et al. (2005) showed that an improved understanding of the key perceptions influencing adoption decisions can greatly assist the planning and evaluation of an extension program involving technology acceptance. Learning and development activities can then be designed to target these perceptions (and misperceptions) to lead to greater adoption, as shown in Figure 18.

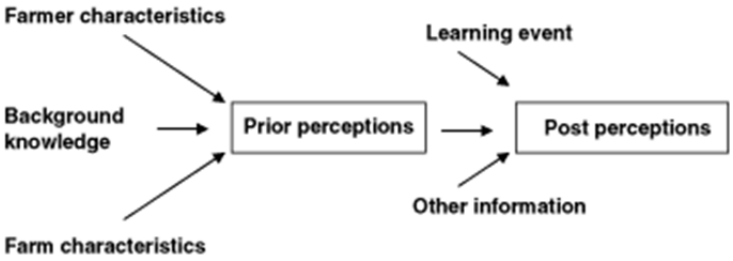


Figure 18. Graphical representation of Llewellyn et al.'s model.

Source: Llewellyn et al. (2005).

Other Australian studies have confirmed that speed of adoption is influenced by the relative advantage of the innovation (Lindner 1987) and other factors such as managerial education, farm size and spatial issues, particularly in the early stages of the diffusion process (Marsh, Pannell & Lindner 2000). Information that is readily available and of high quality, reliability and relevance have been shown to influence adoption of innovations (Baumgart-Getz, Prokopy & Floress 2012; Feder & Umali 1993; Llewellyn 2007; Llewellyn, Vanclay & Pannell 2011; Marsh, Pannell & Lindner 2000). One study described adoption as a 'multi-stage decision process involving information acquisition and learning-by-doing' (Abadi Ghadim & Pannell 1999, p. 145). Studies of conservation tillage have shown that the number of training activities undertaken by farmers is positively associated with the adoption rate (Cary, Webb & Barr 2001; D'Emden, Llewellyn & Burton 2008; Nguyen, Llewellyn & Miyan 2007; Rodriguez et al. 2009) as did the utilisation of consultants (D'Emden, Llewellyn & Burton 2006). In one study it was shown that by increasing the attendance at relevant training events an extra day per year, the likely adoption rate increased by 5% (D'Emden, Llewellyn & Burton 2006).

Another important Australian contribution was to highlight that for any adoption decision, one needs to consider both the extent to which the innovation would deliver the desired outcome and to what degree the decision maker cares about that outcome (Pannell 2014). While these two factors are closely linked, they should be considered separately.

Communication is an important element in the adoption process, as the very fact that some other farmers had adopted the new practice was a stimulus for the remaining ones (Ryan & Gross 1943). This was later described as the *interaction effect* whereby those who have adopted an innovation influence those who have not yet done so (Havens & Rogers 1961).

A recent experiment (Falk et al. 2013) exposed a group of people to several ideas while connected to a functional MRI brain scanner. The results showed that the ideas that people wanted to spread activated a very specific region of the brain, the temporoparietal junction. This area is believed to be involved in thoughts related to what other people think and feel. As people ponder whether to spread an idea or not, they are most likely working through who else they can tell about the innovation. If they are unable to adequately answer that question, then it is unlikely they will spread the idea (Inventium 2013). The results indicate that for an innovation to be widely adopted, the end users need to perceive it as being appealing to their cohorts and want to tell them about it.

Criticisms of model

Roger's model has been applied in over 5000 studies (Rogers 2004) and has generally been accepted and used in agricultural extension (Stephenson 2003), yet there have been a number of criticisms. Rogers believes that 'the progress of a scientific field is helped by realization of its own assumptions, biases, and weaknesses' (Rogers 1995, p. 106) and therefore included a section in his books covering the criticisms. The four main categories of criticisms are pro-innovation bias, individual-blame bias, recall problem, and the issue of equality.

The pro-innovation bias implies that an innovation should indeed be diffused and adopted by all farmers (Rogers & Shoemaker 1971), whereas in reality farmers should only adopt innovations that are appropriate to their situation. This patronising attitude by researchers and advisers is particularly directed at the laggards – those 'recalcitrant farmers who refuse to adopt the new techniques that scientists consider are appropriate' (Vanclay 1992, p. 47).

The individual-blame bias occurs when the blame for non-adoption is put on the farmers, whereas sometimes it is the fault of the extension agent for poor or unclear communication of the innovation. So instead of considering the whole system and the possible influence of external factors, blame is attributed upon the individual (Caplan & Nelson 1973).

The recall problem occurs when adopters of an innovation cannot accurately recall the exact time they adopted the innovation, let alone when they may have first heard about it, which then affects the accuracy of the adoption related data. However research by Mayer et al. (1990) indicates that subjects can accurately recall detail about an event and how they heard about it several weeks afterwards.

The equality issues relate to the socio-economic benefits of an innovation not being equally distributed through a given population and the consequent widening of the socio-economic gap due to the adoption of the innovation. This is possibly the most difficult of the criticisms to be resolved by the researcher (Haider & Kreps 2004). Bordenave (1976) suggests not asking the typical research-style questions, but a much broader set of questions that seek answers to societal issues.

The linearity of Rogers' model has been criticised, as some authors suggest that innovation diffusion is an unstructured, emergent phenomenon (Baskerville & Pries-Heje 2001). Kaine (2008) cautions against using Roger's adoption attributes to estimate the number of potential adopters. His studies showed this often leads to overestimating the size of the potential population of adopters, and underestimating the actual level of uptake. Kaine proposes the relative advantage of an innovation is the key factor limiting the adoption of innovations in agricultural contexts (Kaine et al. 2011).

Another criticism is that it implies that innovativeness is a personal characteristic, yet adopters will often fall into different categories for different innovations (Pannell et al. 2006). So while being a laggard for one innovation, the same adopter may be an early adopter for a different innovation. There is also an issue with the possible negative impacts from the use of the theory. For example, if all farmers grew the same variety of hybrid corn, this mono-culture situation could exacerbate a pest or

disease wiping out all the crops in the entire region, possibly leading to food shortages (Stephenson, 2003).

A challenge to this model is from Moore (2002) who suggests that the adoption curve is not continuous for discontinuous technologies (where adopters are required to substantially change their behaviour or to modify other products and services they use). Rather, there are gaps between each of the segments, and a rather large one referred to as a 'chasm' between Early adopters and the Early majority, as shown in Figure 19.

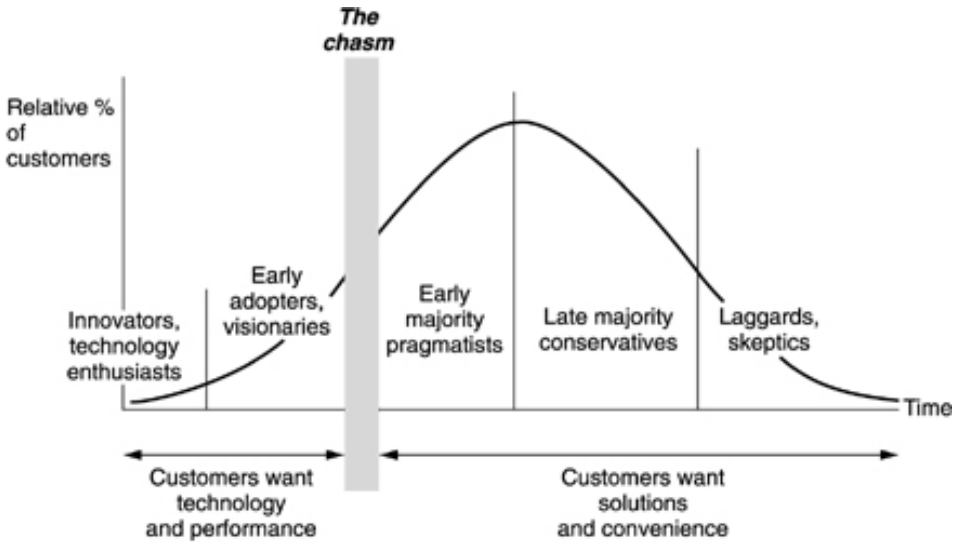


Figure 19. Visual representation of the Chasm.

Source: Norman (1999, p. 33).

This implies there are two separate markets for the product on either side of the chasm. Moore asserts that leading edge adopters are looking for a competitive advantage (e.g. lower product costs, faster time to market) and accept this will involve the pain of changing from the old, established ways to the new, improved ways. They accept that there will be bugs and glitches involved in the change, but they do it so as to gain the business advantage. As Norman (1999, p. 31) says, 'they are willing to suffer the inconvenience and high cost to get it'.

In contrast, the early majority are seeking productivity improvement for existing operations. They want 'evolution, not revolution' (Moore 2002, p. 20), and expect the technology to work with their existing systems without any glitches. While the early majority seek references from other users to validate their purchasing decisions, they do not consider early adopters as suitable references. This catch-22 situation, where the early majority only respect the opinion of other early majority members, means it is difficult for many innovations to survive past the chasm.

While many authors refer to Moore's work (Easingwood, Moxey & Capleton 2006; Ebner, Holzinger & Maurer 2007; Lamb, Frazier & Adams 2008), only a few have tested the hypothesis. An Australian study (Brennan et al. 2007) that investigated the poor adoption of decision support software by farmers tested Moore's hypothesis, but the results were inconclusive.

An alternative to Roger's model for the adoption process over time is the Gartner Hype cycle (Fenn & Linden 2005). As shown in Figure 20, the Hype cycle describes the five stages of how a product is perceived in a market over time. When the technology initially appears in the market (Technology Trigger) there is often hype by the media and industry representatives, even though often no usable products exist and it is commercially unproven. This creates heightened levels of expectations (Peak of Inflated Expectations) in the form of unrealistic projections during which a flurry of publicised activity by technology leaders results in some successes. Then interest wanes as the promised benefits are not realised in practice (Trough of Disillusionment). Once the product is improved to the satisfaction of the early adopters and it shows the real applicability of the technology, more users adopt the technology (Slope of Enlightenment). Finally the uptake stabilises (Plateau of Productivity) and the final height of this plateau is dependent upon the size of the target market (Gartner 2013; Wikipedia 2013g).

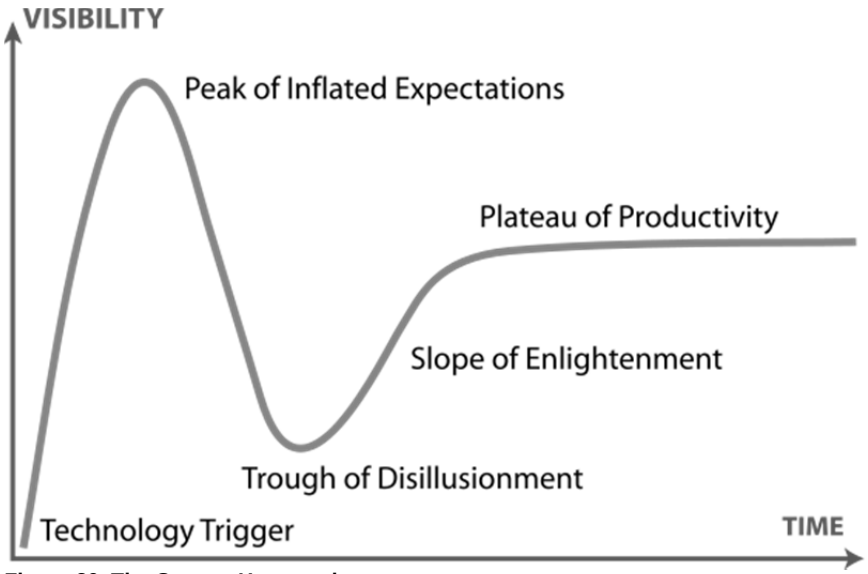


Figure 20. The Gartner Hype cycle.

Source: Wikipedia (2013g).

Despite the criticisms, Rogers' work is generally well accepted by both academics and practitioners in the agricultural science community (Stephenson 2003). While the previous studies provide generic details of adoption, the following section is specific to information technology adoption, which is also relevant to our study of the adoption of modern communication technologies.

2.1.2. Technology acceptance models

The adoption and use of new technology can be viewed from the organisation's perspective and that of the individual (end-user). Several theoretical models attempt to describe the end-user acceptance of innovative technology, as described below.

Theory of Reasoned Action

The Theory of Reasoned Action (TRA), published by Fishbein and Ajzen in 1975, brought 'a compelling and coherent structure on the field of attitudes, which was in relative disarray before their work' (Sheppard, Hartwick & Warshaw 1988, p. 340). It distinguished between beliefs, attitudes, intentions and behaviours, and aimed to

develop a ‘cumulative body of knowledge in the attitude area’ (Fishbein & Ajzen 1975, p. 520). It was based upon the assumption that ‘human beings are usually quite rational and make systematic use of information available to them’ (Ajzen & Fishbein 1980, p. 5). As shown in Figure 21, the TRA model asserts that *Attitude* and the *Subjective norm* indicate intention, which then determines behaviour.

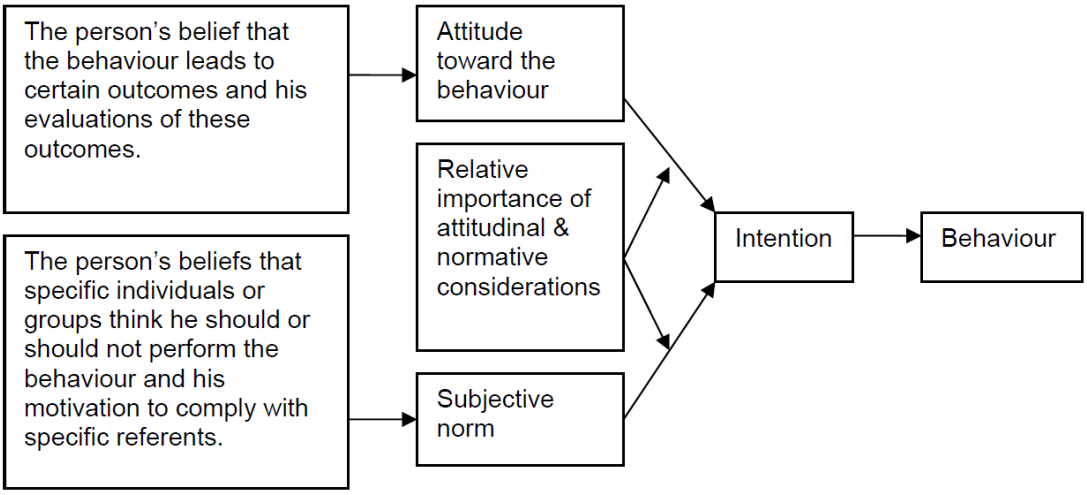


Figure 21. Interaction of the elements of the Theory of Reasoned Action.

Source: Jackson et al. (2006, p. 2).

It is important to note that the model was developed to address behaviours (such as shopping for a new car) and not outcomes from the behaviours (for example owning a new car). It was designed for situations where the target behaviour was under the subjects' volitional control, the situation involved a choice problem, and the intentions of the subject are assessed when they had all of the required information to make a confident intention. Despite this, a detailed meta-analysis determined that the TRA model had strong predictive utility, even when used in situations that did not fall within the original boundary conditions specified for the model (Sheppard, Hartwick & Warshaw 1988). Numerous other studies have confirmed the model as a predictor of an individual’s intention or behaviour (Ajzen & Fishbein 1977, 1980; Charng, Piliavin & Callero 1988; Davis, Bagozzi & Warshaw 1989; Jackson et al. 2006; Madden, Ellen & Ajzen 1992; Sheppard, Hartwick & Warshaw 1988).

Criticisms have included that irrational decisions, habitual actions and other unintentional behaviours are not adequately explained by the model (Ajzen & Fishbein 1980; Fishbein & Ajzen 1975). Also, while it considers the extent the innovation delivers the desired outcome, it does not take into consideration the degree to which the decision maker cares about that particular outcome (Pannell 2014). The model is limited by its reliance upon subjects self-reporting, which may lead to subjective data (Ajzen & Fishbein 1980; Farhoomand, Kira & Williams 1990; Tan & Teo 2000). Despite criticisms (Charng, Piliavin & Callero 1988; Sheppard, Hartwick & Warshaw 1988) it has remained ‘a powerful tool’ (Jackson et al. 2006, p. 6).

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) was published by Ajzen in 1985 in order to overcome some of the deficiencies identified in TRA (Ajzen 1985, 1991; Ajzen & Madden 1986). As shown in Figure 22, the construct *Perceived behavioural control*

was added as a determinant of *Intention* and *Behaviour*. The TPB model has been applied to a variety of situations and technologies (George 2004; Harrison, Mykytyn & Riemenschneider 1997; Mathieson 1991; Taylor & Todd 1995). While this theory has successfully described individual adoption behaviour, it has provided only limited success at the organisational level (Ajzen & Driver 1992; Cheung, Chan & Wong 1999; Madden, Ellen & Ajzen 1992; Randall & Gibson 1991). Like TRA, TPB assumed that individuals used the available information logically with rational decision making. Also like TRA, while it considers the extent the innovation delivers the desired outcome, it does not take into consideration the degree to which the decision maker cares about that particular outcome (Pannell 2014).

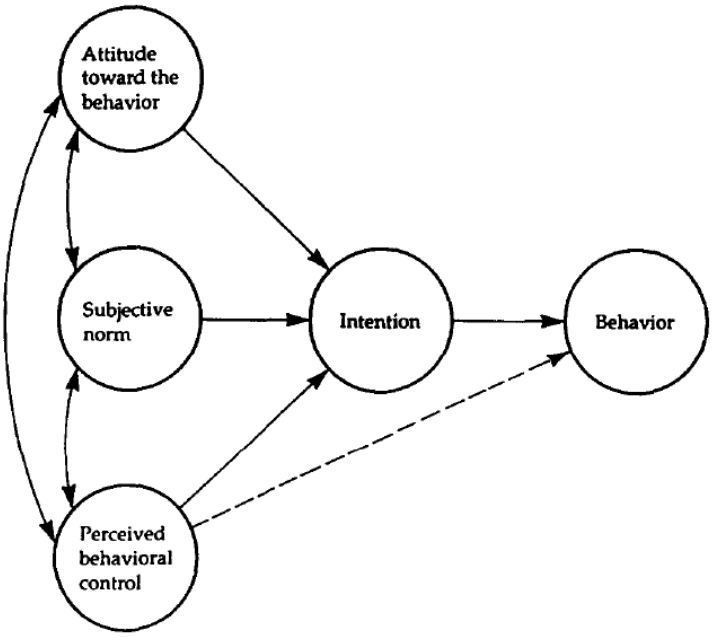


Figure 22. Interaction of the elements of the Theory of Planned Behaviour.

Source: Ajzen (1991, p. 182).

Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed by Davis (1986) as part of his doctoral thesis. It has become the 'leading model in explaining and predicting system use' (Chuttur 2009, p. 2) and the most widely applied model in Information Systems research (Lee, Kozar & Larsen 2003). It provided clarification of user behaviour regarding the acceptance of computer technology and focused on two determinants of actual usage, *Perceived usefulness* and *Perceived ease of use* (Davis 1989) as shown in Figure 23. It was derived from Rogers (1962) work and assumed that technology usage is voluntary. TAM has been commonly used and has been tested in a wide range of situations (Burton-Jones & Hubona 2005; Chuttur 2009; Davis, Bagozzi & Warshaw 1989; Dennis 2003; Hong et al. 2011; Rai, Ravichandran & Samaddar 1998). One criticism relates to its inability to produce clear determinants and that sometimes these are inconsistent (Burton-Jones & Hubona 2005), while another criticism relates to its ignoring of changes in user perceptions and intentions over time (Agarwal & Karahanna 2000). Some TAM studies are criticised for using students and administrative staff for validation, as they have limited computing experience (Hu, Chau & Sheng 2002). An analysis of 101 research studies by Lee, Kozar and Larsen (2003) showed that while the relationship between Perceived usefulness and Behavioural intention is strongly significant

(confirmed by 74 studies), only 58 studies detected a significant relationship between Perceived ease of use and Attitude toward using or Behavioural intention to use. Several healthcare related studies produced findings inconsistent with non-healthcare studies (Spil & Schuring 2006), so further investigation is required to explain this variation (Gururajan 2009).

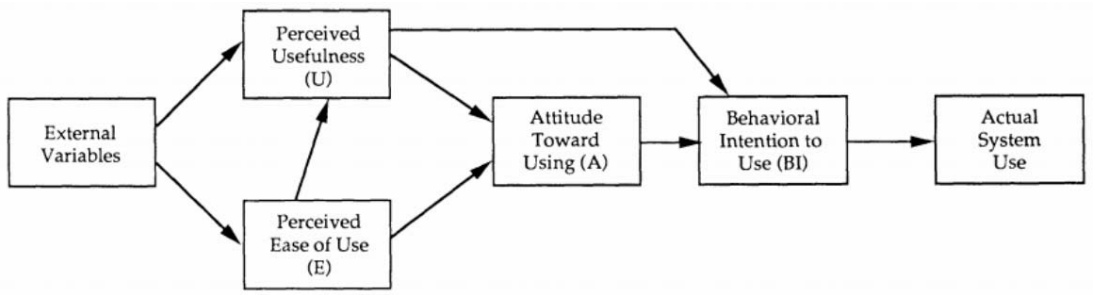


Figure 23. Interaction of the elements of the Technology Acceptance Model.

Source: Davis, Bagozzi and Warshaw (1989, p. 985).

An extension of TAM, referred to as TAM2 (Venkatesh & Davis 2000), added two new processes, namely social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability and perceived usefulness). The extended model has proven useful (Chismar & Wiley-Patton 2002; Holden & Karsh 2010; Legris, Ingham & Collerette 2003; Wu & Wang 2005; Wu et al. 2008) and is shown in Figure 24. However analytical studies have shown that the results using TAM and TAM2 are not totally consistent or clear, suggesting that perhaps significant factors are still missing from the models (Legris, Ingham & Collerette 2003).

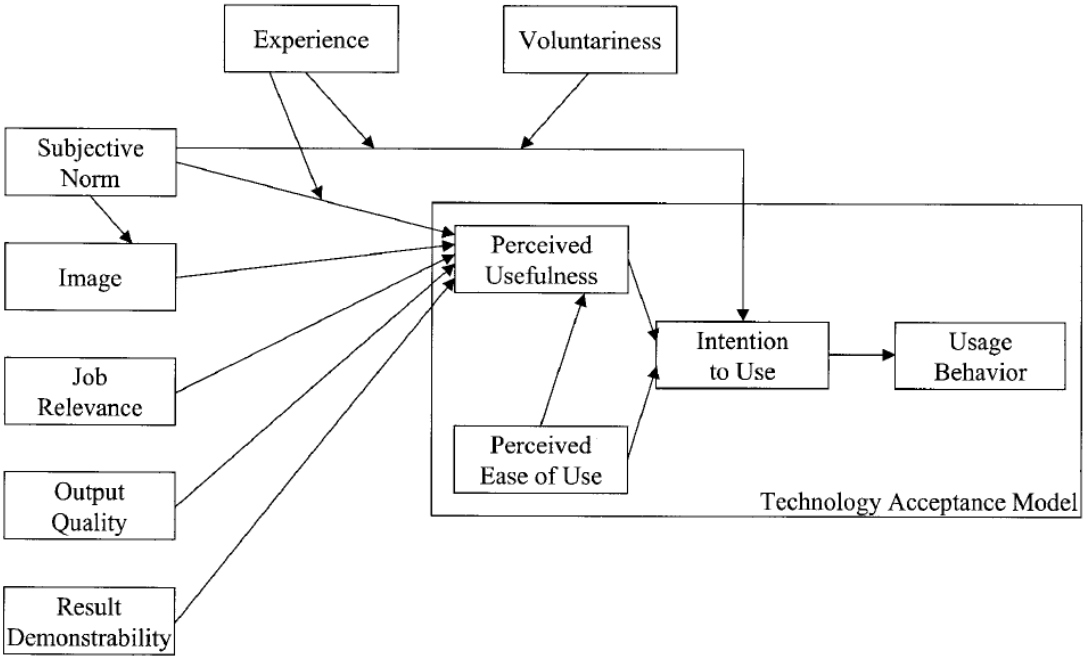


Figure 24. Interaction of the elements of TAM2.

Source: Venkatesh and Davis (2000, p. 188).

A further extension of TAM, referred to as TAM3, was developed in 2008 to better determine how managers can make more informed decisions regarding interventions that lead to greater acceptance and effective utilisation of computer technology (Venkatesh & Bala 2008). This further extension, illustrated in Figure 25, added Anchor and Adjustment as determinants of Perceived ease of use and has proved useful (Behrend et al. 2010; Pynoo et al. 2011; Verkasalo et al. 2010; Wu 2011; Zimmerman et al. 2011). This and other variants of TAM are criticised for not considering 'group, cultural, or social aspects of decision making and usage' (Bagozzi 2007, p. 247).

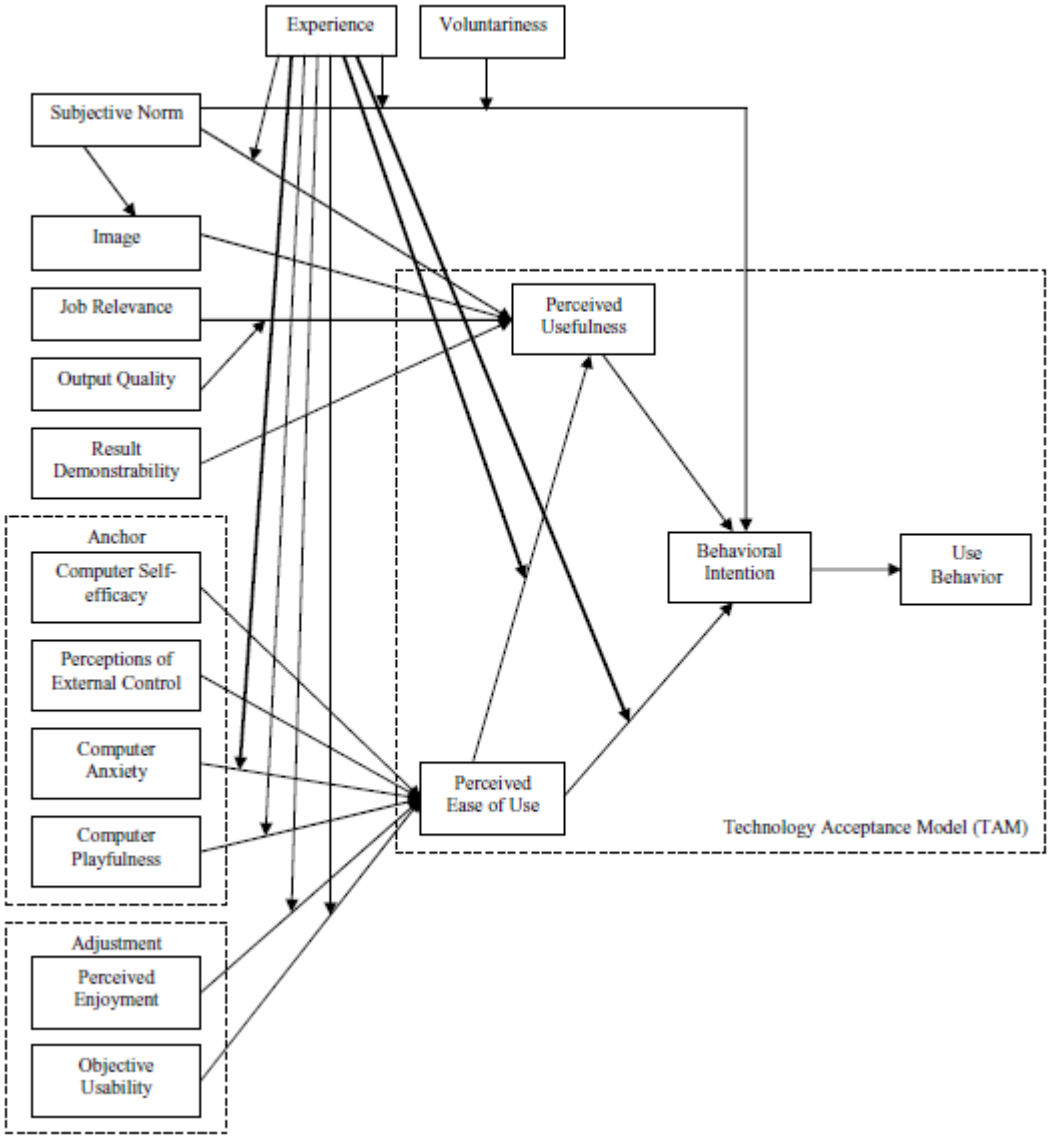


Figure 25. Interaction of the elements of TAM3.

Source: Venkatesh and Bala (2008, p. 280).

Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) model was developed by Venkatesh, Morris, Davis and Davis in 2003. It integrated elements from eight previous models of technology acceptance (Venkatesh et al. 2003), namely: the Theory of Reasoned Action (Davis, Bagozzi & Warshaw 1989), the Technology Acceptance Model (Davis 1989), the Motivational Model (Davis, Bagozzi & Warshaw 1992), the Theory of Planned Behaviour (Ajzen 1991), a combined model of Technology Acceptance Model and Theory of Planned Behaviour (Taylor & Todd 1995), the Model of Personal Computer utilisation (Thompson, Higgins & Howell 1991), the Diffusion of Innovations theory (Rogers 1995), and Social Cognitive Theory (Compeau & Higgins 1995).

As seen in Figure 26, this model has four core determinants of intention and usage and four moderators of key relationships. *Performance expectancy* is defined as the degree to which an individual believes that using the system will help him or her to attain gains in job performance. It is moderated by gender and age, such that the effect will be stronger for men and particularly for younger men. *Effort expectancy* is defined as the degree of ease associated with the use of the system. It is moderated by gender, age, and experience, such that the effect will be stronger for women, particularly younger women, and particularly at early stages of experience.

Social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new system. It is moderated by gender, age, voluntariness, and experience such that the effect will be stronger for women, particularly older women, particularly in mandatory settings in the early stages of experience.

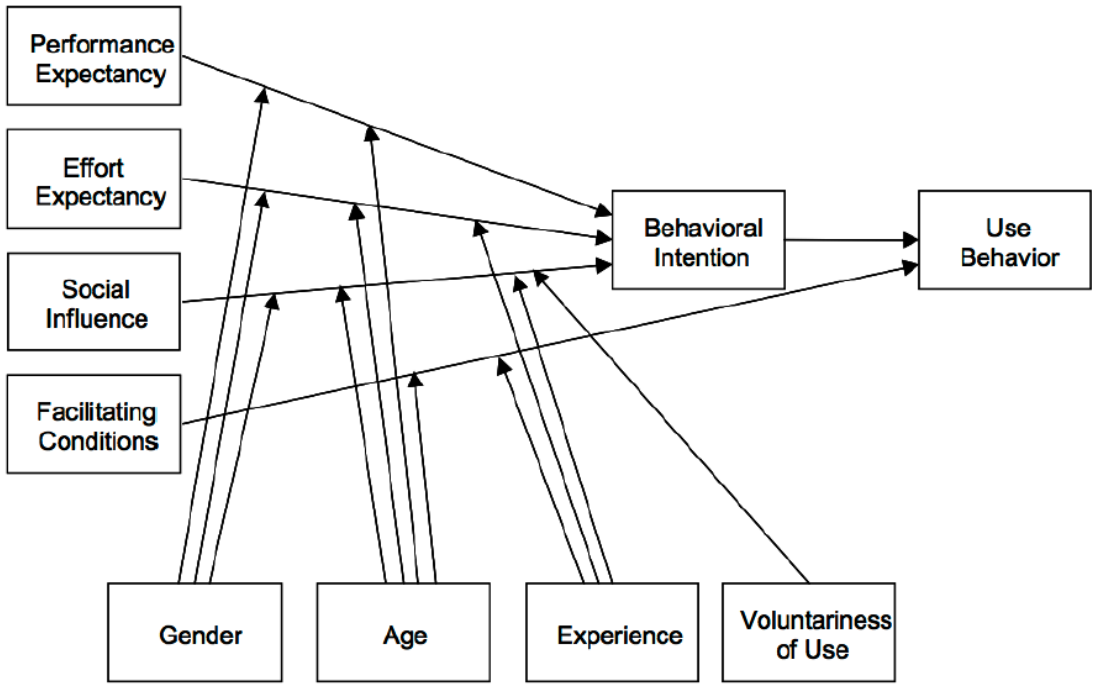


Figure 26. Interaction of the elements of the UTAUT model.

Source: Venkatesh et al. (2003, p. 447).

Finally, the *Facilitating conditions* are defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system. They are moderated by age and experience, such that the effect will be stronger for older workers, particularly with increasing experience. Figure 27 is an annotated summary showing these relationships between the determinants and moderators.

The UTAUT model has been confirmed as being reasonably accurate in determining technology acceptance at an organisational level (Abrahams 2010; Al-Shafi & Weerakkody 2010; Anderson & Schwager 2004; Casey & Wilson-Evered 2012; Godin & Goette 2013; Gruzd, Staves & Wilk 2012; Kidd & Davis 2012; Lakhal, Khechine & Pascot 2013; Lin, Lu & Liu 2013; Robinson 2006; San Martín & Herrero 2012; Yu 2012). However when the four key constructs were tested with undergraduate students' acceptance of blogs, invariant true scores were found for most but not all sub-populations, implying that further testing is required (Li & Kishore 2006). Further study is required regarding the three additional indirect determinants of self-efficacy, anxiety and attitude towards using technology (Carlsson et al. 2006; Cody-Allen & Kishore 2006; Li & Kishore 2006; Robinson 2006). However its complexity is criticised by Bagozzi (2007, p. 245) describing it as a 'model with 41 independent variables for predicting intentions and at least eight independent variables for predicting behaviour'.

The UTAUT model is relevant to this research study as it focuses on the adoption of new technologies, albeit new hardware related technologies. A focus of this research study is to see whether it equally applies to the area of new communication technologies.

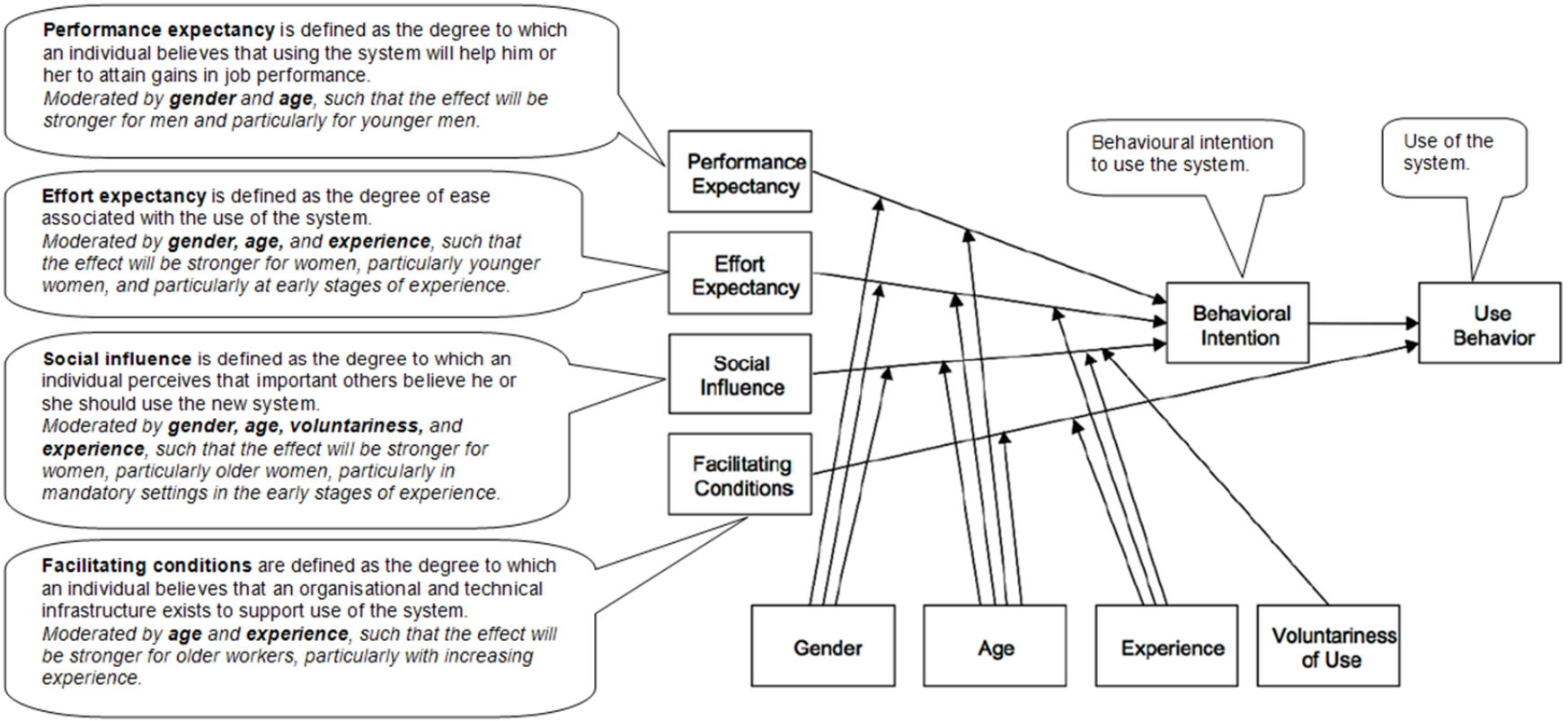


Figure 27. Annotated summary of UTAUT model.

Source: Author's summary based upon Venkatesh et al. (2003, p. 447).

2.1.3. Switch model

A contemporary organisational science model that relates to the area of adoption and change is introduced in the book *Switch: How to change things when change is hard* (Heath & Heath 2010). The Switch model is based on the ancient premise that the human mind is divided into parts that at times conflict. This was described by Plato in The Phaedrus, which was written around 370 BC (Wikipedia 2013a). In this dialogue, Plato used the metaphor of a chariot rider controlling two horses – one essentially good (loving honour and other virtuous characteristics) and the other unruly and difficult to control. Centuries later, Sigmund Freud (1920) published his controversial essay, *Beyond the pleasure principle*. In it he proposed that the mind is divided into three parts: the ego (the rational, conscious self), the superego (the conscience which relates to society's rules and norms) and the id (the desire for immediate pleasure). More recently, Haidt (2006) used the metaphor of an elephant and its rider to represent the divided mind with its automatic and controlled behaviours. The controlled processes (of the rider) are sequential and are represented by language and reasoning, whilst the automatic processing (of the elephant) allows multiple tasks to be processed in parallel and unconsciously. This effect of this unconscious processing has been demonstrated in three separate experiments (Bargh, Chen & Burrows 1996).

Metaphorical concepts are defined as 'those which are understood and structured not merely on their own terms, but rather in terms of other concepts' (Lakoff & Johnson 1980c, p. 195). While previously seen as 'irrational and dangerous' (Lakoff & Johnson 1980b, p. 453), metaphors should be seen as a way to unite 'reason and imagination' (Lakoff & Johnson 1980a, p. 134). The Switch model utilises a metaphorical framework for change, using an Elephant, its Rider and the Path, as shown in Figure 28.

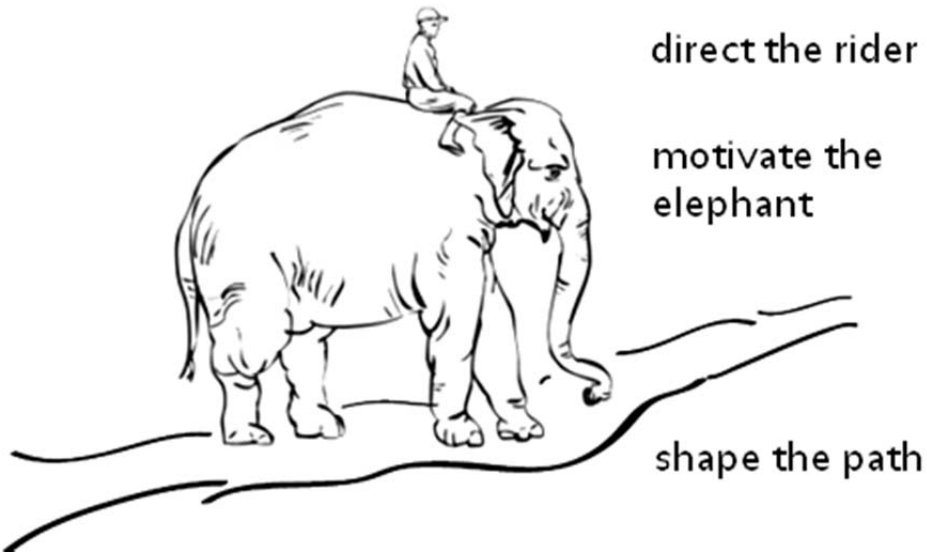


Figure 28. A visual representation of the Switch model.

Source: Modified by author based on Delightability (2011).

The Elephant represents our emotional side, and the Rider our rational side. While the Rider holding the reigns appears to be in control, in reality it is the Elephant with its much larger size. The strengths of the Rider include long-term thinking and planning for the future, whereas the strengths of the Elephant are emotional fortitude

and the energy to get things done. On the other hand, the weaknesses of the Rider include a tendency to over-analyse and over-think situations, resulting in analysis paralysis. The Elephant is often lazy and fickle, looking for instant gratification, undermining the Rider who is willing to suffer short-term sacrifices for long-term benefits.

For effective change, the authors propose that you need to appeal to both the Elephant (which provides the energy) and the Rider (which provides planning and direction). The third element of the model is the Path (the surrounding environment) which considers structural changes that support the desired change. By designing the path to avoid distractions or temptations, it is possible to create a supportive environment for change.

The Switch model effectively comprises three core elements and ten variables, as shown in Figure 29. The ten variables are: find the bright spots, script the critical moves, point to the destination, find the feeling, shrink the change, grow the people, tweak the environment, build habits, rally the herd, and keep the change going.

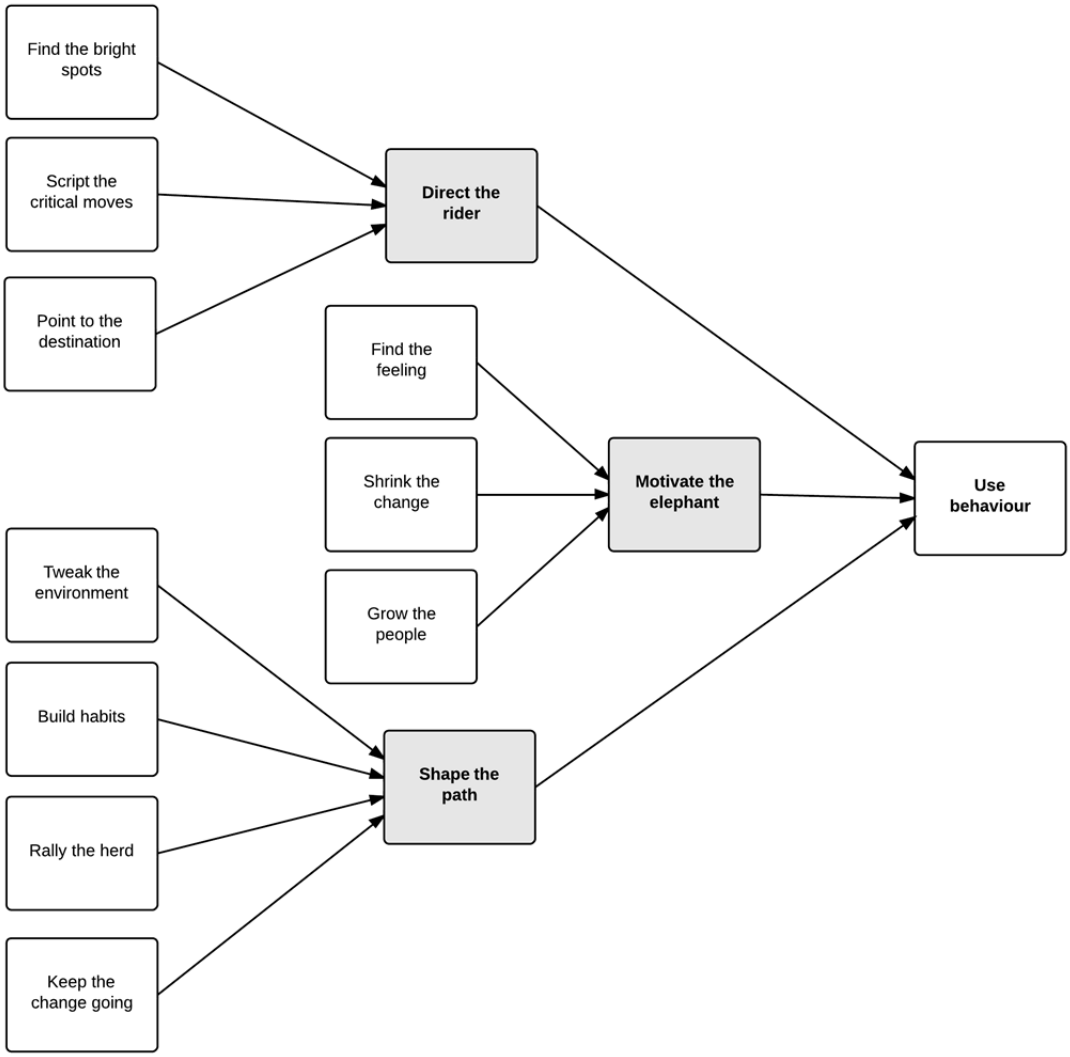


Figure 29. Interaction of the elements of the Switch model.

Source: Created by author based on Heath and Heath (2010).

When directing the Rider, it is important to follow the bright spots, where pockets of successful change already exist, and then replicate it. It is vital to clearly script the critical moves, giving clear, easy-to-follow instructions and state specific behaviours. These should point to the destination, as change is easier when the destination and outcomes are clear. To motivate the Elephant, it is important to identify the emotions that relate to the change, as knowledge on its own is not sufficient to create change. Where possible, the change should be shrunk by breaking it into smaller chunks which no longer spook the Elephant. The authors suggest that when shaping the Path, the environment should be altered since when the situation changes, the behaviour changes. Habits should be built, as when behaviour is habitual it doesn't wear down the Rider. Where possible, connections should be formed with others wanting to undertake similar change, as seeing their changed behaviour is contagious.

A number of authors have used the model (Boucher 2010; Cohen & Green 2013; Cuillier 2012; Davidson et al. 2011; Giluk & Rynes 2012; Hothersall, de Bellis-Ayres & Jordan 2012; Wilkins & Boahen 2013; Witter 2012) and found it useful for their change endeavours. A possible criticism is that it could be categorised as an 'interesting' theory, which by definition is one which attacks the 'taken-for-granted world of their audience' (Davis 1971, p. 311). This can lead to 'nonreplicable findings, fragmented theory, and irrelevance' (Pillutla & Thau 2013, p. 187).

It was included in this study as it represented a different approach to enabling change and could provide a good contrast from the other more mechanical models.

2.1.4. ADOPT model

The Adoption and Diffusion Outcome Prediction Tool (ADOPT) was devised to better estimate the likely extent and rate of adoption of new agricultural practices and technologies (Kuehne et al. 2011a, Kuehne et al. 2011b). It refined the initial work undertaken by Lindner (1987) which categorised previous empirical studies as adoption studies which focused on adopter characteristics, and diffusion studies which focused on innovation characteristics. The ADOPT model splits this into four quadrants, as shown in Figure 30, where the two left-hand quadrants of *Population specific influences on the ability to learn about the innovation* and *Learnability characteristics of the innovation* relate to the time taken to reach the peak adoption level, based on the work of Griliches (1957). The right-hand quadrants of *Relative advantage for the population* and *Relative advantage of the innovation* predominantly influence the peak adoption level, but they also influence the time taken to reach peak adoption through the *Relative advantage* node and the *Short-term constraints* variable (Kuehne et al. 2013).

Like UTAUT, the ADOPT model integrated a number of existing adoption theories and views, namely Lindner (1987), Feder and Umali (1993), Rogers (1995) and Pannell et al. (2006). The tool enables a user to enter their responses to the 22 conceptual framework variables into an Excel spreadsheet, which then calculates the predicted time to peak adoption and the peak adoption level (Pannell 2012). The results are presented as an S-shaped cumulative adoption curve that can then be used to redesign the draft project for greater effectiveness.

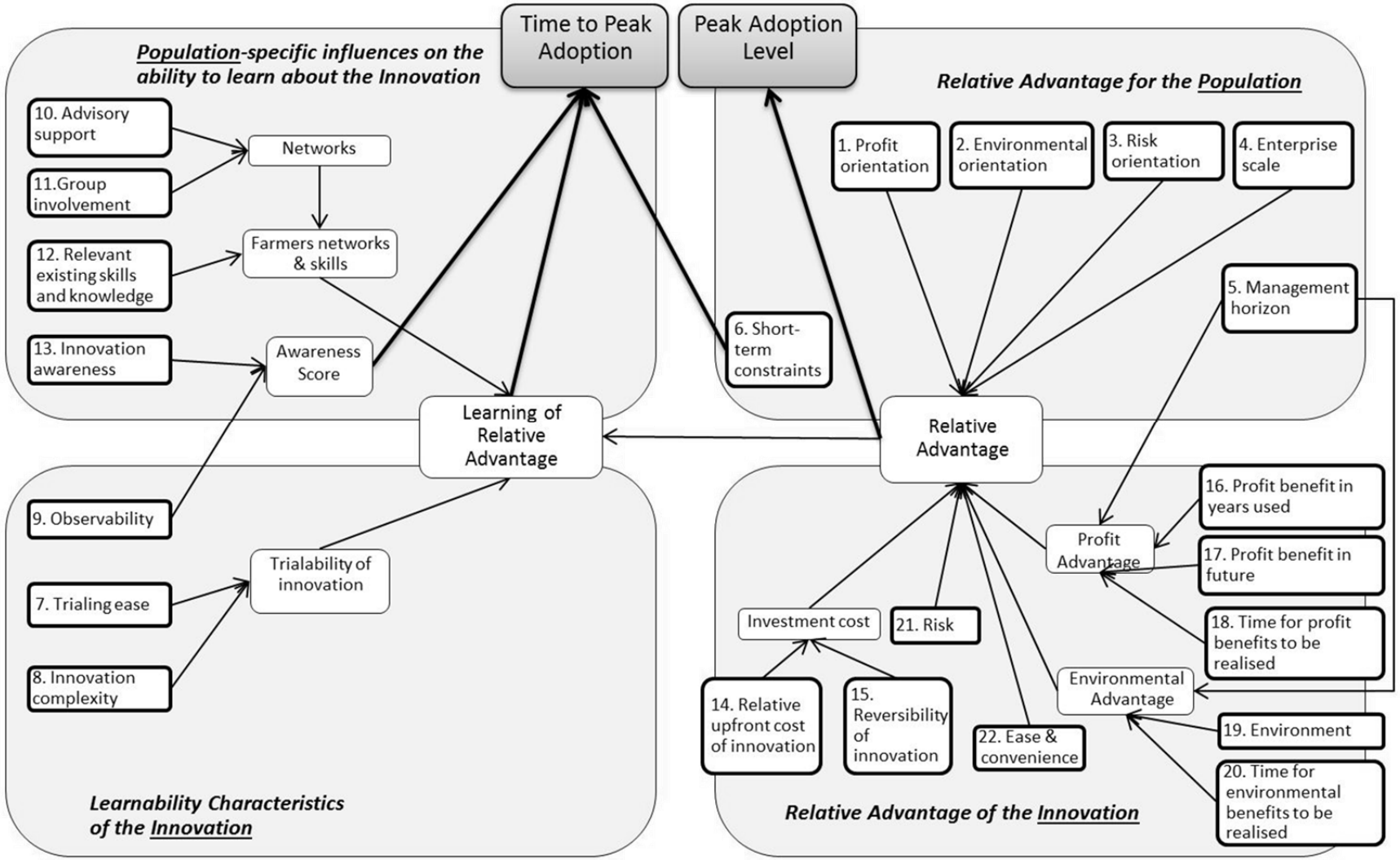


Figure 30. Interaction of the elements of the updated ADOPT model.

Source: Kuhne et al. 2013.

The twenty-two variables in this model and their definitions were:

1. profit orientation (where maximising profit is a strong motivation),
2. environmental orientation (where protecting the natural environment is a strong motivator),
3. risk orientation (where risk minimisation is a strong motivator),
4. enterprise scale (defines the number of farms among the target population that could benefit from adopting the innovation),
5. management horizon (proportion of the target population that has a long-term (greater than ten years) management horizon),
6. short-term constraints (proportion of the target population that is under conditions of severe short-term financial constraints),
7. trialling ease (ease with which innovation can be easily trialled on a limited basis before a decision is made to adopt it on a larger scale),
8. innovation complexity (degree to which the complexity of the innovation allow the effects of its use to be easily evaluated),
9. observability (extent the innovation would be observable to other farmers when it is used in a district),
10. advisory support (proportion of the target population that uses paid advisors capable of providing advice relevant to the innovation),
11. group involvement (proportion of the target population participate in farmer-based groups that discuss farming),
12. relevant existing skills and knowledge (proportion of the target population that will need to develop substantial new skills and knowledge to use the innovation),
13. innovation awareness (proportion of the target population that would be aware of the use or trialling of the innovation in their district),
14. relative upfront cost of innovation (the size of the up-front cost of the investment relative to the potential annual benefit),
15. reversibility of innovation (the extent the adoption of the innovation is able to be reversed),
16. profit benefit in years used (extent the use of the innovation is likely to affect the profitability of the farm business in the years that it is used),
17. profit benefit in future (extent the use of the innovation is likely to have additional effects on the future profitability of the farm business),
18. time for profit benefits to be realised (time after the innovation is first adopted that it would take for effects on future profitability to be realised),
19. environment (extent the use of the innovation would have environmental benefits or costs),
20. time for environmental benefits to be realised (time after the innovation is first adopted that it would take for the expected environmental benefits to be realised),
21. risk (extent the use of the innovation would affect the exposure of the farm business to risk), and finally,
22. ease and convenience (extent the use of the innovation would affect the ease and convenience of the management of the farm).

The ADOPT tool was designed to help reduce the chances of ‘poor investment returns and unsatisfactory or illusory on-ground benefits’ in agricultural RD&E projects (Kuehne et al. 2011a, p. 2) . It was tested against 28 ex-ante projects and continues to be tested for reliability (Kuehne et al. 2011b) . No specific criticisms have been found in the published literature to date.

While the ADOPT model is relatively new, it was included in this research study due to its integration of several existing models and its relevance to the agricultural extension sector.

Summary

The previous nine models are summarised in Table 3, which shows the authors, publication dates, background and criticisms for each of the models.

The preceding models generally relate to the adoption and use of physical products, such as hybrid corn seed (Diffusion of innovation model), digital health care and telecommunication products (Technology acceptance models and the Switch model), and agricultural products and practices (ADOPT model). However this research study focuses on the adoption of Web 2.0 collaboration technologies, which are generally intangible products and services. The next section focuses on the attributes and categorisation of these technologies.

Table 3. Summary of models being considered.

Source: Created by the author for this study.

Model	Author/s	Year	Background	Criticisms/ weaknesses
Diffusion of Innovation (DoI)	Rogers	1962	Has been used in over 5000 studies worldwide.	Accused of a pro-innovation bias, individual-blame bias, recall problems, issues of equality, the linear approach, that innovativeness is a personal characteristic, and that the adoption curve is not continuous but has gaps (chasms) between the segments.
Theory of Reasoned Action (TRA)	Fishbein and Ajzen	1975	First model to consider attitudes, distinguishing between beliefs, attitudes, intentions and behaviours.	Criticised for addressing behaviours not outcomes, and irrational decisions, habitual actions and other unintentional behaviours are not explained by the model. Does not take into account the degree to which the decision maker cares about the outcome. Limited by the subject's self-reporting. Assumes people are rational and make systematic use of information available to them.
Theory of Planned Behaviour (TPB)	Ajzen	1985	Built upon TRA adding perceived behavioural control as a construct.	Provided only limited success in organisational settings. Assumes people are rational and make systematic use of information available to them. Does not take into account the degree to which the decision maker cares about the outcome.
Technology Acceptance Model (TAM)	Davis	1986	Derived from TRA. Most widely used model in Information Systems research. Introduced Perceived usefulness and Perceived ease of use.	Unable to produce clear determinants which are sometimes inconsistent. Ignores changes in user perceptions and intentions overtime.
TAM2	Venkatesh and Davis	2000	Added Social influence processes and Cognitive instrumental processes.	Results can be inconsistent and unclear.

Model	Author/s	Year	Background	Criticisms/ weaknesses
TAM3	Venkatesh and Bala	2008	Added Anchor and Adjustment as determinants of Perceived ease of use.	Doesn't consider group, cultural, or social aspects of decision making and usage.
Unified Theory of Acceptance and Use of Technology (UTAUT)	Venkatesh, Morris, Davis and Davis	2003	Designed as a parsimonious model, integrating 8 previous models.	Its complexity is criticised due to its 41 independent variables for predicting intentions and at least eight independent variables for predicting behaviour.
Switch model	Heath and Heath	2010	A relatively new concept but based on work by Plato and Freud. Coming from an organisational science discipline, this metaphorical model considers the psychological aspects to change.	Could be criticised for being more 'interesting' than theoretical, which could lead to non-replicable findings.
Adoption and Diffusion Outcome Prediction Tool (ADOPT)	Kuehne, Llewellyn, Pannell, Wilkinson, Dolling and Ewing	2011	Another relatively new model that integrates a number of earlier adoption and diffusion models. This electronic tool was designed to estimate the likely extent and rate of adoption of a new agricultural practice/ technology, based on the user's response to 22 conceptual framework variables.	No specific criticisms have been found in the published literature to date.

2.1.5. Web 2.0 technologies

As outlined in the introductory chapter, the Internet has moved from being a very large collection of static information (a virtual library) to being a large collection of people interacting and collaborating online (Madden & Fox 2006). This 'new' Internet is being referred to as Web 2.0 (O'Reilly 2007) to indicate the significant change that has occurred. Web 2.0 technologies or new communication technologies are enabling online sharing, collaboration and networking. These 'weapons of mass collaboration' (Tapscott & Williams 2006, p. 11) allow organisations to better engage, connect and interact – with minimal cost and time commitment.

Research by Li and Bernoff (2008) categorised people by the way in which they participate in these activities into six categories: inactives, spectators, joiners, collectors, critics and creators. These are sequential and are depicted as the Social technographics ladder, shown in Figure 31. Each step on the ladder indicates a group of people more involved than the previous steps.

A survey by Bernoff (2008) indicated that Spectators are by far the largest group, involving 69% of American online adults. This is in comparison to the 21% of the same group who are Creators.

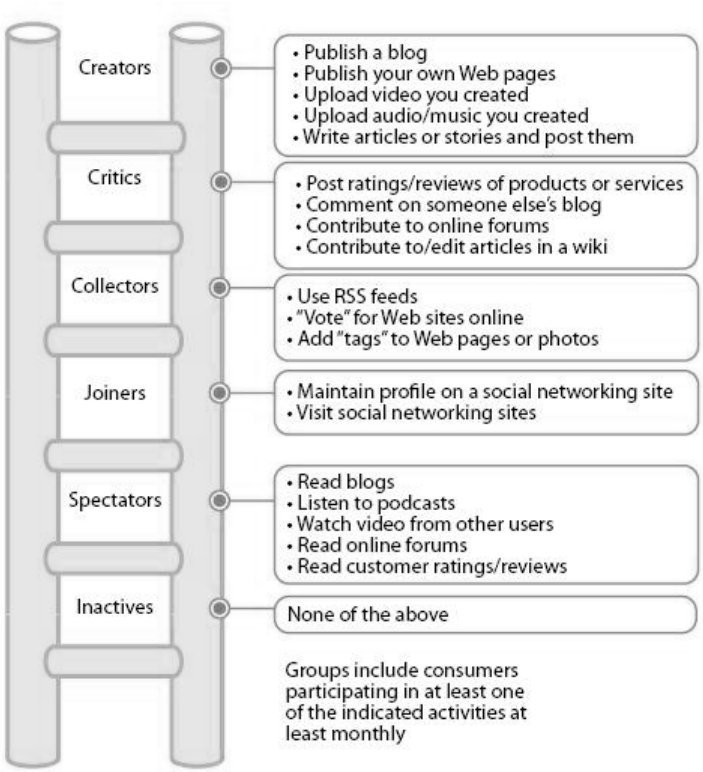


Figure 31. The social technographics ladder.

Source: Li and Bernoff (2008).

The increase in the usage of the Internet by American adults has steadily increased from only 14% in June 1995 to 85% in May 2013 (Zickuhr 2013), as depicted in Figure 32.

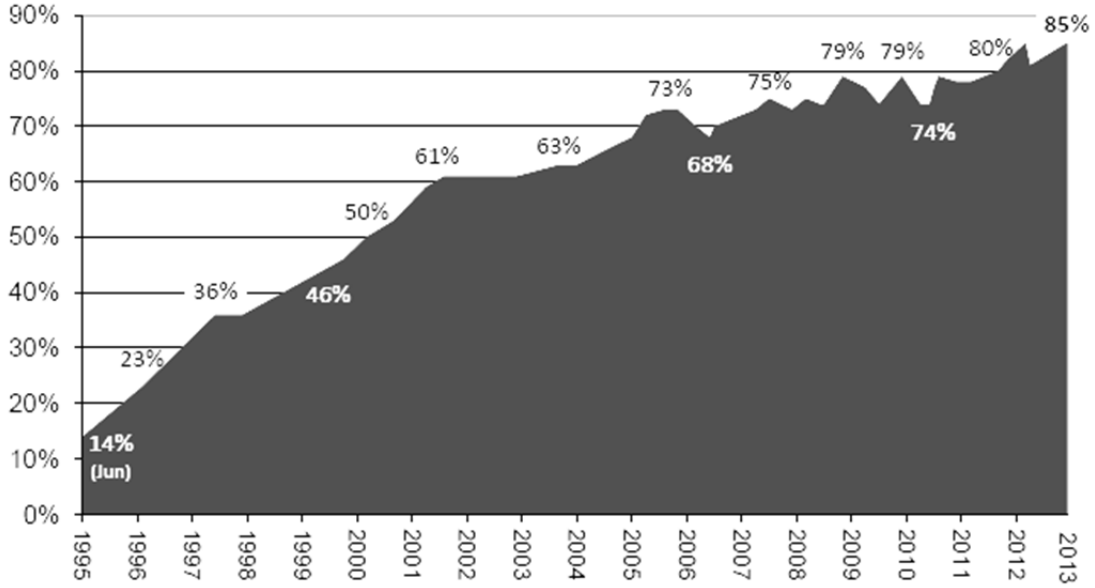


Figure 32. Increase in Internet adoption from 1995 to 2013.

Source: Zickuhr (2013, p. 4).

Of the 15% of American adults in May 2013 aged 18 and older who did not use the internet or email, 34% thought the internet was not relevant to them, 32% felt that the internet was not very easy to use, 19% cited the expense of owning a computer or paying for an internet connection, and finally 7% had a physical lack of availability or access to the internet (Zickuhr 2013).

Categorisation of Web 2.0 technologies

There is already a 'bewildering array' of Web 2.0 tools available (James 2010c, p. 167), and this is growing at an almost exponential rate (Tapscott & Williams 2006). There appears to be significant overlap with what various eTools offer to do, and this has created a confusing environment for users to make informed choices. In an attempt to simplify the situation, the most common eTools were categorised using a matrix of one-way versus two-way communication and text versus audio-visual communication (James 2010c). The more common Web 2.0 technologies are categorised in Table 4 using this approach.

Table 4. Categorisation of Web 2.0 technologies.

Source: Modified by author based on James (2010c, p. 168).

Communication approach	Examples of Web 2.0 technology
One way communication	
One-way text	Web page, Targeted email campaign, SMS messaging
One-way audio-visual	Podcast, Webcast, YouTube video
Two way communication	
Two-way text	Blog, eSurvey, Wiki, Twitter
Two-way audio-visual	Webinar/ web conference, Social networking

One-way communication

One-way text

Communicating an urgent message to a target audience in a timely, cost effective manner is often difficult. For example, the Equine influenza outbreak in Australia in August 2007 (Kirkland et al. 2011) required various government departments to share information as quickly as possible with members of the public to dispel myths and rumours (Callinan 2008). While media releases to newspapers were extensively used, the final content of each article was at the discretion of newspaper editor. Paid advertising could overcome this problem, but it is an expensive option. If printed fact sheets or similar were used, a significant time lag (for graphic design, production of proofs and then the printing and distribution of the material) needs to be factored in, as this can take several weeks.

This is where a simple **web page** can be an effective means of communication, as once the material is written it can be available for viewing within minutes and is accessible to millions of viewers (Wikipedia 2013i). While web pages are not as personal or engaging as other means of electronic communication, they are still far better than the absence of quality information which can raise unfounded fears and concerns. They are an example of 'pull technology'(Mowery & Rosenberg 1979, p. 108), which expect the user to take the initiative to visit the pages to gain the desired information.

In contrast, a 'push technology' (Coombs, Saviotti & Walsh 1987, p. 95) actively sends information to the user. If the email addresses of a target audience (such as members of an industry group) are known, then a **targeted email campaign** can be used. These allow a series of smaller, personalised communications to be sent on a regular basis using proprietary software. It is desirable to use a segmented database, so that specific, relevant messages are sent to sub-groups of the overall audience. In the Equine influenza example, messages could have been customised based on geographic location or work role (such as veterinarian, racehorse owner or pony club member).

Short Message Service, now popularly known as **SMS messaging**, allows users to create and send messages of up to 160 characters via mobile phones (Wikipedia 2013h). They can be used to deliver short, often time critical, messages in times of emergency when time is of the essence (Aloudat & Michael 2011).

One-way audio/ visual

The use of **podcasts** or other sound files allow an audience to hear the presenter's voice and other sound effects (Clark, Taylor & Westcott 2012). This adds a more personal touch, so the audience can hear the tonal intonations which can add to the understanding of the material. It may also help the audience to better connect with the person making the announcement and so have greater empathy with them. Podcasting bypasses traditional radio and printed media outlets to reach news consumers directly (Fannin 2006). Yet a study by Rhoades and Aue (2010) indicated that agricultural media outlets were rarely using blogs to share information with their audiences.

Webcasts and **YouTube videos** are similar to podcasts but include a video component so the viewer can see a moving picture of the person speaking or the

subject matter being discussed. This allows the audience to better engage with the presenter, as they can read their body language and see product demonstrations in real life, which can then lead to various levels of behavioural change (Thomas 2011).

Two-way communication

Two-way text

The previous methods only allowed one-way communication, from the sender to the receiver. The addition of a feedback loop is important to allow the recipient to clarify aspects of uncertainty and to raise issues relevant to their situation. This helps the communication to be better understood and of greater relevance to the audience.

A **blog** (shortened from 'web log') is a website that has dated entries in reverse chronological order about a particular topic and is similar to an online diary or personal journal where the author expresses their opinion on a topic (Wikipedia 2013j). Readers are able to respond by adding their own comments to what has been written. While the bulk of the material is text based, it is possible to also add audio, graphic and video files, depending on the capabilities of the hosting system. A possible disadvantage of using a blog is that it enables opposing views to be published alongside the original viewpoint. While the blog owner can choose not to display the messages they don't like, etiquette is that only rude or offensive messages are removed. Blogs have been demonstrated to be effective for increasing engagement with target groups (Ivala & Gachago 2012).

eSurveys allow users to easily create questionnaires to gather quantitative and qualitative data. They are faster, simpler and cheaper than paper-based surveys (Bethlehem & Biffignandi 2011), and without the time delay of printing the questionnaires, mailing them out, waiting for them to be returned and then entering the data with its associated risk of data entry error (Wikipedia 2013f). It has been estimated that an eSurvey can be designed, distributed and analysed within six working days, compared to approximately six weeks for a paper-based survey (James 2010c). A concern for some possible respondents is the perceived lack of anonymity to their responses, to the extent that it prevents them from submitting their responses (Schultz & Schultz 2010).

A **wiki**, named by Ward Cunningham from the Hawaiian word meaning quick (Cunningham 2013), is a website that enables multiple authors to collaboratively edit and easily contribute their content to an often much larger collection of knowledge. An example is Wikipedia (www.wikipedia.org), which as of 8 January 2014 had 4,418,753 articles in English, with articles from 286 other languages as well (Wikipedia 2014a). The quality of the content of Wikipedia articles has been shown to be exceptionally high. A study by Reavley et al. (2012) assessed the currency, breadth of coverage, referencing and readability of ten topics from 16 sources. Wikipedia was the most highly rated across all topics and in all domains except readability. A study by Kane (2011) determined that the quality of this peer-produced information was positively influenced by the content shaping activities of other collaborators and the depth of top contributor experience. However the involvement of anonymous contributors and the breadth of top contributor experience negatively affected the quality. Large organisations such as the United Nations use wikis for their knowledge management processes, both internally and externally with great success (Bennett 2007).

Twitter is a social networking service that allows users to send messages using up to 140 characters to those who have chosen to follow them on Twitter. This microblogging service allows registered users to read, post and retweet messages, but unregistered users can only read them (Wikipedia 2013e). Kwak et al. (2010) determined that the majority of topics shared tended to be headline or persistent news, and that a retweeted tweet reached an average of 1000 users regardless the number of followers of the original tweet. Once retweeted, a message was retweeted almost instantly within four hops from the source, which indicated fast diffusion of information after the first retweet. Research by Cha et al. (2010) found that indegree (number of followers) represented only a user's popularity, not their influence, while the number of retweets indicated the content value of a tweet, and the number of mentions was driven by the name value of the user.

Two-way audio/visual

A **webinar** or **web conference** is a means of collaborating with others using a computer, a web-cam, microphone and Internet access (Verma & Singh 2010). This system allows those involved in the meeting to interact verbally and visually, and easily share electronic documents. Nelson (2011) demonstrated that webinar-based instruction was as effective as classroom instruction in achieving learning outcomes. A comprehensive study (Verma & Singh 2010) assessed the effectiveness of a series of 59 webinars delivered to 509 colleges across India, which involved 1147 faculty members and 22,527 students. Using webinars instead of face-to-face delivery saved money due to reduced travel, increased the number of lecturers able to deliver material and increased the geographic reach of the training by 39%. The saving from a one hour web conference with ten participants from regional centres around Queensland was estimated to save 60 hours of travel time (approx $6000, in associated salaries), over $2500 of airfares and over 3 metric tonnes of CO_2 (James 2010b). Over the course of a two year trial, it was estimated that DAFF saved $2.1 million and over 763 tonnes of CO_2 (James 2011).

An example of **social networking** in popular culture is Second Life, an Internet-based virtual world with more than 21.3 million accounts (Wikipedia 2014b). It offers 'unlimited possibilities for extending the real-world into the virtual world' (Mayrath et al. 2011, p. 139). Players (known as residents) can assume the form of animated characters (known as avatars). Over 70 percent of these residents purchase virtual products, primarily to satisfy their social needs (such as prestige, status, uniqueness, and conformity) (Animesh et al. 2011). Virtual worlds offer a new educational approaches to enhance participant learning outcomes beyond the more traditional online and face-to-face activities (Wiecha et al. 2010). Virtual worlds have been described as the 'ultimate manifestation of Social Media' (Kaplan & Haenlein 2010, p. 64), due to their high level of social presence and media richness.

These Web 2.0 technologies are somewhat different from the traditional technologies referred to in the technology adoption models. The traditional technologies, such as computer hardware and healthcare devices, are more tangible and therefore visible to others in the vicinity. Whereas an early adopter using an eSurvey would be virtually unnoticed by the user of a paper-based survey. Their use may only become apparent during conversations or other interactions between the early adopters and yet-to-adopters. Another difference is that many of the new technologies are free to use, though they do require access to certain facilities (e.g. smartphone, computer or

Internet). While some of the technology adoption models have been applied to computer software which is similar to Web 2.0 technologies, the benefits accruing from the use of the new communication technologies are not as easy to quantify as for example a word processing program.

2.2 Research questions

The primary research question to be addressed by this research study is: ***'What factors influence the adoption and use of new communication technologies, and what are the implications for organisations in supporting this change?'***. As a result of the review of the literature, the following secondary research questions were identified:

- What are the factors that promote or inhibit the use of Web 2.0 collaboration technologies?
- What are the benefits derived from the use of these modern technologies?
- Which existing model (if any) best predicts the adoption and use of Web 2.0 collaboration technologies?
- Is it possible to design a new model that incorporates the best elements from the existing four models?
- What are the implications for supporting the use of these new technologies?

As noted earlier, this will be undertaken within the context of the Australian agricultural RD&E system.

The next chapter will focus on the research methodology that was utilised for this study. It will include the research philosophy and methodology, the sampling and data collection, the research methods, survey methodology and data analysis.

3. Methodology

The previous chapter explored and summarised the key theories and models from four discipline areas, so as to help us better understand the theories around the adoption and use of new technologies. That review provided a springboard for this current research study, as it highlighted the gaps in the current understanding and helped identify the key research questions for this study.

This chapter on research methodology details the research philosophy, theoretical foundation and research framework for this research project. It details the methodology and the associated methods and techniques used for data collection and analysis, as illustrated in Figure 33.

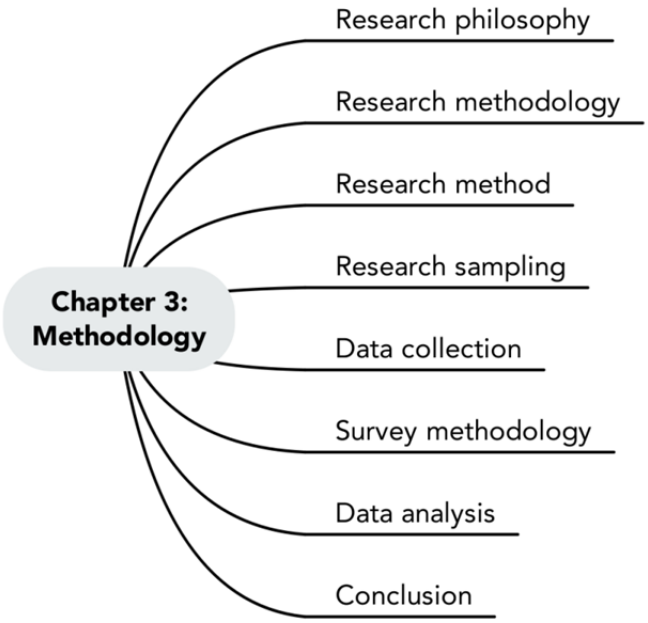


Figure 33. The structure of Chapter 3.

3.1 Research philosophy

As ‘no research can take place in a philosophical vacuum’ (Murray & Overton 2003, p. 3) it is important to clarify one’s research paradigm – the ‘model or framework for observation and understanding, which shapes both what we see and how we understand it’ (Babbie 2004, p. 33). An inquiry paradigm, like a pair of tinted glasses (Covey 2004), defines how a researcher perceives their inquiry and what is included within its boundary (Guba & Lincoln 1994).

This research study focuses on the way individuals view and use Web 2.0 technologies. The literature review highlighted many of the human and technological factors that influence the adoption or use of technologies in a range of contexts. It is this human – technology interaction that underpins this research.

The author approached this research with a view that the uptake of Web 2.0 technologies by individuals will be strongly influenced by their past experiences and the way they view the world – as much as the ‘objective’ characteristics of the

technologies themselves. As such there is a need to understand these views and experiences through their eyes to be able to develop theory and useful models of intervention.

For this reason the author chose surveys which used Likert-type scales to allow respondents to reflect the intensity of their views and experiences – combined with open-ended questions to understand what was behind such a rating. These open-ended questions enabled unbiased and non-leading information to be gathered.

The researcher also had a strong involvement in the process of encouraging the use of the Web 2.0 technologies in this group of people. His own observations and reflections on such involvement can add a richness and context to the research. However, because of such close involvement, he chose to use statistical analyses to more 'objectively' analyse the quantitative data gathered from the Likert-type scales to see where the trends and differences lie. This combination of qualitative immersion and quantitative standing apart provides the mix of analyses and perspectives the author sees as critical in getting a deep and defensible understanding of these phenomena.

3.2 Research methodology

A case study approach (Flyvbjerg 2006), based on a series of related web-based surveys which collected both quantitative data (in the form of respondents using a scale to indicate their usage or views related to the technologies and issues under investigation) and qualitative data, was used for this research study.

The surveys used in this research, while predominantly quantitative in nature, were also designed to collect qualitative data to provide a richer picture of the respondent's perceptions. Qualitative research focuses on the qualities of the items being studied and the processes involved (Flick 2007), and stresses the 'socially constructed nature of reality' (Denzin & Lincoln 2011, p. 10). Much of the quantitative data was collected using Likert-type scales which allowed the respondents to express their responses in a quick and consistent manner. These were then able to be compared with those of other respondents, bearing in mind the results are more rankings and that a rating of seven on one person's scale may be a five on someone else's. The resultant data were then able to be analysed in conjunction with the responses from the qualitative open ended questions, which often provided a context for why particular ratings were provided by the respondent.

The qualitative approach considers the *emic*, or insider's perspectives, as opposed to the *etic*, or outsider's view in other research approaches (Merriam 1998). An *insider* is someone who is similar to their informants in many respects, while the *outsider* differs substantially from their informants (Hay 2005). In this project, the researcher was considered an insider as he was an extension officer within DAFF, and shared many of the organisational interests and outcomes as the members of his study.

A broad focus was initially used to better understand the research situation, and as data were collected, analysed and interpreted, further more focused explorations were designed and undertaken. These explorations included using a slightly different approach for each of the three communication technologies, and with each of the different target groups. This emergent research process allowed the questions to be

thoroughly investigated in a focused yet flexible manner. It provided a balance between problem solving actions and data-driven research, and enabled greater understanding of underlying causes. This process allowed emergent findings from research to inform and shape the next round of research.

Using both quantitative and qualitative data collection and analysis has been described as a *bricolage* (Kincheloe 2001; Lincoln 2001) where the researcher uses a range of different investigative techniques to develop a 'pieced-together set of representations' (Denzin & Lincoln 2011, p. 4) to meet the needs of a complex situation. Originating from the French word, *bricoleur*, it refers to a handyman making the best use of the materials available (Levi-Strauss 1966). Others refer to this as mixed methods (Creswell 2011; Plano Clark et al. 2008; Teddlie & Tashakkori 2003, 2011).

Internal validity considers how closely the research findings match reality (Merriam 1998). In this research study, the validity was strengthened by the use of triangulation from multiple data sources(Creswell & Miller 2000). Perhaps more importantly, the use of multiple case studies instead of a single one strengthened the 'precision, the validity, and the stability of the findings' (Miles & Huberman 1994, p. 29). For case studies, it has been suggested that triangulation should not be a 'technological solution for ensuring validity' but rather a 'holistic understanding' of the situation, so as to construct 'plausible explanations about the phenomenon being studied' (Mathison 1988, p. 17), which is the approach taken by the author of this research study. Instead of using a single data set for the study, six data sets were used to provide a clearer, broader picture of the phenomena being studied. Within those six data sets, both surveys and observation were utilised to gather the data, to give greater clarity to the picture and to minimise possible distortion coming from a single method.

Other writers discuss the 'absurdity of validity' and instead argue for 'understanding' (Wolcott 1994, p. 364). A post-modern approach to triangulation is to consider qualitative inquiry as a crystal with multiple lenses (Ellingson 2009). Crystallisation integrates 'multiple forms of analysis and genres of representation into a coherent text' and produces 'thick, complex interpretation' (Denzin 2012, p. 84).

Reliability, which relates to how well the research results can be replicated, is 'problematic in the social sciences simply because human behaviour is never static' (Merriam 1998, p. 205). In qualitative research, the aim is to describe and ascribe meaning to experiences, and since there are many interpretations of the event, there is no benchmark from which to take repeated measures and so establish reliability in the traditional positivist sense (Merriam 1998). Instead it is better to consider the dependability or consistency of the research results (Lincoln & Guba 1985). Thus the focus of this research is not repeatability but whether the results are indeed consistent with the data collected during the study (Merriam 1998). An audit trail showing how results were derived (Dey 1993) should describe the data collection methods, how categories were created, and other critical decisions during the research project; which is done in this research study.

Since qualitative researchers are 'guests in the private spaces of the world' (Stake 1994, p. 244), they need to behave well and abide by a strict ethics code. The ethics

of observation can be seen as a continuum, where observing public events is at the end of least susceptibility to ethical violations, observing moments of privacy in public situations is at the midpoint, and at the other extreme and most open to ethical violation is 'spying on private behaviour' (Webb et al. 1981, p. 148). In this research project most of the observation centred around public situations and private behaviour was not recorded. When selecting the data to analyse and report upon, there is the conscious and unconscious opportunity for the researcher to exclude data that does not support their argument (Merriam 1998) or to give a particular explanation to an outcome (Burns 1997). Therefore in this research project, all data was used, even if the responses to some survey questions were incomplete.

Merriam (1998) also points out that respondent anonymity is an important factor to consider, especially in case studies where the identity of the participant could be easily guessed by those close to the situation. One should provide anonymity to respondents who unwittingly expose their identities with their responses. This was applied to the survey responses reported upon in this research, so where a respondent inadvertently identified themselves, the identity was removed from the report. When interacting with participants, it is important to be aware of their potential involuntary participation, lack of informed consent, and their deception of the true nature of the research lest it contaminate the results (Burns 1997). Thus in this research project, the potential respondents were reminded of the voluntary nature of their involvement, so that no one should have felt forced to respond.

3.3 Research sampling

This research study primarily used selective whole population, non-probability sampling which allowed the process and relationship questions to be answered (Honigmann 1982). Using selective sampling allowed the selection of the most useful participants for the purpose of their study, in this case DAFF extension officers. Due to the moderate population size, and knowing that it was unlikely that all would respond to survey invitations, whole population sampling was utilised to maximise the number of responses.

Two levels of sample size are required in case study research: that referring to the case itself, and the sampling within the case (Merriam 1998). In this research study, the case boundary related to the adoption and use of new communication technologies by DAFF extension officers. An information-orientated selection process (Flyvbjerg 2011) was used for the selection of the different cases, so as to maximise the likelihood of gaining useful information relevant to this research study. So of all the different work the researcher was involved with during his leadership of the eExtension project, the following three cases were chosen: eSurveys (one-way text), YouTube videos (one-way audio-visual), and web-conferences (two-way audio-visual). This is represented diagrammatically in Figure 34. The categorisation was based on the matrix referred to in Section 2.1.5 (Web 2.0 technologies).

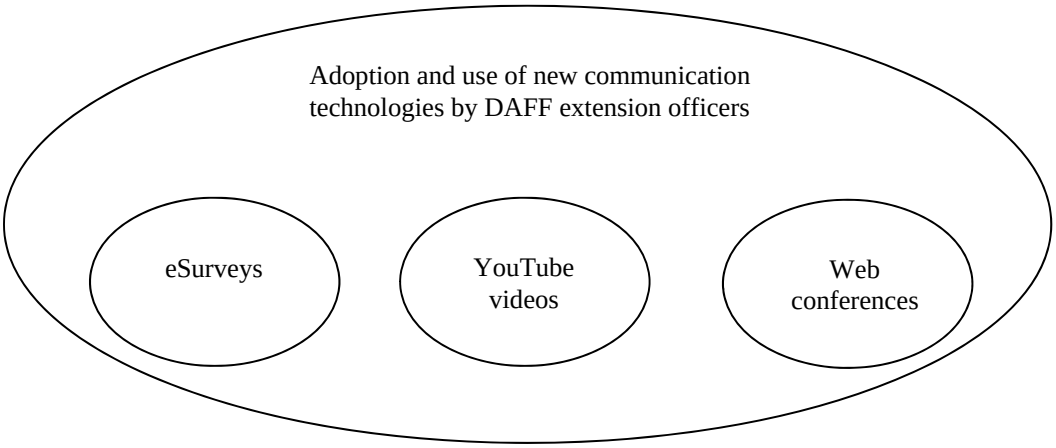


Figure 34. Case study sampling.

Source: Prepared by the author for this study.

The participants were invited to be involved in this research project as part of their DAFF work program and all were known to have access to the Internet. The staff were located across Queensland and were part of the following existing groups:

- DAFF extension officers (approximately 300)
- The DAFF eExtension project interest group (approximately 150)
- DAFF FutureBeef staff group (approximately 40)
- DAFF staff involved with the Leading Sheep project which was trialling some of the Web 2.0 technologies with sheep producers (approximately 6).

There was some overlap between the membership of the groups, which is depicted in Figure 35.

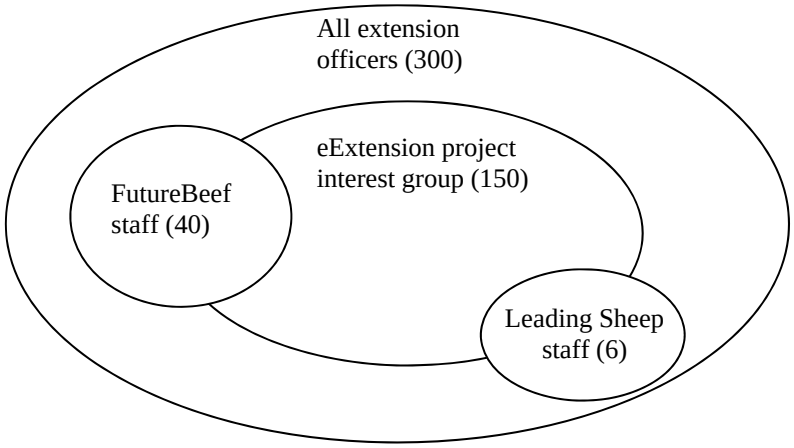


Figure 35. Relationship between sample groups.

Source: Prepared by the author for this study.

Even though whole populations were sampled, the respondents were self-selecting due to the voluntary nature of the survey response. So there is potential for non-response bias, where the answers of those who did not respond to the survey may have had different feelings and perceptions from those who did. For example, those extension officers who were already actively using eTools may have been more

likely to complete the survey than those who were not doing so. Similarly, those who were more comfortable using computer technology and online surveys may have been more likely to respond. To alleviate the effects of these biases, as many respondents as possible were encouraged to complete the surveys by the researcher sending a reminder email approximately 10 days after the initial request.

It is important to note that the results from the convenience sampling used in this study are not necessarily able to be generalised. So even if we now know more about our sample group's behaviour, we may not be able to make inferences about the wider population. However, the insights they provide allow us to gain an understanding and develop theories around the phenomena being studied. The higher the response rate from our sample, then the higher the confidence that the views received are representative.

3.4 Data collection

Much of the data in this research project was gathered to determine respondent's attitudes. There is still contention as to what is actually meant by attitude (Fielding 1986), despite the initial work by Thurstone (1928) being published over 80 years ago. While it can cover values, opinions and dispositions, for the purpose of this research study, attitude will simply refer to the way people feel about an issue (Simmons 2001).

Since case studies have no pre-set methods for data collection (Merriam 1998), it was a matter of choosing ones appropriate to the research situation. Surveys and observation were chosen as suitable methods for data collection for this research study, as they were time efficient and allowed the collection of rich data sets.

3.4.1. Surveys

The primary method for data collection in this research project was online surveys which gathered both quantitative and qualitative data. Control of behavioural events was not required and the study focused on contemporary events, so surveys were a more appropriate research technique than an experiment, archival analysis or historical studies (Yin 2003). All the research participants had ready access to the Internet as part of their work program, so use of online surveys was considered appropriate.

Itemised rating scales can be used to measure attitude, and two common non-comparative scaling techniques are the semantic differential scale and the Likert [pronounced lick-ert, not like-ert (Wuensch 2005)] scale. Both of these methods use self-reporting mechanisms, which are relatively quick and low cost ways to assess psychological constructs such as attitudes (Manstead & Semin 2001).

The semantic differential scale (Osgood 1956) asks questionnaire respondents to indicate their attitude as a relative position on a scale between two bipolar adjectives, such as good and evil. This is undertaken by placing a mark (usually a tick or a cross) in one of the spaces on each of the rating scales (Friborg, Martinussen & Rosenvinge 2006). The ratings are then scored and the scale scores are summed (or averaged) to obtain an overall index of attitude (Cross 2005). A strength of the semantic differential scale is the ease and speed with which it can be used (Manstead & Semin 2001).

The Likert scale has become the most widely used attitude measure employed in survey research (Cvent 2011). Likert (1932) developed a series of questions with five response alternatives: strongly approve, approve, undecided, disapprove, and strongly disapprove. These are often visually presented as a five-point bi-polar scale with appropriate labels under each point on the line. The combined responses from the series of question items when summed create an attitudinal measurement scale. It is important to note that Likert himself did not analyse individual items, but the combined sum of the items (Boone Jr & Boone 2012). One of the strengths of the Likert scale is its ability to capture different aspects of attitude, ranging from beliefs through to behaviour (Manstead & Semin 2001).

The effect of using 'neutral' or 'undecided' as the midpoint on a 5-point, agree/ disagree Likert-type scale was shown to be negligible and that little erosion of score resulted from use of either term (Armstrong 1987). An Australian study (Dawes 2008) looked at the effect of using five, seven and 10-point scales. The results indicate very little difference regarding the variation about the mean, skewness or kurtosis. However, while the five and seven-point scales produced the same mean as each other (after re-scaling), the 10-point scale produced slightly lower relative means (in this case by 0.3 scale points).

Technically speaking, the term Likert scale should only be used to describe a question which is measuring the strength of agreement across four or more uni-directional attitude statements, with an odd number of response items (ranging from strongly disagree to strongly agree), that have been scaled and the central point indicates neutrality; in which case it should be referred to as a Likert-type scale or an ordered response scale (Wuensch 2005). Despite his name being associated with a scale utilising a series of closed questions, he strongly advocated for open-ended questions (Converse 1984).

In this research study, Likert-type scales enabled the researcher to capture the weight of the respondent's view or level of agreement. Seven-point Likert-type scales (with 1 as low and 7 as high) and open-ended questions were utilised to ensure that the data collected was as rich and thick as possible. Seven-point scales were chosen for this study to provide greater scope of responses than five-point scales. Results from the five surveys shown in Table 5 were used in this study.

Table 5. Summary of surveys used in this research study.

Survey	Date	Population	Responses	Anonymous	% response
eExtension project baseline survey	Feb 2012	426	119	No	28%
Impact of web conferencing	July 2011	119	56	Yes	47%
Impact of eSurveys	July 2011	94	47	Yes	50%
YouTube video training workshop	May 2011	50	39	No	78%
Motivation to adopt an innovation	Aug 2012	260	94	Yes	36%

3.5 Research method

The predominant research method used in this research study was a case study approach, plus some observation.

3.5.1. Case studies

Case studies are defined by Thomas, G. (2011, p. 513) as 'analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods. The case that is the *subject* of the inquiry will be an instance of a class of phenomena that provides an analytical frame – an *object* – within which the study is conducted and which the case illuminates and explicates'. Bromley (1990, p. 302) states it more simply as 'systematic inquiry into an event or a set of related events which aims to describe and explain the phenomenon of interest'. The case is considered to be a 'phenomenon of some sort occurring in a bounded context' (Miles & Huberman 1994, p. 25), and it can range from an individual through to an organisation (Zucker 2009).

Ludwig von Bertalanffy (1973) in his classic work *General System Theory*, outlines why the laws and methods of physics should not be applied to social phenomena. Physics deals with closed systems which are isolated from their external environment. Humans and other organisms are essentially open systems which continuously interact with their environment. Case studies allow a holistic view of a process, as opposed to a 'reductionist-fragmented view that is so often preferred' (Patton & Appelbaum 2003, p. 63). According to the holistic view, the whole is not identical to the sum of its parts, so the whole can only be understood by studying it in its entirety (Gummesson 2000).

Even though case studies have been used for over a hundred years (Patton & Appelbaum 2003), they are seen by some as a 'weak sibling among social science methods' (Yin 2003, p. xiii) and there is general confusion and controversy regarding their use (Merriam 1998). The confusion is partly due to the name referring to both the process of the study and the end product of such study. It is also due to the absence of explicit data collection methods, as 'any and all methods of collecting data, from testing to interviewing' (Merriam 1998, p. 28) can be utilised.

An heuristic case study approach was used for this research study as it could 'illuminate the reader's understanding of the phenomenon under study' (Merriam 1998, p. 30). This could relate to a new understanding, add to an existing understanding or merely confirm an existing understanding or experience. A heuristic case study could explain the background and causes of a problem, why an innovation did or did not work, consider why alternatives were not chosen, and finally, evaluate the potential applicability (Merriam 1998).

3.5.2. Observation

Observational data represents 'a firsthand encounter with the phenomenon of interest' (Merriam 1998, p. 94), as opposed to an interview which is considered a second-hand account. An observation is characterised as a research tool when it is a planned, recorded, deliberate research activity with concern for validity and reliability (Kidder 1981). While initially a broad focus may be used, later in the research study it is appropriate to use focused observation (Marshall & Rossman 2006).

The classic spectrum of the researcher's involvement ranges from *complete participant*, to *participant as observer*, to *observer as participant*, to *complete observer* (Gold 1958). In this research study, the researcher took the role of *participant as observer*, as he was primarily participating in his work related role, either using the technologies for his own work use or assisting the participants with the use of the technologies for their work use. The participants knew they were being observed and that their use of the technologies was being observed and measured.

The researcher's observations were recorded for each of the surveys as a way of adding further meaning to the data provided by the survey respondents. In addition, a data set relating to web conferencing usage (provided through the WebEx administration system) was analysed to provide extra meaning to the impact of web conferencing data provided by the respondents.

3.6 Survey methodology

The target audience was extension officers within DAFF. There were approximately 300 potential extension staff members who were eligible to answer the various surveys, though an extra 130 staff in a similar role were targeted to complete the baseline survey. The surveys were conducted between July 2011 and August 2012, as detailed in Table 5. The participants were invited to contribute their responses in the various surveys via email invitations from the researcher. The messages included an explanation of the background and a link to the SurveyMonkey website which was used to conduct the web based eSurveys. A screenshot from one of the online surveys is provided in Figure 36.

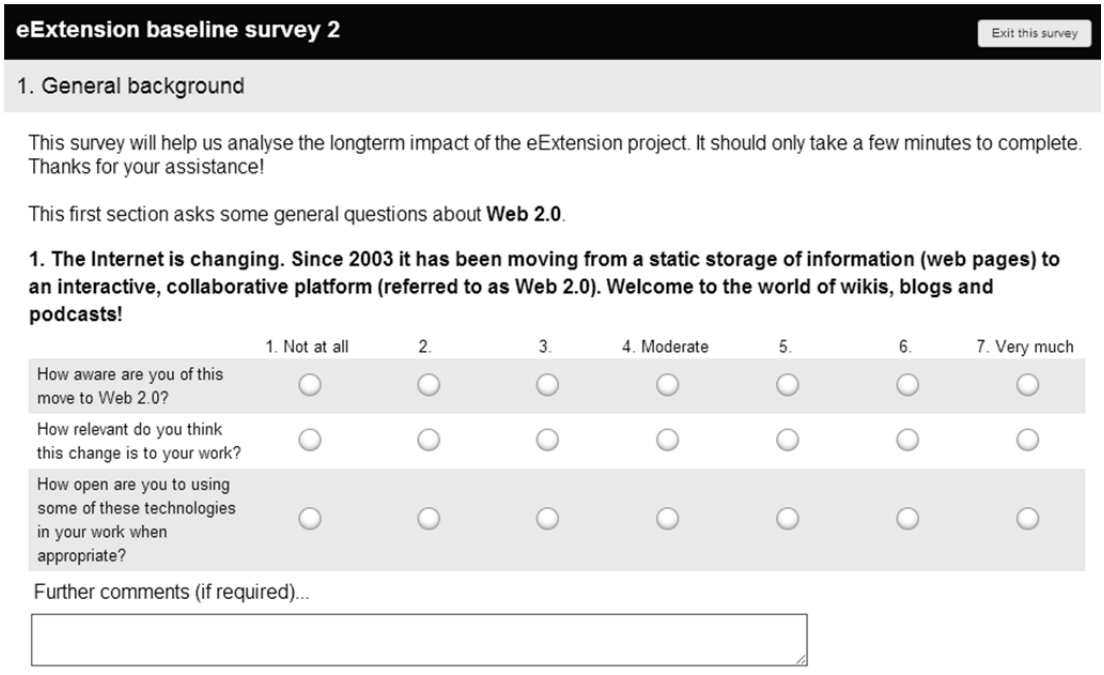


Figure 36. A screenshot of one of the online surveys.

Web surveys are subtly different from paper-based surveys. Online surveys are faster, cheaper and simpler to complete than paper-based ones (Bethlehem & Biffignandi 2011). A study by Kaplowitz, Hadlock and Levine (2004) showed that each completed paper-based survey cost almost $11 each, whereas the email survey

cost just under two dollars each. The same study showed that the response rates for mailed hardcopy and online surveys were similar, as long as both surveys were preceded with an advanced notification by mail.

Since the invitations are usually emailed and the data collected online, a much faster turnaround is possible. It has been estimated that a typical paper-based survey could take approximately six weeks to conduct, whereas an eSurvey might take only six days (James 2010c). Online surveys also make it quicker for the respondent to complete, due to the use of routing questions which enable the respondent to skip the sections of the survey which are not relevant to them (Dillman, Smyth & Christian 2008).

However, an analysis of 45 comparisons between web surveys and other survey modes (Manfreda et al. 2008) showed that web surveys had an 11% lower response rate than mail, telephone and fax surveys. This could be due to security and privacy concerns associated with the internet and limited web literacy of the respondents. Shin, Johnson and Rao (2012) found that while web surveys produce a lower response rate than mail surveys, they elicit higher quality responses to both closed- and open-ended questions. Regarding the length of responses in open-ended questions, a study by Schaefer and Dillman (1998) showed that those completing the questionnaire via email provided an average of 40 words compared with just 10 words from those completing the mailed version of the questionnaire. However a study by Denscombe (2008) determined that there was no statistical difference in the length of responses to open ended questions between paper-based and online surveys.

A methodological concern relates to the fact that since probability samples are highly affected by problems of non-coverage (in this case that not all members of the general population have Internet access) and frame problems (web survey invitations are often distributed by e-mail, but there are no e-mail directories of the general population that might be used as a sampling frame) (Vehovar & Manfreda 2008). This was not relevant to this research study though, as all members of the target population had Internet and email access.

Another concern was that participants would have been aware that they were being tested and may have modified their responses to please the researcher or for reasons of social desirability (Cross 2005). This is similar to the Hawthorne effect, where participants in a study change their behaviour when they know they are being observed (McCarney et al. 2007). Another consideration was that as web surveys were used for data collection, and despite whole target populations being sampled, the responses couldn't be considered random. Thus there was potentially an inherent bias, particularly as those who responded were more likely to be adopters of the new technologies.

These methodological concerns were addressed by sending one and sometimes two reminders to elicit further responses from the target group. Each time the message thanked all those who had already contributed their insights, and politely reminded any yet to complete the survey that there was still time to do so. To overcome the social desirability concern, the majority of the surveys (as shown in Table 5) were anonymous to reduce the concern of the respondents about what the researcher may

have thought of them based on their responses. The other two surveys required the respondents to identify themselves for the purposes of benchmarking or follow up. These could also have been made anonymous by the allocation of unique identity codes, but it was considered impractical for this research study. Interviewer bias was minimised by the use of online surveys, as the respondents typed in their own responses (Bethlehem & Biffignandi 2011). This also eliminated any transcription errors and the need to interpret difficult-to-read writing of the respondents (James 2010c).

3.7 Data analysis

For the quantitative data captured on the Likert-type scales, version 3.0.2 of the R programming language (Pearson 1901) was used to undertake statistical computation and generate graphics. This free software was initially written at the University of Auckland, New Zealand (Hornik 2013), and is perceived as a powerful and well respected statistical analysis package (Mangiafico 2013).

It was assumed for the purpose of analysis that the data resulting from the Likert-type scales was interval. There is considerable debate surrounding the Likert scale's data properties as many researchers claim the data is ordinal while others believe that it carries interval properties (Carifio & Perla 2007; Jamieson 2004; Knapp 1990; Michell 1986; Stevens 1955; Townsend & Ashby 1984). Some state that Likert scaling presumes the existence of an underlying continuous variable, whose value characterises the attitudes and opinions of the respondents. However if it were possible to directly measure the latent variable, then the scale would be interval (Clason & Dormody 1994). Thus for this research study it was assumed that Likert-type scales produce interval data, which therefore allowed the use of the mean score along with other multivariate statistics.

The ratings were considered to be normally distributed with homogeneous variances across grouping terms so that analysis of variance (ANOVA) could be used to compare ratings across groups. If significant results were found then levels within groups were compared using least significant differences (lsd). In all analyses a 95% level of significance was used. The absence of a description of a result normally indicated a non-significant result.

Principal Component Analysis (PCA) was used to analyse the complex data set from the Motivation to adopt an innovation data survey, for which the results are presented and discussed in Section 4.6 of this thesis. PCA has been described as 'probably the most popular multivariate statistical technique' (Abdi & Williams 2010, p. 433) and is a multivariate technique that converts data to form a set of orthogonal variables (known as principal components) and displays them as points on a map. The eigenvalues represent the variance of the original data contained in each principal component, and in the data analysis tables of this study, this is referred to as Standard deviation.

The mathematical process was devised by Pearson (1901) and later independently developed by Hotelling (1933) who coined the term 'principal component'. While factor analysis was originally used in psychology and education, it is now being used in other fields, including health (Williams, Brown & Onsman 2010). Using PCA for Exploratory Factor Analysis has been criticised for both the way the analysis is

conducted and the way results are reported (Henson & Roberts 2006). The ease with which researchers can undertake these analyses without sufficient consideration is seen as one of the main contributing factors (Cronkhite & Liska 1980; The University of Texas at Austin 1995).

The first principal component corresponds to a line passing through the multi-dimensional mean of a set of points and which minimises the sum of squares of the distances the points are located from the line. The second principal component can then be calculated the same way after all correlation with the first principal component has been subtracted from the points. If this were being done with a physical object such as a cricket bat, the first principal component (PC1) would be the axis with the largest possible variance, in this case along the length of the bat. The second principle component (PC2) is an axis perpendicular to the first axis and again with the next greatest variance, which in this example would be the face of the bat. It is usual to discard low-variance principal components (Jolliffe 1972, 1973) as it can provide more stable clustering than that obtained using all the variables (Ben-Hur & Guyon 2003).

An example of how the data is presented for the principal components for the Diffusion of innovation model is shown in Table 6. It utilises the Microsoft Excel heat map function, where the more positive the value of the result, the greater the intensity of green. Similarly, the more negative the value, the greater the intensity of red is shown in the relevant cell.

Table 6. Example table showing absolute size of the loadings relative to each other.

Loadings	PC1	PC2	PC3	PC4	PC5
Q6.1 (better)	0.477073	-0.1423	0.097162	0.079016	-0.85818
Q6.2 (compatible)	0.194582	0.87775	0.437228	-0.02048	0.010239
Q6.3 (simple)	0.606472	-0.36593	0.464988	0.242018	0.472755
Q6.4 (experiment)	0.456216	0.021968	-0.28928	-0.82937	0.140859
Q6.5 (noticeable)	0.398244	0.273705	-0.70675	0.496894	0.141737

Biplots were used to explore the relationship between the questions within each adoption model. The length of the arrows indicate how much a question contributed to explaining variation between respondents. The direction of the arrows of two questions describes the relationship between them, with arrows in the same direction indicating the questions are correlated, arrows in opposite directions indicate a negative correlation, and arrows that are becoming perpendicular to each other are collecting information that are more independent of each other. An example of the biplot of the first two principal components for the Diffusion of innovation model is shown in Figure 37.

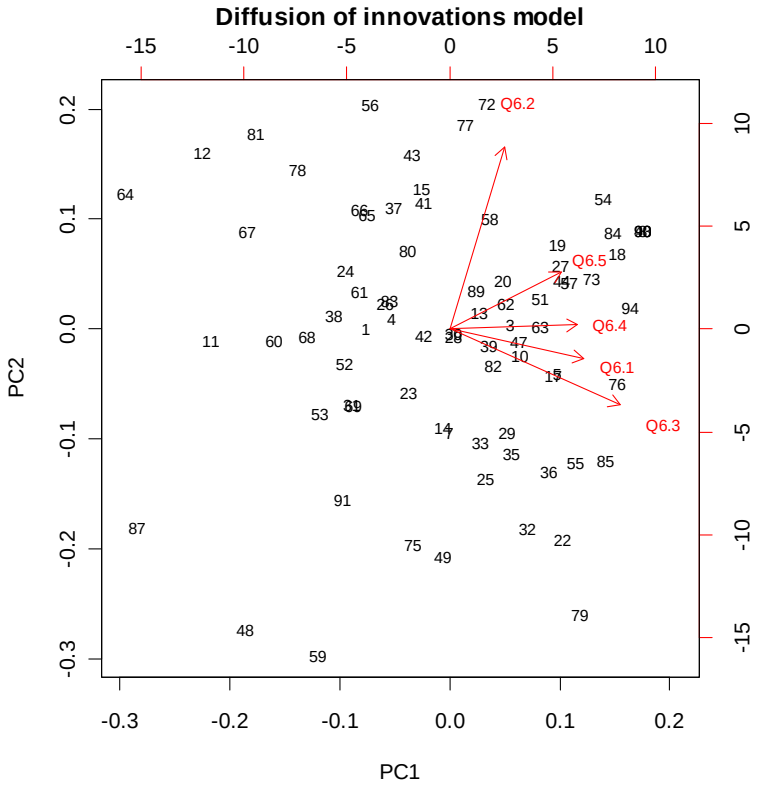


Figure 37. Example figure showing biplot of the first two principal components.

For the qualitative data, the primary analysis method used was content analysis, where recurring patterns of meaning were sought. This tends to focus at a more micro level (Braun & Clarke 2006), and often provides frequency counts, which then allows for quantitative analyses of initially qualitative data (Ryan & Bernard 2000). Historically this has been considered quantitative in nature, as 'standardized measurements are applied to metrically define units and these are used to characterize and compare documents' (Manning & Cullum-Swan 1994, p. 464). Content analysis has also been seen as a qualitative method, where the analytical approach focuses on analysing both the explicit content and interpretations of the 'latent content' of texts, which needs to be derived or interpreted from the text (Graneheim & Lundman 2004, p. 106), which was the approach used in this research study.

Thematic analysis was also utilised, which is a method for identifying, analysing and reporting patterns (themes) within data and it differs from content analysis in that themes tend not to be quantified (Fereday & Muir-Cochrane 2008). However sometimes themes may be quantified and analysed statistically, though the unit of analysis tends to be more than just a word or phrase (Boyatzis 1998). A theme captures an important element about the data in relation to the research question, and 'represents some level of patterned response or meaning within the data set' (Braun & Clarke 2006, p. 82). These themes or patterns can be identified using an inductive ('bottom up') method, or in a theoretical or deductive ('top down') process. The inductive approach was used for this research study as it produces themes that are strongly linked to the data (Patton 1990).

While computer software could have aided this process, the researcher chose to analyse the data manually to ensure the richness of the data was captured and

understood in the context of the individual respondents. This also allowed the researcher to become more intimate with the data sets and not become distanced from the data (Merriam 1998). The exception was where the Leximancer software (www.leximancer.com) and Wordle (www.wordle.net) were used to analyse the combined qualitative responses of all five data sets containing qualitative responses, to elicit overall themes from all the surveys. Leximancer analysed concepts within the text and graphically depicted inter-connectedness and co-occurrence of key terms. Whereas Wordle counted the frequency of words and depicted them as a word cloud where the size of the word was in proportion to its frequency. This was undertaken as an overarching audit of the research findings and provided results unbiased by the researcher.

3.8 Conclusion

A mix of quantitative and qualitative data was collected from multiple web-based surveys. Case studies were used as the primary research method for the extra depth of understanding that they provided. Whole population sampling was used for the research study to maximise the number of responses. Online surveys were the primary but not exclusive method for gathering both quantitative and qualitative data. Observation was also used as a means of data collection. The quantitative data was analysed using R and the qualitative data was analysed using content analysis.

A process flow map of the stages in the methodology including ethics approval and iterative paths taken between data collection and data analysis is shown in Figure 38.

The next chapter will present the results gathered from five surveys and one observational study using the methodology described in this chapter.

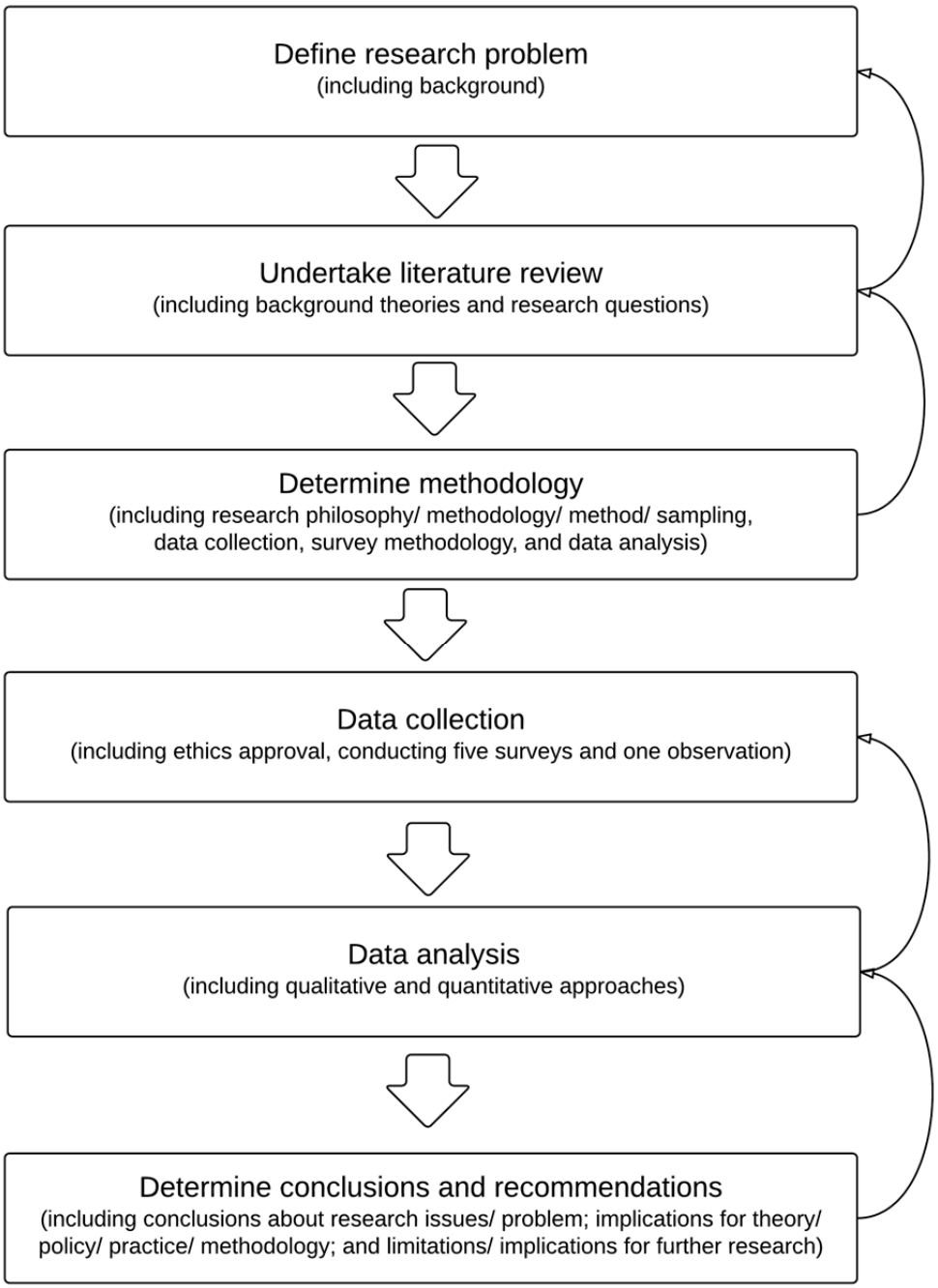


Figure 38. Methodology process flow map.

This page was deliberately left blank.

4. Results

The preceding chapters have set the scene for this research project by reviewing the literature and outlining the methodology used by the researcher. This section now analyses and makes sense of six different data sets (as shown in Figure 39) that will elucidate the factors that affect the adoption and use of new communication technologies.

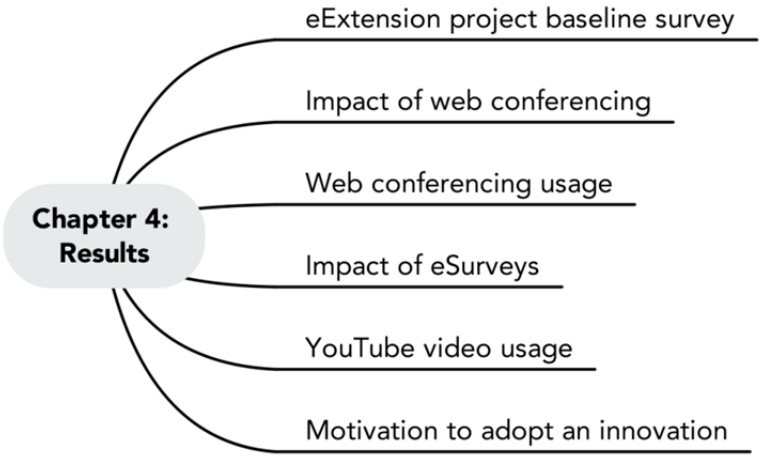


Figure 39. The structure of Chapter 4.

4.1 eExtension project baseline survey

4.1.1. Background

A baseline survey was undertaken at the commencement of the eExtension project in 2009, to determine the existing familiarity and use of eTools within DAFF. The follow-up comparative survey was undertaken in February 2012, to determine shifts in familiarity and experience with the eTools across the three years. The results from that 2012 survey are the focus of this section.

A pre-test of the survey was conducted with a small number of participants and the survey questions were slightly modified based on their feedback to improve comprehension and relevance. The survey participants were invited by email to click a hyperlink and complete a web-based survey using SurveyMonkey, a screenshot of which is provided in Figure 40.

The initial survey was conducted in 2009 and whole population sampling of the known 300 or so DAFF extension officers was undertaken, so as to gain the maximum number of responses. A follow up email was sent to remind the officers to complete the survey, eliciting a total of 130 responses. The second survey was conducted in 2012 and 426 people were invited to respond, and after a reminder message, a total of 119 responses were collected. The respondents were invited to voluntarily include their contact details and 39 respondents were able to be identified as responding to both surveys. Averages between the two groups were compared, and when possible, individual changes were noted. The questionnaire consisted of 16 questions, which can be viewed in Appendix 1a.

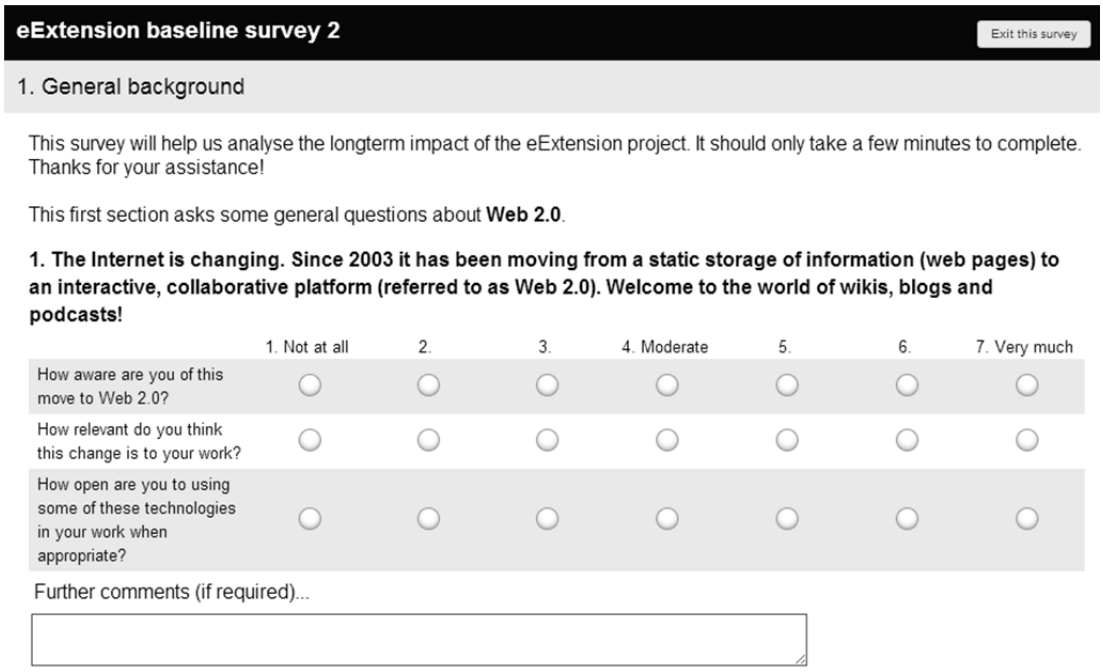


Figure 40. A screenshot from the eExtension baseline survey.

As not all the respondents answered all the questions, the descriptive statistics (including percentages) for the quantitative analysis were calculated from all the potential respondents (as opposed to actual respondents for each question). This helped provide consistency for the number of respondents. Counts of respondents in regions across the two surveys (2009 and 2012) were analysed for differences in distribution using a chi-square test on a contingency table (region by survey).

The seven-point Likert-type rating scale used in the survey had the following labels: 1 ‘Not at all’, 4 ‘Moderate’ and 7 ‘Very much’. The ratings along the scale were considered to be normally distributed with homogeneous variances across grouping terms so that analysis of variance (ANOVA) was able to be used to compare ratings across groups. If significant results were found, then levels within groups were compared using least significant differences (lsd), or equivalently with only two levels to compare the confidence interval difference in means was able to be used to see whether it contained zero (then the means were not significantly different).

As a proportion of the respondents were able to be identified as the same across the two surveys, two separate analyses were undertaken. The means were calculated and compared for all respondents (n=130 for 2009; n=119 for 2012), and the respondents known to be the same across both surveys (n=39).

The first analysis had the advantage of more responses and was used as the main reporting method of results, though it didn’t account for the shifts in the attributes of individuals. The second analysis had the disadvantage of fewer responses, but was able to directly compare shifts in the same individuals. Consequently it removed the changes in attributes from having different groups of people answering the surveys. The analyses across questions used the respondent as a blocking term (where appropriate) to remove this variation and made the analysis more sensitive to detect differences across questions.

In all analyses a 95% level of significance was used. If a probability was between 5% and 10%, it was described as 'approaching significance'. Where a respondent provided a range for their answer (instead of a single rating point) when asked for the percentage of their work time, the data were prepared by converting the range to a midpoint (e.g. 50-60% became 55%). Where numerical information in a response was provided as text, it was manually translated to a numerical value. If percentages reported exceeded 100% (perhaps due to the respondent not correctly understanding the question), the data were restricted to not go above 100%, for example values of 120% were converted to 100%.

Qualitative comments from the 'Further comments' sections of the survey were grouped into major themes where appropriate. This was undertaken manually to allow the researcher to better familiarise himself with the data. Spelling mistakes and minor grammatical errors were corrected, without changing the meaning or intent of the comments.

4.1.2. Key results

This survey was conducted as part of the DAFF eExtension project by the researcher and the data relevant to this research study are included below.

Demographics of respondents

It was important to analyse the demographic details of the respondents to better understand the two sample populations and to see whether any significant changes occurred between the two surveys. The distribution is shown diagrammatically in Figure 41, with the data summarised in Appendix 1b in Table 31 and the contingency tables shown in Table 32.

The reduced numbers of respondents from Brisbane in the 2012 survey was most likely as a result of the government's approach to reducing the number of head office staff while maintaining service delivery (particularly in the regions).

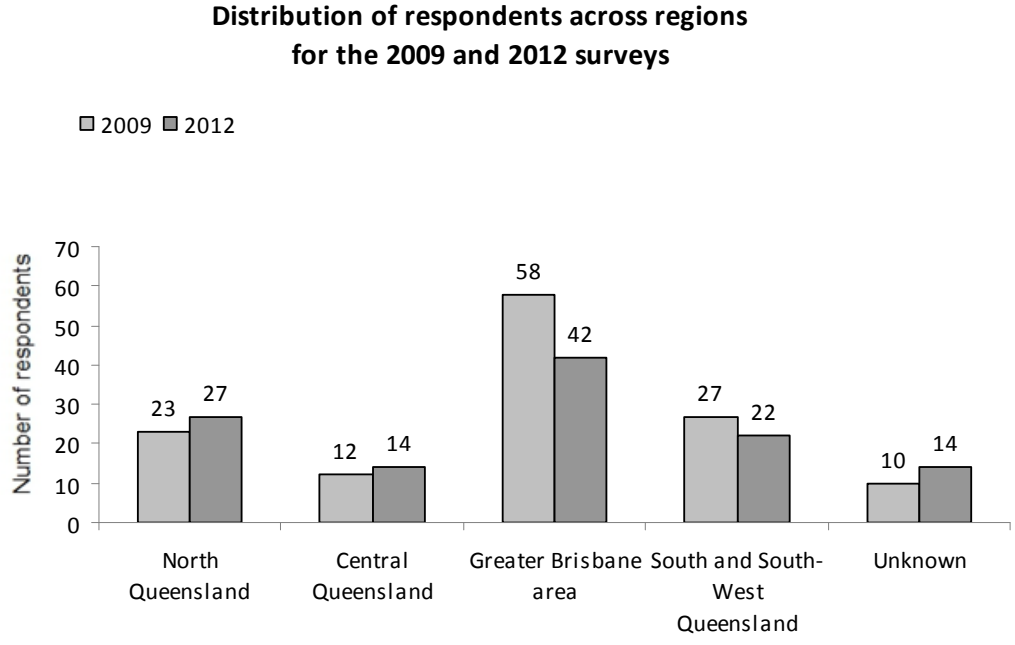


Figure 41. Distribution of respondents across regions for the 2009 and 2012 surveys.

The analysis showed that the greatest proportion of the respondents in the 2012 survey came from the greater Brisbane area, then from north Queensland, south and south-west Queensland and finally central Queensland. The distribution of respondents in 2012 did not change substantially from the survey completed in 2009.

Awareness, relevance and openness to change to Web 2.0

The first question in this survey related to the Internet changing from static storage of information to an interactive, collaborative platform (Web 2.0). Three sub-questions invited the respondents to rate their 'Awareness of move to Web 2.0 tools', 'Relevance of the change to the work of the respondent' and the 'Openness to use of new technologies in the workplace'. This provided insight into the participants' situation and how they perceived the Web 2.0 tools.

Quantitative analysis

An analysis of ratings for the three sub-questions for the 2009 and 2012 survey results was undertaken for all respondents (n=119), as shown in Figure 42 and detailed in Table 33 in Appendix 1a. As the respondents were invited to disclose their identities, a separate analysis was undertaken on the data from respondents common to both surveys (n=39), as that allowed a more accurate comparison between the 2009 and 2012 responses. The second analysis supported the change for awareness and relevance, but not for openness where a slight increase was detected. This inconsistency was discounted due to the relatively smaller size of sample for the second analysis.

The average ratings did not change consistently across the surveys. This was demonstrated by the average rating for awareness increasing from the 2009 survey to the 2012 survey, but then decreasing for relevance and openness,

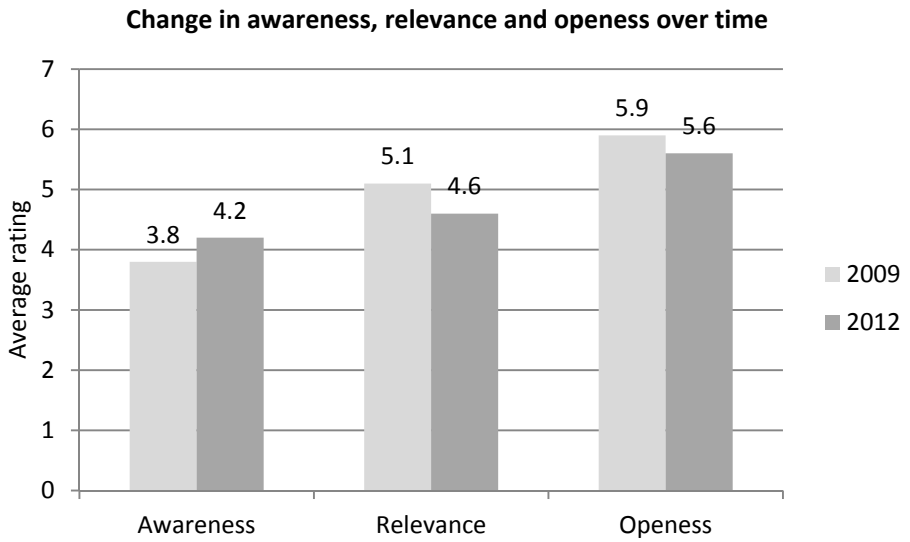


Figure 42. Change in awareness, relevance and openness.

Awareness. As shown in Figure 43, there was a slight increase in awareness of the move to Web 2.0 from an average rating of 3.8 to 4.2 (non-significant, p=0.086) when comparing all respondents. This was confirmed by an analysis of the respondents who answered both surveys which showed a significant increase (p=0.003) from 4.0 to 5.0.

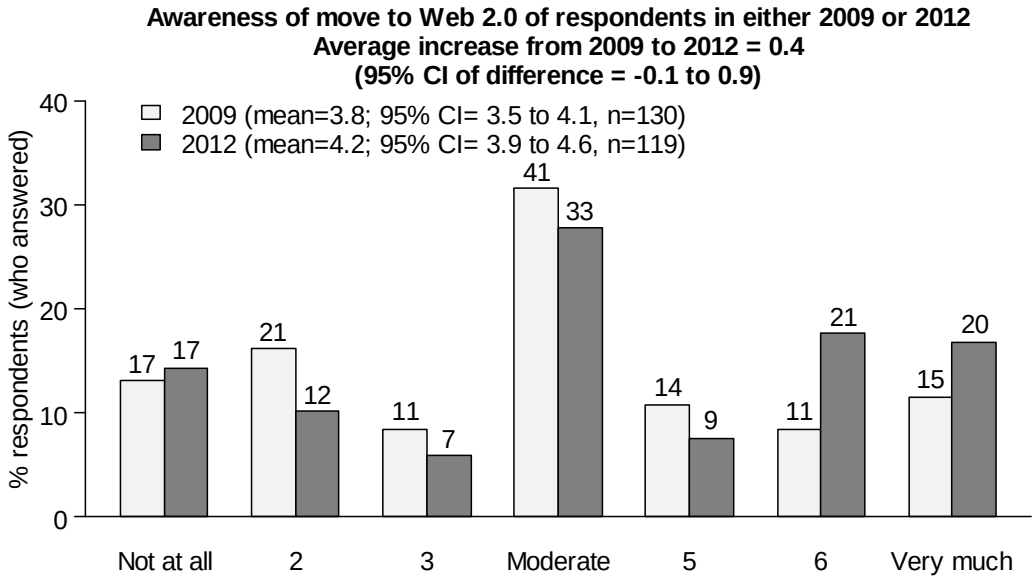


Figure 43. Awareness of move to Web 2.0.

The distribution of response doesn't follow the normal distribution, as there is a large peak in the middle and smaller peaks at the opposing ends of the continuum. This One of the objectives of the eExtension project was to increase the awareness of staff regarding Web 2.0. However the positive change can't be attributed entirely to the project as there were possibly many other contributing sources.

Relevance. The relevance of the change to Web 2.0 for the participants' work decreased slightly from an average rating of 5.1 to 4.6 from 2009 to 2012 using all the respondents in the two surveys, as shown in Figure 44. However the analysis with just the respondents in common to the two surveys (n=39) did not show a significant decrease (5.0 to 4.9). The slight difference in results could be attributed to the differences between the two sample sets, in that the 39 respondents are not truly representative of the larger sample (n=117).

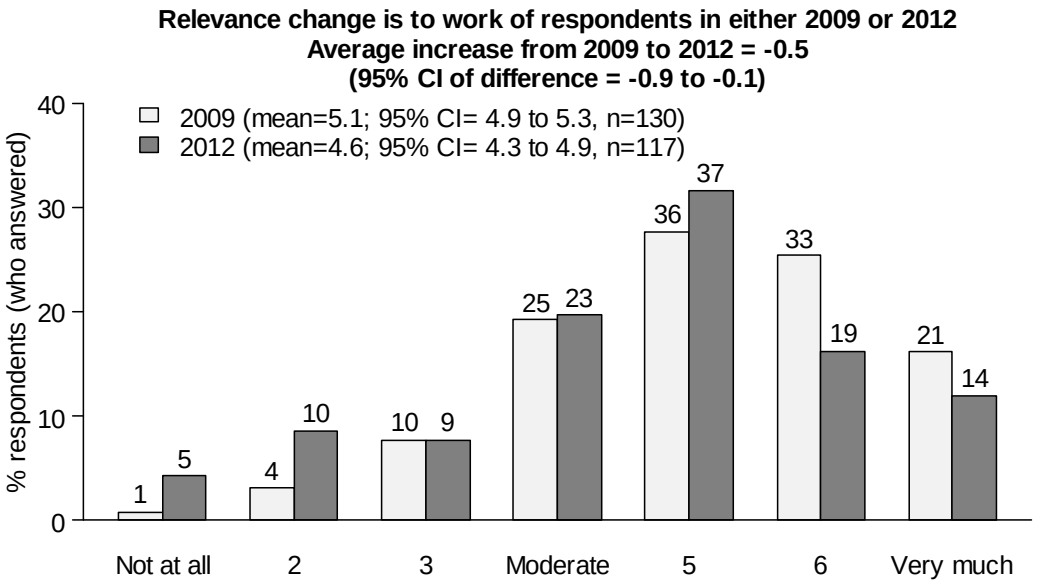


Figure 44. Relevance of the change to Web 2.0 for participants' work.

The negatively skewed distribution indicated that generally more respondents considered the change to Web 2.0 as being relevant to their work, than those who didn't. For the eExtension project, this was an encouraging sign as it indicated people already perceived the relevance of these technologies to their work.

Openness. The level of openness (or willingness) to using these Web 2.0 technologies was reasonably high but slightly (and significantly) decreased over the two time periods from 5.9 to 5.6 when analysing all results, as shown in Figure 45. This was contradictory in trend to the analysis of the respondents who completed both surveys where no significant increase in openness was detected.

The negatively skewed distribution indicated that generally more respondents considered themselves as being open to use the new technologies, than those who didn't.

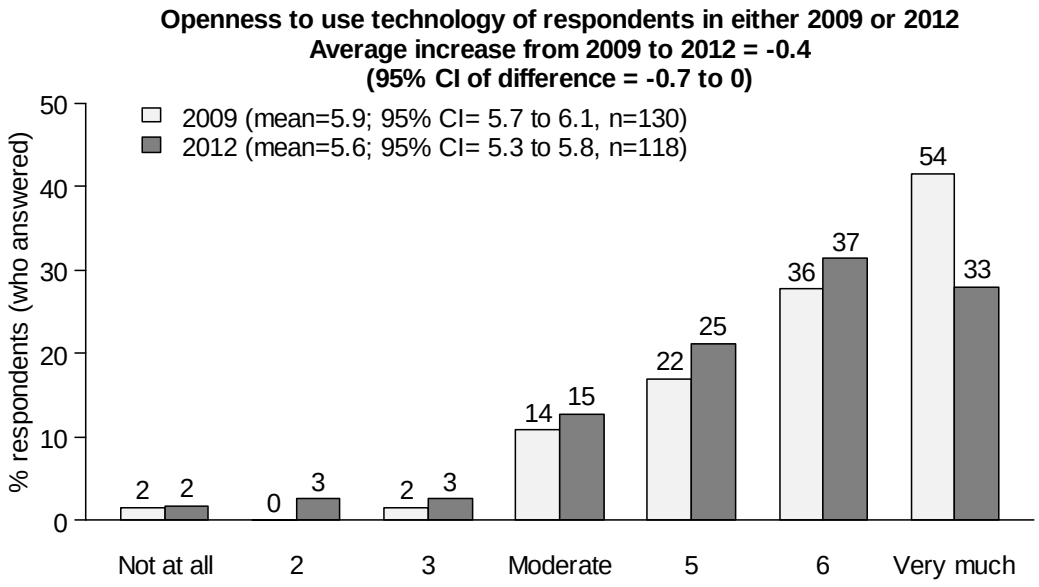


Figure 45. Openness to using Web 2.0 technologies.

Qualitative analysis

A thematic analysis of the comments from the survey relating to the awareness of change to Web 2.0 tools, its relevance and the respondents' openness to the technology in the workplace was undertaken and a summary is presented in Table 44 in Appendix 1c.

The comments were sorted into the following four categories (with the number of respondents in brackets):

- lack of departmental (DAFF) support in using the technology (8), as demonstrated by comments such as 'Dept (is) very restrictive', 'We've wanted to use blogs for years but have been hampered by dept requirements', 'Lack of access to platforms has stymied our development' and 'Put off by all the Queensland Government red tape';
- lack of understanding and need of training in eTools (6), with comments such as 'It is extremely important that senior managers understand the use of this Internet platform', 'Web 2.0 is great as long as there is managerial support', and 'Need better training in their use and how to integrate them into our work environment';
- the relationship with eTools and extension work (4), as demonstrated by comments such as 'I am a believer of face-to-face contact', 'The Internet doesn't build a 'relationship' with stakeholders', Some of the new social media can be a bit time wasting', and 'It is hard to beat personal contact'; and
- the use or potential use of eTools by the respondents (2), with comments such as 'I don't have a need to use Web 2 technologies in my role'.

A recurrent theme was the perception that the department's IT platform (hardware and software) and policies were restrictive and out-dated. Respondents felt that this was stymieing their ability to use these new communication technologies. There was also a strong theme around the importance of face-to-face engagement and that electronic means should not replace it.

Summary and observations

The quantitative responses indicated that the respondents were highly open to using the new technologies, they considered them of moderate relevance to their work, but they had relatively low levels of awareness about them. The qualitative responses added the extra dimension of the department's IT platform and policies being restrictive and out-dated. Since the respondents were so open to using the technologies and could see the relevance for doing so, there was probably a high level of frustration being felt by them when they weren't able to utilise the Web 2.0 technologies.

The results regarding the awareness of Web 2.0 align with the researcher's perceptions of the situation. Between 2009 and 2012 he observed an increase in the number of enquiries he received regarding the eExtension project and the associated eTools. He noticed that those already aware of the project and eTools were discussing them more frequently, and those who were previously unaware of the project or the eTools wanted to know more about them.

The level of the relevance of the eTools to the work of the respondents was consistent with the researcher's perceptions. However the decrease in the levels over time was not consistent with the researcher's observations. While the results show a slight decrease (all respondents) or no change (common respondents), the researcher's perception was that the relevance increased during that time. This was based on the messages coming from senior management which endorsed and encouraged the use of the new communication tools. For example, an eExtension discipline champion (Greg Bath) was appointed within the FutureBeef team in February 2010. The purpose of that role was fourfold:

1) have an oversight of the discipline and provide advice to management as part of FutureBeef program
2) be the primary contact for that discipline: the discipline champions should have a well-established internal and external network of contacts in this discipline
3) create opportunities to inform FutureBeef team about discipline activities
4) support and mentor interested staff in discipline development.

That demonstrated the interest and commitment in the new communication technologies by management and their desire for more staff to utilise them in their work.

Similarly, the level of the results from all the respondents regarding their openness (or willingness) to use the new technologies was as the researcher had observed. However the decrease over time was not as the researcher had observed, as he perceived either a steady level of openness over this time period or a slight increase. This is supported by the data from the respondents common to both surveys, where there was no significant increase in levels. Perhaps this decrease could be attributed to the fact that staff had tried unsuccessfully to gain access to the eTools, but after successive unsuccessful attempts, became less open to wanting to use them. A limitation of the survey was that while it allowed general comments about the set of three sub-questions, it didn't specifically seek feedback about each sub-question. That may have enabled greater opportunity for the respondents to provide further information about the reason for the change in levels over time.

Regarding the relative levels of awareness, relevance and openness; the researcher was not surprised that openness was the highest level of all three variables, as his perception was that DAFF staff were generally open to using any new technology where they could easily see the benefits. For example, the researcher's perception was that the uptake of facsimile machines in the 1980s and mobile phones in the 1990s was fairly rapid within DAFF. The high level of openness could help explain the perceived sense of frustration of the respondents regarding the department's IT platform and policies being restrictive and out-dated. So while they were open to using the new technologies, it would possibly appear that they were encountering barriers that were preventing them from doing so.

Familiarity with Web 2.0 tools

The second question asked 'How familiar are you with these Web 2.0 tools?'. While 13 Web 2.0 tools were included in the original question and analysed, only the data for eSurveys and web conferencing will be discussed in detail, as the other 11 eTools are not the subject of this research study.

Quantitative analysis

An analysis of the ratings for familiarity with eTools across the two surveys was undertaken, as detailed in Table 34 in Appendix 1b and illustrated in Figure 46.

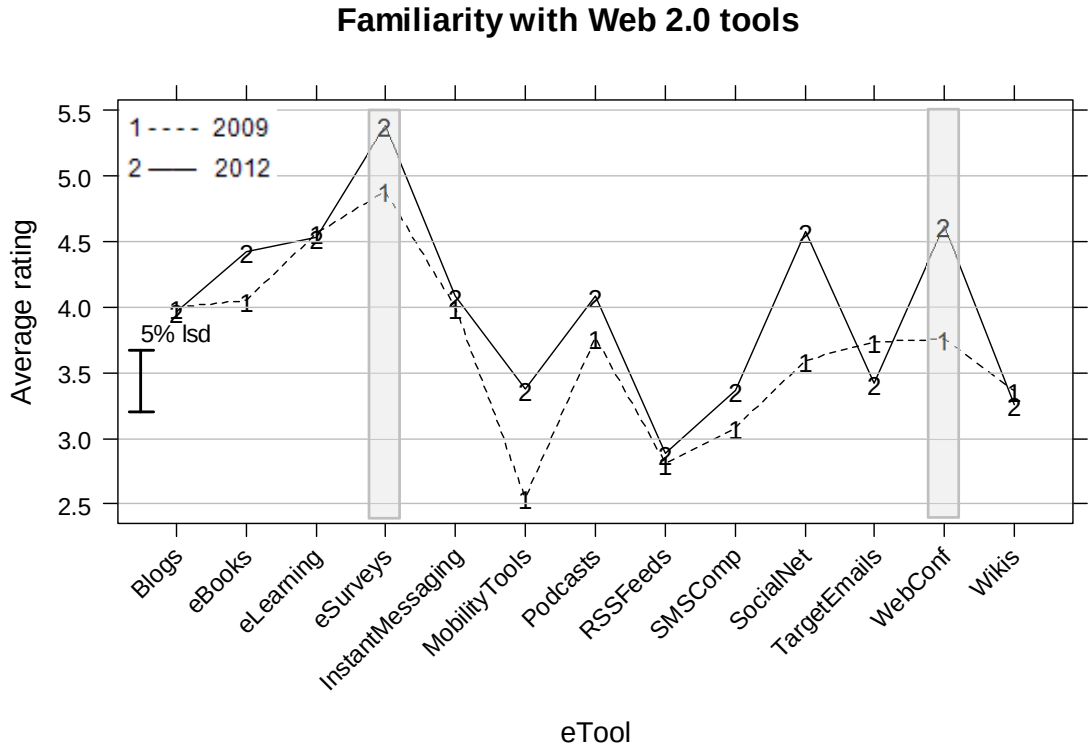


Figure 46. Average ratings for Familiarity with Web 2.0 eTools.

eSurveys. The average level of familiarity with eSurveys significantly increased from 4.9 to 5.4 over the two surveys, with the analysis of respondents who completed both surveys also showing a significant increase of 4.9 to 5.7, as detailed in Table 35 in Appendix 1b and illustrated in Figure 47.

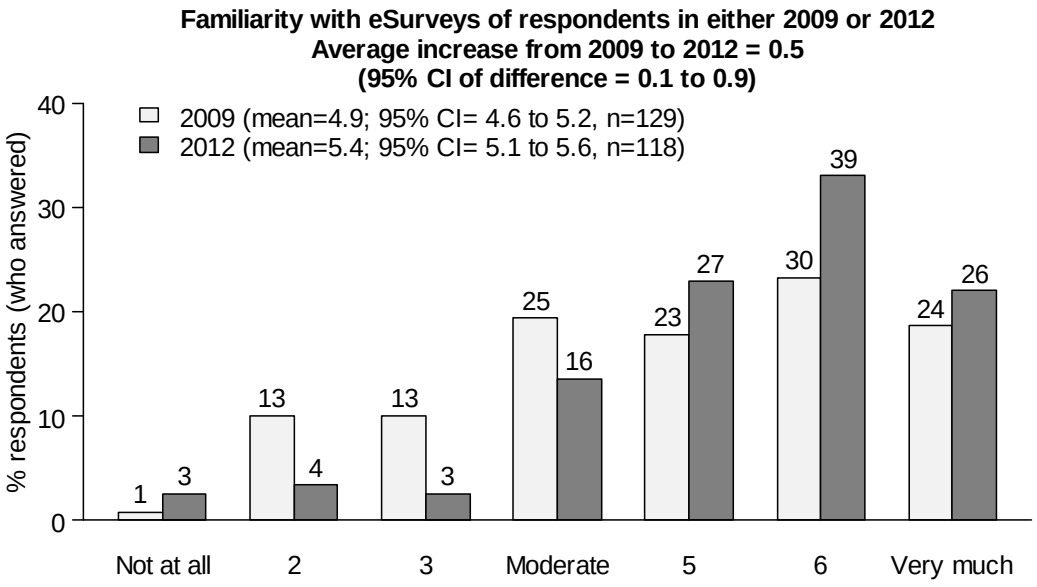


Figure 47. Familiarity with eSurveys.

The negatively skewed distribution indicates that many more respondents were familiar with eSurveys than those who weren't. The fact that this already high level of familiarity increased over time can't be attributed entirely to the eExtension project as there were possibly many other contributing sources.

Web conferencing. The average rating for familiarity with web conferencing increased significantly across the two surveys from below moderate (3.8) to above moderate (4.6) when analysing all respondents, as detailed in Table 36 in Appendix 1b and illustrated in Figure 48. When analysing respondents who answered both surveys there was also a similar and significant trend of increase from 3.7 to 4.7.

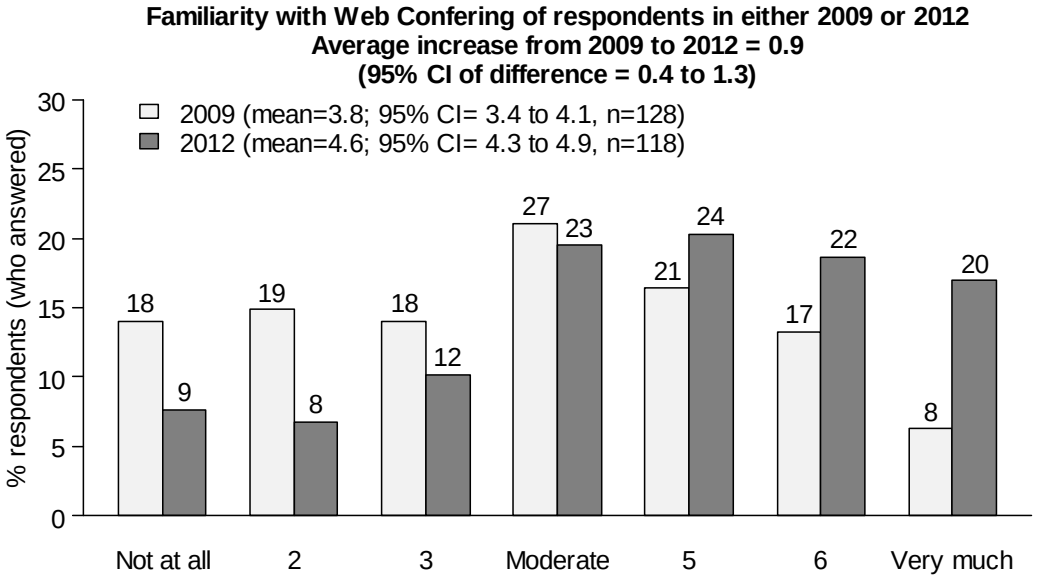


Figure 48. Familiarity with web conferencing.

While the average levels of familiarity with web conferencing (3.8 and 4.6) were lower than those for eSurveys (4.9 and 5.4), the change over time was greater for

web conferencing (0.8) than eSurveys (0.5). This indicates that the uptake of web conferencing was greater than that for eSurveys.

Qualitative analysis

A thematic analysis of the comments was undertaken and is presented in Table 45 in Appendix 1c. Once again, a comment was made relating to the theme of the department's IT system and policies being out-of-date (which was also mentioned by this respondent in the previous section). Five comments were made regarding the fact that the respondents didn't understand the eTool terminology, which emphasised their lack of familiarity. Two comments related to the use of word *familiar* in the survey and whether it was synonymous with awareness (which was the researcher's intention).

Summary and observations

As DAFF is a science-based organisation, many of its staff need to undertake surveys on a regular basis. It was therefore no surprise to the researcher that eSurveys were the most familiar eTool of the 13 included in this questionnaire. The researcher knew there were 109 users of SurveyMonkey, as they needed to contact him for details of the shared licence. His perception was that there was a steady amount of interest from new users from 2009 to 2012, as also shown by the results of this survey.

Experience as a reactive user

This section of the survey focused on whether a difference existed between the amount of experience the respondents had with the eTools as a reactive user (for example where they merely respond to someone else's eSurvey) versus as a proactive user (for example creating and distributing their own eSurvey). The analysis of the ratings of amount of experience as a reactive user is detailed in Table 37 in Appendix 1b and illustrated in Figure 49.

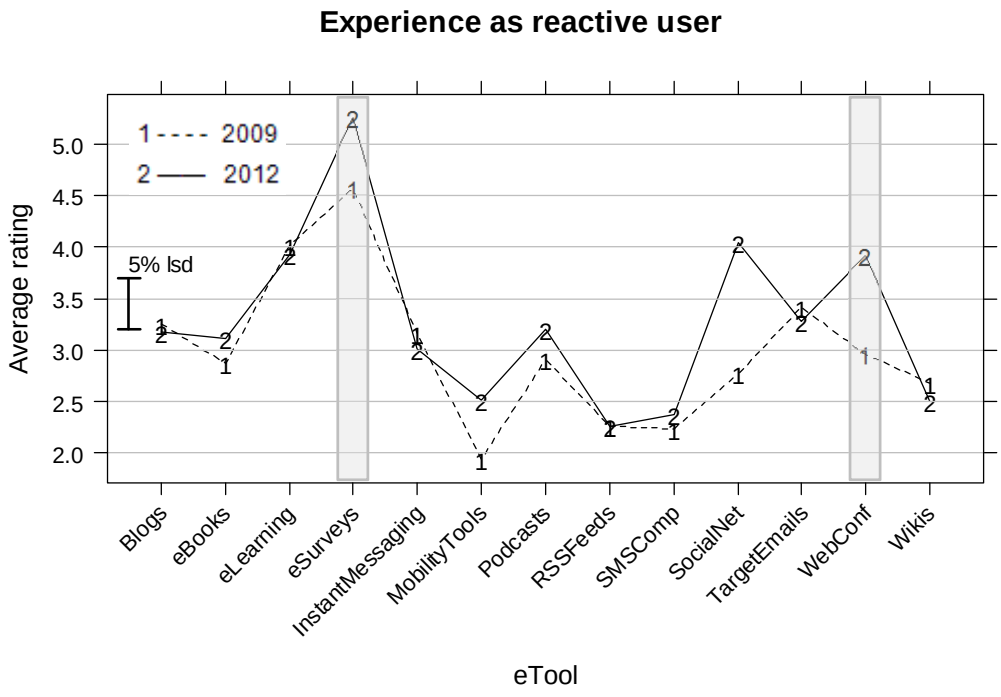


Figure 49. Average ratings for experience as a reactive user of Web 2.0 eTools.

Some eTools showed no obvious change in average rating across surveys (namely Blogs, eBooks, eLearning, instant messaging, RSS Feeds, SMS via the computer, targeted emails and Wikis), while other eTools (such as eSurveys, social networking and web conferencing) had a much greater increase in average rating. Once again, this research study will focus on the results for eSurveys and web conferencing.

eSurveys. The eSurveys showed the highest average rating of experience as a reactive user in both surveys, with a significant increase in ratings of 4.6 to 5.3 for the 2009 and 2012 surveys, as detailed in Table 38 in Appendix 1b and illustrated in Figure 50. The analysis of respondents who answered both surveys also showed a significant increase in average ratings of 4.6 to 5.6 across surveys.

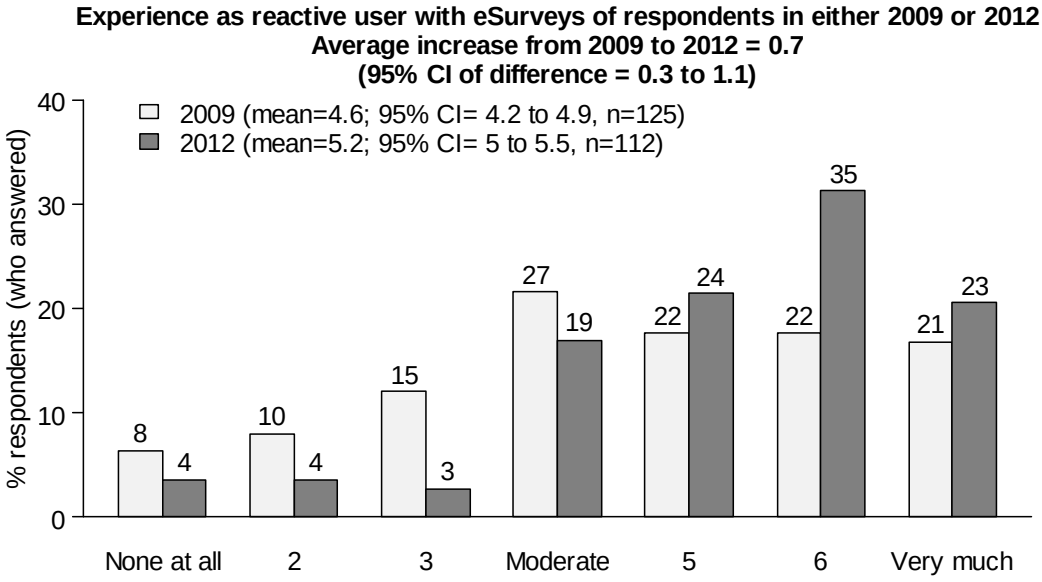


Figure 50. Experience as a reactive user with eSurveys.

The negatively skewed distribution indicates that many more respondents were reactive users of eSurveys than those who weren't. The fact that this already high level of use increased over time can't be attributed entirely to the eExtension project as there were possibly many other contributing sources.

Web conferencing. The amount of experience as a reactive user with web conferencing increased significantly from 3.0 to 3.9 across the 2009 to 2012 survey, as detailed in Table 39 in Appendix 1b and illustrated in Figure 51. This was supported by the analysis of respondents who answered both surveys, with a significant increase from 2.8 to 4.2 across the two surveys.

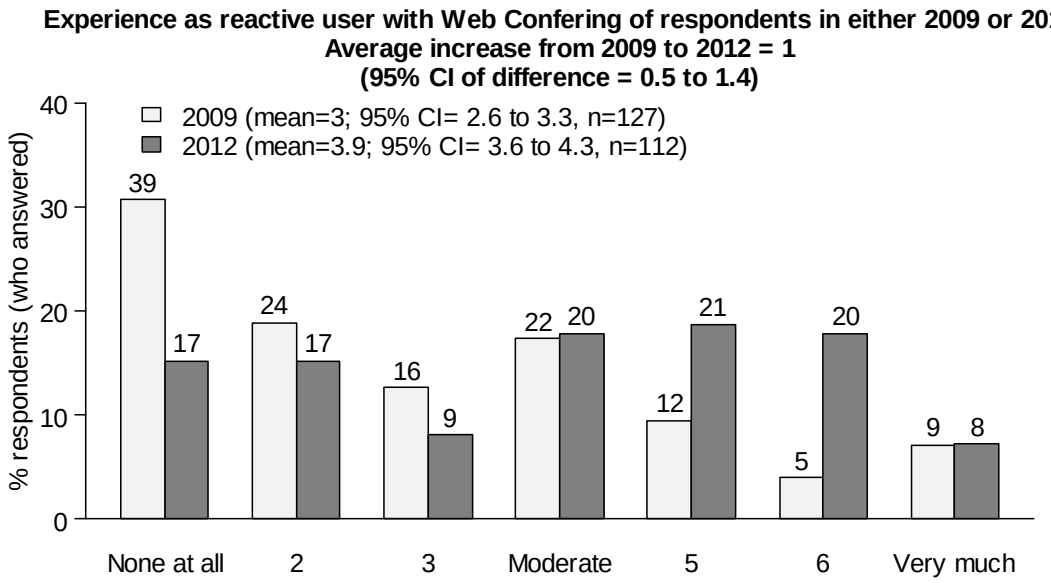


Figure 51. Experience as a reactive user with web conferencing.

The slightly positively skewed distribution (for 2009 data) indicates that more respondents had little experience as reactive users of web conferencing than those who had more experience. Once again, the fact that this already high level of experience increased over time can't be attributed entirely to the eExtension project as there were possibly many other contributing sources.

Summary and observations

Most respondents had moderate or high levels of experience with eSurveys as reactive users, as shown in Figure 50. As mentioned previously, this was to be expected working in a science-based organisation. In contrast, Figure 51 shows that few respondents had moderate to high levels of experience with web conferencing, where the greatest number of responses in 2009 was 'none at all'. This was consistent with the researcher's observations, in that even the staff at the DAFF IT helpdesk in 2009 were generally unaware of web conferencing when he phoned them about this technology.

Experience as a proactive user

This section focuses on the proactive use of eTools, where for example the user actively created an eSurvey and distributed it to the recipients (who would then be seen as reactive users). An analysis of ratings for the amount of experience as proactive user showed a significant interaction between eTool and the two surveys, as detailed in Table 40 in Appendix 1b and illustrated in Figure 52.

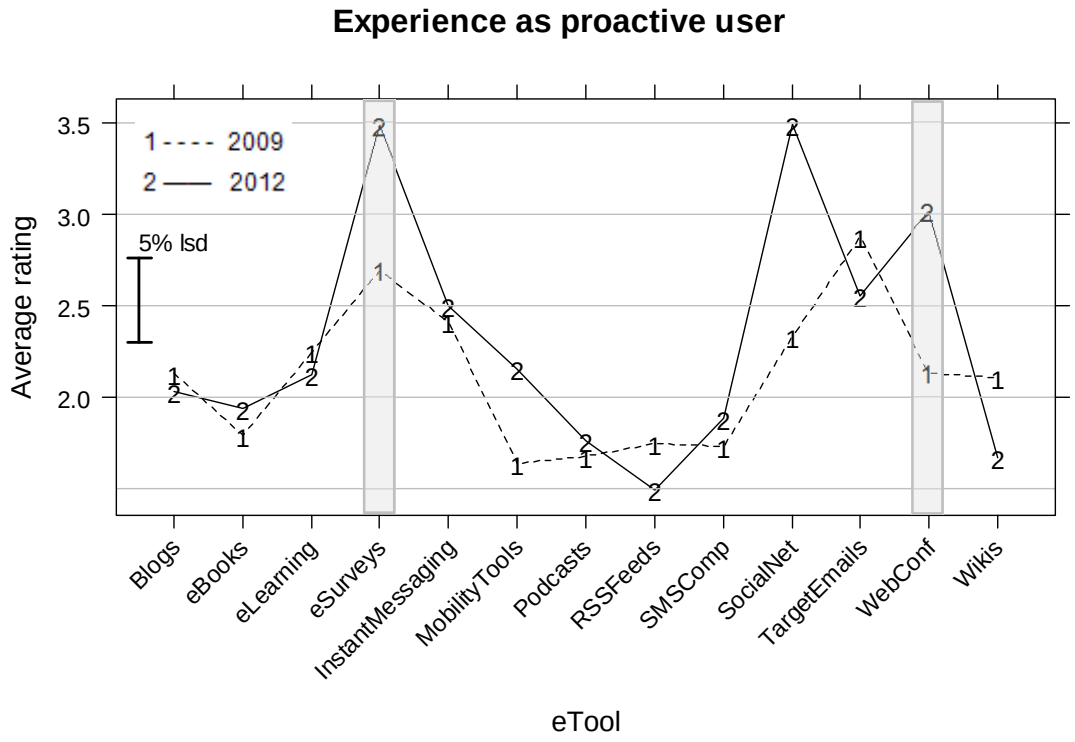


Figure 52. Average ratings for experience as proactive user of Web 2.0 eTools.

Some eTools showed little change (Blogs, eBooks, eLearning, instant messaging, Podcasts and SMS via computer), some showed larger increases (eSurveys, mobility tools, social networking and web conferencing) and some even showed decreases (RSS Feeds, targeted emails and Wikis). Again, this research study will focus only on the results for eSurveys and web conferencing.

eSurveys. The eSurveys proved to be one of the highest rated eTools for proactive use with a significant increase in average ratings from 2.7 to 3.5 across surveys, as detailed in Table 41 in Appendix 1b and illustrated in Figure 53. Similarly the analysis using respondents who answered both surveys significantly increased from 2.6 to 4.0.

The positively skewed distribution indicates that many more respondents had little experience as proactive users of eSurveys than those who had more experience. Once again, the fact that this already high level of experience increased over time can't be attributed entirely to the eExtension project as there were possibly many other contributing sources.

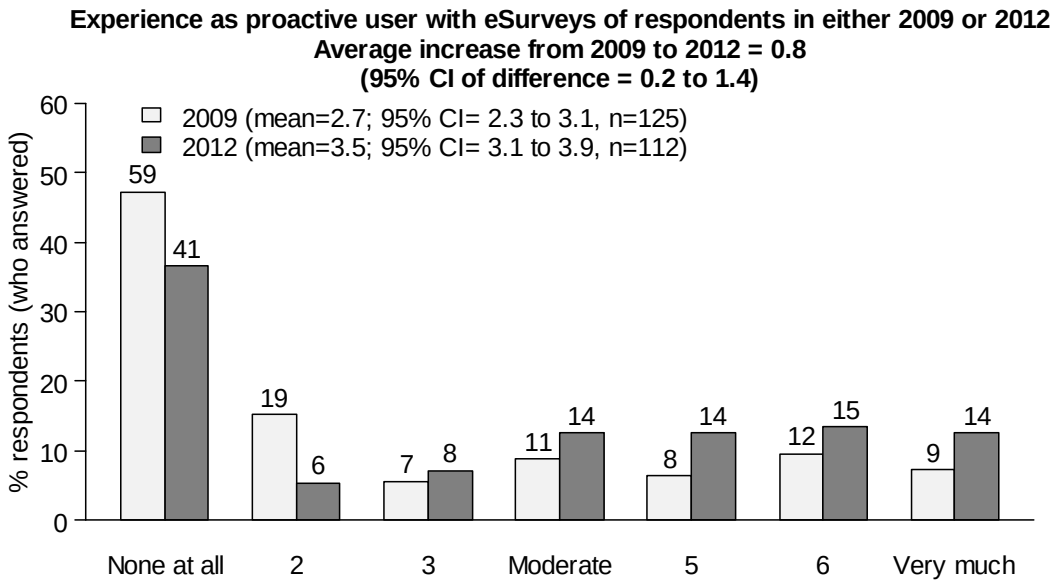


Figure 53. Experience as proactive user with eSurveys.

Web conferencing. There was a significant increase in the average rating of experience as a proactive user of web conferencing from 2.1 to 3.0 across the two surveys, as illustrated in Figure 54 and detailed in Table 42 in Appendix 1b. This was also supported by the analysis of respondents who answered both surveys with a significant increase of average rating from 1.6 to 3.2 across the two surveys.

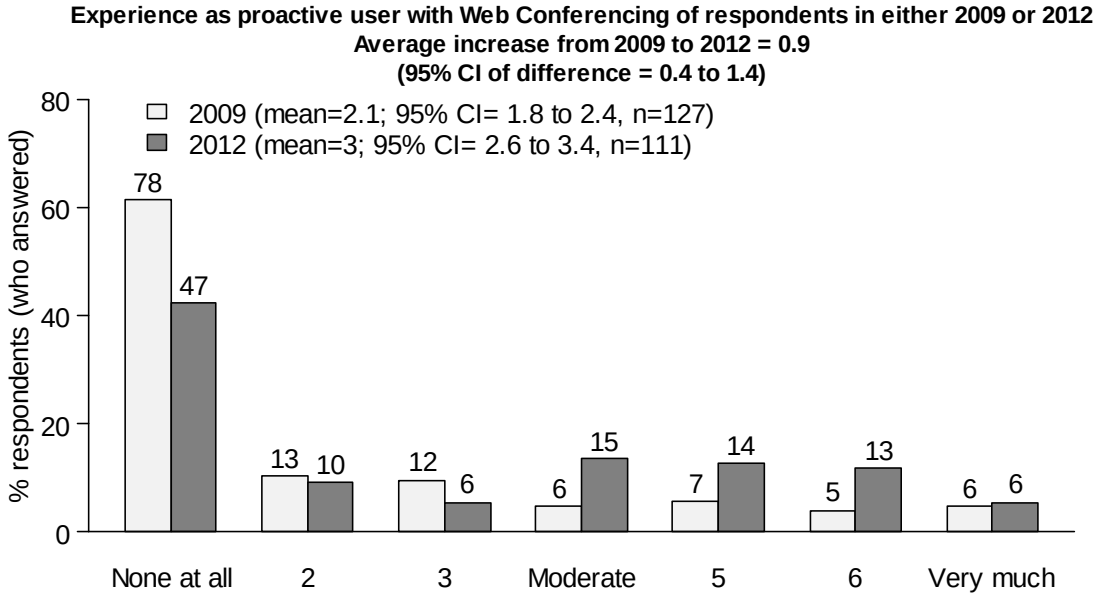


Figure 54. Experience as proactive user of web conferencing.

The positively skewed distribution indicates that many more respondents had little experience as proactive users of web conferencing than those who had more experience. Once again, the fact that this already high level of experience increased over time can't be attributed entirely to the eExtension project as there were possibly many other contributing sources.

Summary and observations

As detailed in Table 7, the mean values for reactive and proactive use of all eTools in 2009 and 2012 were quite low, considering that it was a seven-point scale.

Table 7. Changes in reactive and proactive use of eTools.

	2009	2012	Change
All eTools reactive	3.0	3.3	0.3
All eTools proactive	2.1	2.3	0.2
eSurveys reactive	4.6	5.3	0.7
eSurveys proactive	2.7	3.5	0.8
Web conference reactive	3.0	3.9	1.0
Web conference proactive	2.1	3.0	0.9

While this data showed that the respondents made more use of the eTools as reactive users, generally little use was made in either capacity. eSurveys rated higher than web conferencing for both reactive and proactive use in 2009 and 2012, though the amount of change across the years for both was fairly similar.

The researcher had noted that both eSurveys and web conferencing received more interest than any other eTools. He also knew that most staff used them reactively as part of their work. However he thought that the change in proactive use for those two eTools would have been higher than that indicated by the survey results, so possibly some of the reactive users did not respond to the survey invitation.

How the workplace benefited from the use of the technologies

The respondents were asked ‘How much has your workplace benefited from your use of these technologies (with either internal or external clients)?’. There was a significant difference in the average ratings across eTools for how much the work place of the respondent had benefited from their use of the eTools in the 2012 survey, as illustrated in Figure 55 and as detailed in Table 43 in Appendix 1b. The two eTools with the highest ratings were eSurveys with an average rating of 3.9 and web conferences with an average rating of 3.4.

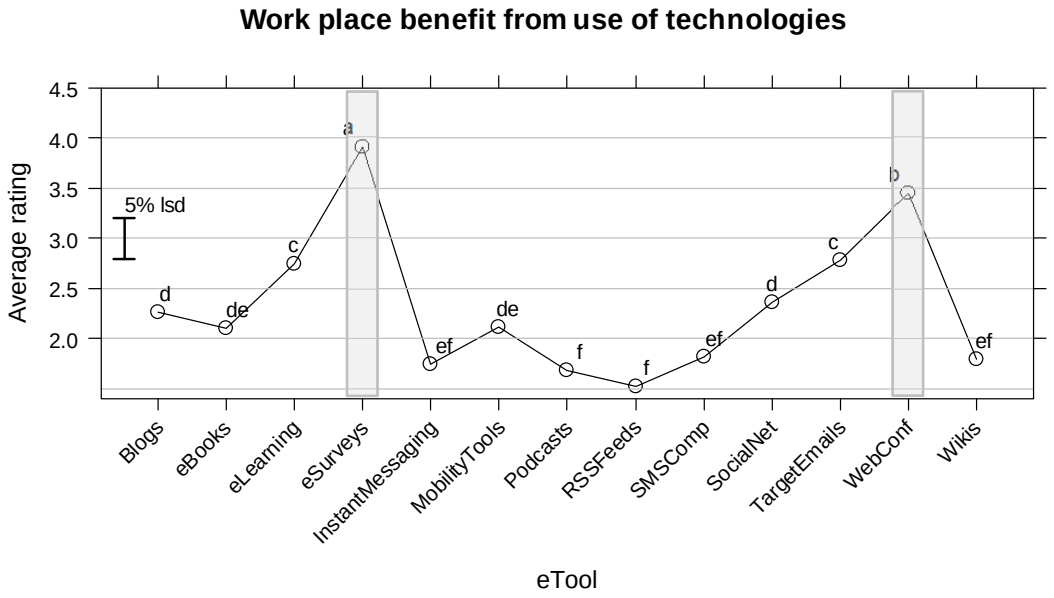


Figure 55. Average ratings for the benefit the work place has received from the respondent using the eTool technologies.

Note: Averages with the same letter are not significantly different from each other.

The distribution of the ratings of how much the workplace had benefitted from eSurveys is shown in Figure 56, and web conferencing in Figure 57.

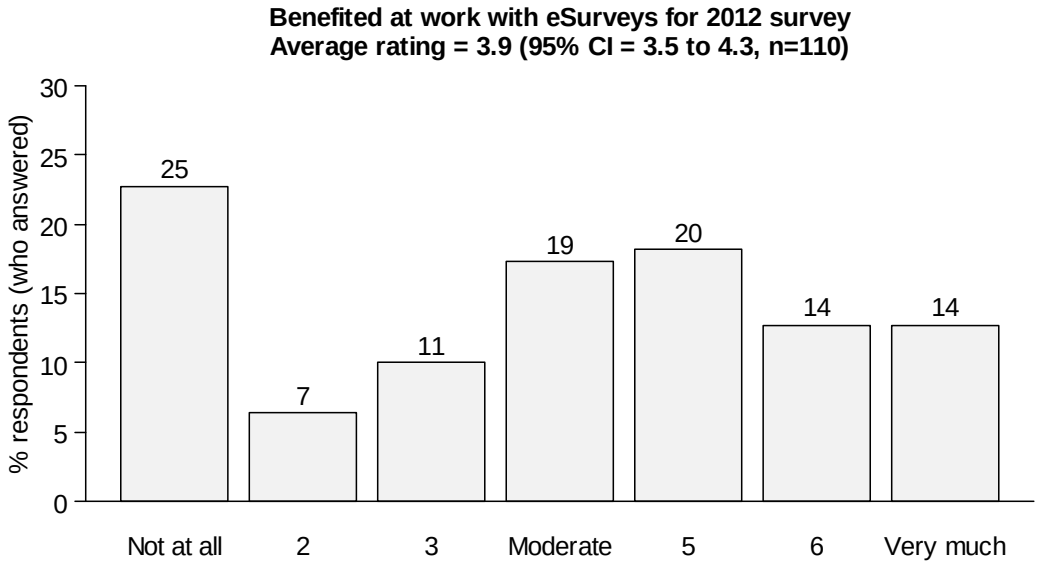


Figure 56. Distribution of ratings of how much the work place has benefited from respondents using eSurveys.

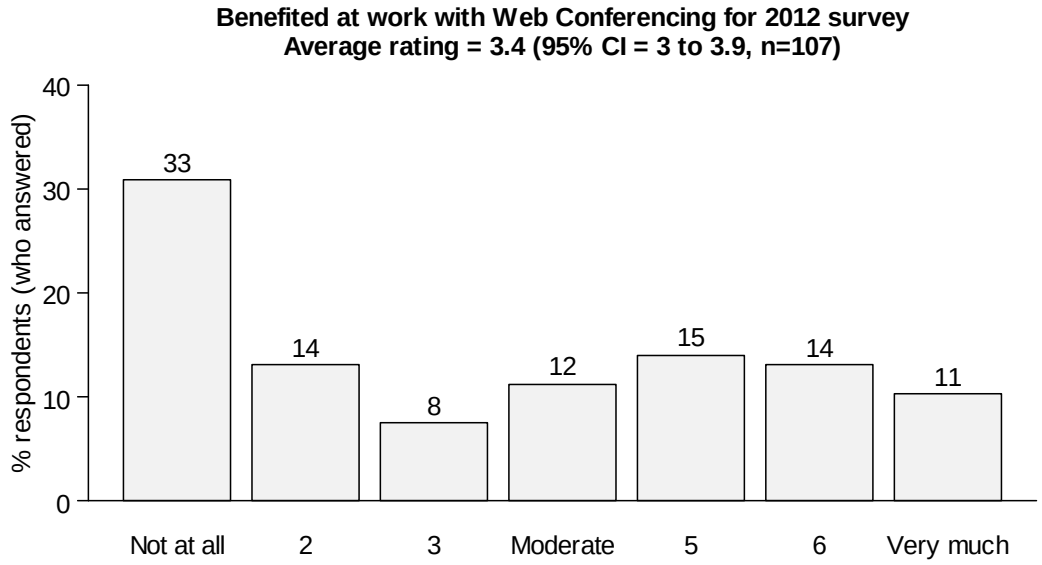


Figure 57. Distribution of ratings of how much the work place has benefited from respondents using web conferencing.

For both eSurveys and web conferencing, the most frequent response was 'Not at all' and the average ratings were below the halfway point of 4.0. This indicates that even though these were the two highest rated eTools for workplace benefit, neither had a large impact on the workplace.

Summary and observations

The fact that 25 and 33 percent of respondents said that eSurveys and web conferencing respectively made no benefit to the workplace is not unexpected, since so few of the respondents had any experience using the two eTools (either as a reactive or proactive user).

Experiences with eTools

The respondents in the 2012 survey were asked 'If you've had moderate to high experience with one or more eTools, please specify the eTool and tell us how it helped you'. eSurveys were mentioned by the largest number of respondents (21), followed by web conferencing (14).

eSurveys

The 21 comments regarding eSurveys are listed in Table 46 in Appendix 1c and were mostly positive, with 12 respondents commenting on their use on getting feedback from workshops, training sessions and events, with comments such as 'eSurveys allow us to easily capture evaluation data after an event', 'Easy and cost effective way to gain feedback' and 'Easily set up and easy for people to respond'.

There were seven respondents who mentioned eSurveys as a quick, easy, cheap and successful way of completing a survey, including comments such as 'Cheaper to produce and execute, easier to use and collate results' and 'Intuitive, simple to use and quick. Saves money and time. Very easy to view results'. A further two respondents mentioned more generally how the eSurveys linked in with other work and was part of a collection of eTools to help keep in contact with geographically remote clients. One respondent mentioned issues with poor response rate with on-

line responses, while another mentioned it was their clients' preferred method of being surveyed.

Web conferencing

The 14 comments referring to web conferencing are listed in Table 47 in Appendix 1c. A thematic analysis created three broad groups. The first with seven responses focused on how web conferencing had been resource effective by saving time, travel and enabling more people to participate than would otherwise have been possible. Comments included 'Webinars have been marvellous in saving time and engaging with a much wider and spread out audience', 'Able to participate in events that I would otherwise not be able to attend', and 'Enabled cost and time efficient means of participating from remote location'.

There were six comments referring to how the use of web conferencing had allowed for better contact with the team and others outside their team for a smaller cost. Those comments included 'Web conferencing has been a great way to keep in contact with the team', 'Much better than a teleconference' and 'Allows us to reach a wide audience in a timely manner and using expert presenters for little cost'.

There were another three comments regarding the use of web conferencing for training and attending national events. The remaining two were general comments made about a respondent's low use of webinars in their current role, and the feeling that the department wasted money by not using Skype which was free.

Summary and observations

Once again the theme coming through the data is that staff tend to use the eTools when they help make the respondents' work easier or more effective. This is particularly true if they are both quick and easy to use, like eSurveys. This is in accord with comments made to the researcher during the eExtension project.

Ways eExtension tools generate interest

When asked in what way eExtension interested them, 81 out of a potential 119 respondents (68%) provided comments, as detailed in Table 48 in Appendix 1c. Most of the comments (75 out of 81) were about why the respondents used eExtension.

A thematic analysis determined the following major categories:

- A means of communicating with clients, stakeholders, industry, public and colleagues (16), with comments such as 'A great tool for getting the message to our major stakeholders', 'Finding new ways to communicate information to industries and the public, in a modern and progressive way' and 'It significantly increases the capacity to communicate and engage with clients and consequently the potential for greater impacts from our projects'.
- Using technology to achieve outcomes (4), the technology as a tool (10), and as a way to interact with users of the internet (19), with comments such as 'New tools to allow me to do my job better', 'The potential, particularly in multi-media information provision, is enormous' and 'We have to find a way of re-engaging with our clients. Current 'group extension' methods don't work. Growers are not attending workshops. Perhaps some of the new media will provide opportunities'.

- Getting access to a larger audience across large distances (9), with comments including ‘Enabling us to reach remote clients 24/7’ and ‘Instant access to audience - no time lags’.
- Using a tool that improves efficiency and effectiveness, and save resources such as time and money (9), with comments such as ‘Opportunities for innovative, cost effective and far reaching delivery of services and information’ and ‘Efficiency and effectiveness of creating and delivering learning experiences to achieve change’.
- A way of making information readily available that is convenient and efficient (8), including comments such as ‘Use of electronic technologies to reach our customer base and provide material in a way that is useful to them and convenient to access when it suits them’.
- Another four respondents commented on wanting or needing to understand the technologies better, with comments such as ‘Learning about new technologies and how we can use them to benefit us internally and our clients’.

Summary and observations
A theme encapsulating many of the sentiments expressed in that data would be ‘working smarter’. This included the concepts of working with a geographically dispersed audience and being able to do things that would not have otherwise been possible without the new technologies.

Other comments
The final question of the survey invited respondents to submit any final comments. There were 31 respondents out of 119 (26%) who provided more comment, as detailed in Table 49 in Appendix 1c. They were broadly grouped into categories of:
- Lack of departmental support to allow use of the tools at all or in a timely and cost efficient fashion (7), with comments including ‘One of the biggest problems is the time and effort it takes to get access to technology through the DAFF system - and the cost associated with doing so’;
- Suitability to the audience (6), with comments such as ‘The usefulness of eTools will depend primarily on the willingness and ability of my clients (farmers) to take-up and use the technology’;
- Use of eExtension tools, with four respondents noting the advantages of them, including the comment ‘It works well in conjunction with tradition extension methods - just another tool in the bag’, and one respondent noting their role does not have a need to use them;
- Content being thought through to ensure it is appropriate for audience (3), with the comment ‘With all these eTools, I think one of the most important long term questions to ask is who is going to be putting the ‘up-to-date’, ‘regionally appropriate’, ‘good quality’ information onto these eTools’;
- Other comments including an example of using remote tools in the field, need for more training or information, and encouragement to the researcher with comments such as ‘Really grateful to John for pioneering and persisting with the development of eTools and eLearning within the Dept. It has made a huge difference to the reception we get to ideas when we are not the lone voice’.

Summary and observations
This ‘Other comments’ section enabled a wide variety of comments to be expressed, possibly as the respondents’ final shots before submitting their survey results. The

themes that emerged were generally similar to previous ones, though a new theme emerged around the need to consider the audience's needs.

Summary of key findings and themes identified from this survey
The respondents were highly open to using the new technologies, they considered them of moderate relevance to their work, but they had relatively low levels of awareness about them. The respondents considered the department's IT platform and policies restrictive and out-dated. Since the respondents were so open to using the technologies and could see the relevance for doing so, there was probably a high level of frustration being felt by them when they weren't able to utilise the Web 2.0 technologies.

The respondents' interest in eExtension tools was generally as a way of communicating with clients, stakeholders and others, especially over large distances with no time lag. Essentially they were looking for ways to work smarter.

In summary, the themes identified from the analysis of this eExtension baseline survey in descending order of importance were:

- The department's IT platform (hardware and software) and policies were restrictive and out-dated. Respondents felt that this was stymieing their ability to use these new communication technologies.
- The importance of face-to-face engagement and that electronic means should not replace it.
- eTools allowed the respondents to 'work smarter', especially when operating with a geographically dispersed audience, allowing them to do things that would not have otherwise been possible.
- The importance of considering the audience's needs.

4.2 Impact of web conferencing

The results from the previous survey indicated that web conferencing was one of the most widely used eTools of the eExtension project. To better understand the factors that may have contributed to this result, an analysis of the impact of web conferencing was undertaken. A large number of staff had signed up to use web conferencing but then never took the next step of hosting a web conference. This analysis sought to determine the reasons for non-adoption and the factors that may have prevented them from doing so.

4.2.1. Background

This survey investigated the impact of web conferencing since the introduction of Cisco WebEx as an interim corporate solution on 21 May 2009. Since that time 137 DAFF staff registered as WebEx hosts, of which 119 were still working for DAFF at the time of this survey.

SurveyMonkey was used to conduct the web based survey and all 119 WebEx hosts were given the opportunity to respond to the survey. A pre-test of the survey was conducted with a small number of participants and the survey questions modified based on their feedback to improve comprehension and relevance. A total of 56 of the 119 participants responded to the survey (47% response rate). The responses were received from 18 to 27 July 2011.

The questionnaire consisted of 13 questions, which can be viewed in Appendix 2a. The questions were routed after question five, depending on whether the respondents had hosted their own web conference. Those that had hosted a web conference were routed to questions 6 and 7 (how web conferencing had helped), and those who hadn't were routed to question 8 (reasons for not hosting).

The rating questions used a seven-point Likert-type scale which ranged from very low to very high of the attribute being measured. The ratings were considered as normally distributed and 95% confidence intervals of the mean were reported and t-tests were conducted.

Analyses across questions were done as an analysis of variance, again assuming the assumptions of the analyses were met (data is independent and normally distributed with similar variances). The analyses used the respondent as a blocking term to remove this variation and made the analysis more sensitive to detect differences across questions. The significance level was set at 95%. The least significant difference (lsd) procedure was used to compare levels when there was a significant effect. Letters placed next to bars on graphs show that the averages with the same letter are not significantly different.

Qualitative comments were grouped into major themes where appropriate and percentages were given out of the 119 potential respondents. Obvious spelling mistakes were corrected, but any changes that could potentially change the meaning of the comments were left unchanged.

4.2.2. Key results

About the respondents

Business group. The majority (70%) of the respondents belonged to the Science, Agriculture, Food and Regional Services group, while 17% were part of Employment and Economic Development, and 13% part of Mines and Energy as shown in Figure 58. There were two respondents who did not provide this information. An analysis of the data (detailed in Table 53 in Appendix 2b) showed there was no significant difference in the average ratings of the questions in this survey due to business group.

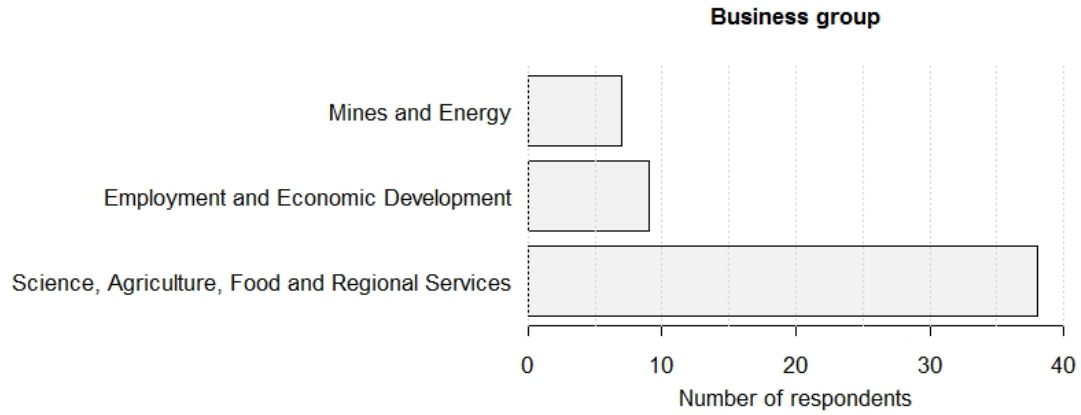


Figure 58. Distribution of respondents by Business group.

Age. The age distribution peaked at the 40 to 49 year age group with 39% of the respondents being in this group, as shown in Figure 59. The next biggest group was the 50-59 year olds with 26%, then the 20 to 29 year olds with 19%, 30 to 39 year olds with 15% and only 2% older than 60 years. The approximate average age was 42 years (using the midpoints of the age categories and assuming the midpoint for 60+ years was 64.5). Two respondents did not provide details of their age. There was no significant difference in the average ratings of the questions in this survey due to age (see Table 54 in Appendix 2b).

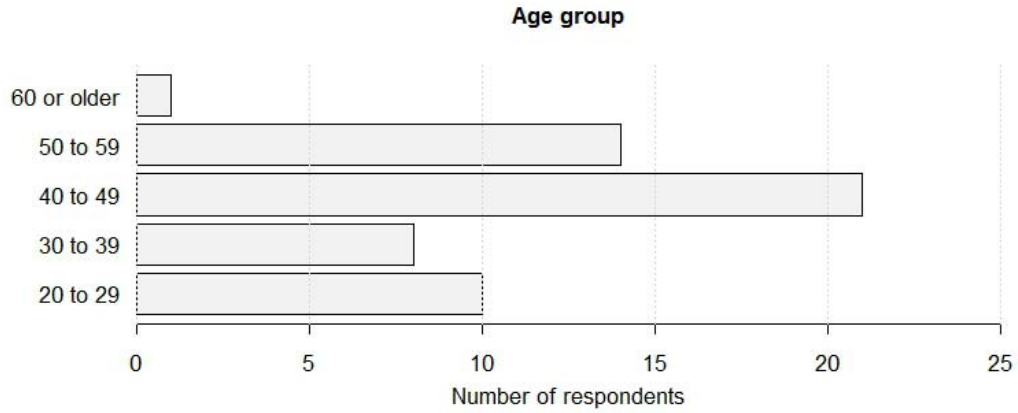


Figure 59. Distribution of respondents by age group.

Gender. Forty percent of the respondents were female and 60% were male. An analysis showed that there was no significant difference in the average ratings of the questions in this survey due to gender (see Table 55 in Appendix 2b).

Summary and observations

The age distribution of DAFF staff (as at 27 February 2014 as earlier data was not available) compared with that of the respondents is shown in Table 8.

Table 8. Age distribution of DAFF staff and respondents.

Age	DAFF staff	Respondents
20 to 29	10%	19%
30 to 39	22%	15%
40 to 49	29%	38%
50 to 59	30%	26%
60 and over	9%	2%
Total	**100%**	**100%**

This indicates that slightly more of our respondents were in the 20 to 29 and 40 to 49 age groups than the overall DAFF staff population, and slightly fewer in the 30 to 39, 50 to 59 and 60 and over age groups. This suggests that the ages of our 56 respondents are not necessarily representative of the 2337 staff of DAFF, which is not surprising considering the smaller sample size of our respondents. The implication is that the results and recommendations from this study may not be entirely applicable to the wider DAFF staff population.

However when we explore the gender balance of our respondents compared to the larger DAFF population, we see that the gender balance of our respondents is the same as that of all DAFF staff (again as at 27 February 2014), as shown in Table 9. This indicates that the sample reflects the age distribution of the broader DAFF population.

Table 9. Gender balance of respondents.

Gender	DAFF staff	Respondents
Male	60%	60%
Female	40%	40%
Total	**100%**	**100%**

Webinars that had been conducted

The introductory questions asked about webinar involvement. The number of webinars conducted per respondent was on average 5.8 as a host (see Figure 60). There were 17% of the respondents who had never hosted a webinar, 21% that had hosted only one webinar and 19% who had hosted two webinars, making up 57% of the respondents. The maximum number of webinars hosted was reported to be 75.

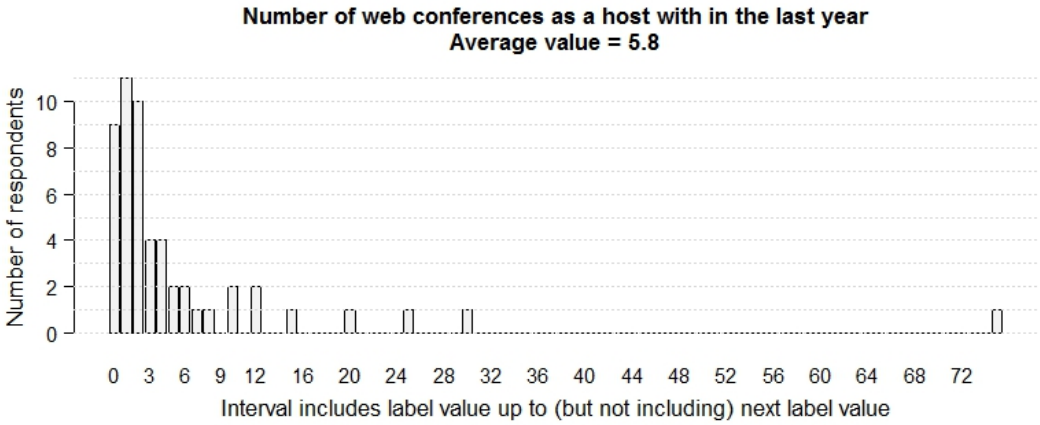


Figure 60. Number of web conferences as a host.

The number of webinars conducted per respondent was on average 4.6 as a participant (see Figure 61). There were 15% of the respondents who had never participated in a webinar, 19% that had participated in one webinar and 23% who had participated in two webinars, again making up 57% of the respondents. The maximum number of webinars participated in was reported to be 30.

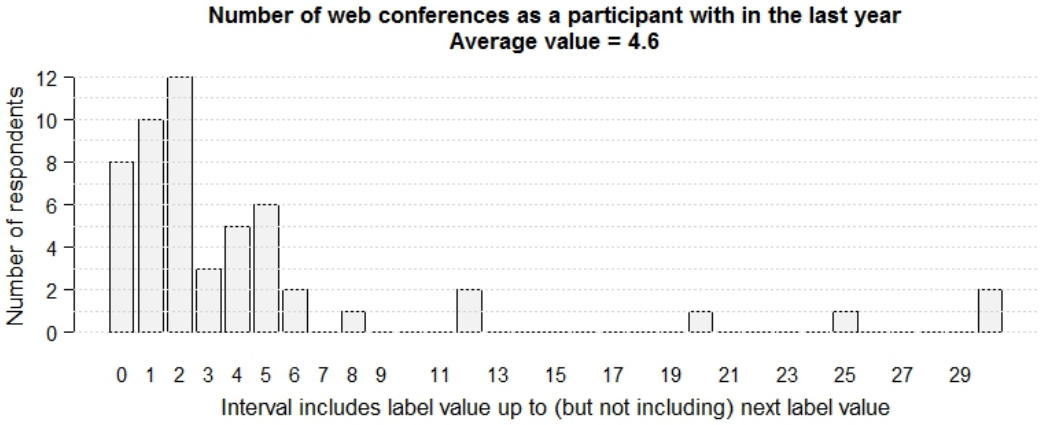


Figure 61. Number of web conferences as a participant.

The respondents reported that on average 65% of these webinars replaced the need to have face-to-face meetings, as shown in Figure 62, with 15% stating that none of the webinars replaced any face-to-face meetings and 40% of respondents saying that 100% of their webinars had replaced the need for a face-to-face meeting.

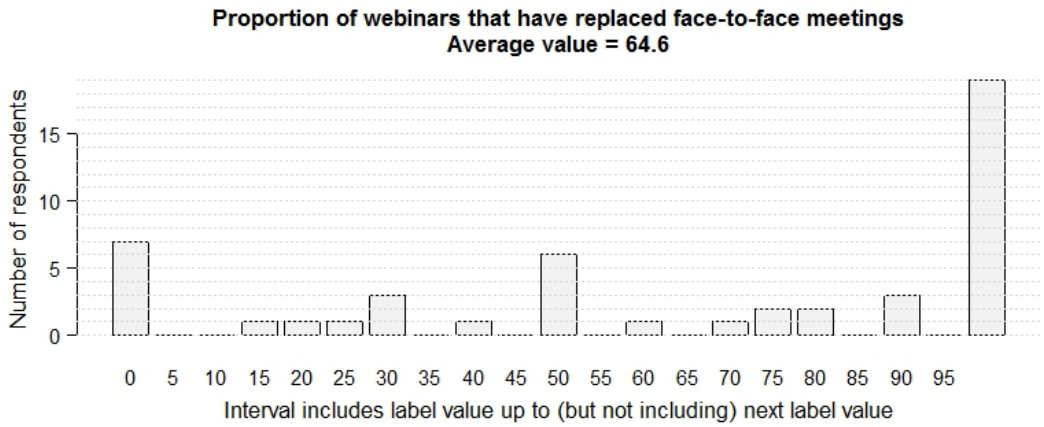


Figure 62. Proportion of webinars that have replaced face-to-face meetings.

Additional meeting opportunities that would not have happened as face-to-face meetings were reported to be on average 55% of the webinars, as shown in Figure 63. Fifteen percent of the respondents stated that none of their webinars were new opportunities and 32% stated all of their webinars were additional opportunities.

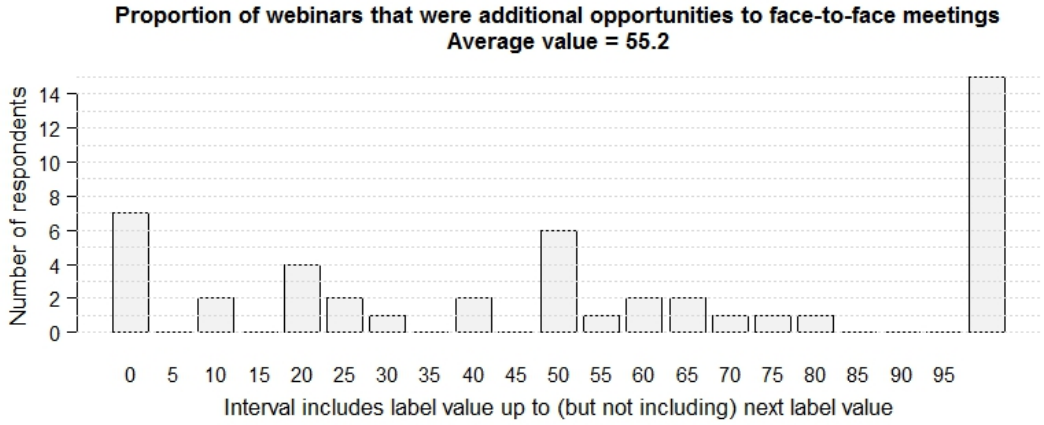


Figure 63. Proportion of webinars that were additional opportunities.

Reasons for signing up to use web conferencing

This question dealt with the expectation of benefits from using the web conferencing system. As detailed in Table 50 in Appendix 2b and shown in Figure 64, on average the most highly rated reasons for signing up to use the WebEx web conferencing system were:

- that it would save time for the webinar organiser and/or the participants (average rating 5.6 on 1 to 7 scale),
- it would reduce the need to travel away from home (5.4),
- allow more regular contact with participants (5.4), and
- save money for the webinar organiser/ participants (5.2).

These were rated much higher than ‘I’ve seen my colleagues use webinars successfully’ (4.4) and ‘Saves the environment’ (4.1). The lowest rated reason, which was much lower than the other reasons, was ‘My supervisor encourages the use of webinars’ (3.4).

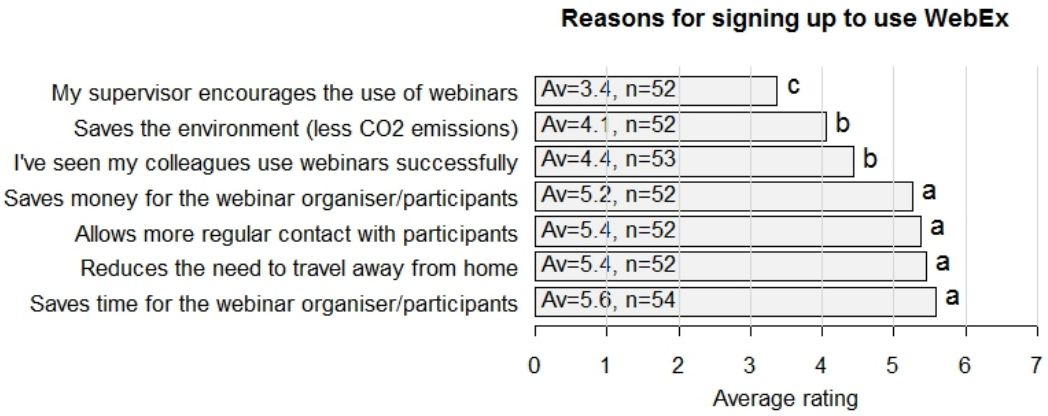


Figure 64. Reasons for signing up to use WebEx.

Note: As not all respondents answered every question, the actual number of responses (n) is shown together with the average for each item.

The distribution of responses for each question can be seen in Figure 65, Figure 66, Figure 67, Figure 68, Figure 69 and Figure 70.

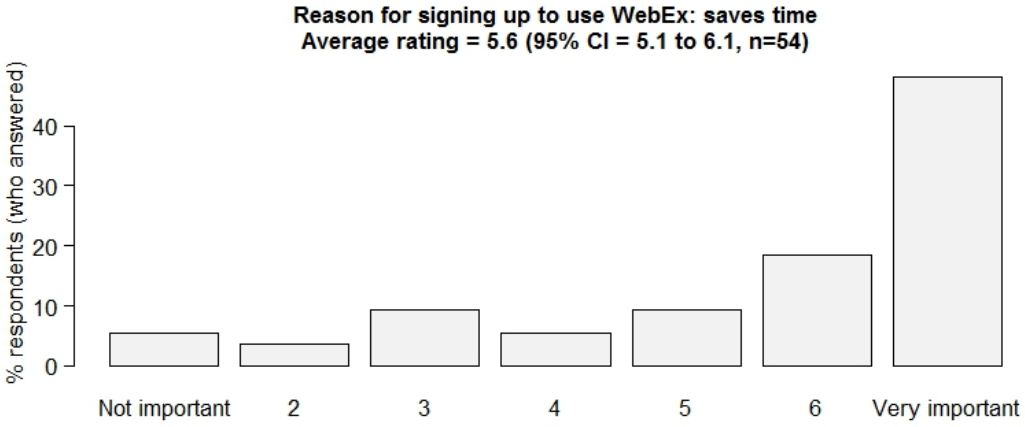


Figure 65. Reason for signing up to WebEx: saves time.

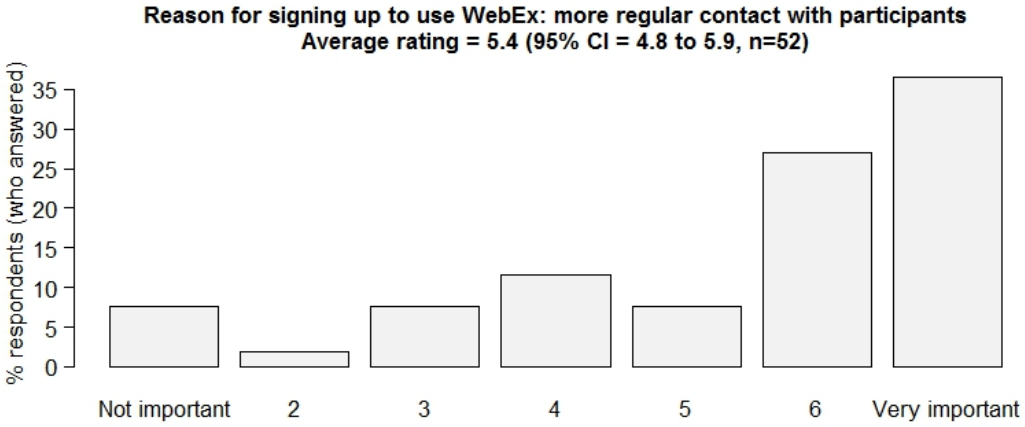


Figure 66. Reason for signing up to WebEx: more regular contact with participants.

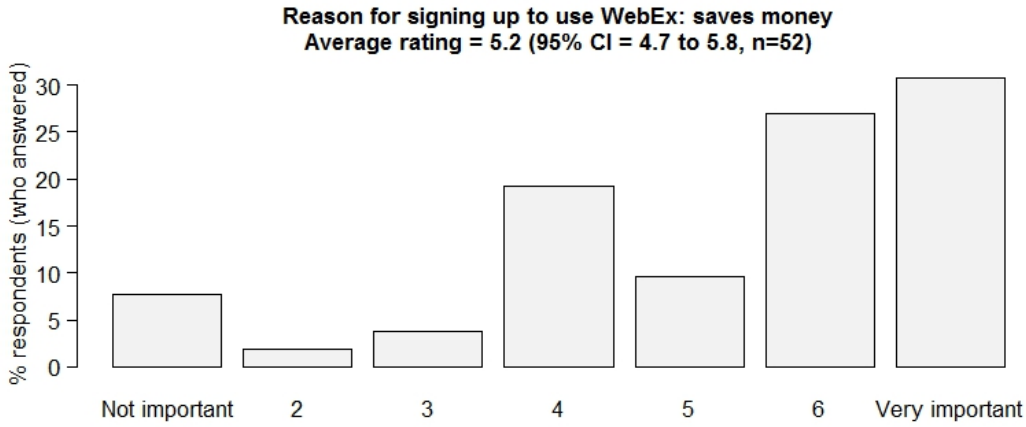


Figure 67. Reason for signing up to WebEx: saves money.

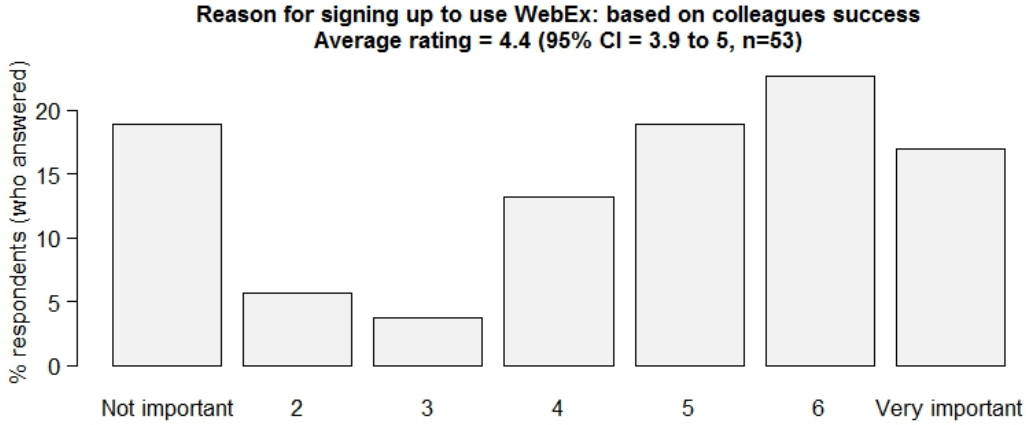


Figure 68. Reason for signing up to WebEx: based on colleagues success.

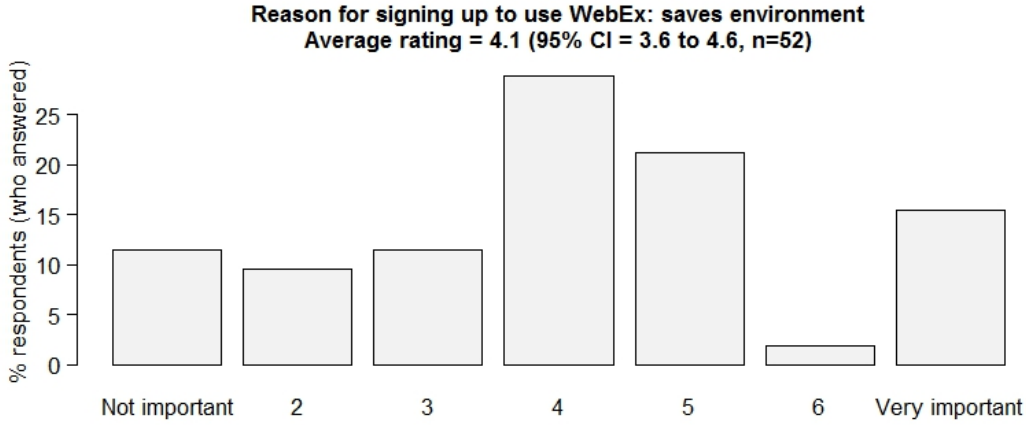


Figure 69. Reason for signing up to WebEx: saves environment.

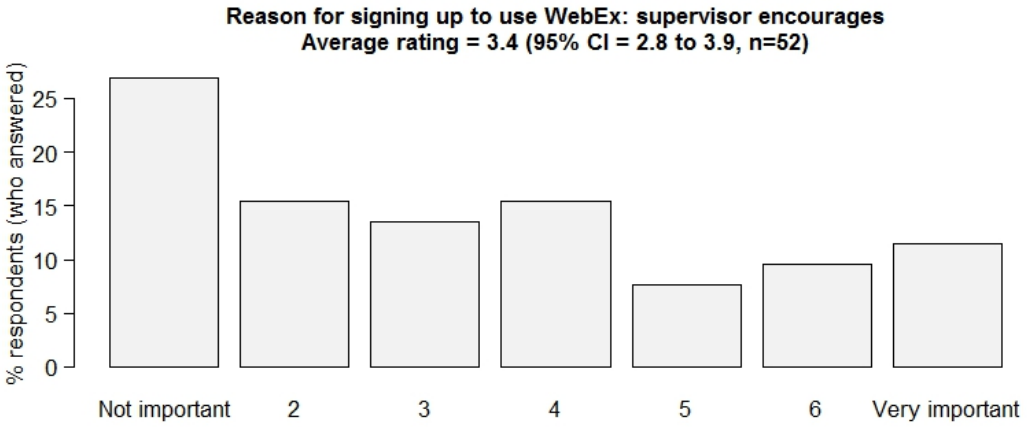


Figure 70. Reason for signing up to WebEx: supervisor encourages.

The comments provided by 23 respondents regarding the reasons for signing up to use WebEx are listed in Table 56 in Appendix 2c and were categorised into the following major areas:

- WebEx was good for sharing documents (6), with comments such as 'It enabled us to work on reports together rather than our usual inefficient email and track changes method';
- Allowed geographically dispersed participants to interact together (6), with comments such as 'As a participant in an international project, being able to get all the team together from NSW, Vic and Laos on a regular basis to go over planning and implementation strategies is vitally important and WebEx just does it!';
- Using WebEx saved on time, money and/or travel (6), with comments including 'It's a great tool that saves on travel expenses and the time associated with travel';
- General comments that WebEx was a good tool (9), with comments such as 'Essential tool for our clients and staff';
- The cost of WebEx was expensive (5), with comments such as 'It was very effective but way too expensive for ongoing use';
- Some needed more information to start re-using WebEx (2), such as the comment 'Not sure that I understand how to do it'; and
- Miscellaneous comments on the reasons they used WebEx (5).

Summary and observations

The themes emerging from this data were that respondents expected web conferencing to help them work more effectively and efficiently (saving time, reducing travel, enabled greater contact with clients and saved money), which can be summed up as working smart.

While many of the graphs were negatively skewed (saves time, more regular contact, and saves money), the graph related to the supervisor encouraging the use of webinars was positively skewed and had the lowest mean. This indicated that it was generally the least effective in encouraging use of web conferencing, although it did have a positive impact for a few of the respondents. That reason aligns with the core determinant of social influence in the UTAUT model, which is defined 'as the degree to which an individual perceives that important others believe he or she should use

the new system' (Venkatesh et al. 2003, p. 451). As such, it is unexpected that it did not rate higher in this survey.

The reason 'I've seen my colleagues use webinars successfully' was in the second grouping of reasons, behind four other reasons in the first grouping; even though it aligns with one of Roger's five attributes of a successful innovation, namely observability. One might have expected that to have been more highly rated by the respondents. Similarly, the reason 'My supervisor encourages the use of webinars' was the lowest rated reason, yet it could be seen to align with the UTAUT questions Q2.9 'People who influence my behaviour think that I should use the system' and Q2.10 'People who are important to me think that I should use the system'.

How web conferencing has helped

While the previous question investigated the expected benefits of using web conferencing, this question focuses on the actual benefits derived from using it. As can be seen in Figure 71 and Table 51 in Appendix 2b, web conferencing helped the respondents by:

- saving time (reduced travel time) (average rating of 5.8 on 1 to 7 scale),
- saving money (reduced travel expenses) (5.7),
- better engaging with their clients/ colleagues (5.6),
- being more innovative with their work (5.3), and
- being more responsive to their clients/colleagues needs (5.0).

These average ratings were not significantly different from each other.

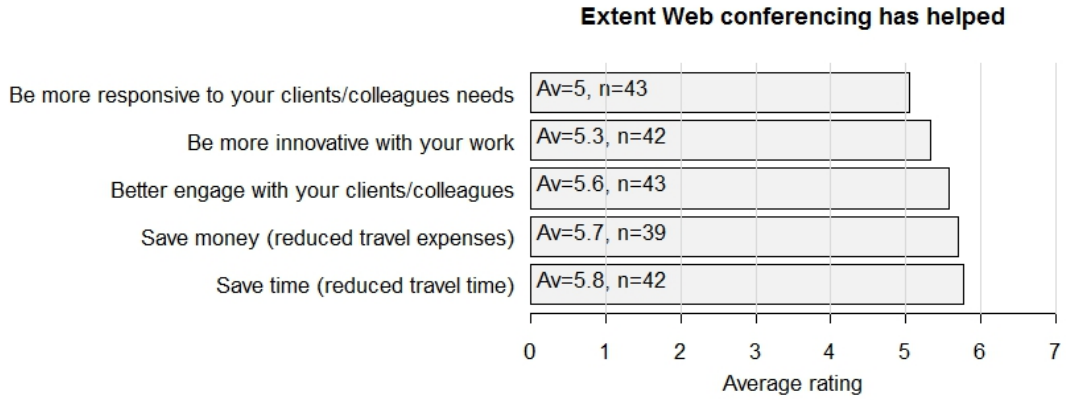


Figure 71. Extent web conferencing has helped.

The distribution of responses for 'Save time (reduced travel time)' is displayed in Figure 72 and Table 51 in Appendix 2b. The average rating was 5.8 and 86% of responses were at or above the rating of 4.

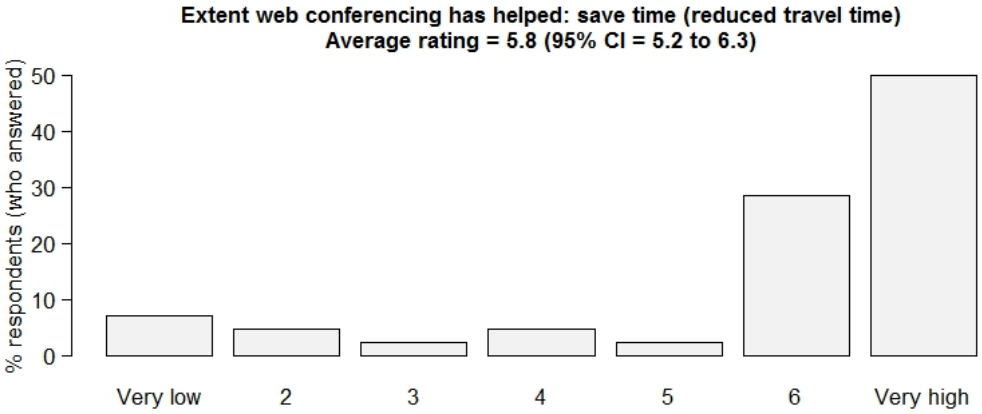


Figure 72. Extent web conferencing has helped: save time.

The distribution of responses for 'Save money (reduced travel expenses)' is displayed in Figure 73 and Table 51 in Appendix 2b. The average rating was 5.7 and 85% of responses were at or above the rating of 4.

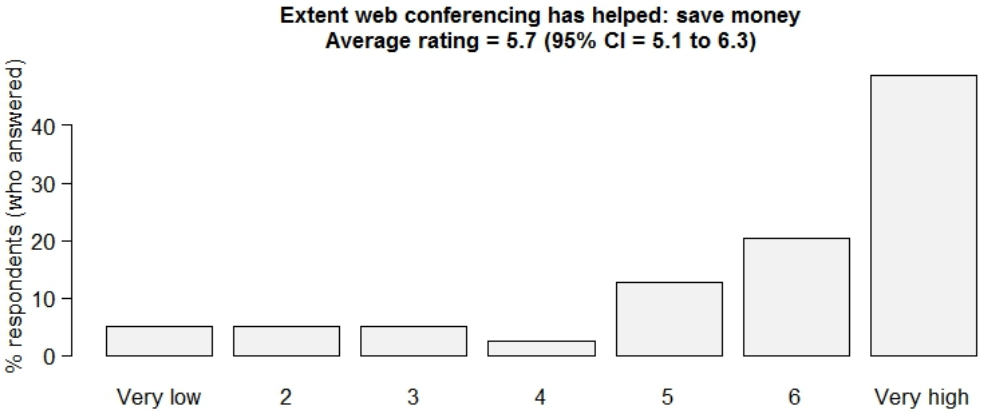


Figure 73. Extent web conferencing has helped: save money.

The distribution of responses for 'Better engage with your clients/ colleagues' is displayed in Figure 74 and Table 51 in Appendix 2b. The average rating was 5.6 and 86% of responses were at or above the rating of 4.

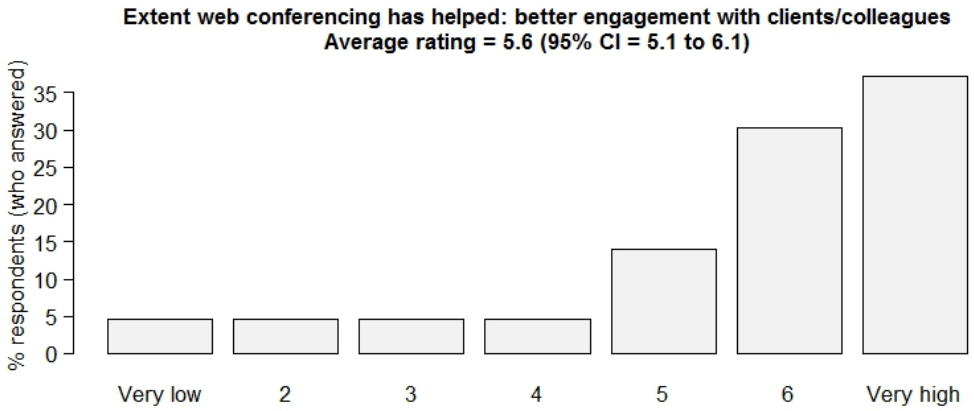


Figure 74. Extent web conferencing has helped: better engagement with clients/ colleagues.

The distribution of responses for 'Be more innovative with your work' is displayed in Figure 75 and Table 51 in Appendix 2b. The average rating was 5.3 and 83% of responses were at or above the rating of 4.

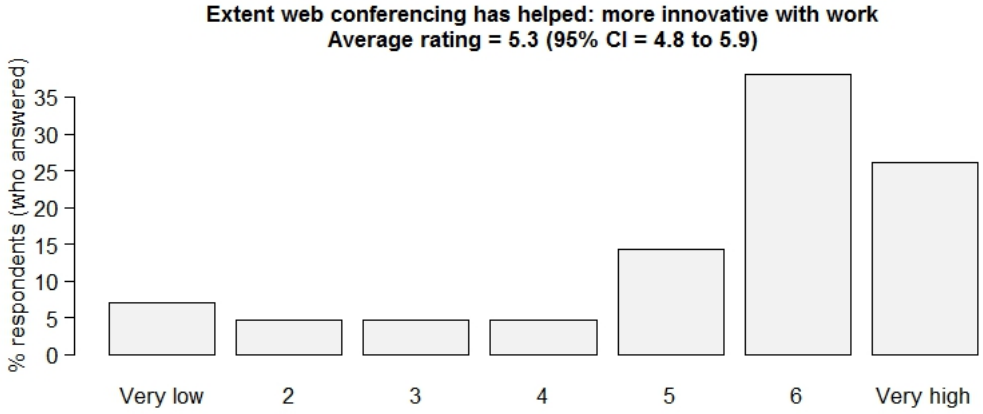


Figure 75. Extent web conferencing has helped: more innovative with work.

The distribution of responses for 'Be more responsive to your clients/ colleagues needs' is displayed in Figure 76 and Table 51 in Appendix 2b. The average rating was 5.0 and 84% of responses were at or above the rating of 4.

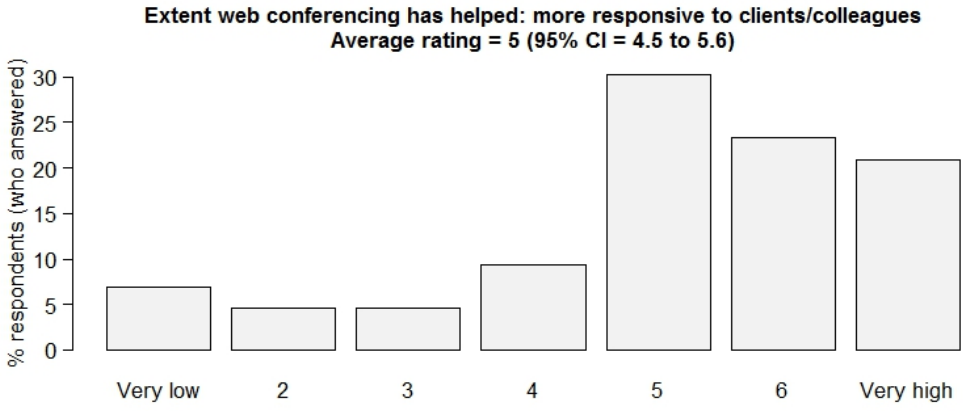


Figure 76. Extent web conferencing has helped: more responsive to clients/ colleagues.

Summary and observations
The results indicate that web conferencing helped the respondents by:

- saving time (reduced travel time),
- saving money (reduced travel expenses),
- better engaging with their clients/ colleagues,
- being more innovative with their work, and
- being more responsive to their clients/colleagues needs.

All five graphs for those reasons are negatively skewed, showing the majority of respondents gave a high score to each of the questions. The means were all between five and six (out of seven), indicating that web conferencing had helped the majority of respondents to a large degree.

Further comments
An analysis of the further comments section showed a broad range of comments regarding the extent to which web conferencing had helped, as listed in Table 57 in Appendix 2c. These have been clustered as follows:

- Positive benefits of being able to attend meetings, used in training, meetings were more effective in reduced time and being able to bring together geographically dispersed participants (4), with comments such as 'Able to attend meetings I wouldn't otherwise been able to', and 'Clients are very scattered so we can reach people who would not be able to participate at face-to-face';
- The benefit of obtaining skills in using WebEx/ web conferencing technology and facilitation skills (2) with comments including 'We need to encourage others to become more confident in using WebEx';
- The costs of using WebEx is expensive, but benefit of reduced travel costs (1), with the comment 'I used it the once, and found it to be very expensive';
- One participant did not like web conferencing due to time, expense and a bad experience with a host (1), commenting that 'They have not helped me at all. They are time consuming, expensive and unnecessary'; and
- Miscellaneous comments on the communication of a web seminar not being good, and comments on clarifying how previous questions were answered (2), including the comment 'I only organised one web seminar but the communication was not good. I still believe in the system'.

Summary and observations
While the previous question focused on intended benefits, this question focused on actual benefits. The main theme was that web conferencing had most helped the participants by enabling them to work more effectively and efficiently (saving time and money, better engagement with clients and being more innovative and responsive), which could be summarised as 'working smart'.

Brief stories about how web conferencing has helped

The respondents were asked to provide a brief story about how web conferencing had helped them to achieve something useful or important. The stories are listed in Table 58 in Appendix 2c and were broadly grouped into these categories:

- Using web conferencing to network with people in a project, often to complete project milestones (10), with a key story being:

‘During the write-up phase of our Laos fishways project, all project participants were able to collaborate on-line, sharing documents and providing active discussion while editing. We were then able to propose a new follow-on project, workshop the ideas behind this project and draw up the appropriate documentation for submission. This has resulted in our project being extended for 5 years, with $2M of funding, well worth the cost of WebEx’;

- Using web conferencing to overcome geographical distribution of participants (8), with a key story being:
  ‘We were able to liaise with our Victorian counterparts and share demonstrations of software in real time, something that only a face-to-face meeting would have been able to achieve. It was as good as being in the same room, even though we were thousands of km's away’;
- Web conferencing allowed the transfer of information quickly, particularly in natural disaster situations (3), with a key story being:
  ‘Ability to get information out to flood affected producers very quickly and particularly when they could not leave their homes’;
- Training could be planned or delivered through the use of web conferencing (6), with a key story being:
  ‘With five team members editing documents and reports is usually a nightmare. However with web conferencing we were able to all work on one document together which saved a lot of time without the need for a face-to-face meeting. As we became more confident with using web conferencing we thought it would be great for delivering training to irrigation growers located in a variety of locations without the need to hold training sessions at multiple centres’;
- It saved the cost of getting a recognised presenter (1).

Summary and observations

The brief stories allowed the respondents to share the following key messages of their appreciation for web conferencing:

- Using web conferencing to network with people in a project, often to complete project milestones,
- Using web conferencing to overcome geographical distribution of participants,
- Web conferencing allowed the transfer of information quickly, particularly in natural disaster situations, and
- Training could be planned or delivered through the use of web conferencing.

Reasons for not hosting a webinar

There were 12 out of 55 (22%) of the respondents that had not yet hosted their own web conference. Of these, there were ten respondents (out of 55) who rated the reasons for not yet using hosting a webinar. As can be seen in Figure 77 and Table 52 in Appendix 2b, none of the reasons were rated by the respondents as more than moderately important.

The reasons in decreasing importance (based on average rating on 1 to 7 scale) were:

- It seemed like a good idea at the time but they just didn’t get around to it (4.2);
- They preferred to use face-to-face interaction (4.1);
- It was hard to learn how to use the system (4.0);

- Their work role had changed so they no longer needed to run webinars (3.4);
- Their target audience wasn't confident in using the Internet (3.3);
- Their target audience didn't have access to the Internet (3.1);
- It seemed too expensive to use (3.1); and
- Their colleagues hosted the webinar they were thinking of doing (2.3).

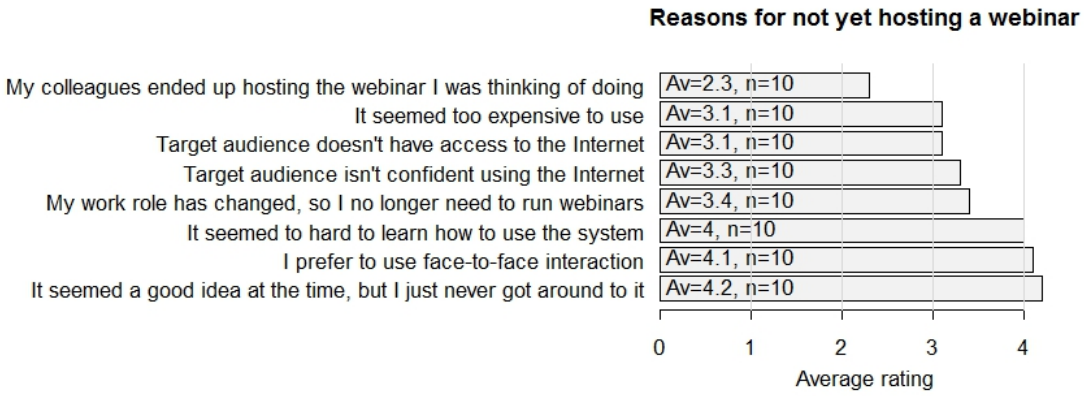


Figure 77. Reasons for not yet hosting a webinar.

Summary and observations

While a numbers of reasons were provided as to why respondents weren't using web conferencing, none of the reasons were rated more than moderately important. The top three reasons provided were:

- It seemed like a good idea at the time but they just didn't get around to it,
- They preferred to use face-to-face interaction, and
- It was hard to learn how to use the system.

Summary of key findings and themes identified from this survey

In summary, the main theme that emerged from this survey was that web conferencing had most helped the participants by enabling them to work more effectively and efficiently (saving time and money, better engagement with clients and being more innovative and responsive), which can be summed up as 'working smart'.

Regarding the expected benefits from using web conferencing, the most highly rated responses were:

- that it would save time for the webinar organiser and/or the participants,
- it would reduce the need to travel away from home,
- allow more regular contact with participants, and
- save money for the webinar organiser/ participants.

These were rated much higher than 'I've seen my colleagues use webinars successfully' and 'Saves the environment'. The lowest rated reason, which was much lower than the other reasons, was 'My supervisor encourages the use of webinars'. That final reason aligns with the core determinant of social influence in the UTAUT model, which is defined 'as the degree to which an individual perceives that important others believe he or she should use the new system' (Venkatesh et al. 2003, p. 451). As such, it is unexpected that it did not rate higher in this survey.

The reason ‘I’ve seen my colleagues use webinars successfully’ was in the second grouping of reasons, behind four other reasons in the first grouping; even though it aligns with one of Roger’s five attributes of a successful innovation, namely observability. One might have expected that to have been more highly rated by the respondents.

Regarding actual benefits, web conferencing helped the respondents by:

- saving time (reduced travel time),
- saving money (reduced travel expenses),
- better engaging with their clients/ colleagues,
- being more innovative with their work and
- being more responsive to their clients/colleagues needs.

It should be noted that the means for these responses were all between five and six (out of seven), indicating that web conferencing had helped the majority of respondents to a large degree.

Brief stories allowed the respondents to share the following key messages of their appreciation for web conferencing:

- Using web conferencing to network with people in a project, often to complete project milestones,
- Using web conferencing to overcome geographical distribution of participants,
- Web conferencing allowed the transfer of information quickly, particularly in natural disaster situations, and
- Training could be planned or delivered through the use of web conferencing.

While a numbers of reasons were provided as to why respondents weren’t using web conferencing, none of the reasons were rated more than moderately important. The top three reasons provided were:

- It seemed like a good idea at the time but they just didn’t get around to it,
- They preferred to use face-to-face interaction, and
- It was hard to learn how to use the system.

4.3 Web conferencing usage

As the administrator of the DAFF WebEx system, the researcher received monthly reports from WebEx regarding the web conferences conducted, together with a large amount of other usage data. This section focuses on this set of observed data.

4.3.1. Background

This provides a summary of the observed information regarding the WebEx usage by DAFF staff from 9 July 2009 to 19 July 2011. This data was sourced from WebEx usage reports across the two year time span. *People minutes* is a term used within the web conferencing industry and is the cumulative number of minutes that the participants stayed in the web conference. So for example, if there were two participants and one stayed for 30 minutes and the other stayed for 40 minutes, the people minutes for that event would equal 70.

4.3.2. Key results

While the primary purpose of this survey was to assess web conferencing usage in DAFF, there were a number of questions relevant to this study which are included below.

There were in total 88 different hosts who conducted from one to 110 webinars. As shown in Table 10, in total there were 816 webinars held, for an average of 55 minutes each, with an average of 4.5 participants per webinar (or 3.9 participants per webinar if averaging the average per host, i.e. no weighting for hosts). There were a total of 3654 participants counted across all the webinars.

Table 10. Summary of web conferencing usage per host.

Information per host	Total people minutes	Total webinars	Average people minutes per webinar	Average time per webinar (minutes)	Average people per webinar
Minimum	5	1	3.7	4	1
1st quartile	167	2	66	30	2
Median	812	4	150	52	2.7
3rd quartile	1842	8	269	73	4.3
Maximum	26,056	110	1257	158	20
Average	**2342**	**9.3**	**227**	**55**	**3.9**
Total	206,118	816	-	-	-

The following graphs display the distribution of the results, allowing for greater understanding of the situation. As can be seen in Figure 78, most of the webinars were either fairly short or had few participants, as the people minutes were fairly small.

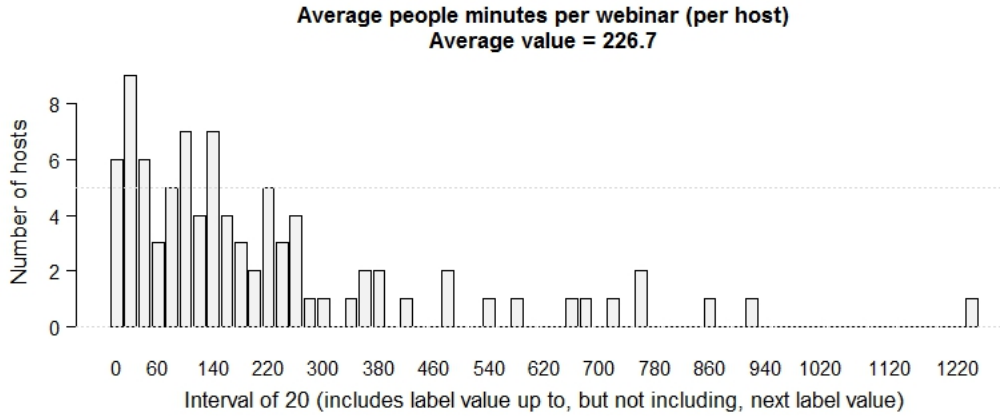


Figure 78. Average people minutes per webinar.

Regarding the total people minutes per host, as shown in Figure 79, only a few hosts made extensive use of the system.

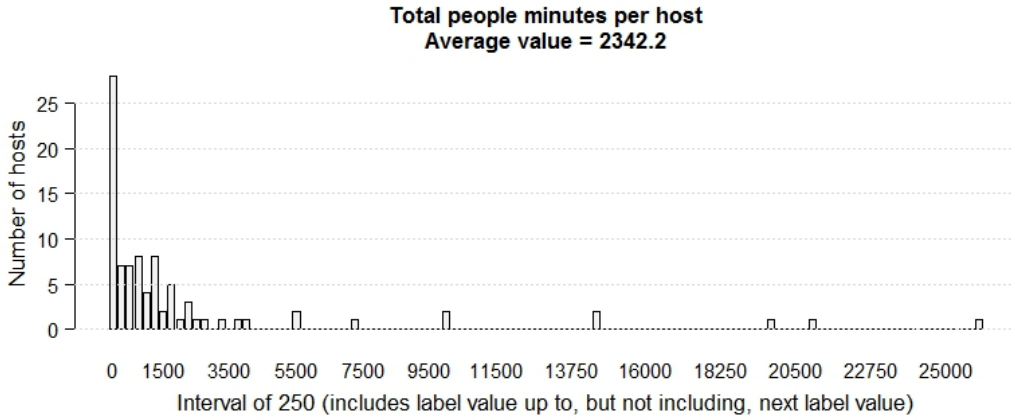


Figure 79. Total people minutes per host.

Looking at the total number of webinars run over the time period, as shown in Figure 80, once again only a few hosts made extensive use of the system.

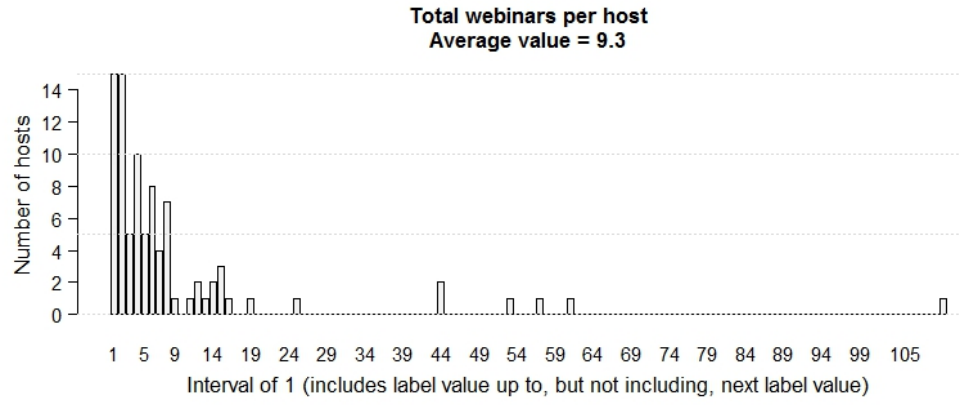


Figure 80. Total webinars per host.

The average number of participants per webinar is shown in Figure 81, indicating that the majority of webinars only had up to four participants.

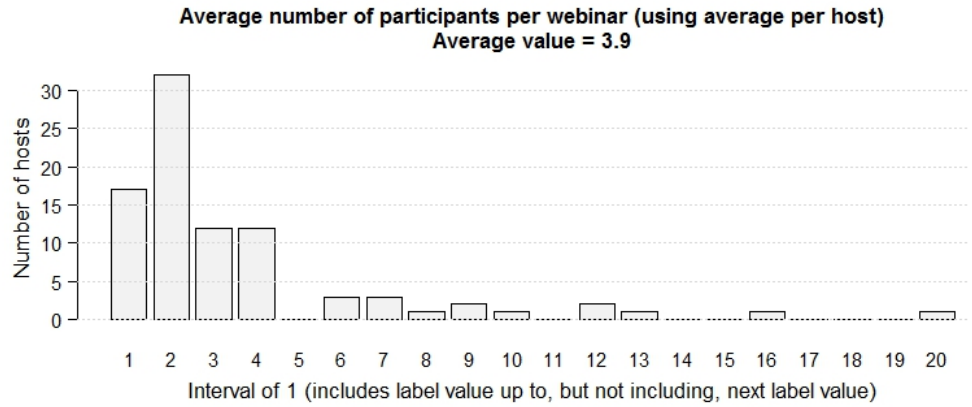


Figure 81. Average number of participants per webinar.

Figure 82 shows the distribution of total people minutes per host. This illustrates the exponential drop in webinar usage across hosts, highlighting that there were a small number (8 out of 88) of hosts who could be considered to be power users.

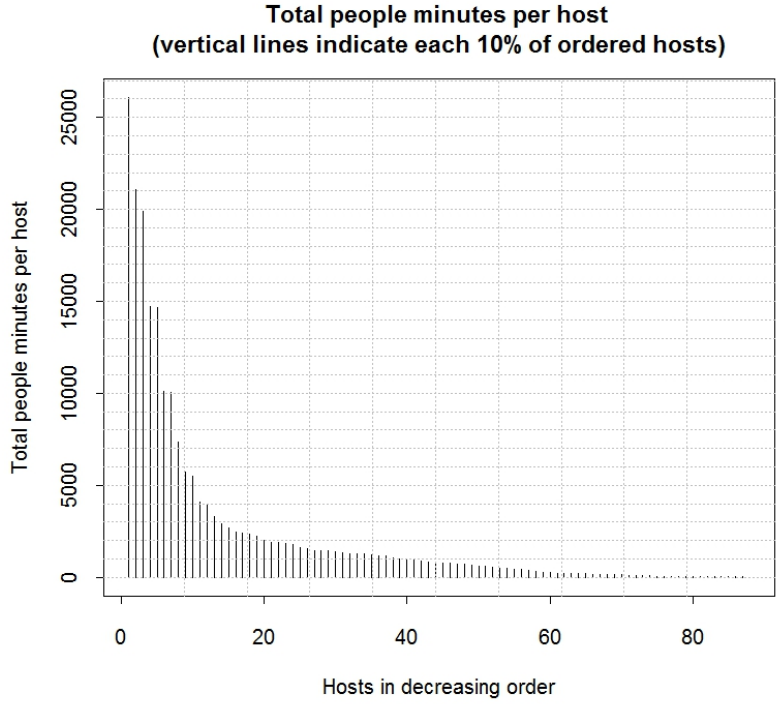


Figure 82. Total people minutes per host.

Summary of key findings and themes identified from this survey

This observational data provided new information that had not been identified in the early data sets, namely that there were a small number of power users who made extensive use of the system. The responses of these users could differ markedly from those of the more typical user, so a way to identify these super users and explore possible effects upon other responses should be considered in future research. The results from this survey helps put the results of the Impact of web conferencing survey into perspective, now that we know that there were a small number of power users. This could explain some of the variation in responses in the previous survey, where some users were highly satisfied with web conferencing while others thought it a waste of time and money.

4.4 Impact of eSurveys

The results from the eExtension baseline survey indicated that eSurveys were the second most adopted eTools from the eExtension project. This section further explores how staff used the eSurveys and the impact this technology had upon their work.

4.4.1. Background

SurveyMonkey was approved as an interim corporate solution on 21 May 2009. Since that time 109 DAFF staff registered as SurveyMonkey users, of which 94 were still working for DAFF at the time of this survey. SurveyMonkey allows users to design surveys, collect responses and analyse results. It is an externally hosted solution at www.surveymonkey.net.

SurveyMonkey was used to conduct the web based survey and all 94 SurveyMonkey users were given the opportunity to respond to the survey. A total of 47 of the 94 participants responded to the survey (50% response rate). The responses were received from 24 June to the 27 July 2011. The questionnaire consisted of sixteen questions, which can be viewed in Appendix 3a.

The ratings were explored for differences in the respondents' business group, age and gender. Analyses across questions and between grouping terms were done as an analysis of variance, assuming the assumptions of the analyses are met (data is independent and normally distributed with similar variances). The analyses across questions used the respondent as a blocking term to remove this variation and make the analysis more sensitive to detect differences across questions. The significance level was set at 95%. The least significant difference (lsd) procedure was used to compare levels when there was a significant effect. Letters placed next to bars on graphs show that the averages with the same letter are not significantly different.

Qualitative comments were grouped into major themes where appropriate and percentages are given out of the 47 potential respondents. Obvious spelling mistakes were corrected, but any changes that could potentially change the meaning of the comments were left unchanged.

4.4.2. Key results

While the primary purpose of this survey was to evaluate the impact of eSurveys in DAFF, there were a number of questions that are relevant to this thesis and are included below.

Surveys previously conducted by the respondents

To gauge the relative importance of eSurveys, respondents were asked how many paper-based, telephone and electronic surveys they conduct in a year. On average there were significantly higher numbers of electronic surveys conducted in a year (3.3 per respondent, with 11% reporting none) than paper-based surveys (1.4 per respondent, with 55% reporting none) which were significantly higher than telephone surveys (0.5 per respondent, with 72% reporting none).

The distribution of responses regarding number of electronic surveys conducted in a year is shown in Figure 83 and detailed in Table 59 in Appendix 3b. This shows that the bulk of respondents only created one to three eSurveys each year.

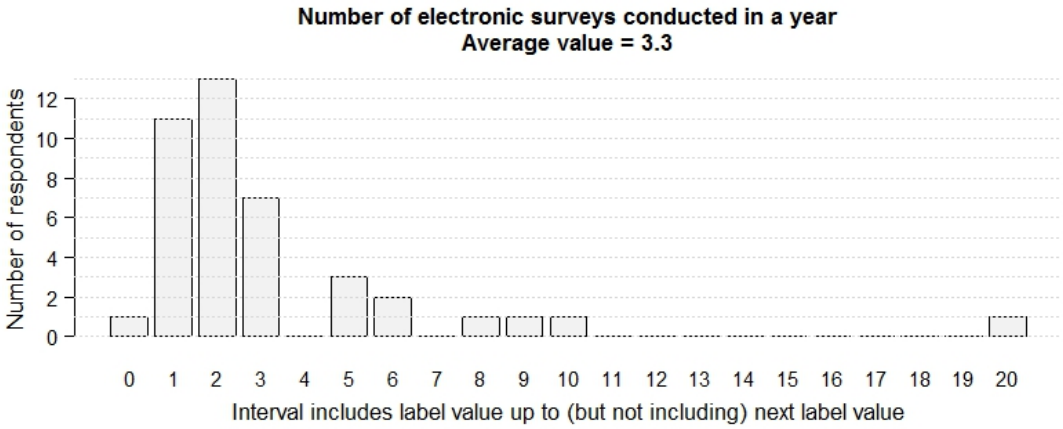


Figure 83. Number of electronic surveys conducted in a year.

There was a broad distribution of the proportion of surveys sent internally versus externally with an average of 38% internal (hence 62% external), with 30% reporting that all of their surveys were internal, while 39% reported all of their surveys were external to DAFF staff.

One respondent reported 280 paper-based surveys and this response was later removed from the summaries, as upon investigation they reported the number of respondents rather than the number of surveys.

Changes in number or type of surveys in recent times

The comments from thirty respondents on the changes in number or type of surveys are recorded in Table 66 in Appendix 3c. A theme analysis determined the following categories:

- There was no change reported by 10 respondents, with comments such as ‘No the number and types of surveys haven't changed, although my job has changed. I’ve been using SurveyMonkey for about 3 to 4 surveys a year, focusing on staff and internal customer feedback to inform further activities.’;
- Use of electronic surveys, generally making it more convenient to conduct and analyse surveys (6), with comments including ‘I use electronic surveys exclusively as they are easy to use, allows interim data analysis prior to closing date, final analysis and reporting that is incredibly fast’ and ‘Used to do surveys via mail or phone but since the intro of SurveyMonkey they are all electronic’;
- The number of surveys have increased, in particular due to the ease of conducting them with SurveyMonkey (4), with comments such as ‘Increasing now with SurveyMonkey and the ease of delivering surveys’;
- Changed from paper-based to electronic based surveys (2), with comments such as ‘Electronic surveys have made it a lot easier to canvas people’s views as paper ones in the past seem to get lost and are not as convenient’;
- The changes in surveys number or type are dependent on the events for which they are used (2), with comments including ‘The number of surveys created and sent out is dependent on the number of events/ seminars run throughout the year’;
- Increased number of eSurveys to provide workshop feedback and documented feedback (2), with comments such as ‘More requirements to provide documented feedback on effectiveness of policy initiatives undertaken’;
- Miscellaneous comments that the respondents had only done one survey (2).

- Reduced number of responses from paper-based surveys (1);
- The questionnaire has reduced number of questions for comments (1).

Summary and observations
These results showed that staff were undertaking more surveys, and of those surveys, more were utilising eSurveys as they were quicker and easier to administer, allowing 'analysis and reporting that is incredibly fast'. This is consistent with the perceptions of the researcher who has observed a steady increase in interest of DAFF staff to use eSurveys.

Reasons for signing up to use SurveyMonkey

This question dealt with the expectation of benefits from using eSurveys. The most important reasons for the respondents signing up to use SurveyMonkey, as shown in Figure 84 and detailed in Table 60, were as follows:

- no longer need to decipher hand written responses (average rating 6.3, on 1 to 7 scale),
- they could quickly see and analyse results (6.1), and
- it would be easy for the respondents to use (5.9).

Other important reasons (rated more than moderately important, i.e. average rating greater than 4), included that it would:

- save time for the survey respondent (5.5),
- save money (5.4) and
- save time (5.1) for the survey creator and
- save the environment as no paper wasted (4.6).

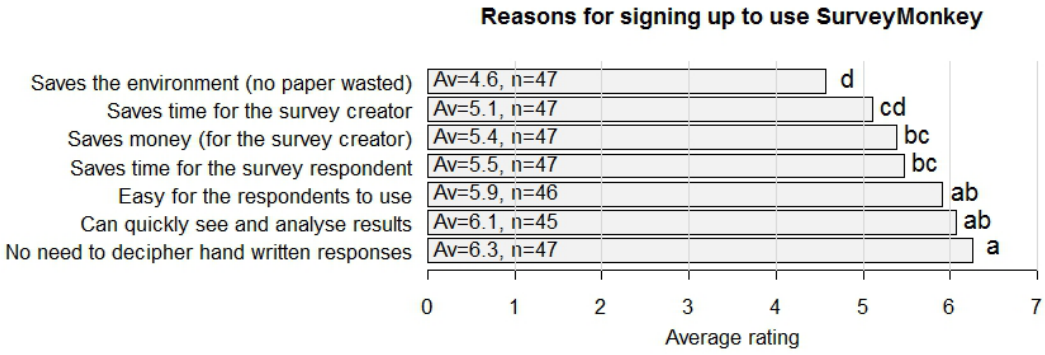


Figure 84. Reasons for signing up to use SurveyMonkey.

Note: As not all respondents answered every question, the actual number of responses (n) is shown together with the average for each item.

The distribution of responses for each question can be seen in Figure 85, Figure 86, Figure 87, Figure 88, Figure 89, Figure 90 and Figure 91. The first six graphs for those reasons are negatively skewed, showing the majority of respondents gave a high score to each of the questions. The means were all between 4.6 and 6.3 (out of seven), indicating that eSurveys had helped the majority of respondents to a large degree. This could be due to the fact that the respondents were all early adopters of this technology (as they had already signed up to use SurveyMonkey) and therefore had relatively similar perceptions.

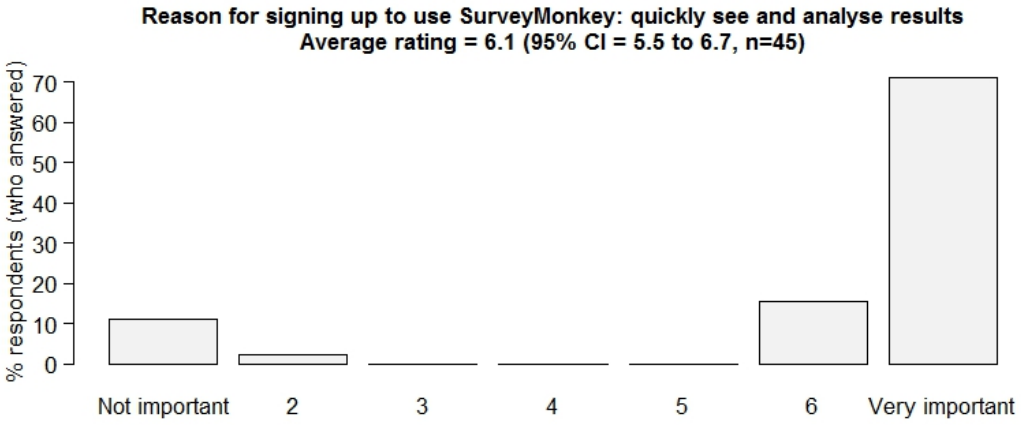


Figure 85. Reason for signing up to use SurveyMonkey: quickly see and analyse results.

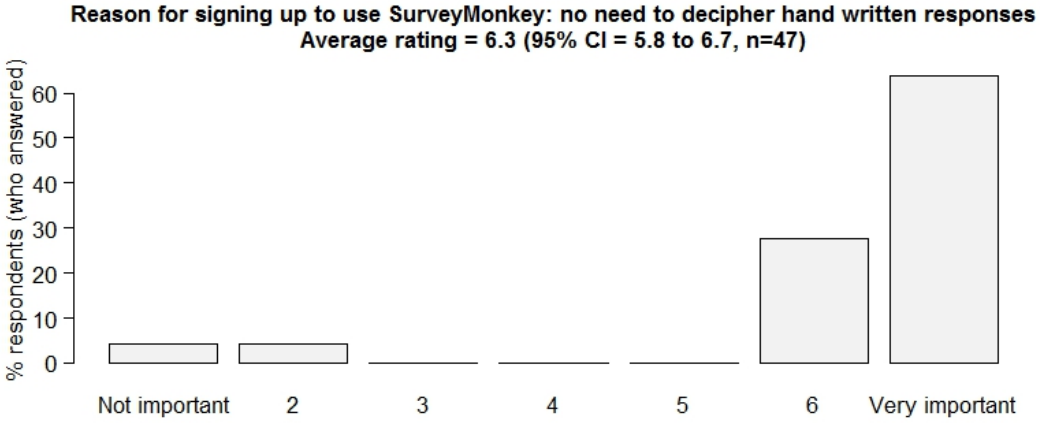


Figure 86. Reason for signing up to use SurveyMonkey: no need to decipher hand written responses.

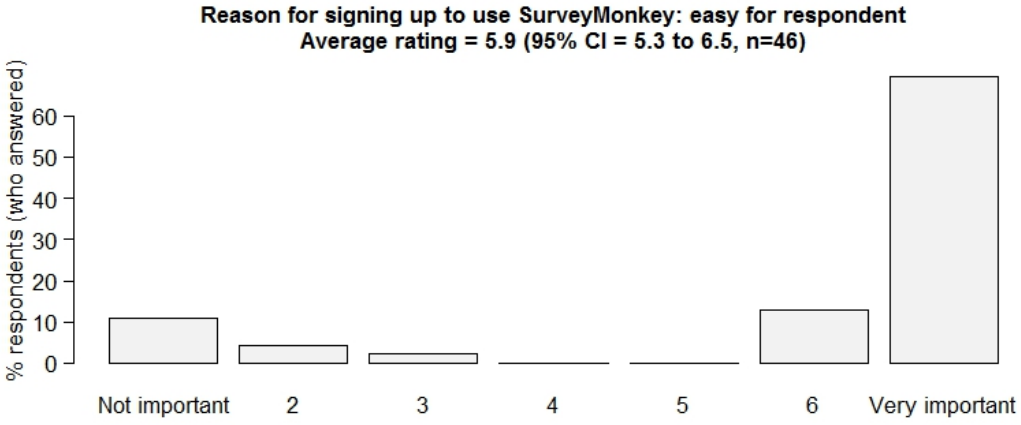


Figure 87. Reason for signing up to use SurveyMonkey: easy for respondent.

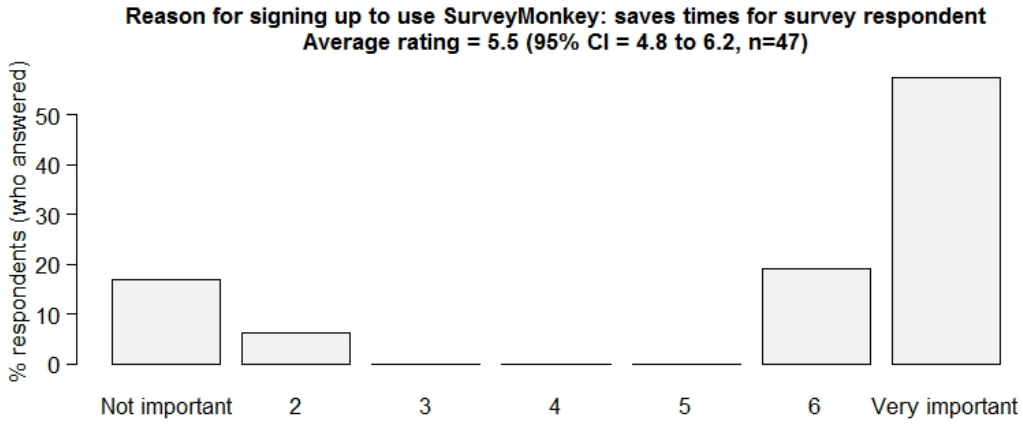


Figure 88. Reason for signing up to use SurveyMonkey: saves time for survey respondent.

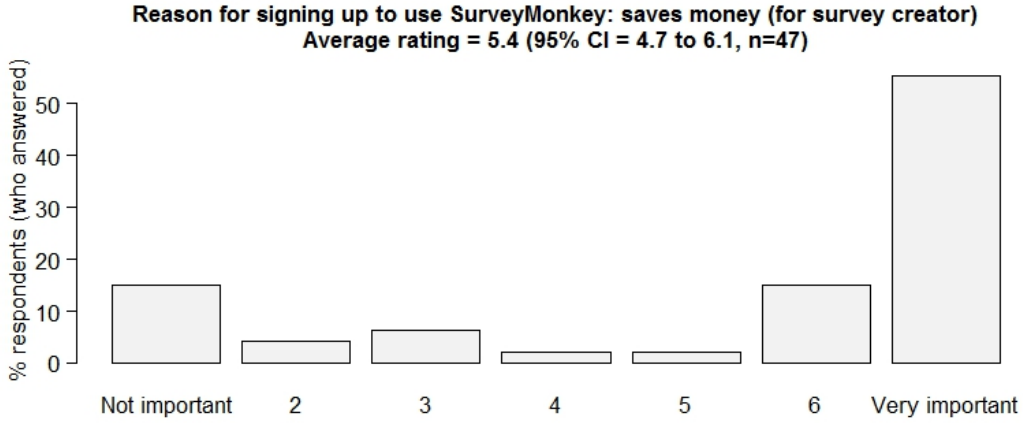


Figure 89. Reason for signing up to use SurveyMonkey: saves money (for survey creator).

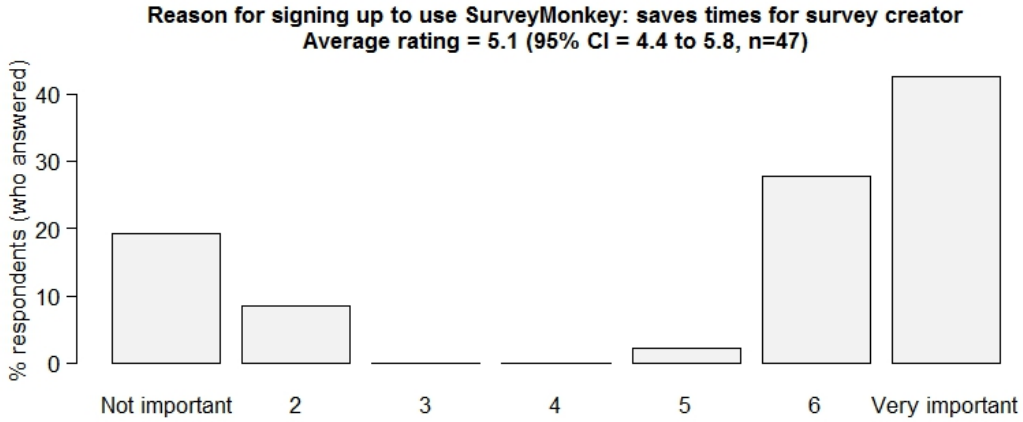


Figure 90. Reason for signing up to use SurveyMonkey: saves time for survey creator.

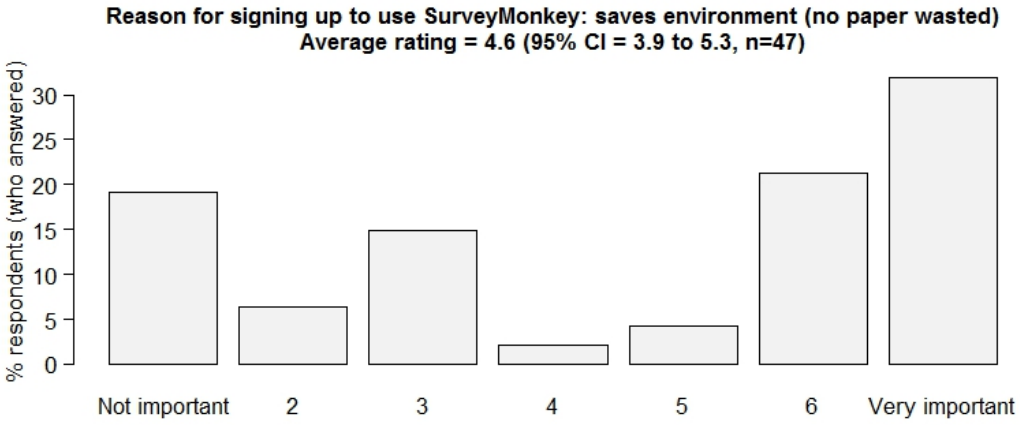


Figure 91. Reason for signing up to use SurveyMonkey: saves environment (no paper wasted).

As detailed in

Table 60 in Appendix 3c, there was a significant difference in average ratings for 'saves money and 'saves the environment' between males and females, with females rating them higher at 6.3 and 5.4 (n=23) while males rated them at 4.5 and 3.7 (n=22) respectively.

Comments on the reasons for signing up to use SurveyMonkey are shown in Table 67 in Appendix 3c and were sorted into the following categories:

- SurveyMonkey was convenient, efficient and easy to use (5), with comments such as 'Has been really great and essential tool to have' and 'I couldn't justify the time spent doing a paper-based survey compared to electronic surveys. I find the 'reminder' option invaluable as both a survey creator and a survey respondent';
- It was an essential tool to document feedback (1), with the comment 'It is essential we do an After Action Review of DAFF participants, so eSurveys are a principal tool for securing feedback which may be called upon by the State Ombudsman, Auditor General or in civil litigation matters'.

Summary and observations

Two strong themes emerged from this data. The first was around the theme of ease of use (easy to read the responses, easy to see and analyse the results, and easy for the respondents to use). This can be summarised as working smart. The second theme focused around savings (saves time, money and the environment).

Usefulness of SurveyMonkey

The respondents generally highly agreed that SurveyMonkey had helped to create a survey (average rating 6.0), collect responses (6.3) and analyse results (6.0). In fact only 5%, 5% and 8% respectively of the respondents gave a rating less than moderately helping (i.e. a rating less than 4.0). There was no significant difference between these ratings.

A thematic analysis of the responses shown in Table 68 in Appendix 3c, determined the following categories:

- During analysis of surveys there were issues with getting the results into Word, loading the graphics, report not as expected and it could be easier (4), with comments such as ‘Sometimes the report doesn't come out in the way I was envisioning but that's more to do with survey design and my need to build further skills in that area’;
- When creating surveys there were problems with question types (i.e. hierarchical) (1), with the comment ‘Some question formats it cannot cope with e.g. hierarchical questions where the answer to question 1 influences the answer to Q2 etc’;
- There were no deficiencies (1), with the comment ‘No deficiencies. Excellent product for my purpose’;
- Miscellaneous comments on the respondents not having sent a survey from SurveyMonkey yet, and it was easier to use the full version than the free one (3), with comments such as ‘Had difficulty the first time I used it because I was not part of the DPI&F system (i.e. I was using the free simplified version). Second (and only other) time I've conducted a SurveyMonkey survey, I was as a fully-fledged user and things were much easier’.

The respondents had also reported that SurveyMonkey had provided a sufficient range of question types (average rating 5.7 on 1 to 7 scale), was easy to use for the first time (5.6) and to a less extent found the online support helpful (4.9). These ratings were significantly different from each other.

The most highly rated aspects of eSurvey’s usefulness (as shown in Figure 92 and detailed in Table 61 in Appendix 3b) were:

- being more efficient by saving time and effort (average rating 6.3 on 1 to 7 scale)
- getting feedback from clients (6.2)
- being more responsive to client needs (6.0),
- being more innovative (5.8),
- making better informed decisions (5.7) and
- gathering feedback after an event (5.5).

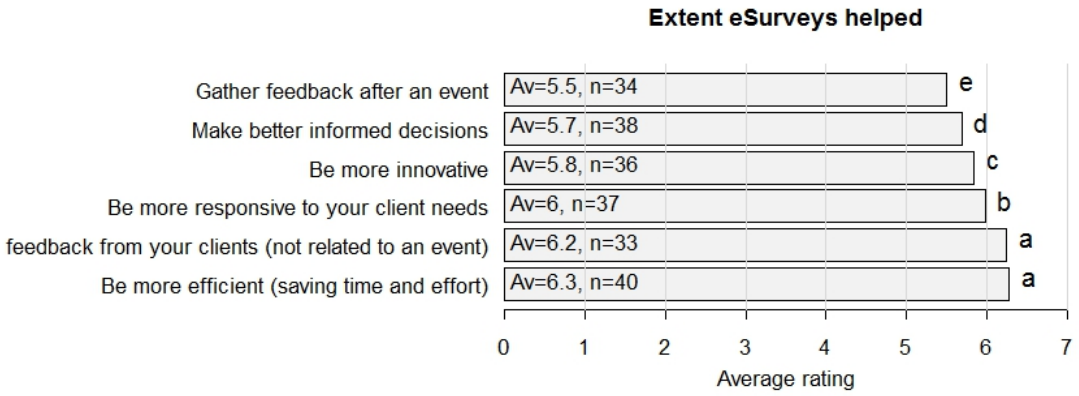


Figure 92. Extent eSurveys helped.

Note: As not all respondents answered every question, the actual number of responses (n) is shown together with the average for each item.

The distribution of responses for ‘Be more efficient (saving time and effort)’ is displayed in Figure 93 and Table 61 in Appendix 3b. The average rating was 6.3 and 90% of responses were at or above the rating of 4.

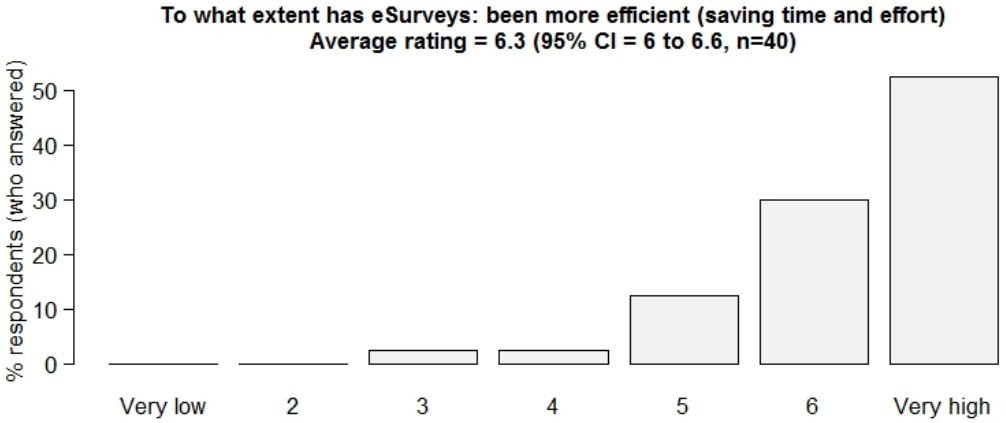


Figure 93. Extent eSurveys have been more efficient (saving time and effort).

The distribution of responses for ‘Seek feedback from your clients (not related to an event)’ is displayed in Figure 94 and Table 61 in Appendix 3b. The average rating was 6.2 and 73% of responses were at or above the rating of 4.

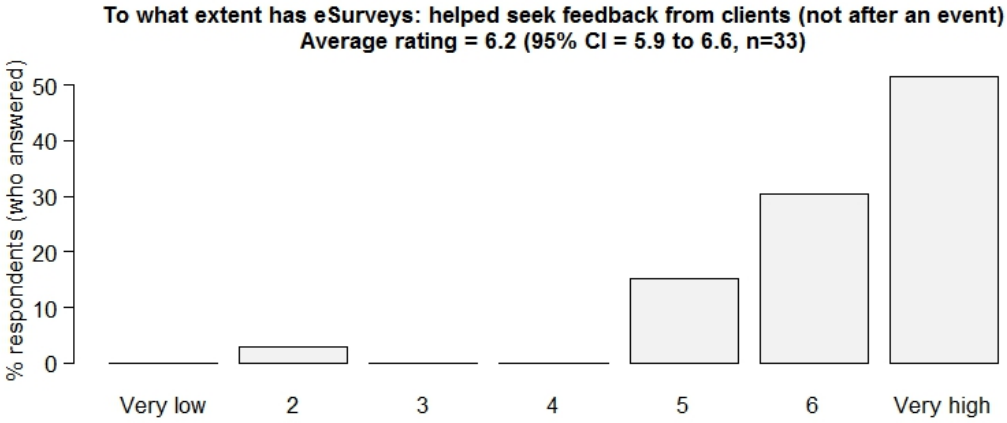


Figure 94. Extent eSurveys have helped seek feedback from clients (not after an event).

The distribution of responses for ‘Be more responsive to your client needs’ is displayed in Figure 95 and Table 61 in Appendix 3b. The average rating was 6.0 and 83% of responses were at or above the rating of 4.

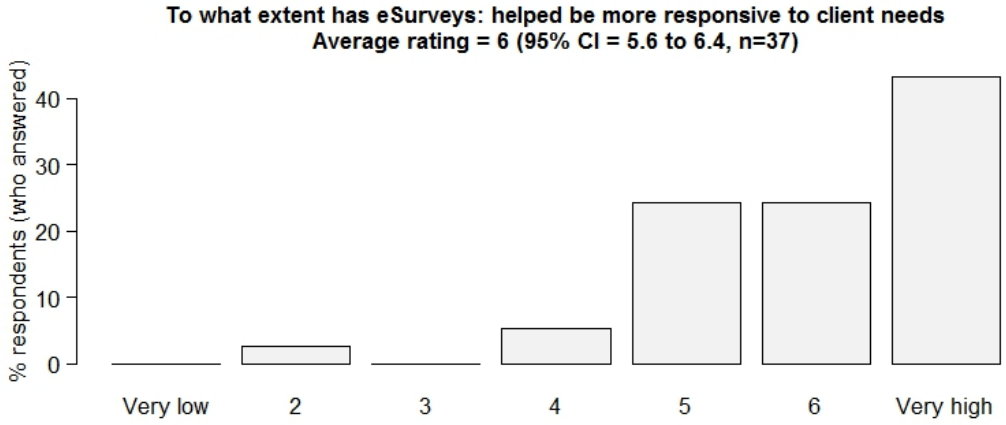


Figure 95. Extent eSurveys have helped be more responsive to client needs.

The distribution of responses for ‘Be more innovative’ is displayed in Figure 96 and Table 61 in Appendix 3b. The average rating was 5.8 and 85% of responses were at or above the rating of 4.

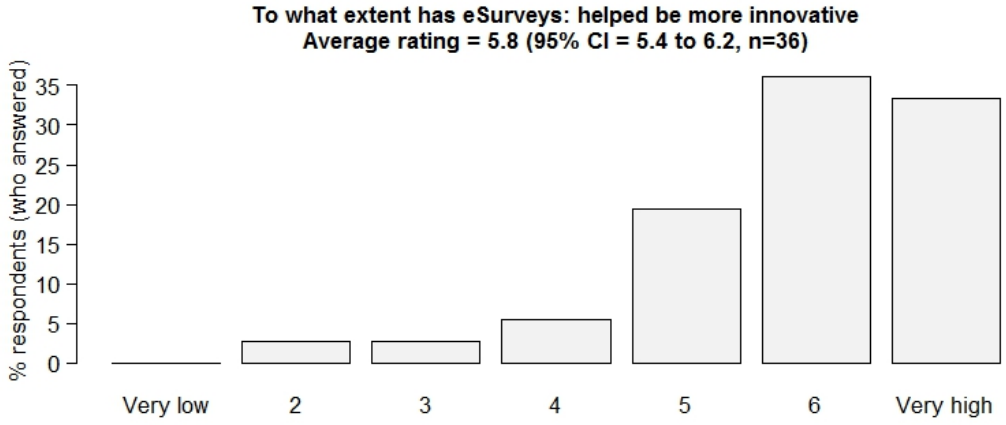


Figure 96. Extent eSurveys have helped be more innovative.

The distribution of responses for ‘Make better informed decisions’ is displayed in Figure 97 and Table 61 in Appendix 3b. The average rating was 5.7 and 83% of responses were at or above the rating of 4.

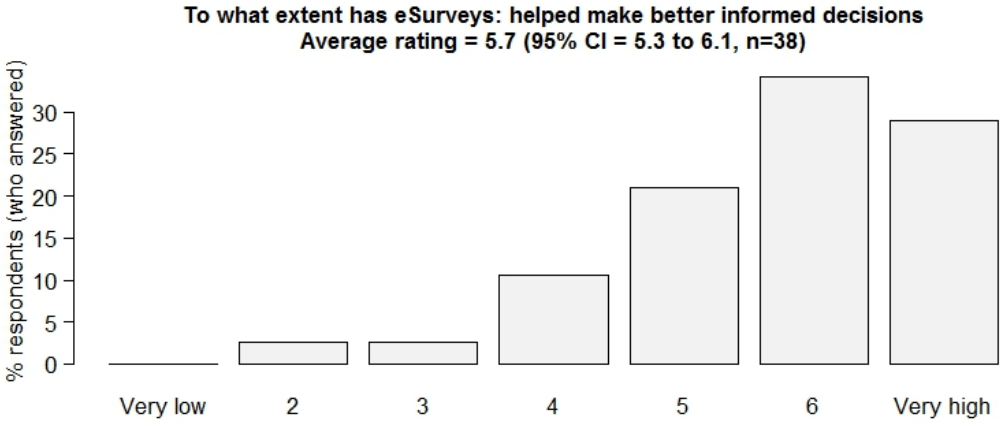


Figure 97. Extent eSurveys have helped make better informed decisions.

The distribution of responses for ‘Gather feedback after an event’ is displayed in Figure 98 and Table 61 in Appendix 3b. The average rating was 5.5 and 63% of responses were at or above the rating of 4.

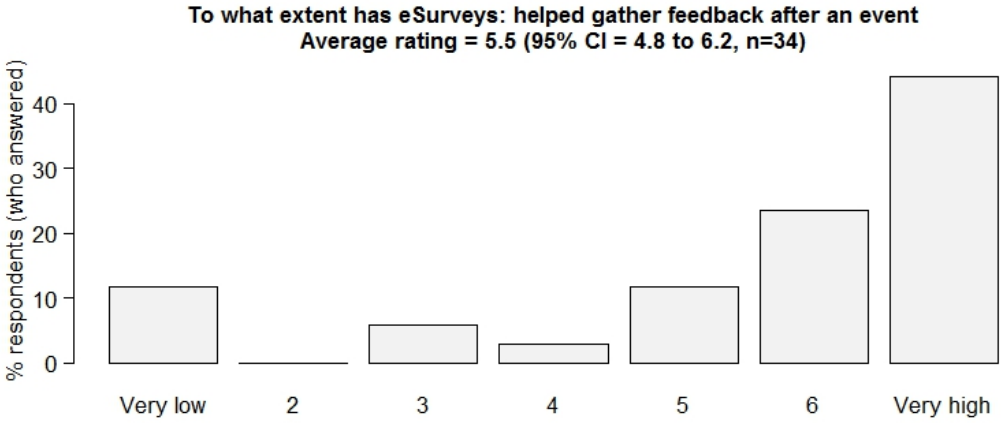


Figure 98. Extent eSurveys have helped gather feedback after an event.

Summary and observations

The responses regarding SurveyMonkey being helpful to create a survey, collect responses and analyse results were strongly positive. The themes to emerge from this data were regarding efficiency (saving time and effort), client engagement (receiving feedback and being responsive) and working smarter (being more innovative and making better informed decisions).

Stories about how eSurveys have helped

The respondents were asked to provide a brief story about how eSurveys have helped them to do something useful or important. These stories were thematically analysed (as shown in Table 69 in Appendix 3c), which determined the following categories:

- Using eSurveys was convenient and efficient for both the creator of the surveys and the respondents (4), with a key story being:

‘Having a survey that someone can complete relatively quickly from either their office or their vessel without the need to complete and then post back to us, has helped survey fishers of the unloading facilities. Making it easy to complete and not having to decipher hand writing has saved a lot of time’;

- eSurveys were used to gather feedback after an event (9), with a key story being:
  ‘Within a couple of days of conducting a workshop, I was able to get the survey out to participants and have responses back and analysed within a week. This was much quicker than anything I'd previously experienced, not to mention how easy and convenient the how process was’;
- eSurveys were used to gather information from respondents regarding various projects (7), with a key story being:
  ‘It has allowed us to measure the true success of our programs. We have been able to see that 20% of the companies we work with have won over $10M worth of work in the last 6 months, saving these companies from closing. It has also allowed us to identify the areas that clients need help with and develop targeted resources that will increase the 20% to 50%+’;
- Using eSurveys saved both time and money (1), with the key story:
  ‘We worked with seafood industry to gather information on port infrastructure - a traditional paper-based survey that they were considering would have been costly and time consuming’; and
- eSurveys allowed trainers to assess the needs of the participants (2), with the key story:
  ‘Collecting pre-workshop information from Central Region staff at each centre on where they were with the DAFF changes enabled us to prepare material relevant to those particular staff... It assisted us greatly with engagement by participants in each workshop’.

Summary and observations

The brief stories allowed respondents to share how this eTool had practically benefitted their work practices. The theme to emerge from this data was that eSurveys were convenient for both the survey creators and respondents to gather information after events and as part of project activities – it helped them work smarter.

Reasons for not yet using SurveyMonkey

The respondents were asked to rate the reasons regarding why they had not yet used SurveyMonkey. All the reasons for not using eSurveys were on average rated less than moderately important (i.e. average rating less than 4.0). The reasons in descending order (as shown in Figure 99 and detailed in Table 62 in Appendix 3b) were as follows:

- that the target audience doesn’t use the Internet (average rating 3.5 on 1 to 7 scale),
- the respondents prefer to hand out printed surveys at the end of an event (3.0),
- it seemed like a good idea at the time but the respondent never got around to it (2.8),
- timid respondents needed face-to-face encouragement (2.7),
- target audience needed assistance in completing survey questions (2.4),
- colleagues ended up creating the eSurvey they were thinking of doing (2.2, based on 4 respondents),

- it was too hard to learn how to use the software (1.9),
- printed surveys gave better quality results (1.8), and
- that their work role had changed so they no longer needed to create eSurveys (1.5).

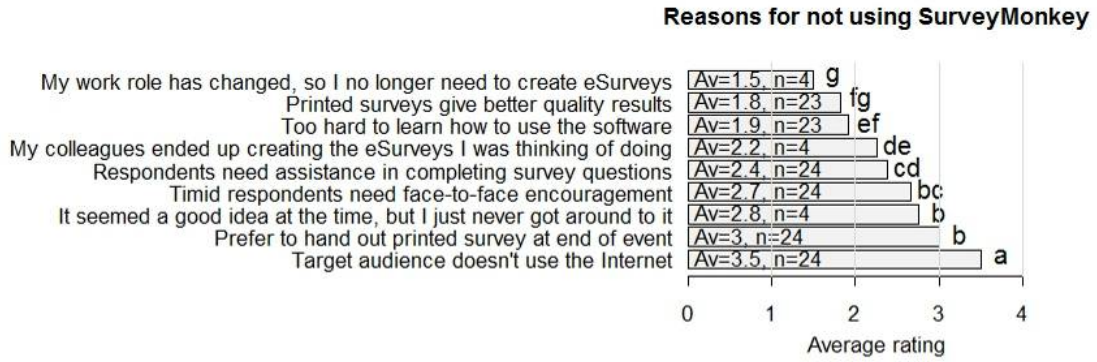


Figure 99. Reasons for not yet using SurveyMonkey.

The most highly scored response of 'Target audience doesn't yet use the Internet' raises the interesting point of co-dependent adoption, where adoption by the primary users (DAFF staff) is affected by the adoption of the technology by a secondary target audience, in this case farmers. Yet the more online surveys that a farmer is exposed to may influence them to start using the technology. This chicken and egg (or horse and cart) dynamic affects the adoption of the technology, though in this case it is difficult to say to what degree without further study.

The comments regarding why they hadn't yet used SurveyMonkey are listed in Table 70 in Appendix 3c. A theme analysis indicated the following two categories:

- Paper-based surveys were good for end of events to hand out (and use with on the spot incentives) or to send hard copy information with; and bad in that the survey may never have been done unless electronic (4), with comments such as 'Target audience may use the internet but prefer to have a hardcopy survey or hardcopy version of a publication that is accompanied by a survey';
- Still intend to use SurveyMonkey but haven't got around to it due to workload, other priorities and still researching different styles (3), with comments such as 'I have been too busy to get back to the reason for wanting to do the survey - the reason is still current - matter of workload'.

These themes aligned with the second and third most highly rated presented in the survey ('Prefer to hand out printed survey at end of event' and 'It seemed a good idea at the time, but I just never got around to it').

Summary and observations

The top reasons for respondents not yet using eSurveys were:

- that the target audience doesn't use the Internet,
- the respondents prefer to hand out printed surveys at the end of an event, and
- it seemed like a good idea at the time but the respondent never got around to it.

Unlike the reasons for signing up to use SurveyMonkey, where the reasons were all rated around 5.5 on average, the reasons for not using it were all rated lower than 4.0

on average. So it would appear the respondents had strong reasons for using it and weaker reasons for not using it.

The relatively low rate of response (50%) for this survey was disappointing to the researcher as he thought that as most of the respondents were survey creators themselves, they may have been more understanding about the need to gain feedback.

About the respondents

Business group. As shown in Figure 100 and detailed in Table 63 in Appendix 3b, the majority of the respondents (60%, n=47) were part of the Science, Agriculture, Food and Regional Services business group, followed by 21% from Employment and Economic Development, 9% from Strategic Relations and Communications, 6% from Finance and ICT and 4% from Office of the Chief Operating Officer.

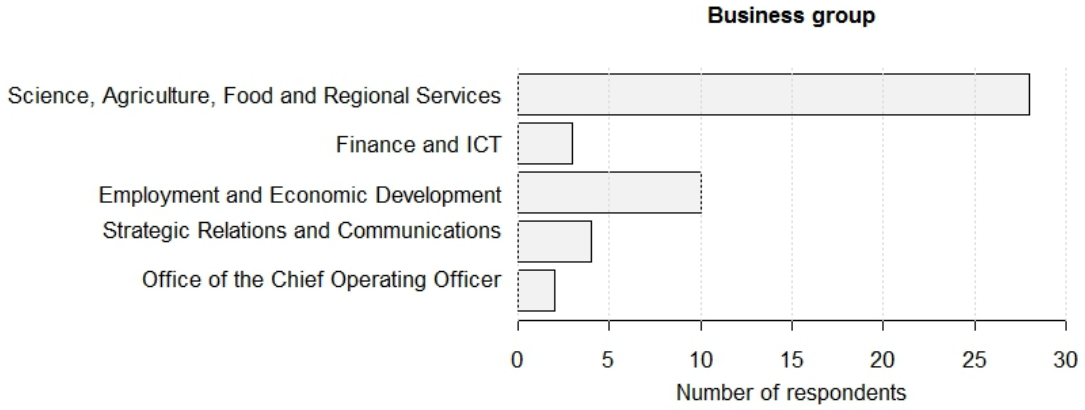


Figure 100. Distribution of respondents by Business group.

There were some significant differences in the proportion of surveys sent to internal DAFF staff (versus external), with the 10 respondents from the Employment and Economic Development group having an average of 2% internal surveys, which was significantly lower than the business groups Office of the Chief Operating Officer (100%, n=2), Finance and ICT (100%, n=3) and Strategic Relations and Communications (75%, n=4). The Science, Agriculture, Food and Regional Services group (35%, n=27) was also significantly lower than the Office of the Chief Operating Officer and Finance and ICT. This variation is most likely due to the different roles undertaken within each of these business groups, and is not relevant to this study.

There was also significant differences between the ratings given for the importance of using SurveyMonkey to save time for the survey creator, with the respondents from Employment and Economic Development group having a significantly lower average rating (3.1, n=10) than the Office of the Chief Operating Officer (6.5, n=2) and Finance and ICT (6.3, n=2). The average ratings for the Strategic Relations and Communications, and the Science, Agriculture, Food and Regional Services groups both were 5.5 and weren't significantly different to the other business groups. Again, these variations are most likely due to the different roles undertaken within each of these business groups, and is not relevant to this study.

Gender. There were nearly equal numbers of male (49%, n=22) and female (51%, n=23) respondents, as detailed in Table 64 in Appendix 3b. When the gender balance of the respondents is compared to the larger DAFF population, it is seen that the gender balance of the respondents is similar to that of all DAFF staff (as at 27 February 2014), as shown in Table 11. This indicates that the sample reflects the gender distribution of the broader DAFF population.

Table 11. Gender balance of respondents.

Gender	DAFF staff	Respondents
Male	60%	49%
Female	40%	51%
Total	**100%**	**100%**

As mentioned earlier and detailed in Table 46, there was a significant difference in average ratings for saving money and the environment between males and females, with females rating them higher at 6.3 and 5.4 (n=23) while males rated them at 4.5 and 3.7 (n=22) respectively.

Age. The age distribution, as illustrated in Figure 101, peaked at the 40 to 49 year age group with 33% of the respondents being in this group, followed by the 30 to 39 age group. The approximate average age was 41.5 years (using the midpoints of the age categories and assuming the midpoint for 60+ years was 64.5).

The age distribution of DAFF staff (as at 27 February 2014 as earlier data was not available) compared with that of the respondents is shown in Table 12.

As the proportion of respondents in each of the age groups was fairly consistent with that of the overall DAFF staff population, this indicates that the sample reflects the age distribution of the broader DAFF population.

There were some significant differences between age groups in how they rated the importance of ‘saves the environment’ for signing up to SurveyMonkey, with the 50-59 year age group having a significantly lower rating (average 3.0, n=4) than the 30-39 year (6.5, n=8) and 40-49 year (5.8, n=9) age group, and the 30-39 year age group having a significantly higher average rating than the 20-29 year age group (4.0, n=4).

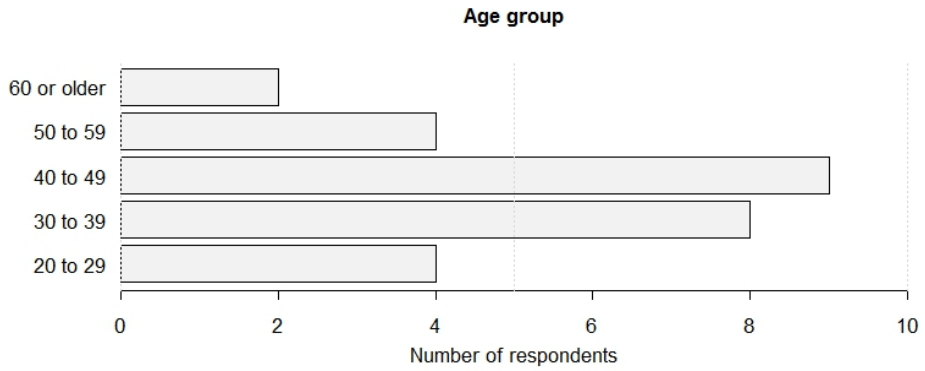


Figure 101. Distribution of respondents by age group.

Table 12. Age distribution of DAFF staff and respondents.

Age	DAFF staff	Respondents
20 to 29	10%	7%
30 to 39	22%	15%
40 to 49	29%	33%
50 to 59	30%	30%
60 and over	9%	15%
Total	**100%**	**100%**

Summary and observations

The results regarding the reasons for signing up to use SurveyMonkey indicated that on average females rated 'saves money' and 'saves the environment' higher than males rated them. Additionally the 30-39 year age group rated 'saves the environment' the highest, while the 50-59 year age group rated it the lowest. The sample populations were rather small (n=45), so further research with larger sample populations would be required to validate these results.

Summary of key findings and themes identified from this survey

To gauge the relative importance of eSurveys, respondents were asked how many paper-based, telephone and electronic surveys they conduct in a year. On average there were significantly higher numbers of electronic surveys conducted in a year than paper-based surveys which were significantly higher than telephone surveys. These results showed that staff were undertaking more surveys, and of those surveys, more were utilising eSurveys as they were quicker and easier to administer, allowing 'analysis and reporting that is incredibly fast'.

Two strong themes emerged from this data. The first was around the theme of ease of use (easy to read the responses, easy to see and analyse the results, and easy for the respondents to use). This can be summarised as working smart. The second theme focused around savings (saves time, money and the environment).

Regarding the expected benefits from using eSurveys, the most highly rated responses were:

- no longer need to decipher hand written responses,
- they could quickly see and analyse results, and
- it would be easy for the respondents to use.

Regarding actual benefits, eSurveys helped the respondents by:

- being more efficient by saving time and effort,
- getting feedback from clients,
- being more responsive to client needs,
- being more innovative,
- making better informed decisions, and
- gathering feedback after an event.

The themes to emerge from this data were regarding efficiency (saving time and effort), client engagement (receiving feedback and being responsive) and working smarter (being more innovative and making better informed decisions).

The key reasons that respondents hadn't yet used eSurveys were:

- the target audience doesn't use the Internet,
- the respondents prefer to hand out printed surveys at the end of an event, and
- it seemed like a good idea at the time but the respondent never got around to it.

Unlike the reasons for signing up to use SurveyMonkey, where the reasons were all rated around 5.5 on average, the reasons for not using it were all rated lower than 4.0 on average. So it would appear the respondents had strong reasons for using it and weaker reasons for not using it.

Two strong themes emerged from this data. The first was around the theme of ease of use (easy to read the responses, easy to see and analyse the results, and easy for the respondents to use). This can be summarised as working smart. The second theme focused around savings (saves time, money and the environment).

4.5 YouTube video usage

While the previous sections have considered the adoption and use of software applications, this section focuses on the adoption and use of an approach to creating content for later viewing on the Internet, namely YouTube videos.

4.5.1. Background

This section provides a summary and analysis of material from the 'YouTube video training workshop series' post-event evaluation surveys. It examines the impact the four workshops in 2011 had on the 44 DAFF participants. The survey covered the participants' self-evaluation of their skills, knowledge and confidence before and after the workshop in the areas of pre-production, production and post-production; their feedback on the process and content of the workshops; and the likelihood of the participants adopting the use of YouTube videos in the future.

The two-day workshops allowed participants to learn how to make well designed and produced online videos, and was focused towards staff who were involved in communicating and enabling change in industries or communities. The workshops were organised through the eExtension project within the DAFF. The survey target audience were participants of four YouTube video training workshops run on 10/11 May 2011 (10 participants), 17/18 May 2011 (11 participants), 24/25 May 2011 (11 participants) and 31 May/1 June 2011 (12 participants).

A pre-test of the survey was conducted with a small number of participants and the survey questions slightly modified based on their feedback to improve comprehension and relevance. SurveyMonkey was used to conduct the web based eSurveys and the workshop participants were given the opportunity to respond to the survey. As the respondents were self-selecting there could be potential biases in the results that need to be kept in mind, however the majority of the respondents answered the evaluation (89% response rate) so the bias should be minimal. The questionnaire consisted of 19 questions, which can be viewed in Appendix 4a.

The rating scale questions used a range from 1=very low to 7=very high. The ratings were considered as normally distributed and 95% confidence intervals of the mean were reported and t-tests were used to analyse differences in before and after ratings. Analyses across questions were done as an analysis of variance, again assuming the assumptions of the analyses were met (data is independent and normally distributed with similar variances). The analyses used the respondent as a blocking term to remove this variation and made the analysis more sensitive to detect differences across questions.

4.5.2. Key results

While the primary purpose of this survey was to evaluate the effectiveness of the training activity, there were a number of questions that are relevant to this thesis and are included below.

Creation of videos by participants in the future

The participants were asked to estimate the number of videos they would create in the following 12 months. This provided a measure of their intended adoption of this new communication medium. The participants often gave a range of values for the number of videos planned over the next 12 months, and these were converted to a

single number by either taking a mid-point when possible, or taking the lower range when open ended. The average of these values was 6.8 planned videos, ranging from 1 to more than 30. The median number of videos was 4. The total number of videos planned for the next 12 months was 243.

Factors encouraging participants to create or use videos

When asked what factors were encouraging them to create or use videos, 36 out of 39 respondents reported reasons listed in Table 71 in Appendix 4b. A theme analysis identified the following categories:

- Using video media is an effective communication tool (14), with comments such as 'The boom in social media and the fact that a picture tells a thousand words' and 'It can present our work in a more relaxed and 'digestible' manner';
- The use of video as an alternative to paper-based information (7), with comments such as 'More people prefer to watch videos than read through information on a website';
- Participating in the workshop providing the confidence to create videos (6), with comments such as 'The knowledge gained from this program has vastly increased my confidence and ability to create suitable videos for the workplace';
- Using video as an effective training tool (4), with comments such as 'Effective way of providing messages and training to clients';
- Using video to meet project milestones and address client needs (4), with comments such as 'Enthusiasm expressed by clients, support from industry, effectiveness of the medium for extension and milestone deadlines!'; and
- Attendance of workshop was to be able to brief specialists (1).

Summary and observations

The main themes emerging from this data are that respondents perceive videos as an effective communication tool and as an alternative to paper-based information.

Factors discouraging participants to create or use videos

When asked to nominate factors that would discourage the creation or use of videos, 36 out of 39 respondents reported reasons listed in Table 72 in Appendix 4b. A theme analysis identified the following categories:

- Time constraints (17), with comments such as 'Substantial time investment (editing etc.)' and 'Time - never enough';
- Confidence (5), with comments such as 'Possibility of spending a lot of time and still ending up with junk';
- Access to equipment and resources (5), with comments such as 'Not having our own equipment and having to borrow them';
- Department constraints (approval) (3), with comments such as 'Approvals and red tape still a barrier within DAFF'; and
- Opportunity (finding a topic) (4), with comments such as 'Not my core role to actually produce them'.

Summary and observations

The strongest factor discouraging the respondents from creating videos was related to the lack of resources (especially time and also access to equipment and other resources).

Participant needs to maximise their creation or use of videos

When asked what else they needed to maximise their creation or use of videos, 36 out of 39 respondents reported reasons listed in Table 73 in Appendix 4b. A theme analysis identified the following categories:

- Access to equipment and resources (e.g. editing software, decent PC, support) (13), with comments such as 'Software and a decent PC';
- More practice (and time) and support (e.g. helpline, manager support, additional workshop/ user group, inspiration, encouragement and enthusiasm from others) (12), with comments such as 'Practice and more practice!' and 'Encouragement and enthusiasm from others doing the same thing';
- More time available to create videos (9), with comments such as 'Time and application'; and
- Departmental approval (2), with comments such as 'Permissions to do so within my work time'.

Summary and observations

The theme emerging from this data is that to maximise their creation and use of videos, respondents need resources (time, hardware and software) and support.

Summary of key findings and themes identified from this survey

The factors that were encouraging the use of YouTube style videos by the respondents included:

- Using video media is an effective communication tool,
- The use of video as an alternative to paper-based information, and
- Using video to meet project milestones and address client needs.

The factors that discouraged the creation of YouTube style videos by the respondents included time constraints, confidence, access to equipment and resources, and Department constraints (approval).

4.6 Motivation to adopt an innovation

The previous surveys have examined individual technologies and identified the factors that affect their adoption and use. These factors were identified from the participants' responses to Likert-type scales and open-ended questions regarding their actual use of modern communication technologies.

This section uses similar methods but now focuses on the theoretical use of the technologies. This questionnaire invites the respondents to select one of three Web 2.0 technologies and to then consider that technology as they rate factors derived from four theoretical models of adoption. These results will help determine the factors that motivate people to adopt new communication technologies.

4.6.1. Background

A survey was conducted in July 2012 to determine the factors that affect the adoption of new technology within DAFF. The technologies being investigated were eSurveys, webinars and YouTube style videos. The bulk of the questions in the survey were based around four adoption models and the aim was to compare the four models and to contrast the level of adoption between them.

The four adoption models were:

1. Diffusion of innovations by Rogers (1962, 1983, 1995, 2003)
2. Unified theory of acceptance and use of technology (UTAUT) by Venkatesh et al. (2003)
3. Switch: How to change things when change is hard by Chip and Dan Heath (2010)
4. ADOPT (Adoption and diffusion outcome prediction tool) model by Kuehne et al. (2011).

The questionnaire consisted of 15 questions, which can be viewed in Appendix 5a. Some minor modifications of the wording of the questions from the various models were undertaken, so as to increase the relevance and comprehension, as shown in Appendix 5b. The questions were then categorised as human or technology related, so that an analysis could determine whether there was a difference in the responses between the two categories.

A pre-test of the survey was conducted with a small number of participants and the survey questions modified based on their feedback to improve comprehension and relevance. SurveyMonkey was used to conduct the web based survey and 260 people were given the opportunity to respond to the survey. There were 94 respondents who completed the survey (36.2% response rate), though not all respondents answered all questions with 9 respondents failing to fill in the ratings in questions 6, 7, 8 and 9 (for the four adoptions models), leaving 85 responses for data analysis (32.7% response rate of mostly completed surveys). Of all those who completed the survey, 38% were SurveyMonkey users, 23% were YouTube workshop attendees and 39% were Web conference users. The responses were received between 11 June and 3 July 2012.

The low response rate could be due to the potential respondents not seeing the results from the survey directly benefitting their work activities. The survey had many sub-questions which required considerable thought before answering, so this may have

dissuaded time-poor staff from responding. To alleviate this, the email invitation to participate in the study outlined the importance of the study and offered the respondents a summary of the report. Additionally, statements in the questionnaire (e.g. ‘Whew... thanks for wading through all of those questions! You are now half way through’) encouraged the respondents to persist to the end.

Ratings in this survey were on a seven-point scale and were considered to be normally distributed with homogeneous variances across grouping terms, so that analysis of variance (ANOVA) could be used to compare ratings across groups. If significant results were found then levels within groups were compared using least significant differences (lsd) or using contrasts within the analysis of variance.

Predictions of average ratings in covariate analyses (i.e. when degree of usage was included in the model) were calculated at the average value of the covariate. A Principal Components Analysis (PCA) was also used to analyse the questions from each adoption model. The data was not scaled to unit variance (as often done in principal component analysis) so the range of the ratings could contribute to differentiating the respondents. Biplots were used to explore the relationship between the questions within each adoption model. The length of the arrows indicate how much a question contributed to explaining variation between respondents. The direction of the arrows of two questions describes the relationship between them, with arrows in the same direction indicating the questions are correlated, arrows in opposite directions indicate a negative correlation, and arrows that are becoming perpendicular to each other are collecting information that are more independent of each other.

The new transformed variables from the PCA were used to compare with the level of adoption to see if a relationship exists. A PCA of all questions in the four adoption models allowed exploration of the relationship of information from questions across adoption models.

4.6.2. Key results

This section explores the results of the survey including the demographics, degree of use of each of the technologies (eSurveys, Webinars and YouTube style videos), what methods were used prior to using these technologies, the factors that encouraged and discouraged the use of the technologies and the ratings of each of the questions relating to the four different adoption models (Diffusion of innovations, UTAUT, Switch and ADOPT).

For each adoption model the ratings for each question were analysed individually using analysis of variance for differences in technology and if there was a relationship with the degree of usage. These analyses helped to identify questions which were not useful in distinguishing between technologies and/or usage levels. The next stage of analyses used an analysis of variance across questions within an adoption model, with degree of usage included to explore the relationship with this question. This analysis helped identify patterns in the average rating across question and degree of usage.

A PCA was then performed to look at what degree questions within an adoption model helped explain the differences between respondents. From this a biplot was

produced and questions that had been rated similarly could be identified and those that produced contrasting information could also be identified.

To help identify questions that behaved similarly across the different adoption models, another PCA was performed using questions across the adoption models. A hierarchical cluster analysis was also performed which also grouped questions with similar responses from the respondents.

Demographics of respondents

The 94 responses to this survey had an almost equal distribution across the three technologies. However, the number of respondents who answered all the rating questions for each model was only 85, still with an almost equal distribution across the three technologies, as detailed in Table 13.

Table 13. Percentages of respondents to survey.

Technology	All respondents	Respondents who provided ratings
eSurveys	32 (34%)	30 (35.3%)
Webinars	32 (34%)	28 (32.9%)
YouTube style videos	30 (31.9%)	27 (31.8%)
Total	94 (100%)	85 (100%)

The age and gender of the respondents are shown in Table 14. A chi-square test of male and female versus ages (with 50 to 59 combined with 60 or older) showed a significant difference in the ratio of male to female, as detailed in Table 74 in Appendix 5c. The 50 or older respondents had a significantly higher ratio of males than females (83.3%) than the other age categories. However when compared with the demographics of DAFF employees as shown in Table 15, this imbalance is consistent with the wider DAFF employee population which has many more older males than females.

Table 14. Summary of participant demographics.

Age	Female	Male	Not provided	Total
20 to 29	7 (70%)	3 (30%)		10 (12%)
30 to 39	7 (50%)	7 (50%)		14 (17%)
40 to 49	17 (59%)	12 (41%)		29 (35%)
50 to 59	5 (19%)	22 (81%)		27 (32%)
60 or older	0 (0%)	3 (100%)		3 (4%)
Not provided			11	11
Total	36 (43%)	47 (57%)	11	94

Table 15. Summary of DAFF employee demographics.

Age group	Female	Male	Total
20 to 29	115 (49%)	120 (51%)	235 (10%)
30 to 39	250 (49%)	259 (51%)	509 (22%)
40 to 49	280 (41%)	409 (59%)	689 (29%)
50 to 59	250 (36%)	442 (64%)	692 (30%)
60 and over	45 (21%)	167 (79%)	212 (9%)
Total	940 (40%)	1397 (60%)	2337 (100%)

Summary and observations

The age distribution and gender balance of the respondents is similar to that of the overall DAFF employee population, meaning that we can expect to relate the results of this survey to the wider DAFF population. The fact that there are generally more younger females and more older males aligns with the researcher's observation of this distribution for extension officers within DAFF and even more widely across Australia.

Degree of use of technology

The degree to which the respondents had used the technologies was rated from 1=very rarely to 7=very often. The average ratings in descending order were webinars 3.8, YouTube 3.7 and eSurveys 3.1. There was no significant difference in these averages. Figure 102 shows the average of the ratings and their 95% confidence intervals. Bars showing the frequency of each rating are shown to the left of each average.

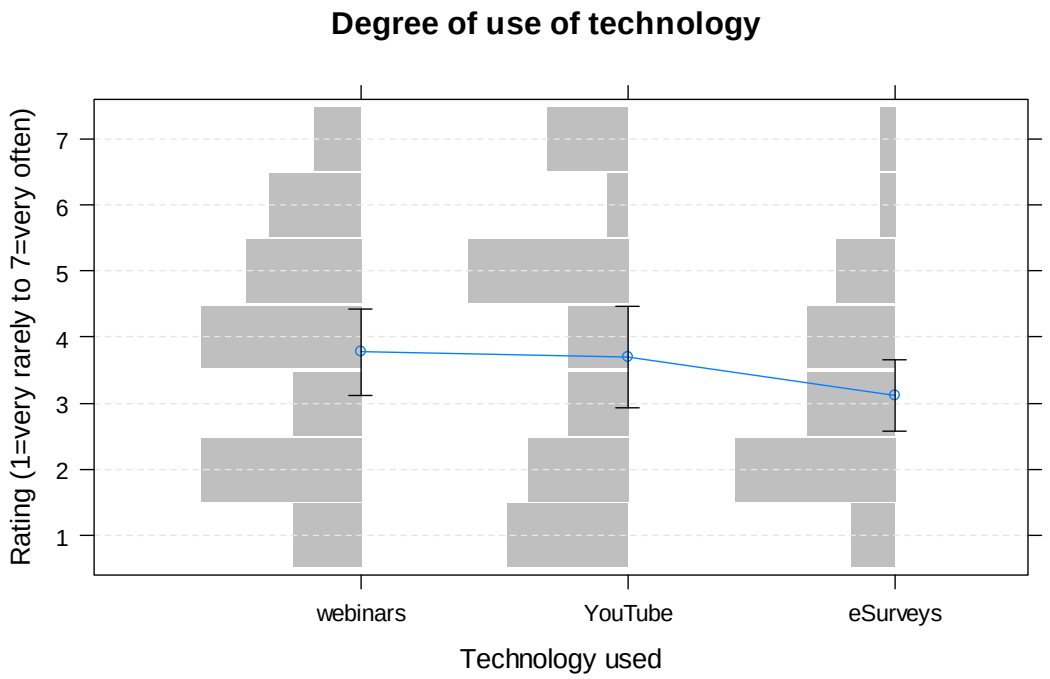


Figure 102. Degree of use of technology.

Note: Line indicates mean and standard deviation.

The comments made about the degree of usage of the technology are collated in Table 98 in Appendix 5d. The main categories emerging from the data for each technology are as follows:
eSurveys: how or when it was used in projects (4), praising eSurvey technology (3), and what projects it was used for (3);
Webinars: projects it was used for (3), technical problems (1), how it was used (1) and what technology was used (1); and
YouTube: describing degree of usage (7), what it was used for (2), its usefulness (2) and technical problems (2).

Summary and observations
While there was no significant difference between the average degree of use of the three technologies, Figure 102 shows that the distribution of responses for webinars generally followed a normal (bell-shaped) distribution, while that for YouTube dipped in the middle and that for eSurveys showed a negatively skewed distribution. Some care will need to be taken in extrapolating these figures further, as while the means are similar, the distributions are not.

Previous methods used before adopting this technology

The respondents were asked to comment on what was previously used to achieve similar outcomes before adopting this technology. A theme analysis of the responses collated in Table 99 in Appendix 5d identified the following categories.

eSurveys The majority of the 32 respondents said that before using eSurveys they used hard copies and/or mailed out copies of questionnaires (23). Methods also included performing face-to-face surveys (3), emailing the questionnaire (6) and/or performing phone surveys (4). Other comments included not doing surveys due to lack or relevance (1) or resources (1), or little done due to difficulty (2).

Webinars The 31 respondents commented that previous to using webinars, they mainly used face-to-face (19), as well as teleconferencing or telephoning (14). There was also emailing (1), Skype (1) or not having an alternative (2).

YouTube The 27 respondents said that previous to using YouTube videos, they used written material (15), including factsheets, flyers, articles in papers, publications and websites. Face-to-face delivery of information was conveyed through processes such as workshops, field days, farm walks and meetings (14). Other methods listed were DVDs, TV commercials, websites, blogs and PowerPoint presentations (6). Other respondents commented on Google searches, camera or not doing anything (3).

Summary and observations
The respondents indicated that prior to using each of the new technologies, they most often used printed surveys, face-to-face meetings and written material. A theme emerging from this data is that the previous methods were all time consuming and resource intensive.

Factors that encouraged adoption

This section identifies the factors the respondents gave that encouraged or helped their adoption of the technologies. A theme analysis of the responses collated in Table 100 in Appendix 5d identified the following categories.

eSurveys The 32 comments for eSurveys were broadly grouped into four categories: being efficient in setting up questionnaires, sending, collating and/or reporting (18), being easy to use by the survey creator and/or respondent (16), being cost effective in using departmental licence (for free), saving time and costs (8), and the accessibility of reaching people and ease of distribution of a link through email (8).

Webinars The 31 comments for webinars were grouped into six categories: that webinars gave more opportunities to interact (8), reduced travel (7) and were cost effective (7), provided visual aids in seeing each other and documents (4), were easy to use (2) or get support and assistance (4), two respondents commented they learnt out of need and another because the technology was available.

YouTube The 28 comments for YouTube were grouped into four categories: using videos as a visual tool for training and/or conveying information (10), lower costs associated with making video (7) as opposed to other options (e.g. running multiple field days, equipment and software to make videos), greater acceptance and/or demand of target audience (6) – for example fewer growers wanting or able to attend field days, having received training to make videos (7) and ad hoc comments such as 'sounded like fun', other colleagues used it, and less restrictions by the Department to use sites such as YouTube.

Summary and observations
The themes that emerged regarding the factors that encouraged adoption of the new technologies were that they needed to be easy to use, save time and money, and they required the provision of support.

Factors that discouraged adoption

This section identifies the factors the respondents gave that discouraged or hindered their adoption of the technologies. A theme analysis of the responses collated in Table 101 in Appendix 5d identified the following categories.

eSurveys The 32 comments were grouped into three main categories: learning how to use eSurveys (12), lack of acceptance of users to the technology (7), and other minor reasons including access to the internet (2), perceived cost and/or availability of eSurvey licence (3), response rates maybe low (1), lack of need to do a survey (1), lack of support from within the Department (1) and eight mentioned there were no discouraging factors.

Webinars The 31 comments for webinars were grouped into five categories: lack of training of organiser or participants (12), lack of Departmental support (e.g. lack of Internet access, software, restrictive policies) (6), having potential participants accepting the technology and having access to equipment (3), preference for face-to-face interaction (4), the cost (5) and three mentioned there were no discouraging factors.

YouTube The 26 comments regarding YouTube were grouped into six categories: lack of training (12), lack of Departmental support (6) for example via policies and management, lack of access to equipment (5) including hardware and software, lack of time (6) and opportunity (3), the uncertainty whether anyone will watch the video (1) and one respondent said there were no discouraging factors.

Summary and observations
The themes that emerged regarding the factors that discouraged adoption of the new technologies were lack of training on how to use the new technology, end-users not being receptive to it, lack of departmental support/ policy, and lack of access to equipment.

Responses to Diffusion of innovation model questions

The five questions asked in the survey (and their shorthand name in brackets) for the Diffusion of innovation model were:
Q6.1 'To what degree is it better using this innovation compared to how it was done previously?' (better)
Q6.2 'To what degree is the innovation compatible with the previous approach?' (compatible)
Q6.3 'To what degree is this innovation simple to use?' (simple)
Q6.4 'To what degree can the innovation be experimented with while it is being adopted?' (experiment)
Q6.5 'To what degree is the use of the innovation visible or noticeable to others?' (noticeable)

Analysis of individual sub-questions
A summary of the averaged responses to these questions for each technology, as well as a combined average for all three technologies, is shown in Table 16.

Table 16. Summary of responses to Diffusion of innovation model questions.

Question	eSurvey	Webinar	YouTube	Combined
Q6.1 (better)	6.4	5.3	5.7	5.8
Q6.2 (compatible)	5.7	5.0	5.1	5.3
Q6.3 (simple)	6.1	5.4	4.9	5.5
Q6.4 (experiment)	6.0	4.9	5.7	5.5
Q6.5 (noticeable)	5.9	5.3	5.9	5.7
Overall average	6.0	5.2	5.5	5.6

Considering that it was a seven-point scale, all these ratings were well above the midpoint of 4.0. eSurveys consistently received the highest or equal highest ratings for the three technologies across the questions.

The next step was to determine whether there was an interaction between the amount of *usage* of the technology and the ratings received, in case those who hardly used the technology rated it poorly, or vice versa. As shown in Table 75 in Appendix 5c, questions 6.2 (compatible) and 6.5 (noticeable) showed no significant difference between the *type of technology* or *level of use of technology*. This non-significant interaction between *technology* and *level of use* indicates no significant difference between the rate of increase in the rating and usage between technologies. However the ratings for questions 6.1 (better), 6.3 (simple) and 6.4 (experiment) did show a significant difference in the *type of technology* and with *degree of usage* of the technology. The positive values of the slopes show an increasing relationship between the rating for usage and the ratings for the model questions. So the more the technology was used, the greater the rating it received for the five questions.

Predictions of average ratings in covariate analyses (i.e. when degree of usage was included in the model) were calculated at the average value of the covariate. The predicted rating for each technology (when significantly different) is shown in Table 17. Q6.1 (better) and Q6.3 (simple) show that respondents who rated eSurveys gave a significantly higher rating than those who rated webinars and YouTube. Q6.4 (experiment) showed those who rated webinars gave a significantly lower rating than those who rated eSurveys and YouTube.

Table 17. Predictions of ratings for each technology.

Question	eSurvey	Webinar	YouTube
Q6.1 (better)	6.4 a	5.3 b	5.7 b
Q6.3 (simple)	6.1 a	5.4 b	4.9 b
Q6.4 (experiment)	6.0 a	4.9 b	5.7 a

Note: Predictions with the same following letters are not significantly different (within a question).

The average ratings and 95% confidence intervals for the questions for each model are plotted in Appendix 5e, with bar graphs of the frequency of each rating in the background. This showed that the responses to all five questions exhibited a negative skew, with generally more positive responses than negative ones.

The degree of usage rating for each of the three technologies is plotted with the rating from each question (with a simple linear regression fitted) in Appendix 5f. This showed that the data for most of the questions had a positive correlation, while Q6.2 (YouTube) had a static correlation and Q6.5 (eSurveys) had a negative correlation.

Analysis of variance across sub-questions

An analysis of variance of ratings across the sub-questions for the Diffusion of innovation model is shown in Table 76 in Appendix 5c. The question and technology terms assess the difference in mean ratings, and their interaction assesses whether the differences in technology remain consistent across questions. The usage term assesses the linear relationship between the ratings and the degree of usage. The interactions with degree of usage and the question and technology factors assess whether the relationship changes for different *questions* and *technologies*.

The results indicate that average ratings for *questions* and *technologies* were significantly different (with their interaction approaching significance), and there was a strong overall relation with the usage (slope=0.205). However the lack of significant interactions with *usage* shows that the trend was reasonably consistent across questions and technologies.

The radar plot in Figure 103 is another way to display the (near significant) interaction between the three technologies and the questions. This shows that eSurveys generally received the highest ratings across the five questions, followed by YouTube and then webinars.

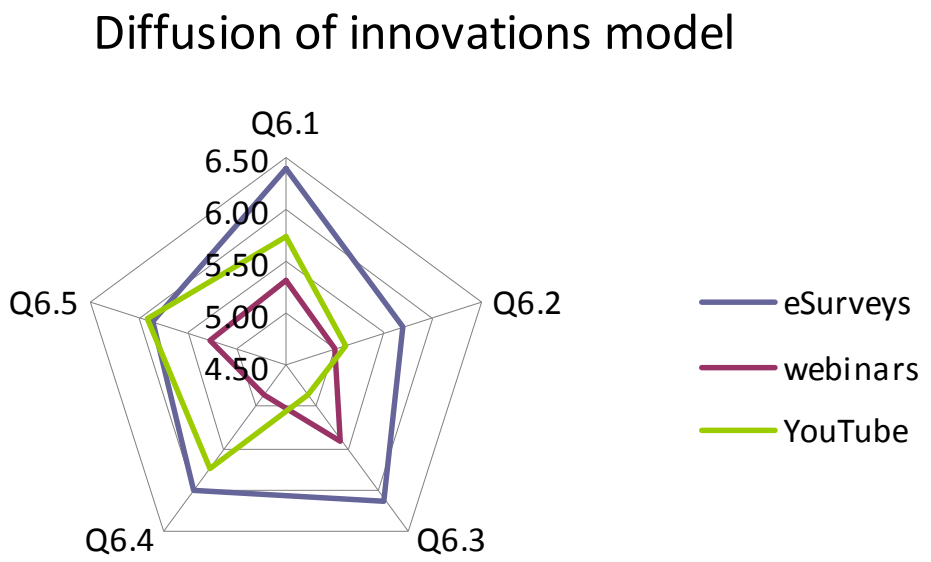


Figure 103. Radar plot of interaction between technology and questions for Diffusion model.

A Principal Components Analysis showed that almost two-thirds of the variance in the data (65.1%) could be explained by the first two principal components as shown in Table 77 in Appendix 5c. The questions, in descending order, that most contributed to these two principal components were Q6.2 (compatible), Q6.3 (simple) and Q6.1 (better).

The analysis used 79 out of 85 respondents in the analysis, as respondents were dropped out if they didn't answer one or more questions. The absolute size of the loadings relative to each other, as shown in Table 78 in Appendix 5c, indicates how much a question contributed to the principal component.

A biplot was also used to present the data. In a biplot, when the direction of arrows of two questions are close, this indicates that the questions are correlated, hence gathering similar information. If they are close to being in opposite directions this indicates they are negatively correlated. The length of the arrow indicates how much influence the question is having on determining the principal component.

The biplot of the first two principal components in Figure 104 showed that Q6.2 (compatible) and Q6.3 (simple) were nearly independent of each other, as indicated by their arrows being nearly at right angles. Their arrows were also the longest, indicating that they contribute most in explaining the variation in the data. The fairly evenly spaced arrows showed a general spread of questions without any distinct question clusters. This indicates that the questions in the model have been well chosen, as there is minimal overlap between them. While having variables that can explain and predict adoption behaviour is the main criteria for well-chosen variables, there is efficiency in minimising the number of questions.

The first principal component was analysed for technology and degree of usage and this showed a significant difference between technologies and the relationship with usage, but no significant difference between this relationship across technologies. The second principal component showed no significant differences with technology or degree of usage, which means it is more universally applicable.

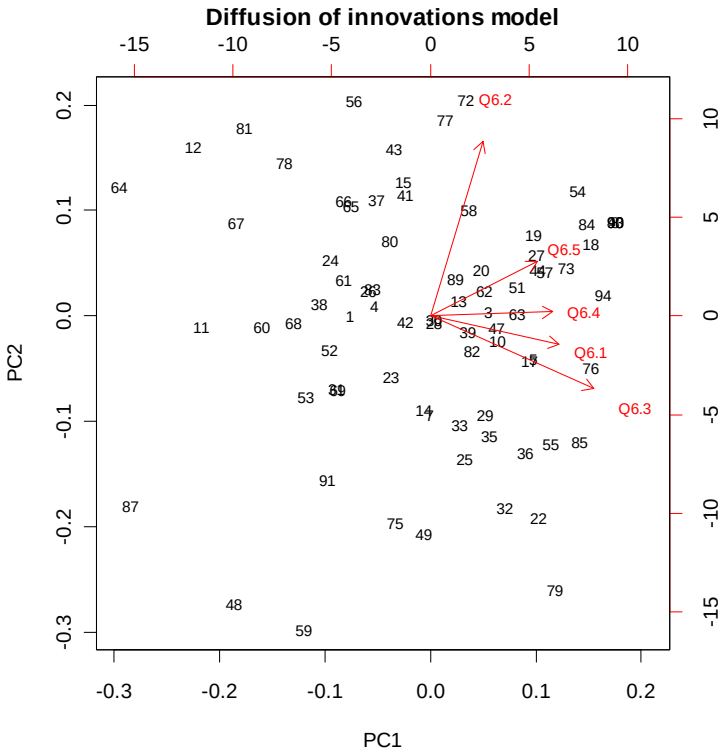


Figure 104. Biplot of the first two principal components for Diffusion model.

Summary and observations

All three technologies (eSurvey, webinar and YouTube) received high ratings for each of the five variables in the Diffusion of innovations model (better, compatible, simple, experiment and noticeable), though eSurveys received the highest ratings. So all five variables influence the adoption of the new communication technologies.

Questions 6.2 (compatible) and 6.5 (noticeable) showed no significant difference between the type of technology and level of use of technology, so the rate of increase in the rating wasn't related to the usage of the technologies. However the ratings for questions 6.1 (better), 6.3 (simple) and 6.4 (experiment) did show a significant difference in the type of technology and the degree of usage of the technology. So the more the new communication technology was used, the greater the rating it received for those three questions.

The average ratings for questions and technologies were significantly different (with their interaction approaching significance), and there was a strong overall relation with the usage. The lack of significant interactions with usage shows that the trend was reasonably consistent across questions and technologies.

A Principal Components Analysis showed that almost two-thirds of the variance in the data (65.1%) could be explained by the first two principal components. A biplot showed that Q6.2 (compatible) and Q6.3 (simple) were nearly independent of each other and contribute most in explaining the variation in the data. Therefore they would be the two most important questions to include in a survey instrument if one needed to minimise the number of questions.

Responses to UTAUT model questions

The 16 questions asked in the survey (and their shorthand name in brackets) for the UTAUT model were:
Q7.1 ‘To what degree is the innovation useful in your job?’ (useful)
Q7.2 ‘To what degree does the innovation enable you to accomplish tasks more quickly?’ (quick)
Q7.3 ‘To what degree does the innovation increase your productivity?’ (productive)
Q7.4 ‘To what degree does using the innovation increase your chance of getting a promotion?’ (promotion)
Q7.5 ‘To what degree is the innovation clear and understandable to use?’ (clear)
Q7.6 ‘To what degree is it easy to become skilful using the innovation?’ (skilful)
Q7.7 ‘To what degree do you find the innovation easy to use?’ (easy to use)
Q7.8 ‘To what degree is learning to use the innovation easy for you?’ (learning easy)
Q7.9 ‘To what degree do people who influence your behaviour think that you should be using the innovation?’ (influencers)
Q7.10 ‘To what degree do people who are important to you think that you should be using the innovation?’ (important people)
Q7.11 ‘To what degree do senior management support your use of the innovation?’ (senior mangt)
Q7.12 ‘To what degree does the organisation support the use of the innovation?’ (org support)
Q7.13 ‘To what degree do you have the resources necessary to use the innovation?’ (resources)
Q7.14 ‘To what degree do you have the knowledge necessary to use the innovation?’ (knowledge)
Q7.15 ‘To what degree is the innovation compatible with other systems you use?’ (compatible)
Q7.16 ‘To what degree is a specific person (or group) available for assistance with system difficulties?’ (assistance)

Analysis of individual sub-questions

A summary of the averaged responses to these questions for each technology, as well as a combined average for all three technologies, is shown in Table 18. The highest combined rating received was Q7.1 (useful) at 5.9 and the lowest for Q7.4 (promotion) at just 3.2. For the overall averages, eSurveys received the highest rating (5.4), followed by webinars (5.3) and YouTube received the lowest rating (4.8).

Questions 7.4 (promotion), 7.12 (org support), 7.13 (resources), 7.15 (compatible) and 7.16 (assistance) showed no significant difference between the type of technology or the level of use of technology. Questions 7.2 (quick), 7.6 (skilful), 7.7 (easy to use) and 7.10 (important people) showed a significant difference between average ratings across the technologies, as well as a significant relationship between the ratings for degree of usage (all positive relationships). In Appendix 5c, Table 79 shows the slopes and Table 80 shows the predicted ratings for the technologies for these questions.

Questions 7.1 (useful), 7.5 (clear), Q7.8 (learning easy), Q7.9 (influencers), Q7.11 (senior mangt) and Q7.14 (knowledge) showed a significant trend with the ratings for degrees of usage (again all positive relationships), but there were no significant differences between technologies (see Table 79 for slopes).

Table 18. Summary of responses to UTAUT model questions.

	eSurveys	webinars	YouTube	Combined
Q7.1 (useful)	5.8	6.1	5.9	5.9
Q7.2 (quick)	6.1	5.5	4.3	5.3
Q7.3 (productive)	5.5	5.3	4.8	5.2
Q7.4 (promotion)	2.8	3.6	3.2	3.2
Q7.5 (clear)	5.9	5.3	5.3	5.5
Q7.6 (skilful)	5.9	5.4	4.9	5.4
Q7.7 (easy to use)	6.0	5.4	5.0	5.5
Q7.8 (learning easy)	5.7	5.4	5.3	5.4
Q7.9 (influencers)	4.7	5.0	5.2	5.0
Q7.10 (important people)	4.7	5.1	5.6	5.1
Q7.11 (senior mangt)	4.9	5.0	4.9	5.0
Q7.12 (org support)	5.0	4.7	4.2	4.7
Q7.13 (resources)	5.5	5.1	4.8	5.2
Q7.14 (knowledge)	5.4	5.8	5.1	5.4
Q7.15 (compatible)	5.9	5.5	5.5	5.6
Q7.16 (assistance)	5.1	5.2	4.2	4.8
Overall average	5.4	5.3	4.8	5.1

Question 7.3 (productive) had significantly different slopes for degree of usage across technologies; however the average rating for technologies was not significantly different. Further investigation of this question revealed that there was no significant trend for eSurveys (slope=0.034), a highly significant trend for webinars (slope=0.529) and a non-significant trend for YouTube (slope=0.120).

The average ratings and 95% confidence intervals for the questions for each model are plotted in Appendix 5e, with bar graphs of the frequency of each rating in the background. The responses to almost all the questions show a negative skew with generally more positive responses than negative ones. The exception is Q7.4 (promotion) which showed the opposite; a positive skew. This indicates that the respondents are not as motivated by this factor and it has little influence on their adopting the innovations being studied.

The degree of usage rating for each of the three technologies is plotted with the rating from each question (with a simple linear regression fitted) in Appendix 5f.

Analysis of variance across sub-questions

An analysis of variance of ratings across the sub-questions for the UTAUT model is shown in Table 81 in Appendix 5c. The question and technology terms assess the difference in mean ratings, and their interaction assesses whether the differences in technology remain consistent across questions. The usage term assesses the linear

relationship between the ratings and the degree of usage. The interactions with degree of usage and the question and technology factors assess whether the relationship changes for different questions and technologies.

The results indicate that the average rating varied across question and technology, with a significant interaction. The relationship with degree of usage varied with technology. The interaction between question and technology was attributable to eSurveys having a different response across the questions compared to YouTube.

The slope of the relationship between degree of usage and technology was significantly different across all pair-wise combinations of the technologies. The estimated slope for eSurveys was 0.222, for webinars 0.345 and YouTube 0.092. As it is not a constant relationship, it cannot be used for predicting adoption behaviour.

Human versus technology classification

An exploration was undertaken to determine whether questions that related to human aspects had greater influence on the adoption of the innovations than those that related to the technology. To enable this analysis, each of the questions in the four models were categorised by the researcher as being predominantly related to human aspects (such as Q2.9 ‘People who influence my behaviour think that I should use the system’) or technology (such as Q2.7 ‘I would find the system easy to use’). The categorisation is detailed in Appendix 5b. Note: the Diffusion of Innovations model only had questions categorised as technology, so no analysis of the results was required.

The analysis revealed that there was an interaction between the human/ technology factor and the communication technologies. However even when this interaction was accounted for there was still an interaction with question and technology. The average rating for technology factors was significantly higher than the average ratings for the human related questions, as detailed in Table 19 and shown in Figure 105 (where bars with the same letter above them are not significantly different).

Table 19. Summary of results for UTAUT model human/ technology analysis.

	eSurveys	webinars	YouTube	Average
Human	4.68	4.93	4.65	4.75
Technology	5.81	5.43	5.10	5.45

Also, the average ratings for human related questions did not vary as much across the technologies as did the technology classified questions. This indicates that the technology related questions were in general better at predicting adoption than the human related questions.

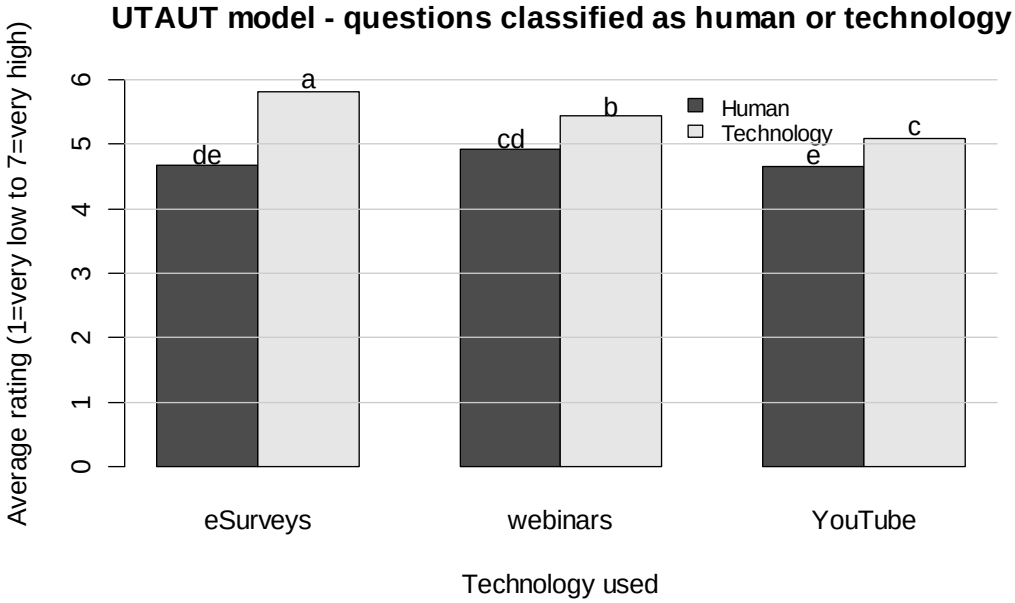


Figure 105. UTAUT model - questions classified as human or technology.

The radar plot in Figure 106 is another way to display the interaction between the three technologies and the questions. This illustrates how Q7.4 (promotion) received significantly lower scores than other questions.

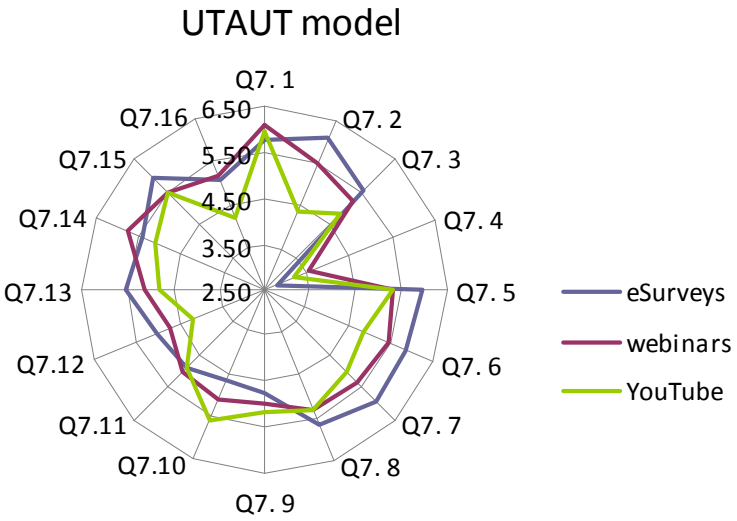


Figure 106. Radar plot of interaction between technology and questions for UTAUT model.

A Principal Components Analysis (see Table 82 in Appendix 5c) showed that nearly half of the variance in the data (48.5%) could be explained by the first two principal components. The questions, in descending order, that most contributed to these two principal components were Q7.2 (quick), Q7.13 (resources) and Q7.12 (org support).

The analysis used 56 out of 85 respondents in the analysis (respondents were dropped out if they didn't answer one or more questions). The absolute size of the

loadings relative to each other, as shown in Table 83 in Appendix 5c, indicates how much a question contributed to the principal component.

The biplot of the first two principal components (see Figure 107) showed the questions which formed clusters, indicating similar responses. For example, questions Q7.11 (senior mangt), Q7.12 (org support), Q7.13 (resources) and Q7.16 (assistance) appear to be quite correlated and would possibly be collecting the same sort of information.

Questions 7.1 (useful), Q7.8 (learning easy), Q7.6 (skilful), Q7.7 (easy to use), Q7.10 (important people), Q7.14 (knowledge) and Q7.15 (compatible) also tend to clump together so may be quite correlated and providing similar information.

Questions 7.4 (promotion), 7.5 (clear), 7.9 (influencers), 7.3 (productive) and 7.2 (quick) tend to be more separated from the other questions, and 7.4 (promotion) is nearly at right angles (hence probably independent) to 7.3 (productive), and 7.2 (quick) is nearly at right angles to the cluster of questions containing 7.13 (resources).

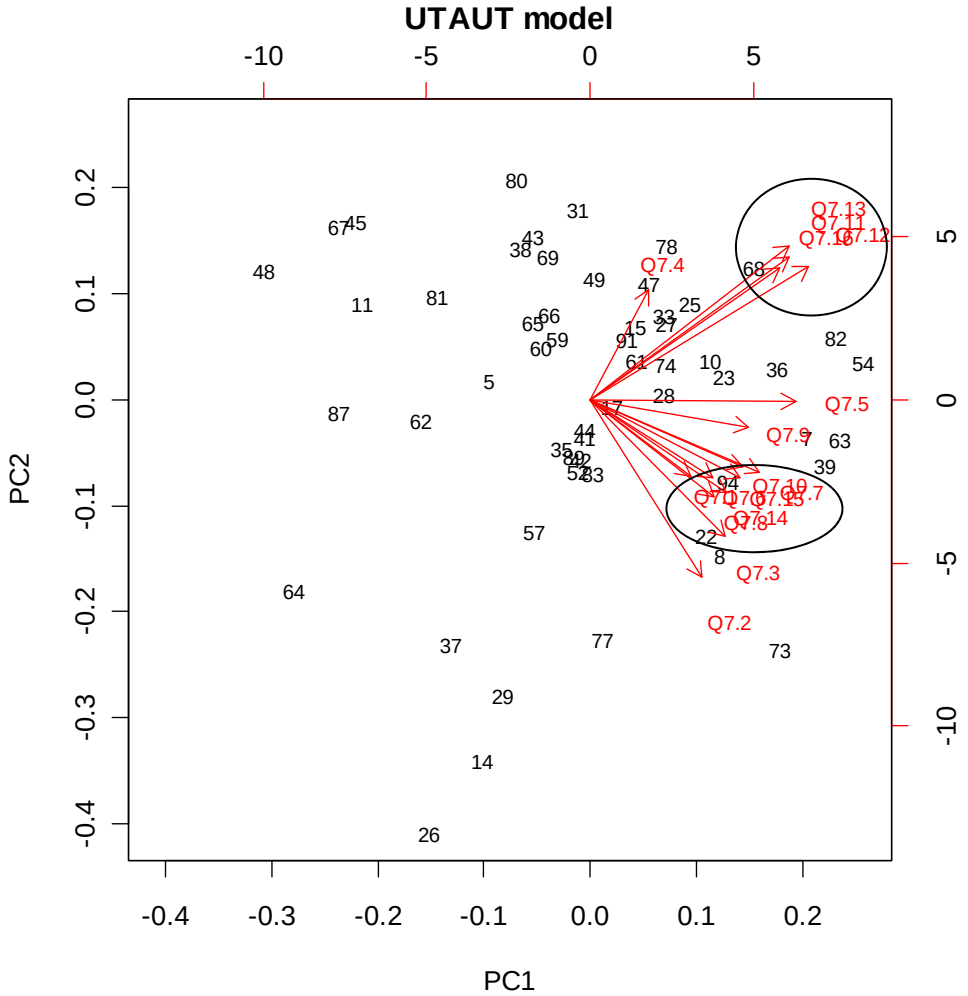


Figure 107. Biplot of the first two principal components for UTAUT model.

Summary and observations

As a result of analysing the 16 questions related to the UTAUT model for the three technologies, eSurveys received the highest rating (5.4), followed by webinars (5.3)

and YouTube received the lowest rating (4.8). Regarding the questions, the highest combined ratings were received by Q7.1 (useful) at 5.9, Q7.15 (compatible) at 5.6, Q7.5 (clear) at 5.5 and Q7.7 (easy to use) at 5.5. So on one hand as these questions received the highest scores it indicates that these might be the best to keep as they are most positively contributing to the adoption of the technologies, especially compared to the lowest rated question Q7.4 (promotion) at just 3.2.

However on the other hand, it was Questions 7.4 (promotion), 7.12 (org support), 7.13 (resources), 7.15 (compatible) and 7.16 (assistance) that showed no significant difference between the type of technology or the level of use of technology, so they might be the better ones to indicate the factors regarding the adoption of the new technologies as they are more generally representative.

Whereas Questions 7.2 (quick), 7.6 (skilful), 7.7 (easy to use) and 7.10 (important people) showed a significant difference between average ratings across the technologies, as well as a significant relationship between the ratings for degree of usage (all positive relationships). Questions 7.1 (useful), 7.5 (clear), Q7.8 (learning easy), Q7.9 (influencers), Q7.11 (senior mangt) and Q7.14 (knowledge) showed a significant trend with the ratings for degrees of usage (again all positive relationships).

There was an interaction with the human/ technology factor and technology used, however even when this was accounted for there was still an interaction with question and technology. This indicates a complex interaction where no one factor stands out as highly significant. In general, the average ratings for human classified questions did not vary as much across the technologies used as the technology classified questions. The technology classified questions received higher average ratings than the human classified questions. This indicates that the technology related questions were in general better at predicting adoption than the human related questions.

The biplot of the first two principal components in Figure 107 show that the questions form clusters with similar responses. For example, questions Q7.11 (senior mangt), Q7.12 (org support), Q7.13 (resources) and Q7.16 (assistance) appear to be quite correlated and would possibly be collecting the same sort of information. It would be possible to label that cluster ‘corporately supported’ to summarise the variables involved.

The same is true for Questions 7.1 (useful), Q7.6 (skilful), Q7.7 (easy to use), Q7.8 (learning easy), Q7.10 (important people), Q7.14 (knowledge) and Q7.15 (compatible) forming another cluster. That cluster is more difficult to label as no one or two terms seem to summarise the rather diverse variables. The ones that contributed most to PC1 were Q7.7 (easy to use), Q7.10 (important people), Q7.15 (compatible), so perhaps ‘easy and compatible’ could be its label.

Questions 7.4 (promotion), 7.5 (clear), 7.9 (influencers), 7.3 (productive) and 7.2 (quick) tend to be more separated from the other questions, and so don’t appear to have any strong connections.

Question 7.4 (promotion) is nearly at right angles to 7.3 (productive), and so can be considered to be probably independent. Question 7.2 (quick) is nearly at right angles to the 'corporately supported' cluster of questions, so can be considered independent of those.

So overall, what this indicates is that in the UTAUT model there are two main clusters of variables that promote adoption of the technologies – 'corporately supported' and 'easy and compatible'.

Responses to Switch model questions

The questions (and their shorthand name in brackets) asked in the survey for the Switch model were:
Q8.1 'To what degree can you learn from the success of others using the innovation and clone it?' (success of others)
Q8.2 'To what degree are the specific steps that you need to take to use the innovation clear to you?' (clear steps)
Q8.3 'To what degree are the outcomes that will be achieved by using the innovation clear to you?' (outcomes)
Q8.4 'To what degree are you emotionally engaged with wanting the innovation to succeed?' (emotionally engaged)
Q8.5 'To what degree can you take small easily achievable steps towards succeeding with the innovation?' (small steps)
Q8.6 'To what degree does successfully using the innovation bring you a sense of identity?' (sense of identity)
Q8.7 'To what degree does your physical environment force you to use the new innovation instead of the old way?' (physical envir)
Q8.8 'To what degree is it easy to make using the innovation a habit?' (habit)
Q8.9 'To what degree is the innovation contagious for others to want to use it?' (contagious)
Q8.10 'To what degree is it sustainable to use the innovation in the long-term?' (sustainable)

Analysis of individual sub-questions

A summary of the averaged responses to these questions for each technology, as well as a combined average for all three technologies, is shown in Table 20. The highest combined rating received was Q8.10 (sustainable) at 5.8 and the lowest for Q8.6 (sense of identity) at just 4.5.

Questions 8.1 (success of others), 8.3 (outcomes), 8.4 (emotionally engaged) and 8.10 (sustainable) received the four highest scores for combined ratings and showed no significant difference between the type of technology or level of use of technology.

Questions 8.6 (sense of identity) showed a significant difference between average ratings across the technologies, as well as a significant relationship between the ratings for degree of usage (all positive relationships). In Appendix 5c, Table 84 shows the slopes and Table 85 shows the predicted ratings for the technologies for these questions.

Table 20. Summary of responses to Switch model questions.

	eSurveys	webinars	YouTube	Combined
Q8.1 (success of others)	5.3	5.1	5.7	5.4
Q8.2 (clear steps)	5.6	4.9	5.0	5.1
Q8.3 (outcomes)	5.9	5.5	5.4	5.6
Q8.4 (emotionally engaged)	5.4	5.4	5.6	5.5
Q8.5 (small steps)	5.3	5.0	5.2	5.2
Q8.6 (sense of identity)	4.1	4.2	5.3	4.5
Q8.7 (physical envir)	4.3	5.0	4.4	4.6
Q8.8 (habit)	5.1	5.0	4.3	4.8
Q8.9 (contagious)	4.9	4.9	5.3	5.0
Q8.10 (sustainable)	5.9	6.0	5.6	5.8
Overall average	4.9	5.0	5.0	4.9

Questions 8.2 (clear steps), 8.5 (small steps), 8.7 (physical envir) and 8.8 (habit) showed a significant trend with the ratings for degrees of usage (again all positive relationships), but there were no significant differences between technologies (see Table 84 for slopes).

Question 8.9 (contagious) had significantly different slopes for degree of usage across technologies; however the average rating for technologies was not significantly different. Further investigation of this question revealed that there was no significant trend for eSurveys (slope=-0.129), a highly significant trend for webinars (slope=0.479) and a near significant (p=0.054) trend for YouTube (slope=0.226).

The average ratings and 95% confidence intervals for the questions for each model are plotted in Appendix 5e, with bar graphs of the frequency of each rating in the background. The degree of usage rating for each of the three technologies is plotted with the rating from each question (with a simple linear regression fitted) in Appendix 5f.

Analysis of variance across sub-questions

An analysis of variance of ratings across the sub-questions for the Switch model is shown in Table 86 in Appendix 5c. The question and technology terms assess the difference in mean ratings, and their interaction assesses whether the differences in technology remain consistent across questions. The usage term assesses the linear relationship between the ratings and the degree of usage. The interactions with degree of usage and the question and technology factors assess whether the relationship changes for different questions and technologies.

The results indicate that the average rating varied across questions, with a significant interaction between questions and technology. The relationship with degree of usage varied with technology. The interaction between question and technology was mainly from the average ratings for YouTube behaving differently across the questions compared to eSurveys and webinars. The lsd for this interaction was 0.763.

The slopes were significantly different between webinars (0.368) and the other two technologies, eSurveys (0.095) and YouTube (0.120), which were not significantly different from each other.

Human versus technology classification

Regarding the human or technology classification of the questions, the results are summarised in Table 21. An analysis revealed that there was an interaction with the human/ technology factor and technology used, however even when this was accounted for there was still an interaction with question and technology. The graph of the average ratings across the human/ technology classification displays the interaction (as shown in Figure 108).

Table 21. Summary of results forSwitch model human/ technology analysis.

	eSurveys	webinars	YouTube	Average
Human	4.98	4.91	5.24	5.05
Technology	5.38	5.25	5.13	5.25

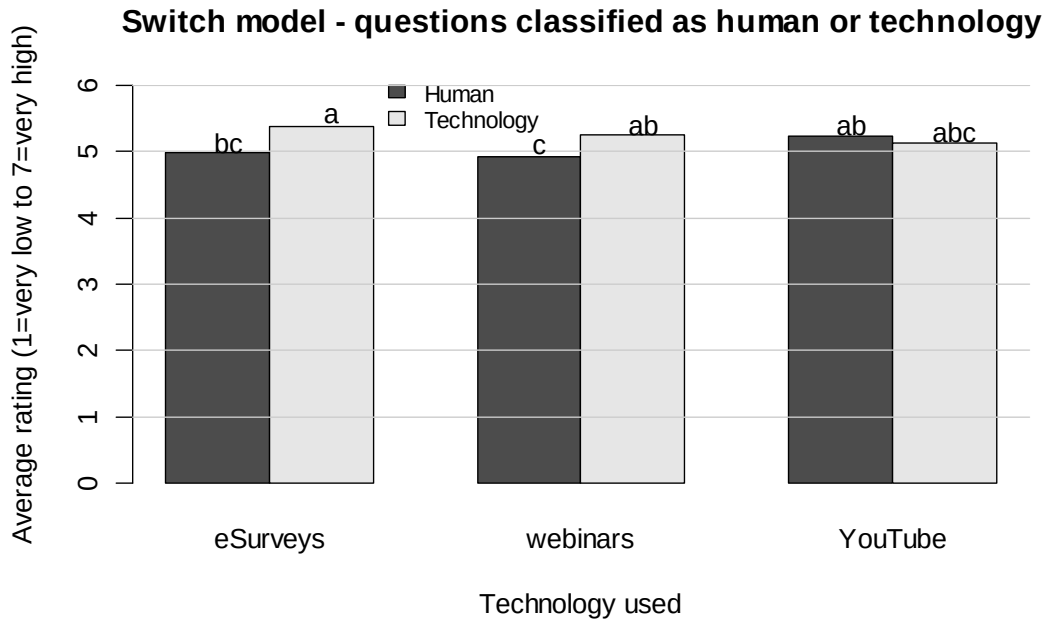


Figure 108. Switch model - questions classified as human or technology.

Note: Bars with the same letter above them are not significantly different.

The average ratings of technology classified questions are significantly higher than the human classification for the eSurveys and webinar technologies, but not for YouTube. This indicates that the technology related questions were in general better at predicting adoption than the human related questions.

The radar plot in Figure 109 is another way to display the interaction between the three technologies and the ten questions of the Switch model. It illustrates how Q8.10 (sustainable) and Q8.3 (outcomes) consistently received the highest ratings, whereas Q8.6 (sense of identity) received the lowest ratings.

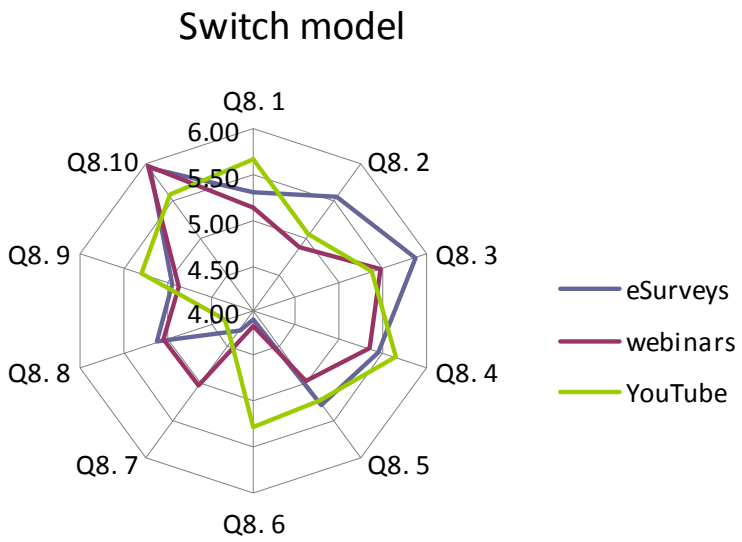


Figure 109. Radar plot for Switch model.

A Principal Components Analysis (see Table 87 in Appendix 5c) showed that over half of the variance in the data (54.1%) could be explained by the first two principal components. The questions, in descending order, that most contributed to these two principal components were Q8.7 (physical environ) and Q8.6 (sense of identity).

The analysis used 76 out of 85 respondents in the analysis (respondents were dropped out if they didn't answer one or more questions). The absolute size of the loadings relative to each other, as shown in Table 88 in Appendix 5c, indicates how much a question contributes to the principal component.

The biplot of the first two principal components show that the questions form clusters with similar responses. There appears to be three main clusters of questions as follows.

1. Questions 8.2 (steps to use innovation clear), 8.3 (outcomes), 8.4 (emotionally engaged), 8.5 (small steps) forming the upper group on the biplot.
2. Questions 8.1 (success of others), 8.6 (sense of identity), 8.8 (habit), 8.9 (contagious), 8.10 (sustainable) forming the next group, however Q 8.1 (success of others) and Q8.10 (sustainable) do not contribute a lot of information to the first two components as shown by the shorter arrow length.
3. Question 8.7 (physical envir) forms a group on its own. This appears to be a main contributor to the first two principal components as shown by the length of the arrow, and also seems to be contributing information independent of the other questions as shown by the angle of the arrow tending to be at right angles to the other questions.

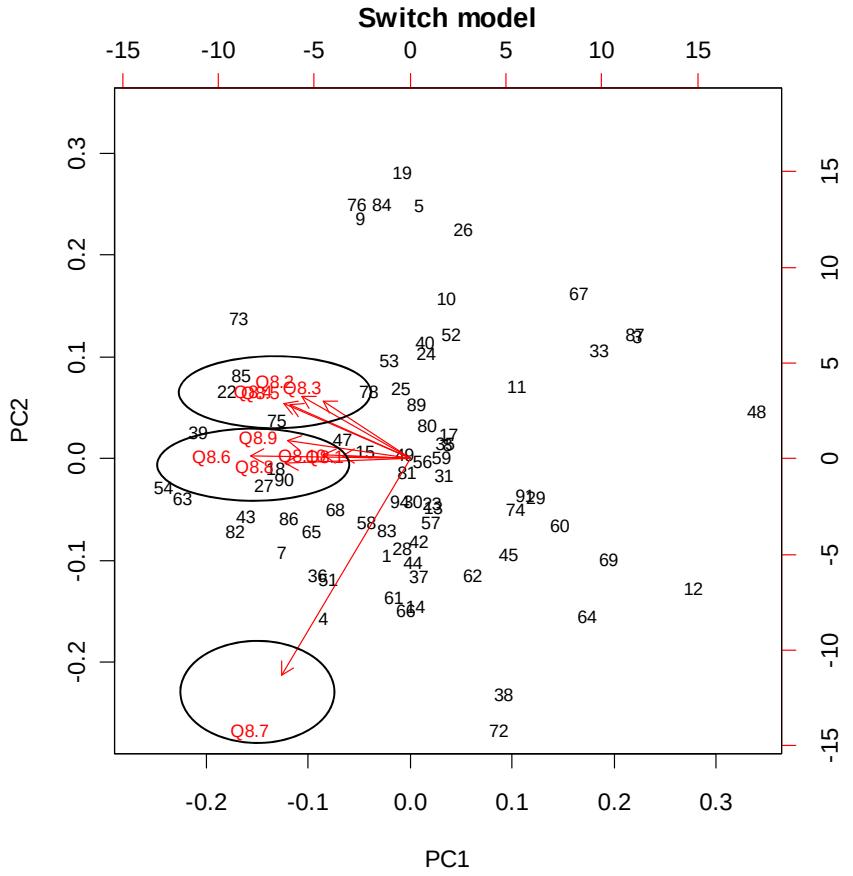


Figure 110. Biplot of the first two principal components for Switch model.

Summary and observations

A summary of the averaged responses to the ten questions from the Switch model for each of the three technologies, as well as a combined average for all three technologies, showed that Questions 8.1 (success of others), 8.3 (outcomes), 8.4 (emotionally engaged) and 8.10 (sustainable) received the four highest scores for combined ratings and showed no significant difference between the type of technology or level of use of technology. This makes them generally good candidates for predicting adoption of the new communication technologies, as they received high scores and are independent of technology and usage.

Questions 8.6 (sense of identity) showed a significant difference between average ratings across the technologies, as well as a significant relationship between the ratings for degree of usage (all positive relationships). Questions 8.2 (clear steps), 8.5 (small steps), 8.7 (physical envir) and 8.8 (habit) showed a significant trend with the ratings for degrees of usage (again all positive relationships); however there were no significant differences between technologies.

Question 8.9 (contagious) had significantly different slopes for degree of usage across technologies; however the average rating for technologies was not significantly different. There was no significant trend for eSurveys (slope=-0.129), a highly significant trend for webinars (slope=0.479) and a near significant (p=0.054) trend for YouTube (slope=0.226).

There was an interaction with the human/ technology factor and technology used, however even when this was accounted for there was still an interaction with question and technology. The average ratings of technology classified questions are significantly higher than the human classification for the eSurveys and webinar technologies, but not for YouTube.

The biplot of the first two principal components show that the questions form three main clusters.

1. Questions 8.2 (steps to use innovation clear), 8.3 (outcomes), 8.4 (emotionally engaged), 8.5 (small steps) forming the upper group on the biplot. These could be labelled 'healthy steps';
2. Questions 8.1 (success of others), 8.6 (sense of identity), 8.8 (habit), 8.9 (contagious), 8.10 (sustainable) forming the next group. A suitable label might therefore be 'contagious habit'.
3. Question 8.7 (physical envir) forming a group on its own and its label could simply be 'physical environment'.

Secondly, Questions 8.1 (success of others) and 8.10 (sustainable) from the second cluster do not contribute a lot of information to the first two components as shown by the shorter arrow length. Finally, Question 8.7 (physical envir) appears to be a main contributor to the first two principal components as shown by the length of the arrow, and also seems to be contributing information independent of the other questions as shown by the angle of the arrow tending to be at right angles to the other questions.

Responses to ADOPT model questions

The questions asked (and their shorthand name in brackets) in the survey for the ADOPT model were:

Q9.1 'To what degree is maximising cost efficiency a strong motivation for you?' (cost efficiency)

Q9.2 'To what degree is protecting the natural environment a strong motivation for you?' (natural envir)

Q9.3 'To what degree are you risk averse with your work activities?' (risk averse)

Q9.4 'To what degree do all of your work activities benefit from the innovation?' (work benefit)

Q9.5 'To what degree do your work activities have a long-term (greater than 10 years) outlook?' (long-term outlook)

Q9.6 'To what degree are your work activities under severe short-term financial constraints?' (financial constraints)

Q9.7 'To what degree can the innovation be trialled on a limited basis before a decision is made to adopt it on a larger scale?' (trialability)

Q9.8 'To what degree can the effects of the innovation be easily evaluated?' (easily evaluated)

Q9.9 'To what degree is the innovation observable to other potential users?' (observability)

Q9.10 'To what degree are consultants available to provide advice to you about the innovation?' (consultants)

Q9.11 'To what degree do you participate in groups where the innovation could be discussed?' (groups)

Q9.12 'To what degree do you need to develop substantially new skills and knowledge to use the innovation?' (new skills)

Q9.13 ‘To what degree are you aware of others using or trialling the innovation?’ (aware of other users)
Q9.14 ‘To what degree is the up-front cost of the investment small in size relative to the potential annual benefit?’ (up-front cost)
Q9.15 ‘To what degree is the adoption of the innovation able to be reversed?’ (reversibility)
Q9.16 ‘To what degree is the use of the innovation likely to reduce your operating costs?’ (reduce operating costs)
Q9.17 ‘To what degree is the use of the innovation likely to have additional effects on the future success of your work activities?’ (additional effects)
Q9.18 ‘To what degree would the effects on future success be quickly realised?’ (success quickly realised)
Q9.19 ‘To what degree would the use of the innovation create environmental benefits?’ (envir benefits)
Q9.20 ‘To what degree would environmental benefits be quickly realised?’ (quick envir benefits)
Q9.21 ‘To what degree would the use of the innovation expose your work to risk?’ (risk exposure)
Q9.22 ‘To what degree would the use of the innovation make the management of your work easier and more convenient?’ (work easier)

Analysis of individual sub-questions

A summary of the averaged responses to these questions for each technology, as well as a combined average for all three technologies, is shown in Table 22. The highest combined rating received was Q9.9 (observability) at 5.6 and the lowest for Q9.21 (risk exposure) at just 3.3. For the overall averages, there was no significant difference between the three technologies.

Table 22. Summary of responses to ADOPT model questions.

	eSurveys	webinars	YouTube	Combined
Q9.1 (cost efficiency)	5.5	5.6	5.2	5.4
Q9.2 (natural envir)	4.8	5.2	5.4	5.1
Q9.3 (risk averse)	4.4	3.6	3.7	3.9
Q9.4 (work benefit)	4.6	5.0	4.7	4.8
Q9.5 (long-term outlook)	4.4	4.5	5.1	4.6
Q9.6 (financial constraints)	5.5	5.0	5.2	5.2
Q9.7 (trialability)	5.7	5.0	5.5	5.4
Q9.8 (easily evaluated)	5.7	4.7	5.4	5.3
Q9.9 (observability)	5.4	5.3	6.2	5.6
Q9.10 (consultants)	3.8	4.4	4.6	4.3
Q9.11 (groups)	3.9	4.4	3.9	4.0
Q9.12 (new skills)	3.8	3.7	4.8	4.1
Q9.13 (aware of other users)	4.8	4.4	5.8	5.0
Q9.14 (up-front cost)	5.6	5.6	5.3	5.5
Q9.15 (reversibility)	5.4	4.8	5.1	5.1

Q9.16 (reduce operating costs)	4.9	5.8	4.6	5.1
Q9.17 (additional effects)	5.1	5.4	5.8	5.4
Q9.18 (success quickly realised)	5.1	5.1	5.3	5.2
Q9.19 (envir benefits)	5.2	5.2	4.9	5.1
Q9.20 (quick envir benefits)	5.1	4.5	4.4	4.7
Q9.21 (risk exposure)	2.8	3.4	3.7	3.3
Q9.22 (work easier)	5.5	5.4	4.3	5.1
Overall average	4.7	4.7	4.5	4.7

Questions 9.1 (cost efficiency), 9.2 (natural envir), 9.3 (risk averse), 9.5 (long-term outlook), 9.6 (financial constraints), 9.7 (trialability), 9.10 (consultants), 9.11 (groups), 9.14 (up-front cost), 9.17 (additional effects) and 9.21 (risk exposure) showed no significant difference between the type of technology or the level of use of technology.

Questions 9.13 (aware of other users) and 9.22 (work easier) showed a significant difference between average ratings across the technologies, as well as a significant relationship between the ratings for degree of usage (all positive relationships). In Appendix 5c, Table 89 shows the slopes and Table 90 shows the predicted ratings for the technologies for these questions.

Questions 9.4 (work benefit), 9.18 (success quickly realised), 9.19 (envir benefits) and 9.20 (quick envir benefits) showed a significant trend with the ratings for degrees of usage (again all positive relationships), but there were no significant differences between technologies (see Table 89 for slopes).

Questions 9.8 (easily evaluated), 9.12 (new skills) and 9.16 (reduce operating costs) showed a significant difference in the average rating across technologies (see Table 90) but there were no significant relationships with the usage ratings.

The average ratings and 95% confidence intervals for the questions for each model are plotted in Appendix 5e, with bar graphs of the frequency of each rating in the background. The degree of usage rating for each of the three technologies is plotted with the rating from each question (with a simple linear regression fitted) in Appendix 5f.

Analysis of variance across sub-questions

An analysis of variance of ratings across the sub-questions for the ADOPT model is shown in Table 91 in Appendix 5c. The question and technology terms assess the difference in mean ratings, and their interaction assesses whether the differences in technology remain consistent across questions. The usage term assesses the linear relationship between the ratings and the degree of usage. The interactions with degree of usage and the question and technology factors assess whether the relationship changes for different questions and technologies.

The results indicate that the average rating varied across question and technology, with a significant interaction. The relationship with degree of usage varied with technology. The interaction between question and technology was attributable to

YouTube having a different response across the questions compared to eSurveys and webinar. eSurveys and webinars were approaching having a significant interaction (p=0.058). The lsd for comparing predictions in the question by technology interaction was 0.918. The slopes were significantly different between eSurveys (0.000) and the other two technologies, webinar (0.150) and YouTube (0.149), which were not significantly different from each other.

Regarding the human or technology classification of the questions, the results are summarised in Table 23. An analysis revealed that there was an interaction with the human/ technology factor and technology used, however even when this was accounted for there was still an interaction with question and technology.

Table 23. Summary of results for ADOPT model human/ technology analysis.

	eSurveys	webinars	YouTube	Average
Human	4.42	4.47	4.82	4.57
Technology	5.10	5.02	5.03	5.05

The graph of the average ratings across the human/ technology classification displays the interaction (as shown in Figure 111). Bars with the same letter above them are not significantly different. The average ratings of technology classified questions are significantly higher than the human classification for the eSurveys and webinar technologies, but not for YouTube. The technology classified questions all had higher average ratings than the human classified questions.

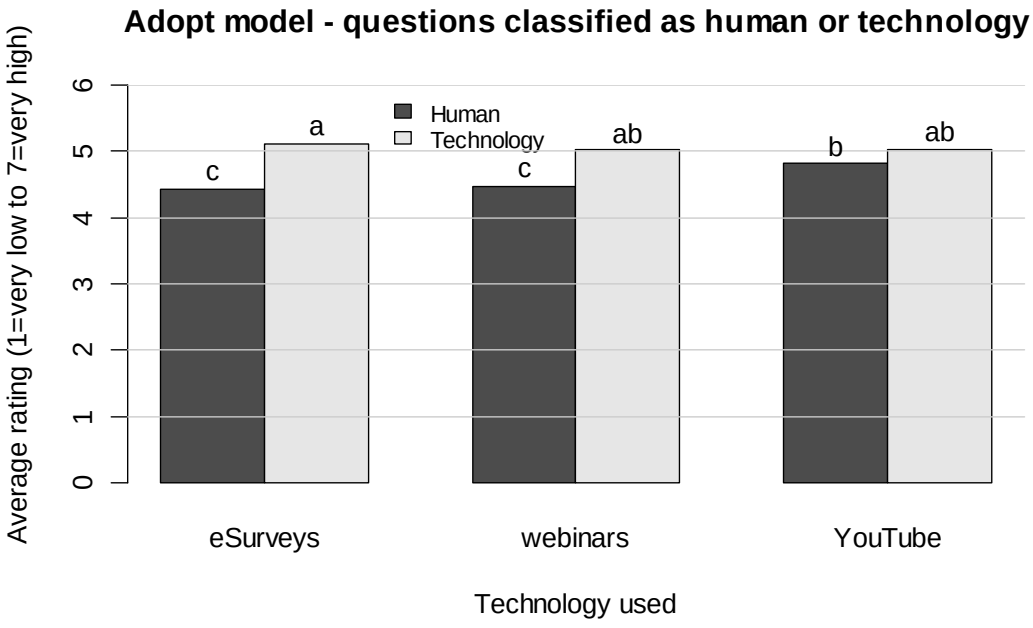


Figure 111. ADOPT model - questions classified as human or technology.

The radar plot in Figure 112 is another way to display the interaction between the three technologies and the questions.

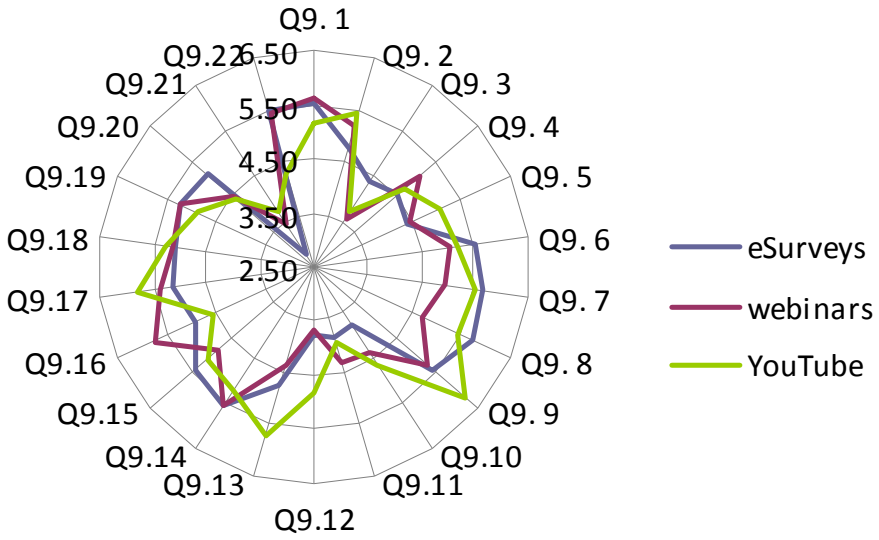


Figure 112. Radar plot for ADOPT model.

A Principal Components Analysis (see Table 92 in Appendix 5c) showed that approximately a third of the variance in the data (33.4%) could be explained by the first two principal components, and approximately half of the variance in the data (50.9%) explained by the first four principal components. The questions, in descending order, that most contributed to these four principal components were Q9.16 (reduce operating costs), Q9.6 (financial constraints) and Q9.15 (reversibility).

The analysis used 58 out of 85 respondents in the analysis (respondents are dropped out if they don't answer one or more questions). The absolute size of the loadings relative to each other, as shown in Table 93 in Appendix 5c, indicates how much a question contributes to the principal component.

The biplot of the first two principal components shows a general spread of the questions without forming distinct clusters of questions. The relative size of the arrows shows how much the questions contribute, and shows that questions such as 9.22 (work easier), 9.16 (reduce operating costs) and 9.21 (risk exposure) contribute least in these first two components.

However question 9.21 (risk exposure) had a large contribution to the third principal component, while very little in the first principal component, so caution is needed if it was to be discarded. The second and the third principal components accounted for similar percentages of variances (10.9% and 9.3%), hence they have similar importance.

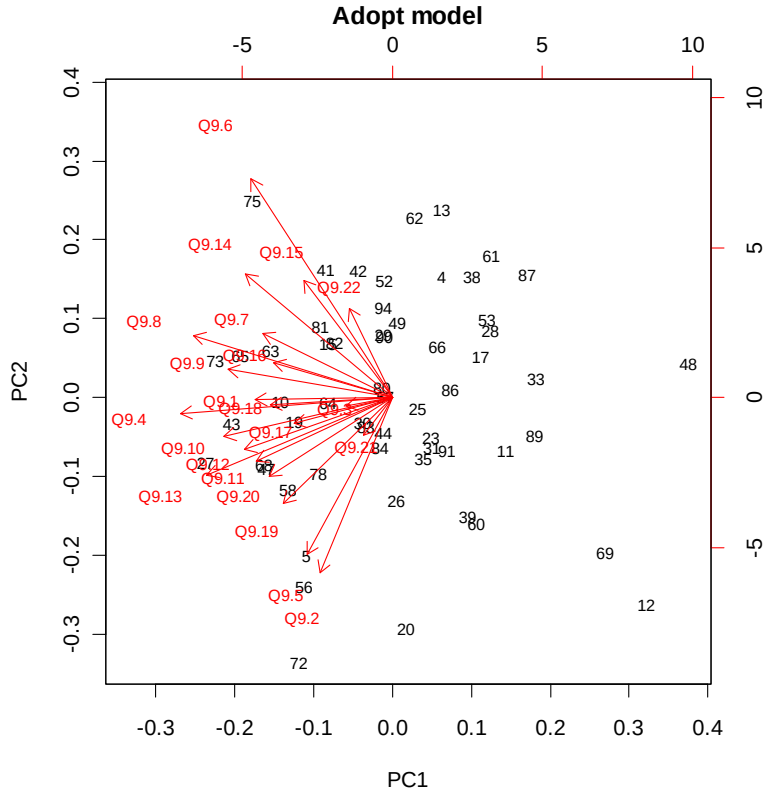


Figure 113. Biplot of the first two principal components for ADOPT model.

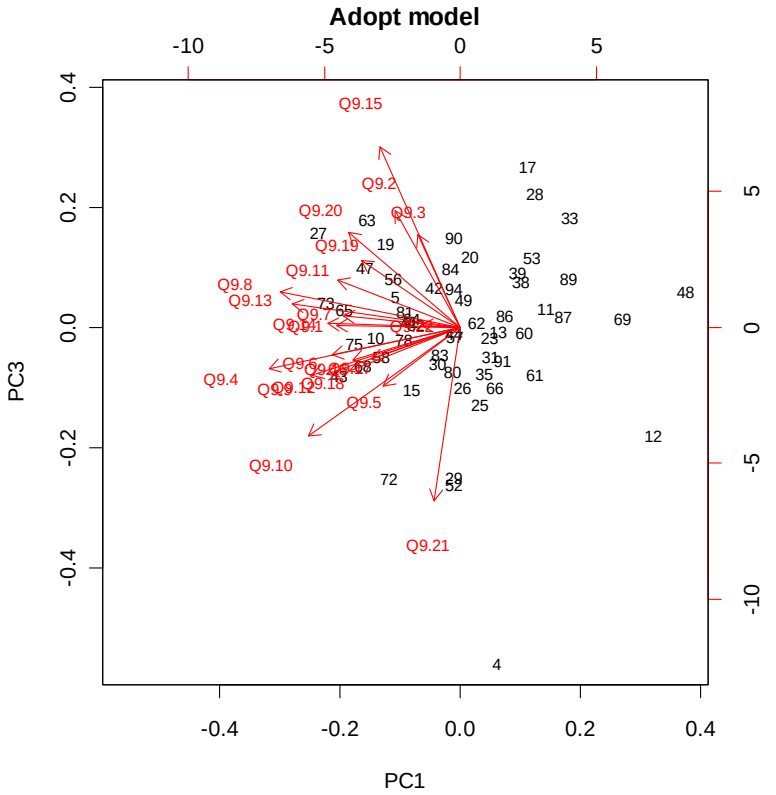


Figure 114. Biplot of the first and third principal components for ADOPT model.

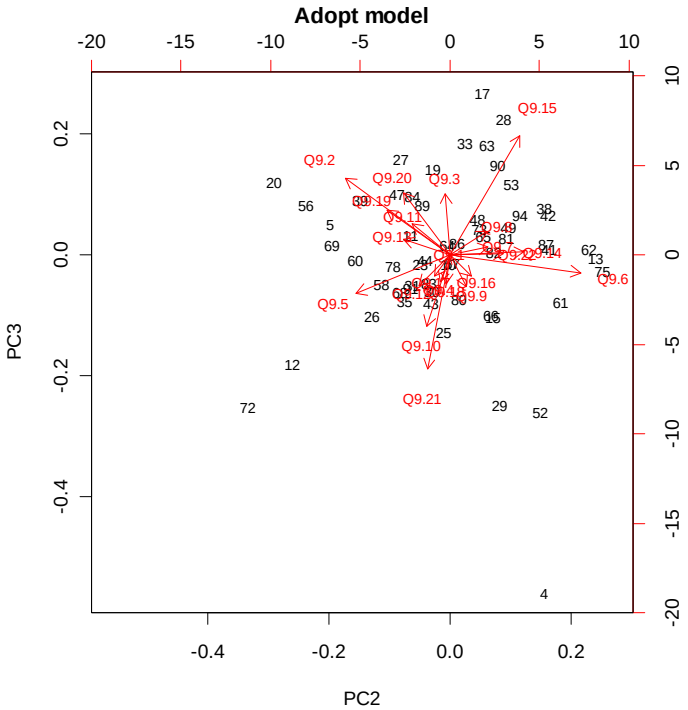


Figure 115. Biplot of the second and third principal components for ADOPT model.

The large number of questions and lack of distinct grouping of them make it difficult to summarise the results of the Principal Components Analysis. The radar plot of the first three components, as shown in Figure 116, shows the relative magnitudes of the loadings. The percentage of variation should be used to consider the weight of importance for each component.

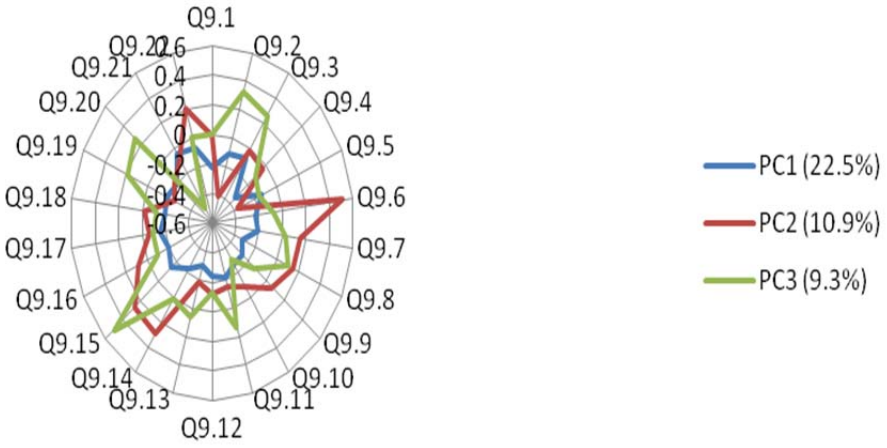


Figure 116. Radar plot of first three principal components for ADOPT model.

An analysis of variance of degree of usage for the first principal component score and type of technology showed a significant relationship with the score (F-prob= 0.0360), but no significant difference between technologies or differences in the relationship with scores across technologies. There was no significant relationship with the second or third score.

Summary and observations

The averaged responses to the 22 questions in the ADOPT model for each technology, shows that the highest combined rating was Q9.9 (observability) at 5.6 and the lowest Q9.21 (risk exposure) at just 3.3. For the overall averages, there was no significant difference between the three technologies.

Questions 9.13 (aware of other users) and 9.22 (work easier) showed a significant difference between average ratings across the technologies, as well as a significant relationship between the ratings for degree of usage (all positive relationships). Questions 9.4 (work benefit), 9.18 (success quickly realised), 9.19 (envir benefits) and 9.20 (quick envir benefits) showed a significant trend with the ratings for degrees of usage (again all positive relationships), but there were no significant differences between technologies.

The average ratings of technology classified questions are significantly higher than the human classification for the eSurveys and webinar technologies, but not for YouTube. The technology classified questions all had higher average ratings than the human classified questions.

The biplot of the first two principal components shows a general spread of the questions without forming distinct clusters of questions. This could indicate that the number of questions in the ADOPT model have been well chosen, as there is minimal overlap between them. The relative size of the arrows shows how much the questions contribute, and shows that questions such as 9.22 (work easier), 9.16 (reduce operating costs) and 9.21 (risk exposure) contribute least in these first two components. So if we need to reduce the number of questions, those might be able to be discarded. However it should be noted for 9.16 (reduce operating costs) that while it had little contribution in the first two principal components, it had the largest effect in PC4. Question 9.21 (risk exposure) had a large contribution to the third principal component, while very little in the first principal component, so caution is needed if it were to be discarded.

The concept of discarding variables based on their comparatively small contribution to the principal components is a fairly subjective determination. Indeed, just because a variable does not capture a lot of the variance at this point in time with this specific set of respondents doesn't mean it won't be an important factor in influencing adoption. The importance of marginal effects needs further investigation. For example, it would be useful to determine the effect a change in ‘supervisor encouraging use’ would have upon adoption.

In conclusion, Q9.9 (observability) was the strongest factor for predicting adoption and Q9.21 (risk exposure) the lowest. However question 9.21 (risk exposure) had a large contribution to the third principal component, while very little in the first principal component, so caution is needed if it was to be discarded. The biplot of the first two principal components showed a general spread of questions without any distinct question clusters. This could indicate that the number of questions in the ADOPT model have been well chosen, as there is minimal overlap between them. While having variables that can explain and predict adoption behaviour is the main criteria for well-chosen variables, there is efficiency in minimising the number of questions.

Comparison across the four adoption models

Factors that encourage or discourage adoption

Respondents who answered questions related to eSurveys indicated that previously they used either hard copies of questionnaires filled out face-to-face or mailed out, did telephone surveys, emailed out questionnaires or did not use them at all. Factors encouraging the adoption of eSurveys were ease of use, effectiveness in performing and collating surveys and efficiency of resources. The main discouraging factors were lack of acceptance or access by users and learning to use eSurveys.

Respondents who answered questions relating to webinars indicated that before the use of webinars they were using face-to-face interaction, teleconferencing, telephoning, emailing or not having an alternative. Factors that encouraged use of webinars were increased opportunities to interact with less need for travel and making it more cost effective, and the visual aid of seeing others and documents. Factors that discouraged use were lack of training and experience of organiser and/or participants, lack of Departmental support, not having ready access to equipment, having a preference for face-to-face interaction and the cost of having a webinar.

Respondents who answered questions relating to YouTube style videos indicated that previously they used written material, attended face-to-face activities or other methods of media. Factors that encouraged the use of YouTube style videos were the advantage of using this visual media for training or information sharing, lower costs of providing YouTube style videos as opposed to attending face-to-face events that potential audiences are finding harder to attend, having a greater acceptance and/or demand from potential audiences and having received training. Discouraging factors were lack of training and experience, lack of departmental support, lack of access to equipment and/or software, and lack of time and opportunity to produce YouTube style videos.

Some common issues across the technologies were access to training and support, IT restrictions and availability of software, equipment, time and opportunity.

Analysis of individual questions

The individual question responses for the four models (Diffusion of innovations, UTAUT, Switch and ADOPT), are summarised in Table 24 according to whether there were significant differences in the average rating across technologies and whether there was a relationship with the usage rating.

There were 22 adoption model questions out of the 53 (41.5%) that showed no significant difference across the three technologies or the degree of usage, namely: 6.2 (compatible), 6.5 (noticeable), 7.4 (promotion), 7.12 (org support), 7.13 (resources), 7.15 (compatible), 7.16 (assistance), 8.1 (success of others), 8.3 (outcomes). 8.4 (emotionally engaged), 8.10 (sustainable), 9.1 (cost efficiency), 9.2 (natural envir), 9.3 (risk averse), 9.5 (long-term outlook), 9.6 (financial constraints), 9.7 (trialability), 9.10 (consultants), 9.11 (groups), 9.14 (up-front cost), 9.17 (additional effects) and 9.21 (risk exposure). The other questions therefore have little value in assessing adoption.

Table 24. Summary of individual question ratings for the four models.

Description	Significant differences in average rating across technologies	Significant relationship with usage rating	Differences in across technology in relationship with usage rating	Question ID
No differences	×	×	×	6.2 (compatible), 6.5 (noticeable), 7.4 (promotion), 7.12 (org support), 7.13 (resources), 7.15 (compatible), 7.16 (assistance), 8.1 (success of others), 8.3 (outcomes). 8.4 (emotionally engaged), 8.10 (sustainable), 9.1 (cost efficiency), 9.2 (natural envir), 9.3 (risk averse), 9.5 (long-term outlook), 9.6 (financial constraints), 9.7 (trialability), 9.10 (consultants), 9.11 (groups), 9.14 (up-front cost), 9.17 (additional effects), 9.21 (risk exposure)
Differences in average rating for technology only	✓	×	×	9.8 (easily evaluated), 9.9 (observability), 9.12 (new skills), 9.16 (reduce operating costs)
Relationship with usage rating only	×	✓	×	7.1 (useful), 7.5 (clear), 7.8 (learning easy), 7.9 (influencers), 7.11 (senior mangt), 7.14 (knowledge), 8.2 (clear steps), 8.5 (small steps), 8.7 (physical envir), 8.8 (habit), 9.4 (work benefit), 9.18 (success quickly realised), 9.19 (envir benefits), 9.20 (quick envir benefits)
Differences in average rating for technology and relationship with usage	✓	✓	×	6.1 (better), 6.3 (simple), 6.4 (experiment), 7.2 (quick), 7.6 (skilful), 7.7 (easy to use), 7.10 (important people), 8.6 (sense of identity), 9.13 (aware of other users), 9.22 (work easier)
Different relationship with usage across technologies			✓	7.3 (productive), 8.9 (contagious), 9.9 (observability), 9.15 (reversibility)

Analyses across questions

An analysis of variance of ratings across the adoption model questions showed a significant interaction across questions and technology. There was also a significant trend with usage that varied with technology and question.

A more complex model was fitted by nesting question within adoption model. This showed that after accounting for the adoption model, questions still showed an interaction with technology, however the relationship with degree of usage was not significantly different with questions within each model (however significantly different across models). ***It was therefore not possible to determine whether one of the four models was any more effective than the others at predicting adoption***.

Due to most of the interactions being significant, as shown in Table 94 in Appendix 5c, more information can be determined by exploring the previous analyses from the individual adoption models.

However, the research study has identified a number of useful observations regarding the usefulness of the 53 questions used across the four models, and their effectiveness at predicting adoption of one of the three innovations. A graph of the predicted ratings across all adoption questions for the three technologies is shown in Figure 117. It is evident that questions 7.4 (promotion), 9.3 (risk averse) and 9.21 (risk exposure) consistently rated the lowest across the three technologies. This would suggest that those three questions consistently provided low levels for predicting the adoption of those technologies.

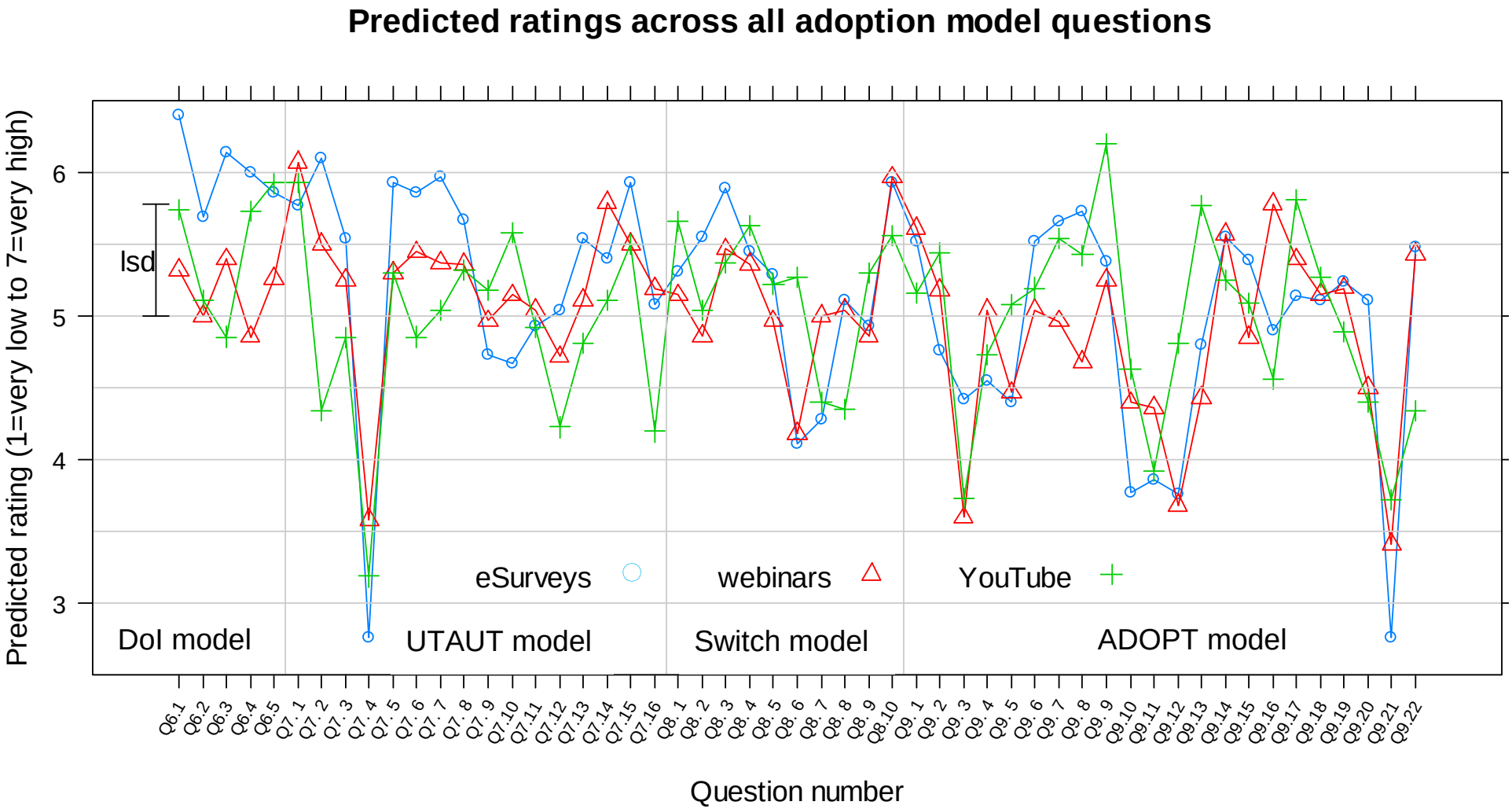


Figure 117. Predicted ratings across all adoption model questions.

The graph visually demonstrates that the questions in the Diffusion of innovations model generally all rated fairly highly with little variation. Whereas the other three models had much more variability, especially the ADOPT model which had five questions which generally received lower ratings – namely questions 9.3 (risk averse), 9.10 (consultants), 9.11 (groups), 9.12 (new skills) and 9.21 (risk exposure). The questions in the UTAUT model and Switch model all rated above 4, with the exception of 7.4 (promotion).

Summary and observations

The main benefit of analysing all questions from the adoption models together was to determine whether generalities can be made across the adoption models. The analysis of variance showed significant interactions with adoption model and questions within adoption model, indicating complex patterns in the data across adoption models. It was therefore easier to interpret the data by considering the individual analyses within adoption models.

The analyses of variances for each adoption model showed a significant (or near significant) interaction between question and technology. This indicated that respondents reporting on different technologies generally didn't answer the same questions in a similar way, and may have ranked the questions within an adoption model in a different order.

Degree of usage

The degrees of usage of each of the technologies were not significantly different across the technologies and overall had an average rating of 3.5. There were however relationships between degree of usage and the ratings that the respondents provided for the questions based on the adoptions models. For the Diffusion of innovations model there was a relatively consistent trend between degree of usage and ratings given to each question, which was not significantly different across technologies (slope=0.205). For the UTAUT, Switch and ADOPT models this relationship with degree of usage varied with technology. The UTAUT webinars had the strongest relationship (slope=0.345), followed by eSurveys (slope=0.222), then YouTube (slope=0.092). The Switch model webinars also had the strongest relationship (slope=0.368), followed by YouTube (slope=0.120) and eSurveys (0.095) which were not significantly different from each other. The ADOPT model showed that webinar (slope=0.150) and YouTube (slope=0.149) were not significantly different from each other but significantly higher than eSurveys (slope=0.000).

Summary and observations

These results show that the trend with degree of usage varied with technology used and adoption models. However, webinars did consistently show the highest relationship with degree of usage across the different adoption models. The absence of significant interactions with degree of usage and questions indicate that summarising degree of usage can be done across technologies without the need of including details about individual questions.

Human or technology classification of questions

Unlike any previous study reviewed, an analysis was undertaken to determine whether there was a difference between human or technology related questions. The UTAUT model had a difference in the average rating of questions depending on

whether they were classified as human or technological, as summarised in Table 25. A significant interaction between technology and question classification showed that in general human classified questions had a lower average rating than technological for each of the technologies, with the largest difference with eSurveys, then webinars and YouTube style videos.

Table 25. Summary of human/ technology ratings for all models.

	eSurveys	Webinars	YouTube	Average
UTAUT - Human	4.68	4.93	4.65	4.75
UTAUT - Technology	5.81	5.43	5.10	5.45
Switch - Human	4.98	4.91	5.24	5.05
Switch - Technology	5.38	5.25	5.13	5.25
ADOPT - Human	4.42	4.47	4.82	4.57
ADOPT - Technology	5.10	5.02	5.03	5.05
Average	5.06	5.00	4.99	5.02

The Switch and Adopt models also showed a significant interaction between classification and technology; however the difference between human and technological question ratings was only significant for eSurveys and webinars for both adoption models. In both of these technologies the human classified questions were rated lower on average.

Summary and observations

As the technology related questions generally scored higher ratings than the human related questions, this indicated that the technology related questions were in general better at predicting adoption than the human related questions.

Overall analysis of qualitative data

In a final attempt to extract as much useful information from the qualitative data as possible, all the text-based responses from the five surveys were analysed using Leximancer. This software analysed concepts within the text and graphically depicted the inter-connectedness and co-occurrence of key terms. This was undertaken as an overarching audit of the research findings to provide results unbiased by the researcher.

When all 14,326 words from the combined qualitative responses were analysed, Leximancer detected the following five main concepts: *use*, *information*, *access*, *practice* and *support*. The concept map and the underlying word networks generated by Leximancer are presented in Figure 118.

The analysis using Leximancer reinforced the importance of organisational support and the need to practice with the technologies to gain confidence in their use. It also highlighted the importance of suitable access to the technologies, despite the restrictive nature of the ICT policies and procedures. It also highlighted that within the concept of use, staff need the time and training to be able to use the technologies efficiently. The terms *people* and *tools* were both located at the intersection between use, information and access. This could indicate that the selection of suitable

technologies and the people who use them was critical to the success of the adoption of new technologies.

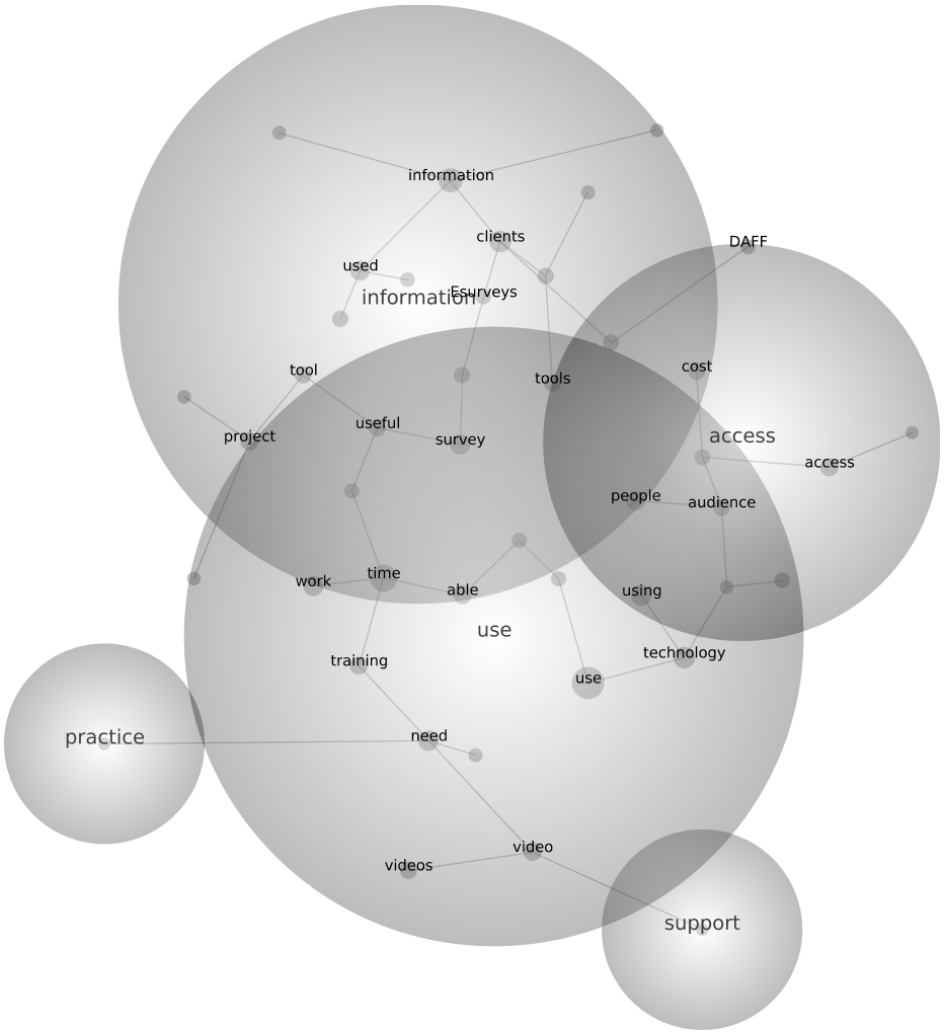


Figure 118. Concept map generated by Leximancer.

As a comparison, the same words were submitted to www.Wordle.net to form a word cloud where the prominence (size and colour) of the words displayed is in proportion to the number of times they occurred in the block of text being analysed. Stop words (such as *to*, *the* and *at*) were automatically removed from the data set as part of the processing. The resultant word cloud is presented in Figure 119.

The software also provided a count of the words analysed and the five most frequently used words were: time (n=116), use (n=109), information (n=56), technology (n=54), and access (n=51). This analysis emphasised the importance of sufficient time to learn and use the technologies, as many of the respondents commented on the time required to learn new technology, but looked forward to the time saving to come from the use of the technologies. Three of these words (use, information and access) are in common with the Leximancer analysis. In contrast, Leximancer gave greater importance to the words support (n=23) and practice (n=20), presumably due to the inter-connectedness and co-occurrence they had with other words.

Figure 119. Word cloud generated by Wordle.

Summary and observations

These final analyses of the qualitative data highlighted the importance of *access* (to the new technologies), *practice* (in using the technologies) and *support* (for new users) as key terms.

Determining which questions in the four models were similar

The final quantitative analysis focused on determining which of the questions from the four models were similar. If determined to be similar, these questions could possibly be removed, leaving a smaller set of questions that could form a new survey instrument.

Principal component and hierarchical cluster analyses will remove a respondent from the analyses if any one of their values is missing. The chances of losing the use of a respondent's data increases when more questions are used in an analysis. The analysis across all four models reduces the number of respondents to 43 out of a possible 85. In this study there was a total of 53 questions and it was identified that questions 7.4 (promotion) and 9.15 (reversibility) had many missing values. In an attempt to increase the number of respondents used in the analysis these were dropped out, increasing the number of respondents from 43 to 49.

A Principal Components Analysis (see Table 95 in Appendix 5c) showed that the first two components accounted for 34.1% of the variation in the data, and the first five components accounted for approximately half of the variation in the data. The absolute size of the loadings relative to each other, as shown in Table 96 in Appendix 5c, indicates how much a question contributes to the principal component. The questions that contributed most to the first two principal components, in descending order, were questions 6.3 (simple), 7.16 (assistance), 7.13 (resources), 8.6 (sense of identity), 8.7 (physical envir) and 9.4 (work benefit).

The biplot of the first two components show which questions tend to group (as their arrows are in the same direction) and the relative importance of the questions in contributing to the first two components by the length of the arrows. As shown in

Figure 120, Q9.21 (risk exposure) is almost perpendicular to many of the arrows in the middle of the cluster, so it might not be wise to drop it from the set of questions.

If the first two components were used to decide on a smaller number of questions that could be used to explain the differences in the respondents' ratings, questions with the longest arrows within each grouping could be used. These questions would include 9.21 (risk exposure), 9.9 (observability), 9.12 (new skills), 9.4 (work benefit), 8.6 (sense of identity), 8.7 (physical envir) and 6.3 (simple).

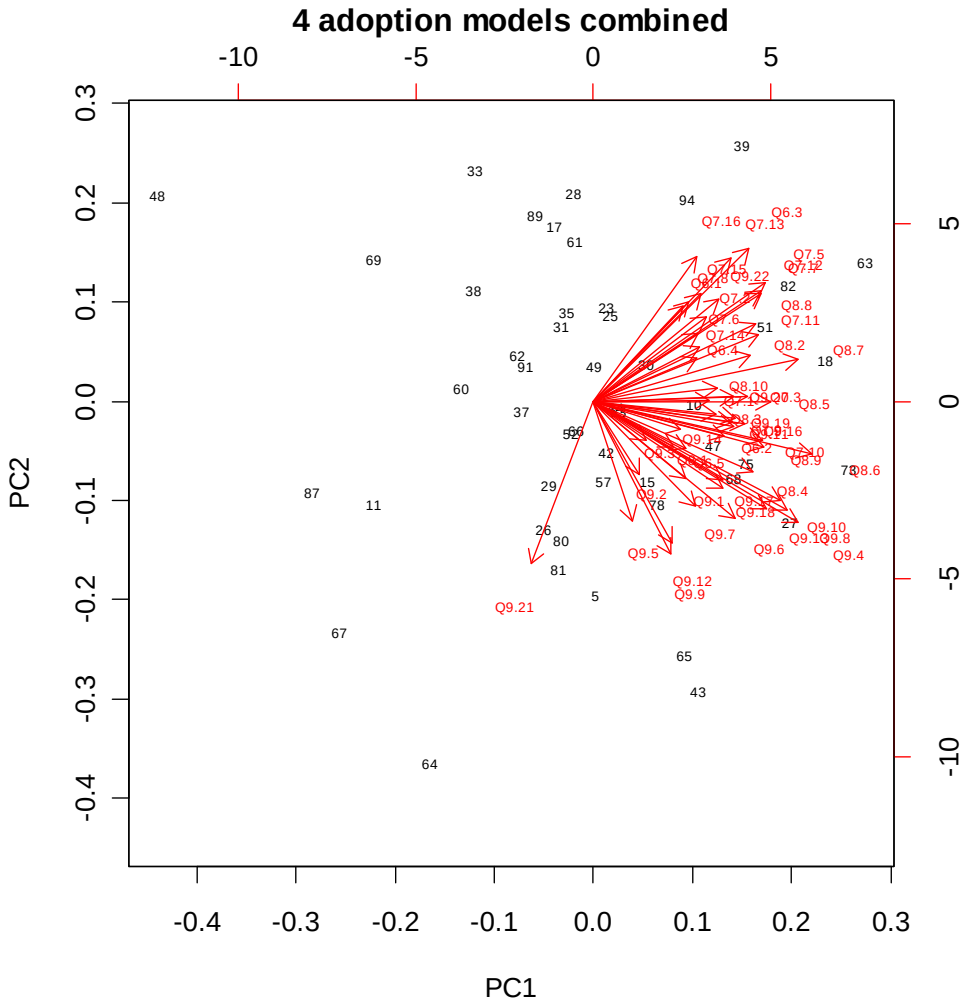


Figure 120. Biplot of the first two principal components for all models.

The first principal component score showed a significant relationship with the degree of usage, but no significant differences between technologies. The second and third principal component scores showed no significant differences in degree of usage or technologies.

A hierarchical cluster analysis was then performed using the R software, on a dissimilarity matrix (using Euclidean distance) data based on the core 49 respondents. The resulting cluster dendrogram located questions close to each other at the end of the branches, based on respondents answering those questions in a similar manner. Conversely, questions become more dissimilar the further up the tree their branches connect.

The cluster dendrogram in Figure 121 shows the four groupings, labelled A to D, which were generated by the program. Four groups were arbitrarily chosen based on the third level of the branch structure, which provided groups with similar numbers of concepts, as detailed in Table 26. It should be noted that Q7.4 (promotion) and Q9.15 (reversibility) were omitted due to the amount of missing data.

While some of these groupings seemed logical, for example grouping Q6.5 (noticeable) and Q9.9 (observability) together, other apparently similar terms didn't get clustered together, for example Q6.2 (compatible) and Q7.15 (compatible), or Q9.2 (natural envir) and Q9.19 (envir benefits). One possible explanation is that survey respondents perceived those questions as being slightly different, based on the questions in the survey that they had just answered. It should be noted that the number of respondents was limited, and that the research should be replicated to confirm the validity of the results.

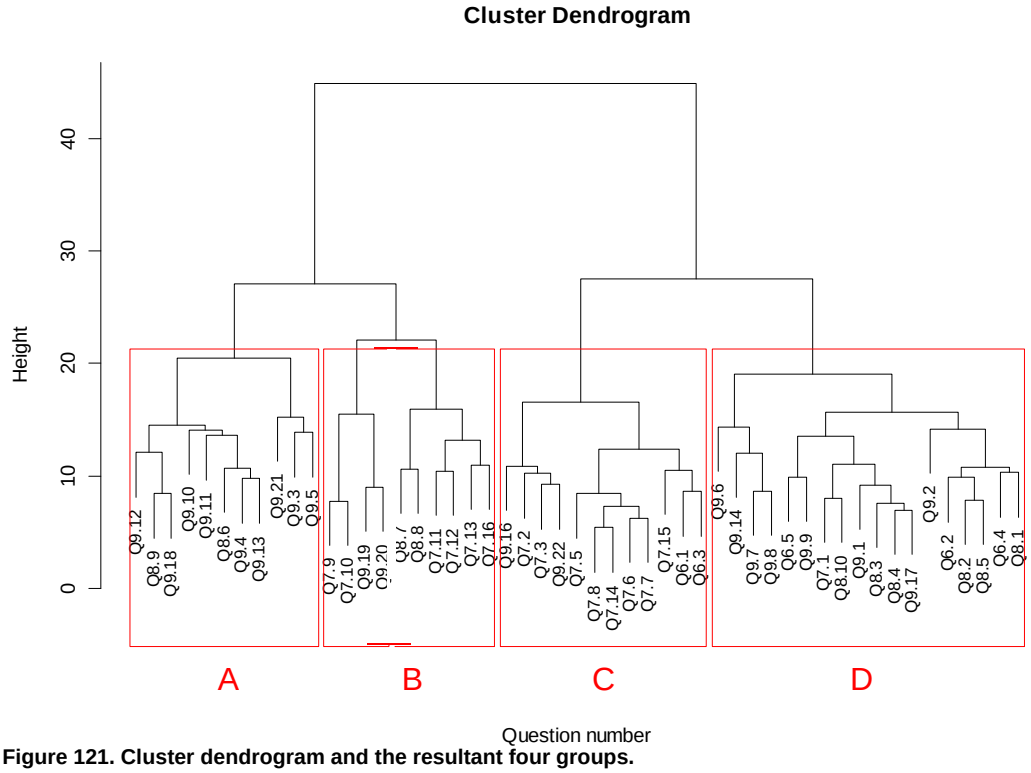


Figure 121. Cluster dendrogram and the resultant four groups.

Table 26. Contribution of the four original models to the four groups.

	A: Contagious benefits	B: Supporting benefits	C: Working smarter benefits	D: Noticeable, trialable benefits	Questions included out of total
DoI			2	3	5/5
UTAUT		4	8	1	15/16
Switch	2	2		6	10/10
ADOPT	9	2	2	8	21/22
Total	**11**	**10**	**12**	**18**	**41/43**

The contributing questions (with their abbreviated names in brackets) for each of the four groups are listed below. The model of origin of the contributing factors to the four new groups is detailed in Table 97 in Appendix 5c.

Group A: Contagious benefits
Q9.12 (new skills), Q8.9 (contagious), Q9.18 (success quickly realised), Q9.10 (consultants), Q9.11 (groups), Q8.6 (sense of identity), Q9.4 (work benefit), Q9.13 (aware of other users), Q9.21 (risk exposure), Q9.3 (risk averse) and Q9.5 (long-term outlook).

This group of 11 terms could be summarised as 'contagious benefits' and includes two concepts from the Switch model, namely the contagious nature of others wanting to use the new technology and the sense of identity gained from using it. It also incorporates nine concepts from the ADOPT model, including concepts around the interaction that occurs through the potential user being part of a group where other members are actively using the technology or when they come in contact with a consultant who spreads the message of other people successfully using the technology. This is accentuated when it provides a work benefit to the user and the benefits accrue quickly. The innovators may be risk averse yet willing to learn the new skills required to use the innovation.

Group B: Supporting benefits
Q7.9 (influencers), Q7.10 (important people), Q9.19 (envir benefits) and Q9.20 (quick envir benefits), Q8.7 (physical envir), Q8.8 (habit), Q7.11 (senior mangt), Q7.12 (org support), Q7.13 (resources) and Q7.16 (assistance).

This group of ten terms could be summarised as 'supporting benefits'. It includes six concepts from the UTAUT model, namely the benefit of support gained from involving influential people (those who influence the user's behaviour) and important people (senior management). It also incorporates the benefit of the organisation supporting the use of the new system, especially senior management, and having the necessary resources and assistance from people to help with difficulties. The two concepts from the Switch model include the way the physical environment can support the change by forcing people to use the new system, and the benefit of having an innovation which can be habitual in nature. It also includes two concepts from the ADOPT model, namely the environmental benefits from using the system and how quickly they will be realised.

Group C: Working smarter benefits
Q9.16 (reduce operating costs), Q7.2 (quick), Q7.3 (productive), Q9.22 (work easier), Q7.5 (clear), Q7.8 (easy learning), Q7.14 (knowledge), Q7.6 (skilful), Q7.7 (easy to use), Q7.15 (compatible), Q6.1 (better) and Q6.3 (simple).

This group of 12 terms originate from three of the models and can be summarised as 'working smarter benefits'. It incorporates the concepts from the DoI model of the innovation being better than the previous alternative and that it is simple to use. It includes the following eight concepts from the UTAUT model: the innovation enables tasks to be completed quicker, increases productivity, and is clear and understandable to use. Learning to use it is easy, users have the knowledge to use the innovation, and it is easy for them to become skilful at using it. The innovation is

easy to use, and compatible with other systems. Finally, the concepts from the ADOPT model are that the innovation reduces operating costs and makes the work easier and more convenient.

Group D: Noticeable, trialable benefits
Q9.6 (financial constraints), Q9.14 (up-front cost), Q9.7 (trialability), Q9.8 (easily evaluated), Q6.5 (noticeable), Q9.9 (observability), Q7.1 (useful), Q8.10 (sustainable), Q9.1 (cost efficiency), Q8.3 (outcomes), Q8.4 (emotionally engaged), Q9.17 (additional effects), Q9.2 (natural envir), Q6.2 (compatible), Q8.2 (clear steps), Q8.5 (small steps), Q6.4 (experiment) and Q8.1 (success of others).

The final group of 18 terms has representative concepts from all four models and can be summarised as 'noticeable, trialable benefits'. It includes the concepts from the DoI model of the innovation being compatible, able to be experimented with while it is being adopted and that it is visible or noticeable to others. The concept from the UTAUT model is that the innovation is perceived as useful. The Switch model provides the following six concepts: users can learn from the success of others who are already using the innovation and there are clear, specific steps for using it. Use of the innovation has clear outcomes and users are emotionally engaged with wanting the innovation to succeed. Small, easy achievable steps can be taken to use the innovation and the use of the innovation is sustainable in the long-term. Finally, the ADOPT model provides the following eight concepts: users are strongly motivated to maximise profit and protect the natural environment. The users are experiencing short-term financial constraints and the up-front cost of the innovation is small relative to the potential benefit. The innovation can be trialled on a limited basis and the effects of it can be easily evaluated and observed. The use of the innovation is likely to have additional effects on the future success of the user's work.

Summary and observations
The dendrogram resulting from the hierarchical cluster analysis placed questions that were rated similarly at the end of the branches. While some of these groupings seemed logical, other apparently similar terms didn't get clustered together, for example Q6.2 (compatible) and Q7.15 (compatible).

Four groups were arbitrarily formed based on this analysis and given the names Contagious benefits, Supporting benefits, Working smarter benefits and Noticeable, trialable benefits.

Summary of key findings and themes identified
The three technologies (eSurveys, webinars and YouTube) were being used to a similar degree by the respondents of this survey. Prior to using eSurveys, the respondents predominantly used hard copies and/or mailed out copies of questionnaires. Prior to webinars, the respondents primarily used face-to-face and teleconferencing to meet with colleagues and clients. Prior to YouTube, the respondents predominantly used written material and face-to-face delivery. All of these earlier alternatives are generally time consuming and resource intensive.

The factors that **encouraged adoption** of eSurveys were the increased efficiency of creating, distributing and analysing surveys; the ease of use for the survey creator and respondent; saving time and money; accessibility of reaching people; and the

ease of distribution. These factors for webinars were that they provided more opportunities to interact; reduced travel and were cost effective; provided visual aids in seeing each other and documents, were easy to use or to get support and assistance. The factors that encouraged adoption of YouTube style videos were their use as a visual tool for training and/or conveying information; lower costs associated with making video as opposed to other options (e.g. running multiple field days); greater acceptance and/or demand by the target audience; and having received training to make the videos. The themes that emerged regarding the factors that encouraged adoption of the new technologies were that they needed to be easy to use, save time and money, and they required the provision of support.

On the other hand, the factors that **discouraged adoption** of eSurveys were learning how to use them and the lack of acceptance of users to the technology. For webinars they were the lack of training of organiser or participants; lack of Departmental support (e.g. lack of Internet access, software, restrictive policies); having potential participants accepting the technology and having access to equipment; the preference for face-to-face interaction and the cost. Finally, for YouTube the factors were lack of training, lack of Departmental support (e.g. policies and management), lack of access to equipment (including hardware and software), and lack of time. The themes that emerged regarding the factors that discouraged adoption of the new technologies were lack of training on how to use the new technology, end-users not being receptive to it, lack of departmental support/ policy, and lack of access to equipment.

The **Diffusion of innovations model** and its five variables (better, compatible, simple, experiment and noticeable) was tested against the three technologies (eSurvey, webinar and YouTube). Each variable received high ratings, though eSurveys received the highest rating, indicating that all five variables influence the adoption of the new communication technologies. Questions 6.2 (compatible) and 6.5 (noticeable) showed no significant difference between the type of technology and level of use of technology, so the rate of increase in the rating wasn't related to the level of usage of the technologies. However the ratings for questions 6.1 (better), 6.3 (simple) and 6.4 (experiment) did show a significant difference in the type of technology and the degree of usage of the technology. So the more the new communication technology was used, the greater the rating it received for those three questions.

As a result of analysing the 16 questions related to the **UTAUT model** for the three technologies, eSurveys received the highest rating, followed by webinars and YouTube received the lowest rating. Regarding the questions, the highest combined ratings were received by Q7.1 (useful), Q7.15 (compatible), Q7.5 (clear) and Q7.7 (easy to use). On one hand since these questions received the highest scores it indicates that these might be the questions most positively contributing to adoption of the technologies, especially compared to the lowest rated question Q7.4 (promotion). However on the other hand, it was Questions 7.4 (promotion), 7.12 (org support), 7.13 (resources), 7.15 (compatible) and 7.16 (assistance) that showed no significant difference between the type of technology or the level of use of technology, so they would be the better ones to indicate the factors regarding the adoption of the new technologies as they are more generally representative. Whereas Questions 7.2 (quick), 7.6 (skilful), 7.7 (easy to use) and 7.10 (important people) showed a significant difference between average ratings across the technologies, as

well as a significant relationship between the ratings for degree of usage (all positive relationships). Questions 7.1 (useful), 7.5 (clear), Q7.8 (learning easy), Q7.9 (influencers), Q7.11 (senior mangt) and Q7.14 (knowledge) showed a significant trend with the ratings for degrees of usage (again all positive relationships).

There was an interaction with the human/ technology factor and technology used, however even when this was accounted for there was still an interaction with question and technology. This indicates a complex interaction where no one factor stands out as highly significant. In general, the average ratings for human classified questions did not vary as much across the technologies used as the technology classified questions. The technology classified questions received higher average ratings than the human classified questions. This indicates that the technology related questions were in general better at predicting adoption than the human related questions.

The biplot of the first two principal components (as shown in Figure 107) indicates that the questions form clusters with similar responses. For example, questions Q7.11 (senior mangt), Q7.12 (org support), Q7.13 (resources) and Q7.16 (assistance) appear to be quite correlated and would possibly be collecting the same sort of information. It would be possible to label that cluster '***corporately supported***' to summarise the variables involved. The same is true for Questions 7.1 (useful), Q7.6 (skilful), Q7.7 (easy to use), Q7.8 (learning easy), Q7.10 (important people), Q7.14 (knowledge) and Q7.15 (compatible) forming another cluster. That cluster is more difficult to label as no one or two terms seem to summarise the rather diverse variables. The ones that contributed most to PC1 were Q7.7 (easy to use), Q7.10 (important people), Q7.15 (compatible), so perhaps '***easy and compatible***' could be its label. Questions 7.4 (promotion), 7.5 (clear), 7.9 (influencers), 7.3 (productive) and 7.2 (quick) tend to be more separated from the other questions, and so don't appear to have any strong connections. Question 7.4 (promotion) is nearly at right angles to 7.3 (productive), and so can be considered to be probably independent. Question 7.2 (quick) is nearly at right angles to the 'corporately supported' cluster of questions, so can be considered independent of those. So overall, what this indicates is that in the UTAUT model there are two main clusters of variables that promote adoption of the technologies – '***corporately supported***' and '***easy and compatible***'.

For the **Switch model**, a summary of the averaged responses to the ten questions for each technology, as well as a combined average for all three technologies, showed that Questions 8.1 (success of others), 8.3 (outcomes), 8.4 (emotionally engaged) and 8.10 (sustainable) received the four highest scores for combined ratings and showed no significant difference between the type of technology or level of use of technology. This makes them generally good candidates for predicting adoption of the new communication technologies, as they received high scores and are independent of technology and usage. Questions 8.6 (sense of identity) showed a significant difference between average ratings across the technologies, as well as a significant relationship between the ratings for degree of usage (all positive relationships). Questions 8.2 (clear steps), 8.5 (small steps), 8.7 (physical envir) and 8.8 (habit) showed a significant trend with the ratings for degrees of usage (again all positive relationships); however there were no significant differences between technologies. Question 8.9 (contagious) had significantly different slopes for degree of usage across technologies; however the average rating for technologies was not

significantly different. There was no significant trend for eSurveys (slope=-0.129), a highly significant trend for webinars (slope=0.479) and a near significant (p=0.054) trend for YouTube (slope=0.226).

There was an interaction with the human/ technology factor and technology used, however even when this was accounted for there was still an interaction with question and technology. The average ratings of technology classified questions are significantly higher than the human classification for the eSurveys and webinar technologies, but not for YouTube.

The biplot of the first two principal components show that the questions form three main clusters.

1. Questions 8.2 (steps to use innovation clear), 8.3 (outcomes), 8.4 (emotionally engaged), 8.5 (small steps) forming the upper group on the biplot. These could be labelled '***healthy steps***';
2. Questions 8.1 (success of others), 8.6 (sense of identity), 8.8 (habit), 8.9 (contagious), 8.10 (sustainable) forming the next group. A suitable label might therefore be '***contagious habit'***.
3. Question 8.7 (physical envir) forming a group on its own and its label could simply be '***physical environment***'.

Secondly, Questions 8.1 (success of others) and 8.10 (sustainable) from the second cluster do not contribute a lot of information to the first two components as shown by the shorter arrow length. Finally, Question 8.7 (physical envir) appears to be a main contributor to the first two principal components as shown by the length of the arrow, and also seems to be contributing information independent of the other questions as shown by the angle of the arrow tending to be at right angles to the other questions.

The averaged responses to the 22 questions in the **ADOPT model** for each technology, shows that the highest combined rating was Q9.9 (observability) and the lowest Q9.21 (risk exposure). For the overall averages, there was no significant difference between the three technologies. Questions 9.13 (aware of other users) and 9.22 (work easier) showed a significant difference between average ratings across the technologies, as well as a significant relationship between the ratings for degree of usage (all positive relationships). Questions 9.4 (work benefit), 9.18 (success quickly realised), 9.19 (envir benefits) and 9.20 (quick envir benefits) showed a significant trend with the ratings for degrees of usage (again all positive relationships), but there were no significant differences between technologies.

Regarding the **technology versus human classified** questions, the average ratings for the technology ones are significantly higher than the human ones for the eSurveys and webinar technologies, but not for YouTube. The technology classified questions all had higher average ratings than the human classified questions.

The biplot of the first two principal components shows a general spread of the questions without forming distinct clusters of questions. This could indicate that the questions in the ADOPT model have been well chosen, as there is minimal overlap between them. The relative size of the arrows shows how much the questions contribute, and shows that questions such as 9.22 (work easier), 9.16 (reduce operating costs) and 9.21 (risk exposure) contribute least in these first two

components. So if we need to reduce the number of questions, those might be able to be discarded. Question 9.21 (risk exposure) had a large contribution to the third principal component, while very little in the first principal component, so caution is needed if it were to be discarded.

In conclusion, Q9.9 (observability) was the strongest factor for predicting adoption and Q9.21 (risk exposure) the lowest. However question 9.21 (risk exposure) had a large contribution to the third principal component, while very little in the first principal component, so caution is needed if it was to be discarded. The biplot of the first two principal components showed a general spread of questions without any distinct question clusters. This could indicate that the questions in the ADOPT model have been well chosen, as there is minimal overlap between them. While having variables that can explain and predict adoption behaviour is the main criteria for well-chosen variables, there is efficiency in minimising the number of questions.

When an **analysis of individual questions** from the four models (Diffusion of innovations, UTAUT, Switch and ADOPT) was undertaken, there were 22 adoption model questions out of the 53 (41.5%) that showed no significant difference across the three technologies or the degree of usage, namely: 6.2 (compatible), 6.5 (noticeable), 7.4 (promotion), 7.12 (org support), 7.13 (resources), 7.15 (compatible), 7.16 (assistance), 8.1 (success of others), 8.3 (outcomes). 8.4 (emotionally engaged), 8.10 (sustainable), 9.1 (cost efficiency), 9.2 (natural envir), 9.3 (risk averse), 9.5 (long-term outlook), 9.6 (financial constraints), 9.7 (trialability), 9.10 (consultants), 9.11 (groups), 9.14 (up-front cost), 9.17 (additional effects) and 9.21 (risk exposure). The other questions therefore have little value in assessing adoption.

An **analysis of variance of ratings across the adoption model questions** showed a significant interaction across questions and technology. There was also a significant trend with usage that varied with technology and question. A more complex model was fitted by nesting question within adoption model. This showed that after accounting for the adoption model, questions still showed an interaction with technology, however the relationship with degree of usage was not significantly different with questions within each model (however significantly different across models). ***It was therefore not possible to determine whether one of the four models was any more effective than the others at predicting adoption***.

A **hierarchical cluster analysis** located questions close to each other at the end of the branches, based on respondents answering those questions in a similar manner. Four groups were arbitrarily chosen based on the third level of the branch structure, which provided groups with similar numbers of concepts. The groups were then named Contagious benefits, Supporting benefits, Working smarter benefits and Noticeable, trialable benefits.

The subsequent and final chapter will draw the various results from this research together, and will present the author's conclusions regarding the research issues and the research problem. Implications for theory, policy and practice and methodology will be presented. Finally, limitations of this research will be identified and implications for further research will be presented.

This page was deliberately left blank.

5. Conclusions and recommendations

This final chapter presents the conclusions arising from this research study seeking to elucidate the factors that affect the adoption and use of Web 2.0 technologies. The findings in Chapter 4 will be integrated into the literature reviewed in Chapter 2 to ascertain the contributions. However, as that literature review was generally completed in early 2012 and data collection concluded in late 2012, some more recent literature will be incorporated into this chapter to permit a more complete discussion of the findings.

This chapter will methodically consider the contributions this research study has made, and will encompass conclusions about research issues and the research problem, implications for theory, policy, practice and methodology, and limitations and implications for further research. The overall structure is outlined in Figure 122.

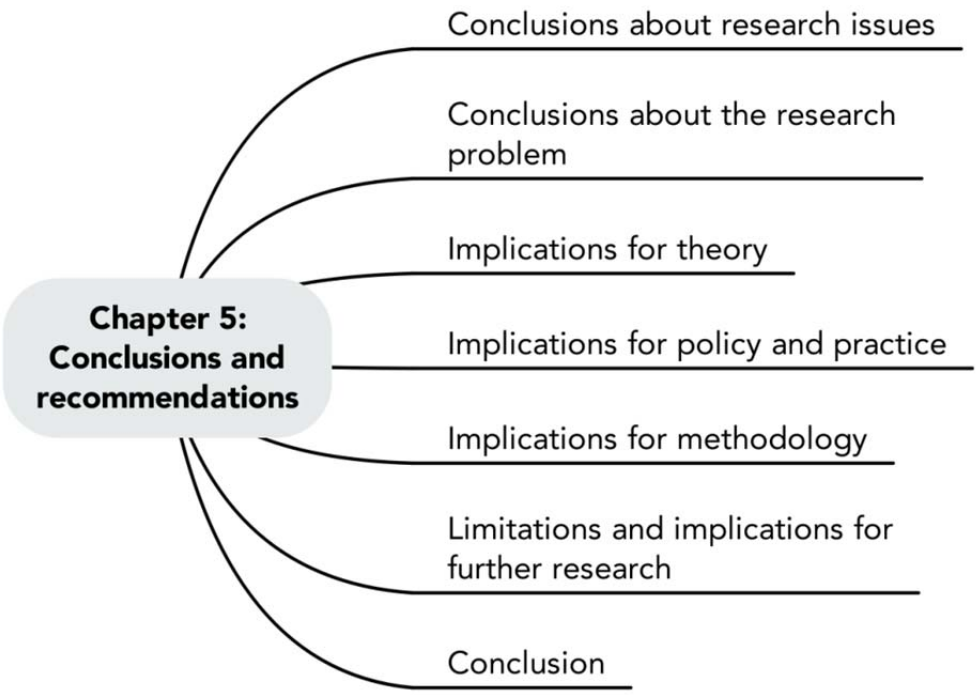


Figure 122. The structure of Chapter 5.

5.1 Conclusions about research issues

This research study aimed to address the primary research question, '*What factors influence the adoption and use of new communication technologies, and what are the implications for organisations in supporting this change?*'. It also aimed to identify:

1. factors that promote or inhibit the use of Web 2.0 collaboration technologies,
2. benefits derived from the use of these modern technologies,
3. which existing model (if any) best predicts the adoption and use of Web 2.0 collaboration technologies,
4. a new model that incorporates the best elements from the existing four models, and
5. implications for supporting the use of these new technologies.

Each of these will be considered in this section, drawing on the extant literature and the results from this research study.

Factors that promote or inhibit the use of Web 2.0 collaboration technologies

The following four models from the extant literature were utilised to identify factors affecting the adoption of innovative technologies.

1. The Diffusion of innovation theory (Rogers 1962) which postulated that the five attributes of an innovation that affect the rate of adoption were relative advantage, compatibility, complexity, trialability and observability.
2. The technology acceptance models, represented by the original version of the UTAUT model (Venkatesh et al. 2003), proposed that use behaviour is determined by behavioural intention and facilitating conditions. It theorised that behavioural intention is determined by performance expectancy, effort expectancy, social influence and facilitating conditions. Individual differences of gender, age, experience and voluntariness of use moderate the effects of these constructs on behavioural intention and use behaviour.
3. The Switch model (Heath & Heath 2010) which utilised a metaphorical framework for change, using an Elephant, its Rider and the Path. The Elephant represented our emotional side, and the Rider our rational side. The Path symbolised the surrounding environment, and considered structural changes that supported the desired change. The Switch model contained ten variables: find the bright spots, script the critical moves, point to the destination, find the feeling, shrink the change, grow the people, tweak the environment, build habits, rally the herd, and keep the change going.
4. The ADOPT model which categorised variables into four quadrants, where the two left-hand quadrants of *Population specific influences on the ability to learn about the innovation* and *Learnability characteristics of the innovation* affected the time taken to reach the peak adoption level. The right-hand quadrants of *Relative advantage for the population* and *Relative advantage of the innovation* predominantly influenced the peak adoption level, but they also influenced the time taken to reach peak adoption through the *Relative advantage* node and the *Short-term constraints* variable.

An extension of the original UTAUT model was published after the data for this research project was collected. The UTAUT2 model (Venkatesh, Thong & Xu 2012) added three new constructs to tailor it for a consumer use context, where consumers generally bear the monetary cost of the new technology (as opposed to employees who do not). This model assumed that the cost and pricing structure affects the use of the technology by consumers.

The additional constructs were hedonic motivation, price value and habit, as shown in Figure 123. Hedonic motivation is defined as ‘the fun or pleasure derived from using a technology’, while Price value is defined as the ‘tradeoff between the perceived benefits of the applications and the monetary cost for using them’ (Venkatesh, Thong & Xu 2012, p. 161). Habit was previously defined as ‘the extent to which people tend to perform behaviours automatically because of learning’ (Limayem, Hirt & Cheung 2007, p. 709).

The construct of voluntariness was dropped and a link was added between facilitating conditions and behavioural intention. Individual differences of age,

gender, and experience moderate the effects of these constructs on behavioural intention and use behaviour. This modification produced a significant improvement in predicting behavioural intent (from 56 percent to 74 percent) and technology use (from 40 percent to 52 percent) (Venkatesh, Thong & Xu 2012). While only published in 2012, some studies have already confirmed its usefulness (Huang et al. 2013; LaRose et al. 2012; Murugesh-Warren et al. 2013; Raman & Don 2013; Slade, Williams & Dwivedi 2013).

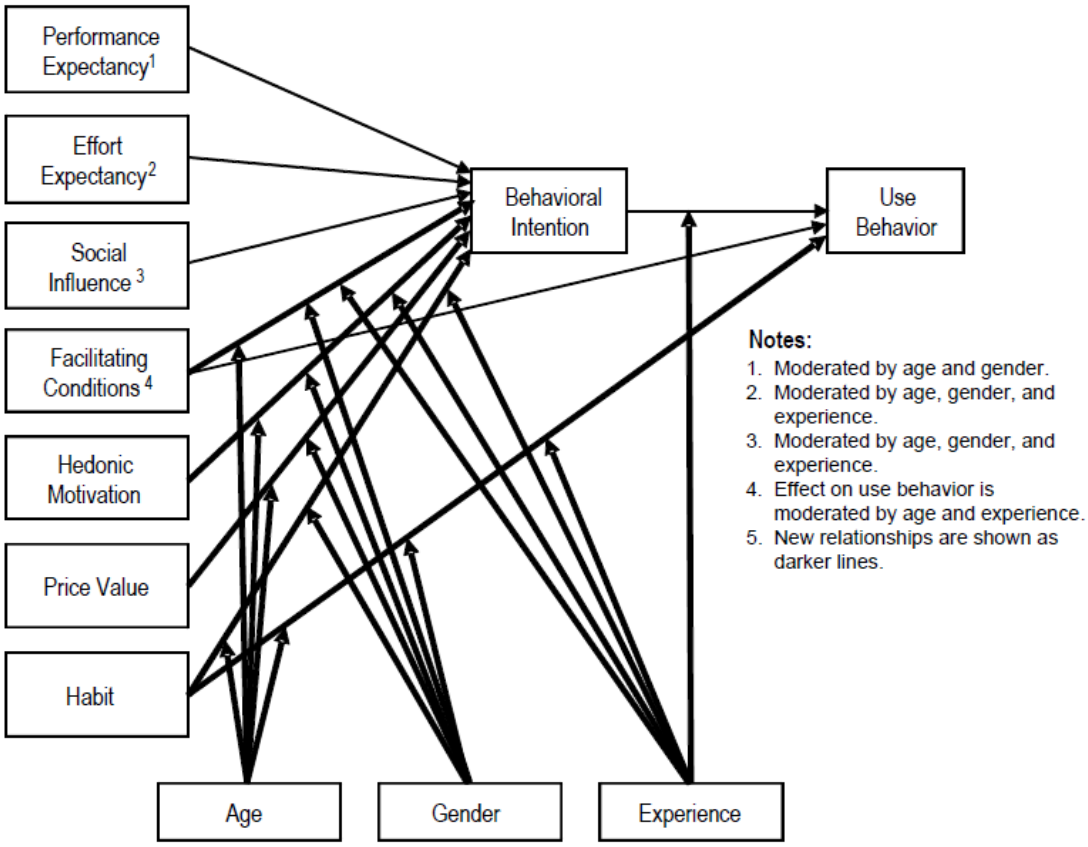


Figure 123. Interaction of the elements of the UTAUT2 model.

Source: Venkatesh, Thong and Xu (2012, p. 160).

The results in Section 4.2 ‘Impact of web conferencing’ determined that the most important factors promoting the use of web conferencing were: saving time, reducing travel, allowing more contact with participants and saving money. The alignment of the factors identified from this research (shown in descending order) and those from the extant literature are summarised in Table 27.

The reason ‘I’ve seen my colleagues use webinars successfully’ was rated below those; even though it aligns with one of Roger’s five attributes of a successful innovation, namely observability. One might have expected that to have been more highly rated by the respondents. Similarly, the reason ‘My supervisor encourages the use of webinars’ was the lowest rated reason, yet it aligns with the UTAUT questions Q2.9 ‘People who influence my behaviour think that I should use the system’ and Q2.10 ‘People who are important to me think that I should use the system’. The graph related to the supervisor encouraging the use of webinars was positively skewed and had the lowest mean. This indicated that it was generally the least effective in encouraging use of web conferencing, although it did have a positive

impact for a few of the respondents. That reason aligns with the core determinant of social influence in the UTAUT model, which is defined ‘as the degree to which an individual perceives that important others believe he or she should use the new system’ (Venkatesh et al. 2003, p. 451). As such, it is unexpected that it did not rate higher in this survey. This may be due to the DAFF staff in this study being self-managed professionals with a high degree of independence. This would need to be tested in a further study.

Table 27. Alignment of research results and extant literature: webinars.

Factors identified from this research (in descending order of importance)	Alignment with factors from extant literature
Saves time [a]	Rogers: relative advantage UTAUT: effort expectancy Switch: rider ADOPT: work benefit
Reduces travel [a]	Rogers: relative advantage UTAUT: effort expectancy Switch: rider ADOPT: cost efficiency, reduce operating costs
Allows more regular contact [a]	Rogers: relative advantage UTAUT: performance expectancy Switch: rider ADOPT: work benefit
Saves money [a]	Rogers: relative advantage UTAUT: effort expectancy UTAUT2: price value Switch: rider ADOPT: cost efficiency, reduce operating costs
Seen colleagues use webinars [b]	Rogers: observability Switch: rider ADOPT: observability
Saves environment [b]	Rogers: relative advantage Switch: rider ADOPT: natural environment
Supervisor encouragement [c]	UTAUT: social influence Switch: elephant

Note: Those with the same superscript letter are not significantly different from each other.

The results in Section 4.4 ‘Impact of eSurveys’ determined that the most important factors promoting the use of eSurveys were: no longer need to decipher hand written responses, they could quickly see and analyse results, it would be easy for the respondents to use, it would save time for the survey respondent, save money and time for the survey creator and save the environment as no paper wasted. The alignment of the factors identified from this research (shown in descending order) and those from the extant literature are summarised in Table 28.

This comparison table demonstrates good alignment between the research outcomes and the extant literature.

Table 28. Alignment of research and extant literature: eSurveys.

Factors identified from this research (in descending order of importance)	Alignment with factors from extant literature
No need to decipher handwriting [a]	Rogers: relative advantage UTAUT: performance expectancy, effort expectancy Switch: rider ADOPT: work easier
Quickly see and analyse results [ab]	Rogers: relative advantage, observability UTAUT: performance expectancy, effort expectancy Switch: rider ADOPT: observability, work easier
Easy for respondents to use [ab]	Rogers: relative advantage, complexity UTAUT: effort expectancy Switch: path ADOPT: work easier
Saves time (respondent) [bc]	Rogers: relative advantage UTAUT: effort expectancy Switch: rider ADOPT: work easier
Saves money (survey creator) [bc]	Rogers: relative advantage UTAUT: performance expectancy Switch: rider ADOPT: cost efficiency
Saves time (survey creator) [cd]	Rogers: relative advantage UTAUT: effort expectancy Switch: rider ADOPT: work easier
Saves the environment [d]	Rogers: relative advantage Switch: rider ADOPT: natural environment, environmental benefits

Note: Those with the same superscript letter are not significantly different from each other.

Benefits derived from the use of these modern technologies

The results in Section 4.2 'Impact of web conferencing' (where respondents were asked to rate the extent to which web conferencing had helped them) indicated that web conferencing had helped them by:

- saving time (reduced travel time),
- saving money (reduced travel expenses),
- better engaging with their clients/ colleagues,
- being more innovative with their work, and
- being more responsive to their clients/colleagues needs.

The majority of respondents gave a high score (from 5.0 to 5.8 on a seven point scale) to each of those responses, indicating that web conferencing had helped the majority of respondents to a large degree. Respondents also noted in their comments the benefit of being able to attend meetings without travelling, and that web conferences were able to bring together geographically dispersed participants. Stories told by respondents included the benefit of being able to network with project members, especially in international projects. An example was provided from a fisheries project in Laos that a DAFF officer was leading. Partly as a result of being able to collaborate and share documents online, the project was extended another five years and received two million dollars funding. Other stories included the ability of web conferencing to overcome geographic distribution of team members, with an

example being given of providing software demonstrations to their Victorian counterparts and it was ‘as good as being in the same room’, even though they were thousands of kilometres away.

The results in Section 4.4 ‘Impact of eSurveys’ (where respondents were asked to rate the extent to which eSurveys had helped them) indicated that eSurveys had helped them by:

- being more efficient by saving time and effort,
- getting feedback from clients,
- being more responsive to client needs,
- being more innovative,
- making better informed decisions, and
- gathering feedback after an event.

Stories from respondents indicated that using eSurveys was convenient and efficient for both the survey creator and respondents. A story from the fisheries sector told of the ease and speed for fishermen to be able to complete the survey whilst still at sea, and the ease of no longer having to decipher handwriting for the survey collectors. Being able to quickly distribute and analyse surveys was mentioned by another respondent who said it was much quicker and convenient than any previous process he had experienced.

The results in Section 4.5 ‘YouTube video usage’ indicated that the main benefit derived from their usage was being an efficient communication tool. Comments included ‘a picture tells a thousand words’ and that they ‘can present our work in a more relaxed and ‘digestible’ manner’. Many respondents saw the videos as an alternative to paper-based information with comments such as ‘people prefer to watch videos than read through information on a website’. Other respondents considered videos as an effective training tool, with comments such as ‘effective way of providing messages and training to clients’.

Existing model (if any) that best predicts the adoption and use of Web 2.0 collaboration technologies

At a superficial level it might appear that the averaged ratings for each of the technologies across the four models, as shown in Table 29, indicated that the Diffusion of Innovation model was the most successful predictor of the adoption and use of the Web 2.0 technologies.

Table 29. Averaged ratings for technologies across models.

	eSurvey	Webinar	YouTube	Average
DoI	6.0	5.2	5.5	5.6
UTAUT	5.4	5.3	4.8	5.1
Switch	4.9	5.0	5.0	4.9
ADOPT	4.7	4.7	4.5	4.7

However an analysis of variance of ratings across the adoption model questions showed a significant interaction across questions and technology. There was also a significant trend with usage that varied with technology and question. A more complex model was fitted by nesting question within adoption model. This showed that after accounting for the adoption model, questions still showed an interaction with technology, however the relationship with degree of usage was not significantly different with questions within each model (however significantly different across models). ***It was therefore not possible to determine whether one of the four models was any more effective than the others at predicting adoption***.

It should be noted that with the Diffusion of Innovation and ADOPT models, the biplot of the first two principal components showed a general spread of questions without any distinct question clusters. This could indicate that the questions in those models have been well chosen, as there is minimal overlap between them. While having variables that can explain and predict adoption behaviour is the main criteria for well-chosen variables, there is efficiency in minimising the number of questions. In contrast, there were numerous clusters present in the UTAUT and Switch models.

A new model that incorporates the best elements from the existing four models
As a result of this research study, a new model for the adoption and use of Web 2.0 technologies was developed for an organisational setting. The User benefits model comprises four factors related to user benefits: contagious benefits, supporting benefits, working smarter benefits and noticeable, trialable benefits. The interaction of these factors is shown in Figure 124.

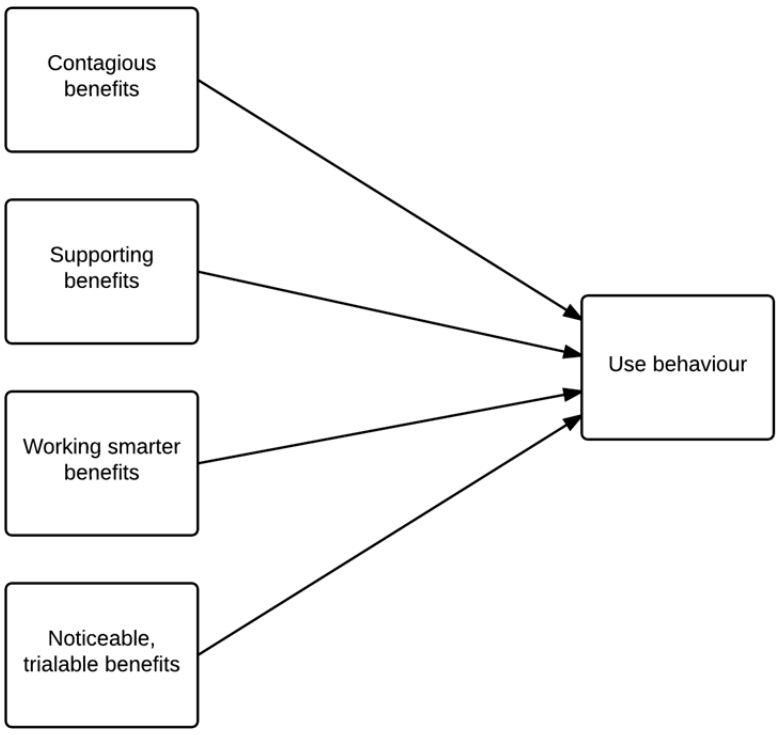


Figure 124. Interaction of the elements of the User benefits model.

Source: Created by author for this research study.

The model was named User benefits, as there was a recurring theme in the qualitative data about users looking for benefits, and if the benefits were significantly worthwhile, then they were willing to use the technology. Quotes from the respondents in this regard included the following:

- 'if the benefit is there it will be time well spent',
- 'how we can use them [the new technologies] to benefit us internally and our clients',
- 'only where it is of genuine benefit to the industry clients I work with',
- 'if the benefit is there it [the time involved] will be time well spent', and
- 'I believe the benefits will be worth the effort'.

The focus on benefits was also supported by the extant literature, for example after an extensive review of the literature, Lindner (1987, p. 150) stated 'The finding that the rate of adoption as well as ultimate adoption level are determined primarily by the actual *benefits* [emphasis added] of adoption to the potential adopters is by far and away the most important result to be culled from the empirical literature on adoption and diffusion'.

Contagious benefits, the first element of the User benefits model was based on the concept of rallying the herd from the Switch model. The authors used the analogy of an elephant following the rest of the herd, so the challenge was to create a new direction for the herd so others would then instinctively follow. They recommended creating social cues about how to behave by sending 'signals about the "norm" of the herd' (Heath & Heath 2010, p. 228). This is related to social transmission, which considers 'why people share some things rather than others' (Berger 2013a, p. 293). It has been shown that emotions characterised by high physiological arousal (e.g. anxiety or amusement), will boost sharing more than emotions characterised by low arousal (e.g. sadness or contentment) (Berger 2011).

Popularised in the *The tipping point* (Gladwell 2006) is the concept that social epidemics are 'driven by the efforts of a handful of exceptional people' (Gladwell 2006, p. 21), referred to by Gladwell as mavens, connectors and salesmen. However in the recent book *Contagious* (Berger 2013b), the author suggests it is less about the people and more about the content. Berger lists six characteristics of contagious content: social currency, triggers, emotion, public (noticeable), practical value and stories. Social currency refers to the notion that people are concerned with how they appear to others in their social circles, and generally are keen to be seen as smart, rich, cool and in-the-know (Berger 2013b). Triggers refer to items that are top-of-mind while emotion refers to the concept that we share with others things that we care about. Public refers to the idea that the more public something is, the more likely people will see it and want to imitate it. Practical value refers to the concept that useful things are shared more readily, and stories refer to the idea that stories are a highly effective way to package messages so that they are passed onto others.

Supporting benefits, the second component in the User benefits model, incorporates the various elements that support the user in their use of the new technology. It includes the people who provide support and encouragement, such as those who influence the behaviour of the users, including those who are perceived as important people to impress such as senior management. It includes the concept of organisational support and resources, and particularly those who can provide

technical support to new users. Finally, it includes the physical environment which supports the use of the new technologies and also the environmental benefits that accrue from the use of the technologies, particularly when those are seen to occur quickly.

The third element, Working smarter benefits, was a commonly recurring theme from the qualitative data analysis of this research. This included the concepts of working more efficiently with a geographically dispersed audience and being able to do things that would not have otherwise been possible without the new technologies (such as working collaboratively on a document). For web conferencing it included the ability to help users work more effectively and efficiently (saving time, reducing travel, enabled greater contact with clients and saved money). For eSurveys it focused around ease of use (easy to read the responses, easy to see and analyse the results, and easy for the respondents to use) and being more innovative and making better informed decisions.

The fourth and final element of Noticeable, trialable benefits, was the only element to have its origins from all four of the models being investigated (as shown in Table 26). The key concepts are that innovations should be highly visible so as to be noticed by those yet to adopt the innovation, and able to be trialled or experimented with before full-scale adoption takes place. Other concepts include that the innovation should be compatible with existing systems, and have clear, specific steps for using it. Adoption is enhanced when users are strongly motivated to maximise profit and protect the natural environment and when they are experiencing short-term financial constraints and the up-front cost of the innovation is small relative to the potential benefit.

Implications for supporting the use of these new technologies

The second element of the new model, supporting benefits, has major implications for organisations regarding the support they need to provide if they want staff to use the new technologies. The results in Section 4.1 (eExtension project baseline survey) indicated that respondents considered the department's IT platform (hardware and software) and policies restrictive and out-dated. They felt that this was stymieing their ability to use these new communication technologies, and made comments including: 'We've wanted to use blogs for years but have been hampered by dept requirements', 'Lack of access to platforms has stymied our development' and 'Put off by all the Queensland Government red tape'. A final comment by one of the respondents was that 'One of the biggest problems is the time and effort it takes to get access to technology through the DAFF system - and the cost associated with doing so'.

The lack of managerial support was also highlighted, with comments such as 'It is extremely important that senior managers understand the use of this Internet platform' and 'Web 2.0 is great as long as there is managerial support'. The importance of adequate training was noted with comments such as 'Need better training in their use and how to integrate them into our work environment'.

5.2 Conclusions about the research problem

Agriculture is a key contributor to Australia's economy, with a gross value of production of $48.0 billion in 2012-13 (ABS 2014). It is estimated that $1.5 billion of rural R&D and related extension activity is funded each year (Productivity Commission 2011) and that for each dollar the government invests in agricultural R&D, farmers generate $12 within 10 years (Department of Agriculture 2014). The importance of agriculture R&D has been confirmed by the federal government recently increasing its investment in it by $100 million (The Hon. Barnaby Joyce MP 2014).

The premise of this research project was that by better understanding the factors that influence the adoption and use of new communication technologies, those working in the Australian agricultural RD&E arena would be better able to utilise these technologies to design and conduct activities that result in greater adoption of innovations by the farming community. This will then lead to greater efficiencies and profitability for the Australian agricultural sector.

This research demonstrated that the use of Web 2.0 technologies was seen to increase the effectiveness and innovativeness of staff. For example, web conferencing was perceived by respondents to save time (through reduced travel), save money (through reduced travel expenses), enable them to better engage with clients/ colleagues, be more innovative with their work, and be more responsive to their clients/ colleagues needs.

While the capacity for the new technologies to increase the effectiveness and innovativeness of staff was confirmed, the difficulty of getting staff to use the technologies still exists. The research identified the factors that promote or inhibit the use of these Web 2.0 technologies. The factors that encouraged adoption of the new technologies were that they needed to be easy to use, save time and money, and they required the provision of support. On the other hand, the factors that discouraged adoption of the new technologies were lack of training on how to use the new technology, end-users not being receptive to it, lack of departmental support/ policy, and lack of access to equipment.

5.3 Implications for theory

It is believed that this research study comparing four quite divergent models is the first of its kind attempted, and similarly its focus on the adoption of Web 2.0 technologies.

The original theory regarding diffusion of innovations undertaken by Rogers (1962) has been used in over 5000 academic studies (Haider & Kreps 2004). While there have been minor criticisms, such as its linearity (Baskerville & Pries-Heje 2001), pro-innovation focus (Rogers & Shoemaker 1971) and individual-blame bias (Caplan & Nelson 1973), it has never been disproven. In fact, other models have been built upon the foundation of the diffusion theory, such as UTAUT (Venkatesh et al. 2003). The results from this research study confirmed the usefulness of Rogers' model, with each of the factors identified in this research that promote the use of webinars and eSurveys aligning with one or more of the factors proposed by Rogers. This alignment is summarised in Table 27 and Table 28. A Principal Components Analysis showed that almost two-thirds of the variance in the data (65.1%) could be

explained by the first two principal components as shown in Table 77 in Appendix 5c. The questions, in descending order, that most contributed to these two principal components were Q6.2 (compatible), Q6.3 (simple) and Q6.1 (better). The biplot of the first two principal components for the Diffusion of innovation model (displayed in Figure 104) showed that Q6.2 (compatible) and Q6.3 (simple) were nearly independent of each other, as indicated by their arrows being nearly at right angles. Their arrows were also the longest, indicating that they contribute most in explaining the variation in the data. The fairly evenly spaced arrows showed a general spread of questions without any distinct question clusters. This indicates that the questions in the model have been well chosen, as there is minimal overlap between them. While having variables that can explain and predict adoption behaviour is the main criteria for well-chosen variables, there is efficiency in minimising the number of questions.

The research data from this study also confirmed UTAUT as a useful model. A Principal Components Analysis (see Table 82 in Appendix 5c) showed that nearly half of the variance in the data (48.5%) could be explained by the first two principal components. The questions, in descending order, that most contributed to these two principal components were Q7.2 (quick), Q7.13 (resources) and Q7.12 (org support). The biplot of the first two principal components (see Figure 107) showed the questions which formed clusters, indicating similar responses. For example, questions Q7.11 (senior mangt), Q7.12 (org support), Q7.13 (resources) and Q7.16 (assistance) appear to be quite correlated and would possibly be collecting the same sort of information. Questions 7.1 (useful), Q7.8 (learning easy), Q7.6 (skilful), Q7.7 (easy to use), Q7.10 (important people), Q7.14 (knowledge) and Q7.15 (compatible) also tend to clump together so may be quite correlated and providing similar information. Questions 7.4 (promotion), 7.5 (clear), 7.9 (influencers), 7.3 (productive) and 7.2 (quick) tend to be more separated from the other questions, and 7.4 (promotion) is nearly at right angles (hence probably independent) to 7.3 (productive), and 7.2 (quick) is nearly at right angles to the cluster of questions containing 7.13 (resources). Consequently, it would appear that there is much overlap between the questions, and that further refinement of the instrument is possible, reducing the number of questions.

The Switch model was also confirmed as useful by the results of this study. A Principal Components Analysis (see Table 87 in Appendix 5c) showed that over half of the variance in the data (54.1%) could be explained by the first two principal components. The questions, in descending order, that most contributed to these two principal components were Q8.7 (physical environ) and Q8.6 (sense of identity).

The biplot of the first two principal components show that the questions form clusters with similar responses. There appears to be three main clusters of questions as follows.

1. Questions 8.2 (steps to use innovation clear), 8.3 (outcomes), 8.4 (emotionally engaged), 8.5 (small steps) forming the upper group on the biplot.
2. Questions 8.1 (success of others), 8.6 (sense of identity), 8.8 (habit), 8.9 (contagious), 8.10 (sustainable) forming the next group, however Q 8.1 (success of others) and Q8.10 (sustainable) do not contribute a lot of information to the first two components as shown by the shorter arrow length.
3. Question 8.7 (physical envir) forms a group on its own. This appears to be a main contributor to the first two principal components as shown by the length of the

arrow, and also seems to be contributing information independent of the other questions as shown by the angle of the arrow tending to be at right angles to the other questions.

So once again, it would appear that there is much overlap between the questions, and that further refinement of the instrument is possible, reducing the number of questions.

Finally, the results from this research study confirmed the ADOPT model as highly useful. A Principal Components Analysis (see Table 92 in Appendix 5c) showed that approximately a third of the variance in the data (33.4%) could be explained by the first two principal components, and approximately half of the variance in the data (50.9%) explained by the first four principal components. The questions, in descending order, that most contributed to these four principal components were Q9.16 (reduce operating costs), Q9.6 (financial constraints) and Q9.15 (reversibility). The biplot of the first two principal components shows a general spread of the questions without forming distinct clusters of questions. The relative size of the arrows shows how much the questions contribute, and shows that questions such as 9.22 (work easier), 9.16 (reduce operating costs) and 9.21 (risk exposure) contribute least in these first two components. However question 9.21 (risk exposure) had a large contribution to the third principal component, while very little in the first principal component, so caution is needed if it was to be discarded. The second and the third principal components accounted for similar percentages of variances (10.9% and 9.3%), hence they have similar importance. This indicates that the questions in the model have been well chosen, as there is minimal overlap between them. While having variables that can explain and predict adoption behaviour is the main criteria for well-chosen variables, there is efficiency in minimising the number of questions.

When an analysis of variance of ratings was undertaken across all the adoption model questions, there was a significant interaction across questions and technology. There was also a significant trend with usage that varied with technology and question. A more complex model was then fitted by nesting question within adoption model. This showed that after accounting for the adoption model, questions still showed an interaction with technology, however the relationship with degree of usage was not significantly different with questions within each model (however significantly different across models). It was therefore not possible to determine whether one of the four models was any more effective than the others at predicting adoption.

Unlike any previous study reviewed, an analysis was undertaken to determine whether there was a difference between human or technology related questions. The UTAUT model had a difference in the average rating of questions depending on whether they were classified as human or technological, as summarised in Table 25. A significant interaction between technology and question classification showed that in general human classified questions had a lower average rating than technological for each of the technologies, with the largest difference with eSurveys, then webinars and YouTube style videos. The Switch and Adopt models also showed a significant interaction between classification and technology; however the difference between human and technological question ratings was only significant for eSurveys and webinars for both adoption models. In both of these technologies the human classified questions were rated lower on average. As the technology related questions

generally scored higher ratings than the human related questions, this indicated that the technology related questions were in general better at predicting adoption than the human related questions.

A hierarchical cluster analysis was then performed using the R software, on a dissimilarity matrix (using Euclidean distance) data based on the core 49 respondents. The diagram in Figure 121 shows the four groupings, labelled A to D, which were generated by the program. In cluster dendrograms, questions that occur close to each other on the end of the branches tend to be more similar based on how the respondents answered those questions. Questions become more dissimilar the further up the tree their branches connect. The resultant four clusters were summarised as contagious success, supporting factors, working smarter and noticeable and trialable. The interaction of these factors is shown in Figure 124.

A new model for the adoption and use of Web 2.0 technologies, the User benefits model as shown in Figure 124, was developed for an organisational setting. It comprised four factors related to user benefits: contagious benefits, supporting benefits, working smarter benefits and noticeable, trialable benefits.

5.4 Implications for policy and practice

The research from this study identified the pre-existing behaviours and the factors that encouraged and discouraged the adoption of the three Web 2.0 technologies: eSurveys, webinars and YouTube videos.

Prior to using eSurveys, the respondents predominantly used hard copies and/or mailed out copies of questionnaires. Prior to webinars, the respondents primarily used face-to-face and teleconferencing to meet with colleagues and clients. Prior to YouTube, the respondents predominantly used written material and face-to-face delivery. All of these earlier alternatives are generally time consuming and resource intensive.

The factors that **encouraged adoption** of eSurveys were the increased efficiency of creating, distributing and analysing surveys; the ease of use for the survey creator and respondent; saving time and money; accessibility of reaching people; and the ease of distribution. These factors for webinars were that they provided more opportunities to interact; reduced travel and were cost effective; provided visual aids in seeing each other and documents, were easy to use or to get support and assistance. The factors that encouraged adoption of YouTube style videos were their use as a visual tool for training and/or conveying information; lower costs associated with making video as opposed to other options (e.g. running multiple field days); greater acceptance and/or demand by the target audience; and having received training to make the videos. The themes that emerged regarding the factors that encouraged adoption of the new technologies were that they needed to be easy to use, save time and money, and they required the provision of support.

On the other hand, the factors that **discouraged adoption** of eSurveys were learning how to use them and the lack of acceptance of the new technology by the end users. For webinars they were the lack of training of organiser or participants; lack of Departmental support (e.g. lack of Internet access, software, restrictive policies); having potential participants accepting the technology and having access to

equipment; the preference for face-to-face interaction and the cost. Finally, for YouTube the factors were lack of training, lack of Departmental support (e.g. policies and management), lack of access to equipment (including hardware and software), and lack of time. The themes that emerged regarding the factors that discouraged adoption of the new technologies were lack of training on how to use the new technology, end-users not being receptive to it, lack of departmental support/ policy, and lack of access to equipment.

Consequently, organisations wanting to encourage staff to move on from using the older methods of communication or to complement them with Web 2.0 ones, could link the old method with the newer ones and highlight the factors that encourage adoption. For example, with eSurveys, one could pitch the message as "Are you tired of using paper-based surveys that you need to post out to your respondents? eSurveys make it easy for you and your respondents, and saves you time and money."

Organisations also need to address the factors that discourage adoption, especially the provision of training to make it easier to learn how to use the new technology. This could be achieved through the use of short, targeted YouTube style videos that the users could view when they need to undertake various steps in the survey creation process. Of course face-to-face training could also be offered but would most likely be more expensive and less effective as it is unlikely it would offered just when users are needing it.

The lack of Departmental support was mentioned as a limiting factor by many of the respondents. To overcome this organisations should have clear policy and guidelines surrounding the appropriate use of Web 2.0 technologies, so it is clear to staff that they are not only allowed to use them, but in many cases, it would be preferable to use them over previous approaches. Senior leaders could also be proactive and lead by example, demonstrating effective use of the technologies to their staff.

It is recommended that a three-pronged approach be adopted by organisations wanting to increase the use and effectiveness of Web 2.0 style technologies. Firstly, to establish clear policies and guidelines that legitimises the use of these technologies by staff when appropriate to their work roles and activities. Secondly that senior management not only endorse the use of the technologies, but they should lead by example and use them as part of their own management activities. For example, a senior leader could use webinars as an effective way to inform and engage with their staff, especially when the staff are geographically dispersed. Managers could use eSurveys as a way of garnering feedback about new policies under development. They could then use YouTube style videos as a mechanism for informing staff about organisational changes or new Workplace Health and Safety regulations. Thirdly, organisations need to provide easy access to suitable professional development activities to allow users to learn the new technologies. While this could be done face-to-face, it would be more efficient to create user guides and short YouTube videos that can be accessed as required by staff.

5.5 Implications for methodology

Although over 5200 studies (Rogers 2003) involving the diffusion of innovation approach have been conducted, most have involved the collection of quantitative data regarding a single innovation gathered from adopters at a single point in time

after widespread diffusion has occurred (Meyer 2004). To provide a broader understanding of the diffusion process, Meyer (2004) recommended that our methodological toolbox be expanded.
This research study used a case study approach with three different innovations: eSurveys, webinars and YouTube videos. Qualitative as well as quantitative data was collected and analysed, providing a much wider approach than most previous studies.

However, despite the author's intentions to give equal emphasis to the qualitative and quantitative data, the quantitative data and its analysis appears to have dominated this report. This of course does not diminish the importance and contribution of the qualitative aspects of this study. Perhaps it is the nature of quantitative data and its analysis that it tends to consume more page space than qualitative data, and hence appear to dominate.

5.6 Limitations and implications for further research

While the research outcomes from this research study have been significant, the focus was essentially only one group within a single government organisation in Queensland, and only three modern technologies. To be able to extrapolate these findings to a wider audience, it would be necessary to repeat this study with multiple groups in multiple organisations, including private enterprise. Similarly, while a geographic spread of respondents within Queensland was used, a much wider sampling will be required to extrapolate this research wider. Further studies will be required to validate the results of this study and extrapolate them further.

5.7 Conclusion

It is believed that this research study comparing four quite divergent change models is the first of its kind attempted, and similarly its focus on the adoption of Web 2.0 technologies. It identified the factors that influence the adoption and use of new communication technologies and the implications for organisations in supporting this change.

It specifically identified: the factors that promote or inhibit the use of Web 2.0 collaboration technologies; the benefits derived from the use of these modern technologies; whether an existing adoption model better predicts the adoption and use of Web 2.0 collaboration technologies; implications for supporting the use of these new technologies and finally, it developed a new model that incorporates the best elements from the existing four models. Unlike any previous study reviewed, an analysis was undertaken to determine whether there was a difference between human or technology related questions.

The contribution this research has made to existing knowledge is summarised in Table 30.

Table 30. Contribution to existing knowledge.

Concept	Extent of contribution
Comparison of four divergent change models	Large extent
Factors that promote or inhibit the use of Web 2.0 collaboration technologies	Large extent
Analysis of human and technology factors	Moderate extent
Benefits derived from the use of these modern technologies	Moderate extent
Existing model that best predicts the adoption and use of Web 2.0 collaboration technologies	Moderate extent
Implications for supporting the use of these new technologies	Moderate extent
A new model that incorporates the best elements from the existing four models	Large extent

Note: These values were subjectively determined by the author.

References

9to5Mac 2012, *Facebook passes 1B active monthly users [video]*, <http://9to5mac.com/2012/10/04/facebook-passes-1-billion-active-monthly-users-video/>.

Abadi Ghadim, AK & Pannell, DJ 1999, 'A conceptual framework of adoption of an agricultural innovation', *Agricultural Economics*, vol. 21, no. 2, pp. 145-54.

Abdi, H & Williams, LJ 2010, 'Principal component analysis', *Wiley Interdisciplinary Reviews: Computational Statistics*, vol. 2, no. 4, pp. 433-59.

Abrahams, DA 2010, 'Technology adoption in higher education: a framework for identifying and prioritising issues and barriers to adoption of instructional technology', *Journal of Applied Research in Higher Education*, vol. 2, no. 2, pp. 34-49.

ABS 2009, *Catalogue 8150.0 - Use of the Internet on Farms, Australia, 2007-08*.

---- 2012a, *Catalogue 3101.0 - Australian Demographic Statistics, Sep 2012*.

---- 2012b, *Population clock*, viewed 22 December 2012, <http://www.abs.gov.au/ausstats/abs%40.nsf/94713ad445ff1425ca25682000192af2/1647509ef7e25faaca2568a900154b63?OpenDocument>.

---- 2012c, *Catalogue 4102.0 - Australian Social Trends, Dec 2012*

---- 2012d, *Catalogue 7106.0 - Australian Farming in Brief, 2012*, Canberra.

---- 2012e, *Catalogue 7503.0 - Value of Agricultural Commodities Produced, Australia, 2010-11*.

---- 2013, *Catalogue 8153.0 - Internet Activity, Australia, December 2012*, Canberra.

---- 2014, *Catalogue 7503.0 - Value of Agricultural Commodities Produced, Australia, 2012-13*.

Agarwal, A, 2009, 'Web 3.0 Concepts Explained in Plain English ', *Digital inspiration*, <http://www.labnol.org/internet/web-3-concepts-explained/8908/>.

Agarwal, R & Karahanna, E 2000, 'Time flies when you're having fun: cognitive absorption and beliefs about information technology usage 1', *MIS Quarterly*, vol. 24, no. 4, pp. 665-94.

Ajjan, H & Hartshorne, R 2008, 'Investigating faculty decisions to adopt Web 2.0 technologies: Theory and empirical tests', *The Internet and Higher Education*, vol. 11, no. 2, pp. 71-80.

Ajzen, I 1985, *From intentions to actions: A theory of planned behavior*, Springer.

---- 1991, 'The theory of planned behavior', *Organizational behavior and human decision processes*, vol. 50, no. 2, pp. 179-211.

Ajzen, I & Fishbein, M 1977, 'Attitude-behavior relations: A theoretical analysis and review of empirical research', *Psychological Bulletin*, vol. 84, no. 5, p. 888.

---- 1980, *Understanding attitudes and predicting social behaviour*, Prentice Hall Inc, Englewood Cliffs.

Ajzen, I & Madden, TJ 1986, 'Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control', *Journal of experimental social psychology*, vol. 22, no. 5, pp. 453-74.

Ajzen, I & Driver, B 1992, 'Application of the theory of planned behavior to leisure choice', *Journal of leisure research*.

Al-Shafi, S & Weerakkody, V 2010, 'Factors affecting e-government adoption in the state of Qatar'.

Aloudat, A & Michael, K 2011, 'The application of location based services in national emergency warning systems: SMS, cell broadcast services and beyond', in P Mendis & A Yates (eds), *Recent Advances in National Security Technology and Research: 2010 National Security Science and Innovation Conference*, Australian Security Research
Centre, Canberra, pp. 21 - 49.

Anderson, JE & Schwager, PH 2004, 'SME adoption of wireless LAN technology: applying the UTAUT model', paper presented to Proceedings of the 7th annual conference of the southern association for information systems.

Anderson, P 2007, *What is Web 2.0? Ideas, Technologies and Implications for Education*.

Animesh, A, Pinsonneault, A, Yang, S-B & Oh, W 2011, 'An odyssey into virtual worlds: exploring the impacts of technological and spatial environments on intention to purchase virtual products', *MIS Quarterly-Management Information Systems*, vol. 35, no. 3, p. 789.

Armstrong, RL 1987, 'The midpoint on a five-point Likert-type scale', *Perceptual and Motor Skills*, vol. 64, no. 2, pp. 359-62.

Babbie, E 2004, *The practice of social research*, 10th edn, Wadsworth/ Thomson Learning, Belmont, CA.

Bagozzi, RP 2007, 'The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift', *Journal of the association for information systems*, vol. 8, no. 4, p. 3.

Bargh, JA, Chen, M & Burrows, L 1996, 'Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action', *Journal of personality and social psychology*, vol. 71, no. 2, p. 230.

Baskerville, R & Pries-Heje, J 2001, 'A multiple-theory analysis of a diffusion of information technology case', *Information Systems Journal*, vol. 11, no. 3, pp. 181-212.

Baumgart-Getz, A, Prokopy, LS & Floress, K 2012, 'Why farmers adopt best management practice in the United States: A meta-analysis of the adoption literature', *Journal of environmental management*, vol. 96, no. 1, pp. 17-25.

Beal, GM, Rogers, EM & Bohlen, JM 1957, 'Validity of the concept of stages in the adoption process', *Rural Sociology*, vol. 22, no. 2, pp. 166-8.

Behrend, TS, Wiebe, EN, London, JE & Johnson, EC 2010, 'Cloud computing adoption and usage in community colleges', *Behaviour & Information Technology*, vol. 30, no. 2, pp. 231-40, viewed 2013/11/03.

Ben-Hur, A & Guyon, I 2003, 'Detecting stable clusters using principal component analysis', in *Functional Genomics*, Springer, pp. 159-82.

Berger, J 2011, 'Arousal increases social transmission of information', *Psychological Science*, vol. 22, no. 7, pp. 891-3.

---- 2013a, 'Beyond Viral: Interpersonal Communication in the Internet Age', *Psychological Inquiry*, vol. 24, no. 4, pp. 293-6, viewed 27 Oct 2014.

---- 2013b, *Contagious: Why things catch on*, Simon and Schuster, New York.

Berners-Lee, T, Hendler, J & Lassila, O 2001, 'The semantic web', *Scientific american*, vol. 284, no. 5, pp. 28-37.

Bernoff, J, 2008, 'New 2008 Social Technographics data reveals rapid growth in adoption', *Empowered*, <http://forrester.typepad.com/groundswell/2008/10/new-2008-social.html>.

Bethlehem, J & Biffignandi, S 2011, *Handbook of Web surveys*, vol. 567, Wiley.

Black, A 2000, 'Extension theory and practice: a review', *Animal Production Science*, vol. 40, no. 4, pp. 493-502.

Boone Jr, HN & Boone, DA 2012, 'Analyzing Likert Data', *Journal of Extension*, vol. 50, no. 2.

Bordenave, JD 1976, 'Communication of Agricultural Innovations in Latin America: The Need for New Models', *Communication Research*, vol. 3, no. 2, pp. 135-54.

Boucher, JL 2010, 'Supporting Patients to Make Health Behavior Changes', *Diabetes Spectrum*, vol. 23, no. 2, pp. 85-6.

Boulos, MN, Maramba, I & Wheeler, S 2006, 'Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education', *BMC medical education*, vol. 6, no. 1, p. 41.

Bowles, M 2011, *Realising the full socio-economic promise of the National Broadband Network in preparing all regions of Australia for participation in the Digital Economy*, University of New England, Armidale.

Bowles, M & Wilson, P 2011, 'Appraising the importance of the National Broadband Network in Australia's race to compete in the Digital Economy', *Australian Quarterly*, vol. 2, no. 1.

Boyatzis, RE 1998, *Transforming qualitative information: Thematic analysis and code development*, Sage.

Braun, V & Clarke, V 2006, 'Using thematic analysis in psychology', *Qualitative research in psychology*, vol. 3, no. 2, pp. 77-101.

Brennan, L, Hochman, Z, McCown, R, Darbas, T, Carberry, P, Fisher, J, Hall, C & NP, D 2007, *Using computer-based technologies to support farmers' decision making*, RIRDC.

Bromley, PD 1990, 'Academic contributions to psychological counselling. 1. A philosophy of science for the study of individual cases', *Counselling Psychology Quarterly*, vol. 3, no. 3, pp. 299-307.

Brunori, G, Barjolle, D, Dockes, AC, Helmle, S, Ingram, J, Klerkx, L, Moschitz, H, Nemes, G & Tisenkopfs, T 2013, 'CAP reform and innovation: the role of learning and innovation networks', *Eurochoices*, vol. 12, no. 2, pp. 27-33.

Burns, R 1997, *Introduction to research methods*, 3rd edn, Addison Wesley Longman, Australia.

Burton-Jones, A & Hubona, G 2005, 'Individual differences and usage behavior: revisiting a technology acceptance model assumption', *SIGMIS Database*, vol. 36, pp. 58-77.

Cabinet Office 2013, *OGP UK 2013 Draft National Action Plan: From Open Data to Open Government*.

Callinan, I 2008, *Equine influenza–the August 2007 outbreak in Australia–report of the equine influenza inquiry*.

Caplan, N & Nelson, SD 1973, 'On being useful: The nature and consequences of psychological research on social problems', *American Psychologist*, vol. 28, no. 3, p. 199.

Carifio, J & Perla, RJ 2007, 'Ten Common Misunderstandings, Misconceptions, Persistent Myths and Urban Legends about Likert Scales and Likert Response Formats and their Antidotes', *Journal of Social Sciences*, vol. 3, no. 3, pp. 106-16.

Carlsson, C, Carlsson, J, Hyvonen, K, Puhakainen, J & Walden, P 2006, 'Adoption of mobile devices/services—searching for answers with the UTAUT', paper presented to System Sciences, 2006. HICSS'06. Proceedings of the 39th Annual Hawaii International Conference on.

Carroll, L 1871, *Through the looking glass: And what Alice found there*, Macmillan, London.

Cary, J, Webb, T & Barr, N 2001, *The adoption of sustainable practices: Some new insights. An analysis of drivers and constraints for the adoption of sustainable practices derived from research.*, Land and Water Australia, Canberra.

Casey, T & Wilson-Evered, E 2012, 'Predicting uptake of technology innovations in online family dispute resolution services: An application and extension of the UTAUT', *Computers in Human Behavior*.

Cha, M, Haddadi, H, Benevenuto, F & Gummadi, PK 2010, 'Measuring User Influence in Twitter: The Million Follower Fallacy', *ICWSM*, vol. 10, pp. 10-7.

Chambers, R 1988, 'Farmer first', *International Agricultural Development*, no. Nov-Dec.

Chambers, R & Ghildyal, B 1985, 'Agricultural research for resource-poor farmers: the farmer-first-and-last model', *Agricultural administration*, vol. 20, no. 1, pp. 1-30.

Chambers, R & Thrupp, LA 1994, *Farmer first: farmer innovation and agricultural research*, KARTHALA Editions.

Charles, KJ & Dickens, V 2012, 'Closing the Communication Gap', *Teaching Exceptional Children*, vol. 45, no. 2, pp. 24-32, EBSCOhost, ehh, item: 82784470.

Charng, H-W, Piliavin, JA & Callero, PL 1988, 'Role identity and reasoned action in the prediction of repeated behavior', *Social Psychology Quarterly*, vol. 51, no. 4, pp. 303-17.

Cheung, SF, Chan, DK-S & Wong, ZS-Y 1999, 'Reexamining the theory of planned behavior in understanding wastepaper recycling', *Environment and behavior*, vol. 31, no. 5, pp. 587-612.

China Daily 2011, 'Microblogs China's 3rd largest source of information: report', *China Daily*, 27 March 2011.

Chismar, WG & Wiley-Patton, S 2002, 'Test of the technology acceptance model for the internet in pediatrics', paper presented to Proceedings of the AMIA Symposium.

Chou, W-YS, Prestin, A, Lyons, C & Wen, K-y 2013, 'Web 2.0 for Health Promotion: Reviewing the Current Evidence', *American Journal of Public Health*, vol. 103, no. 1, pp. e9-e18, EBSCOhost, s3h, item: 84683857.

Chuttur, M 2009, 'Overview of the technology acceptance model: Origins, developments and future directions', *Sprouts: Working Papers on Information Systems*, vol. 9, no. 37, pp. 1-21.

Clark, S, Taylor, L & Westcott, M 2012, 'Using short podcasts to reinforce lectures', paper presented to Proceedings of The Australian Conference on Science and Mathematics Education (formerly UniServe Science Conference).

Clason, DL & Dormody, TJ 1994, 'Analyzing data measured by individual Likert-type items', *Journal of Agricultural Education*, vol. 35, p. 4.

Cody-Allen, E & Kishore, R 2006, 'An extension of the UTAUT model with e-quality, trust, and satisfaction constructs', paper presented to Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges & the future.

Cohen, GR & Green, LA 2013, 'The Policy Context of Patient Centered Medical Homes: Perspectives of Primary Care Providers', *Journal of general internal medicine*, vol. 28, no. 1, pp. 147-53.

Coleman, J 1957, 'The diffusion of innovations among physicians', *Sociometry*, vol. 20, pp. 253-70.

Compeau, DR & Higgins, CA 1995, 'Computer self-efficacy: Development of a measure and initial test', *MIS Quarterly*, pp. 189-211.

Converse, JM 1984, 'Strong arguments and weak evidence: The open/closed questioning controversy of the 1940s', *Public Opinion Quarterly*, vol. 48, no. 1B, pp. 267-82.

Coombs, R, Saviotti, P & Walsh, V 1987, *Economics and technological change*, Rowman & Littlefield.

Coutts, J 2000, 'Five domains of extension - A Queensland perspective', paper presented to Australasia-Pacific Extension Network National Forum, Melbourne, Australia.

Coutts, J & Roberts, K 2003, 'Extension models and best practice in extension', paper presented to Australasia Pacific Extension Network Forum, Hobart.

Coutts, J, Roberts, K, Frost, F & Coutts, A 2005, *The role of extension in building capacity: what works and why: a review of extension in Australia in 2001-2003 and its implications for developing capacity into the future*, Rural Industries Research and Development Corporation, Canberra.

Covey, SR 2004, *The 7 habits of highly effective people: restoring the character ethic*, [Rev. ed.]. edn, Free Press, New York.

Creswell, J 2011, 'Controversies in mixed methods research', in N Denzin & Y Lincoln (eds), *Handbook of Qualitative Research*, 4th edn, SAGE, Thousand Oaks, CA, pp. 269-84.

Creswell, J & Miller, D 2000, 'Validity in Qualitative Inquiry', *Theory Into Practice*, vol. 39, no. 3, pp. 124-30.

Cronkhite, G & Liska, JR 1980, 'The judgment of communicant acceptability', in ME Roloff & GR Miller (eds), *Persuasion: New directions in theory and research*, Sage, Beverly Hills, CA, pp. 101-39.

Cross, RM 2005, 'Exploring attitudes: the case for Q methodology', *Health Education Research*, vol. 20, no. 2, pp. 206-13.

Cuillier, C 2012, 'Choosing Our Futures… Still!', *Journal of Library Administration*, vol. 52, no. 5, pp. 436-51.

Cunningham, W 2013, *Wiki History*, viewed 8 January 2014, <http://c2.com/cgi/wiki?WikiHistory>.

Cvent, 2011, 'Likert scales to measure attitudes', <http://survey.cvent.com/blog/customer-insights-2/likert-scales-to-measure-attitudes#, >.

D'Emden, FH, Llewellyn, RS & Burton, MP 2006, 'Adoption of conservation tillage in Australian cropping regions: an application of duration analysis', *Technological forecasting and social change*, vol. 73, no. 6, pp. 630-47.

D'Emden, FH, Llewellyn, RS & Burton, MP 2008, 'Factors influencing adoption of conservation tillage in Australian cropping regions', *Australian Journal of Agricultural and Resource Economics*, vol. 52, no. 2, pp. 169-82.

DAFF 2012, *Queensland's Agriculture Strategy: A 2040 vision to double the value of production. Discussion paper for consultation*, Brisbane, Queensland.

Davidson, M, Khmelkov, V, Baker, K & Lickona, T 2011, 'Values education: The Power2Achieve approach for building sustainability and enduring impact', *International Journal of Educational Research*, vol. 50, no. 3, pp. 190-7.

Davies, A & Lithwick, D 2010, *Government 2.0 and Access to Information: 1. Recent Developments in Proactive Disclosure and Open Data in Canada*, Library of Parliament.

Davis, D, Bagozzi, R & Warshaw, P 1989, 'User acceptance of computer technology: A comparison of two theoretical models', *Management Science*, vol. 35, no. 8, pp. 982-1003.

Davis, FD 1986, 'A technology acceptance model for empirically testing new end-user information systems: Theory and results', Unpublished Doctoral dissertation, Massachusetts Institute of Technology.

Davis, FD 1989, 'Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology', *MIS Quarterly*, vol. 13, no. 3, pp. 319-40, EBSCOhost, heh, item: 4679168.

Davis, FD, Bagozzi, RP & Warshaw, PR 1992, 'Extrinsic and intrinsic motivation to use computers in the workplace1', *Journal of applied social psychology*, vol. 22, no. 14, pp. 1111-32.

Davis, MS 1971, 'That's interesting', *Philosophy of the Social Sciences*, vol. 1, no. 2, pp. 309-44.

Dawes, J 2008, 'Do data characteristics change according to the number of scale points used? ', *International Journal of Market Research*, vol. 50, no. 1, pp. 61-77.

Dearstyne, BW 2007, 'Blogs, Mashups, and Wikis, Oh, My!', *The Information Management Journal*, vol. 41, no. 4, pp. 24-33.

Delightability, 2011, 'Are you Going Mental?', *Delightability*, <http://www.delightability.com/2011/03/05/are-you-going-mental/>.

Dennis, AR, Venkatesh, V., Ramesh, V. 2003, 'Adoption of Collaboration Technologies: Integrating Technology Acceptance and Collaboration Technology Research', *Sprouts: Working Papers on Information Systems*, vol. 3, no. 8, pp. 1-50.

Denscombe, M 2008, 'The Length of Responses to Open-Ended Questions A Comparison of Online and Paper Questionnaires in Terms of a Mode Effect', *Social Science Computer Review*, vol. 26, no. 3, pp. 359-68.

Denzin, NK 2012, 'Triangulation 2.0', *Journal of Mixed Methods Research*, vol. 6, no. 2, pp. 80-8.

Denzin, NK & Lincoln, YS 2011, *The SAGE handbook of qualitative research*, 4th ed. edn, Sage Publications, Thousand Oaks Calif.

Department of Agriculture 2014, *Rural Research and Development for Profit*, viewed 5 Sep 2014, <http://www.daff.gov.au/agriculture-food/innovation/rural-research-development-for-profit>.

Department of Agriculture Fisheries and Forestry 2013, *Queensland Agricultural Land Audit*.

Department of Finance and Deregulation 2010, *Declaration of Open Government*.

Dey, I 1993, *Qualitative data analysis: a user-friendly guide for social scientists*, Routledge, London.

Dillman, DA, Smyth, JD & Christian, LM 2008, *Mail and Internet surveys: The tailored design method*, 3rd edn, Wiley.

Downes, S 2005, 'E-learning 2.0', *ACM eLearn Magazine*, vol. 10.

Easingwood, C, Moxey, S & Capleton, H 2006, 'Bringing High Technology to Market: Successful Strategies Employed in the Worldwide Software Industry', *Journal of Product Innovation Management*, vol. 23, no. 6, pp. 498-511.

Eaves, D, 2009, 'How GCPEDIA will save the public service', *eaves.ca*, <http://eaves.ca/2009/03/12/how-gcpedia-will-save-the-public-service/#comment-166939922>.

----, 2011, 'Why Social Media behind the Government Firewall Matter', *eaves.ca*, <http://eaves.ca/2011/08/11/why-social-media-behind-the-government-firewall-matters/>.

Ebner, M, Holzinger, A & Maurer, H 2007, 'Web 2.0 Technology: Future Interfaces for Technology Enhanced Learning?', in C Stephanidis (ed.), *Universal Access in Human-Computer Interaction. Applications and Services*, Springer Berlin Heidelberg, vol. 4556, pp. 559-68.

Eggers, WD 2005, *Government 2.0: Using Technology to Improve Education, Cut Red Tape, Reduce Gridlock, and Enhance Democracy*, Rowman & Littlefield, Lanham, Md.

Ellingson, L 2009, *Engaging crystallization in qualitative research*, SAGE, Thousand Oaks, CA.

Encyclopaedia Britannica Online 2014, *Queensland*, <http://www.britannica.com/EBchecked/topic/486932/Queensland>.

Falk, EB, Morelli, SA, Welborn, BL, Dambacher, K & Lieberman, MD 2013, 'Creating Buzz: The Neural Correlates of Effective Message Propagation', *Psychological Science*, vol. 24, no. 7, pp. 1234-42.

Fannin, BL 2006, 'Podcasting agricultural news: producing portable audio news for farmers and ranches', *Journal of Applied Communications*, vol. 9, pp. 9-15.

Farhoomand, AF, Kira, D & Williams, J 1990, 'Managers' perceptions towards automation in manufacturing', *Engineering Management, IEEE Transactions on*, vol. 37, no. 3, pp. 228-32.

Feder, G & Umali, DL 1993, 'The adoption of agricultural innovations: a review', *Technological forecasting and social change*, vol. 43, no. 3, pp. 215-39.

Feder, G, Just, RE & Zilberman, D 1985, 'Adoption of agricultural innovations in developing countries: A survey', *Economic development and cultural change*, pp. 255-98.

Fenn, J & Linden, A 2005, *Gartner's Hype Cycle Special Report for 2005 Gartner*.

Fereday, J & Muir-Cochrane, E 2008, 'Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development', *International journal of qualitative methods*, vol. 5, no. 1, pp. 80-92.

Fielding, P 1986, *Attitudes Revisited: An Examination of Student Nurses' Attitudes Towards Old People in Hospital*, Scutari Press.

Fishbein, M & Ajzen, I 1975, *Belief, attitude, intention and behavior: An introduction to theory and research*, Addison-Wesley, Reading, USA.

Flick, U 2007, *Designing qualitative research*, Sage Publications, London, England.

Flyvbjerg, B 2006, 'Five Misunderstandings About Case-Study Research', *Qualitative Inquiry*, vol. 12, no. 2, pp. 219-45.

Flyvbjerg, B 2011, 'Case Study', in NK Denzin & YS Lincoln (eds), *Handbook of Qualitative Research*, 4th edn, Sage, California, pp. 301-16.

Freud, S 1920, *Jenseits des lustprinzips (Beyond the pleasure principle)*.

Friborg, O, Martinussen, M & Rosenvinge, JH 2006, 'Likert-based vs. semantic differential-based scorings of positive psychological constructs: A psychometric comparison of two versions of a scale measuring resilience', *Personality and Individual Differences*, vol. 40, no. 5, pp. 873-84.

Gartner 2013, *Hype cycles*, viewed 11 August 2013, <http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp>.

George, JF 2004, 'The theory of planned behavior and Internet purchasing', *Internet research*, vol. 14, no. 3, pp. 198-212.

Giluk, TL & Rynes, SL 2012, 'Research Findings Practitioners Resist: Lessons for Management Academics from Evidence-Based Medicine', *The Oxford Handbook of Evidence-Based Management*, pp. 130-64.

Gladwell, M 2006, *The tipping point: How little things can make a big difference*, Hachette Digital, Inc.

Godin, J & Goette, T 2013, 'A Review of Models: Virtual Teamwork Trainng Model and UTAUT'.

Gold, R 1958, 'Roles in sociological field observations', *Social Forces*, vol. 36, pp. 217-23.

Government of Canada 2011, *Open Government Declaration*.

Graneheim, U & Lundman, B 2004, 'Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness', *Nurse education today*, vol. 24, no. 2, pp. 105-12.

Griliches, Z 1957, 'Hybrid corn: An exploration in the economics of technological change', *Econometrica, Journal of the Econometric Society*, pp. 501-22.

Gruzd, A, Staves, K & Wilk, A 2012, 'Connected scholars: Examining the role of social media in research practices of faculty using the UTAUT model', *Computers in Human Behavior*.

Guba, E & Lincoln, Y 1994, 'Competing paradigms in qualitative research', in NK Denzin & YS Lincoln (eds), *Handbook of Qualitative Research*, Sage, Thousand Oaks, California.

Guerin, L & Guerin, T 1994, 'Constraints to the adoption of innovations in agricultural research and environmental management: a review', *Australian Journal of Experimental Agriculture*, vol. 34, no. 4, pp. 549-71.

Gummesson, E 2000, *Qualitative methods in management research*, 2nd edn, Sage.

Gururajan, R 2009, 'Drivers for wireless technology acceptance in Indian healthcare', *International Journal of Healthcare Delivery Reform Initiatives (IJHDRI)*, vol. 1, no. 1, pp. 48-52.

Haider, M & Kreps, GL 2004, 'Forty Years of Diffusion of Innovations: Utility and Value in Public Health', *Journal of Health Communication*, vol. 9, no. sup1, pp. 3-11, viewed 2014/09/08.

Haidt, J 2006, *The happiness hypothesis: Finding modern truth in ancient wisdom*, Basic Books.

Hall, A, Dijkman, J & Sulaiman, R 2010, *Research Into Use: investigating the relationship between agricultural research and innovation*, United nations university (UNU). Maastricht economic and social research and training centre on innovation and technology (MERIT).

Harfoush, R 2009, *Yes we did: An inside look at how social media built the Obama brand*, New Riders Press, Berkeley.

Harrison, DA, Mykytyn, PP & Riemenschneider, CK 1997, 'Executive decisions about adoption of information technology in small business: theory and empirical tests', *Information Systems Research*, vol. 8, no. 2, pp. 171-95.

Hartshorne, R & Ajjan, H 2009, 'Examining student decisions to adopt Web 2.0 technologies: theory and empirical tests', *Journal of Computing in Higher Education*, vol. 21, no. 3, pp. 183-98.

Havens, AE & Rogers, E 1961, 'Adoption of hybrid corn: Profitability and the interaction effect', *Rural Sociology*, vol. 26, pp. 409-14.

Hay, I 2005, *Qualitative research methods in human geography*, 2nd ed. edn, Oxford University Press, Melbourne, Vic.

Heath, C & Heath, D 2010, *Switch: How to change things when change is hard*, Random House, New York.

Henson, RK & Roberts, JK 2006, 'Use of exploratory factor analysis in published research common errors and some comment on improved practice', *Educational and Psychological measurement*, vol. 66, no. 3, pp. 393-416.

Hightower, TE, Murphrey, TP, Coppernoll, SM, Jahedkar, J & Dooley, KE 2011, 'An examination of the strengths, weaknesses, opportunities, and threats associated with the adoption of Moodle™ by eXtension', *Journal of Extension*.

Holden, RJ & Karsh, B-T 2010, 'The Technology Acceptance Model: Its past and its future in health care', *Journal of biomedical informatics*, vol. 43, no. 1, pp. 159-72.

Hong, J-C, Hwang, M-Y, Hsu, H-F, Wong, W-T & Chen, M-Y 2011, 'Applying the technology acceptance model in a study of the factors affecting usage of the Taiwan digital archives system', *Computers & Education*, vol. 57, no. 3, pp. 2086-94.

Honigmann, J 1982, 'Sampling in Ethnographic Fieldwork', in B RG (ed.), *Field Research: A Sourcebook and field Manual*, Allen & Unwin, London.

Hornik, K 2013, *The R FAQ*, viewed 24 Nov 2013, <http://CRAN.R-project.org/doc/FAQ/R-FAQ.html>.

Hotelling, H 1933, 'Analysis of a complex of statistical variables into principal components', *Journal of educational psychology*, vol. 24, no. 6, p. 417.

Hothersall, EJ, de Bellis-Ayres, S & Jordan, R 2012, 'Factors associated with uptake of pandemic influenza vaccine among general practitioners and practice nurses in Shropshire, UK', *Primary Care Respiratory Journal*, vol. 21, no. 3, pp. 302-7.

Howe, J 2006, 'The rise of crowdsourcing', *Wired magazine*, vol. 14, no. 6, pp. 1-4.

Hu, PJ-H, Chau, PY & Sheng, ORL 2002, 'Adoption of telemedicine technology by health care organizations: an exploratory study', *Journal of organizational computing and electronic commerce*, vol. 12, no. 3, pp. 197-221.

Huang, C-Y, Kao, Y-S, Wu, M-J & Tzeng, G-H 2013, 'Deriving factors influencing the acceptance of Pad Phones by using the DNP based UTAUT2 framework', paper presented to Technology Management in the IT-Driven Services (PICMET), 2013 Proceedings of PICMET'13:.

Hunt, W, Birch, C, Coutts, J & Vanclay, F 2012, 'The many turnings of agricultural extension in Australia', *The Journal of Agricultural Education and Extension*, vol. 18, no. 1, pp. 9-26.

Hunt, W, Vanclay, F, Birch, C, Coutts, J, Flittner, N & Williams, B 2011, 'Agricultural extension: Building capacity and resilience in rural industries and communities', *Rural Society*, vol. 20, no. 2, pp. 112-27.

Information Victoria 2009, *Web 2.0: The New Tools for Democratic Conversations – A snapshot of Initiatives in Government*.

Inventium, 2013, 'The brain region that makes ideas go viral', *Our Innovation Blog*, <http://www.inventium.com.au/the-brain-region-that-makes-ideas-go-viral/>.

Ison, R & Russell, D 2000, *Agricultural extension and rural development: breaking out of knowledge transfer traditions*, Cambridge University Press.

Ivala, E & Gachago, D 2012, 'Social media for enhancing student engagement: The use of Facebook and blogs at a University of technology', *South African Journal of Higher Education*, vol. 26, no. 1, pp. 152-67.

Jackson, EL, Quaddus, M, Islam, N & Stanton, J 2006, 'Hybrid Vigour of Behavioural Theories in the Agribusiness Research Domain. is It Possible?', *Journal of International Farm Management*, vol. 3, no. 3, pp. 25-39.

James, J 2010a, 'Using eExtension to better engage with clients and enable change', in J Jennings, W Packham & D Woodside (eds), *Shaping Change: Natural Resource Management, Agriculture and the Role of Extension*, Australasia-Pacific Extension Network (APEN), Australia, pp. 155-61.

---- 2010b, 'Save Time and Money with Web Conferencing', *APEN ExtensionNet*, vol. 17, no. 4, p. 1.

---- 2010c, 'Using Web 2.0 technologies to enable practice change in Australian agriculture', *Extension Farming Systems*, vol. 5, no. 1, pp. 167-72.

---- 2011, 'The road less travelled: a balanced approach to eExtension', paper presented to APEN National Forum: Hitting a Moving Target – Sustaining landscapes, livelihoods and lifestyles in a changing world, Armidale, NSW.

Jamieson, S 2004, 'Likert scales: how to (ab)use them', *Medical Education*, vol. 38, no. 12, pp. 1217-8.

Jimoyiannis, A, Tsiotakis, P, Roussinos, D & Siorenta, A 2013, 'Preparing teachers to integrate Web 2.0 in school practice: Toward a framework for Pedagogy 2.0', *Australasian Journal of Educational Technology*, vol. 29, no. 2.

Jolliffe, IT 1972, 'Discarding variables in a principal component analysis. I: Artificial data', *Applied Statistics*, pp. 160-73.

---- 1973, 'Discarding variables in a principal component analysis. II: Real data', *Applied Statistics*, pp. 21-31.

Jones, GE & Garforth, C 1997, 'The history, development, and future of agricultural extension', in B Swanson, R Bentz & AJ Sofranko (eds), *Improving Agricultural Extension: A Reference Manual*, Food and Agriculture Organisation of the United Nations (FAO), Rome, Italy.

Justiss, LK 2011, 'Survey of Electronic Research Alternatives to LexisNexis and Westlaw in Law Firms, A', *Law Libr. J.*, vol. 103, p. 71.

Kaine, G 2008, 'The Adoption of Agricultural Innovations', Doctoral thesis, University of New England.

Kaine, G, Wright, V, Cooksey, R & Bewsell, D 2011, 'Identifying potential adopters of an agricultural innovation', in D Pannell & F Vanclay (eds), *Changing Land Management: Adoption of New Practices by Rural Landholders*, CSIRO Publishing, Australia, pp. 69-86.

Kane, GC 2011, 'A multimethod study of information quality in wiki collaboration', *ACM Transactions on Management Information Systems (TMIS)*, vol. 2, no. 1, p. 4.

Kaplan, AM & Haenlein, M 2010, 'Users of the world, unite! The challenges and opportunities of Social Media', *Business horizons*, vol. 53, no. 1, pp. 59-68.

Kaplowitz, MD, Hadlock, TD & Levine, R 2004, 'A comparison of web and mail survey response rates', *Public Opinion Quarterly*, vol. 68, no. 1, pp. 94-101.

Kidd, T & Davis, T 2012, 'A Framework to Analyze Faculty Involvement in Online Teaching Using UTAUT and Dewey's Theory of Experience', paper presented to Society for Information Technology & Teacher Education International Conference.

Kidder, LH 1981, *Selltiz, Wrightsman, and Cook's Research methods in social relations*, 4th edn, Holt, Rinehart and Winston, New York

Kim, DJ, Yue, K-B, Hall, SP & Gates, T 2009, 'Global diffusion of the internet XV: Web 2.0 technologies, principles, and applications: A conceptual framework from technology push and demand pull perspective', *Communications of the Association for Information Systems*, vol. 24, no. 1, pp. 657-72.

Kincheloe, J 2001, 'Describing the Bricolage: Conceptualizing a New Rigor in Qualitative Research', *Qualitative Inquiry*, vol. 7, no. 6, pp. 679-92.

Kirkland, P, Davis, R, Wong, D, Ryan, D, Hart, K, Corney, B, Hewitson, G, Cooper, K, Biddle, A & Eastwood, S 2011, 'The first five days: field and laboratory investigations during the early stages of the equine influenza outbreak in Australia, 2007', *Australian veterinary journal*, vol. 89, no. s1, pp. 6-10.

Klerkx, L & Nettle, R 2013, 'Achievements and challenges of innovation co-production support initiatives in the Australian and Dutch dairy sectors: a comparative study', *Food Policy*, vol. 40, pp. 74-89.

Klerkx, L, van Mierlo, B & Leeuwis, C 2012, 'Evolution of systems approaches to agricultural innovation: concepts, analysis and interventions', in *Farming Systems Research into the 21st century: The new dynamic*, Springer, pp. 457-83.

Klerkx, L, Schut, M, Leeuwis, C & Kilelu, C 2012, 'Advances in knowledge brokering in the agricultural sector: towards innovation system facilitation', *IDS Bulletin*, vol. 43, no. 5, pp. 53-60.

Knapp, TR 1990, 'Treating ordinal scales as interval scales: an attempt to resolve the controversy', *Nursing Research*, vol. 39, no. 2, pp. 121-3.

Kuehne, G, Llewellyn, R, Pannell, D, Wilkinson, R & Dolling, P 2011, 'ADOPT: a tool for evaluating adoptability of agricultural innovations', paper presented to 5th World Congress of Conservation Agriculture incorporating 3rd Farming Systems Design Conference, Brisbane, Australia.

Kuehne, G, Llewellyn, R, Pannell, D, Wilkinson, R, Dolling, P & Ewing, MA 2011, 'ADOPT: a tool for predicting adoption of agricultural innovations', paper presented to AARES 55th Annual Conference, Crown Conference Centre, Melbourne.

Kuehne, G, R., L, Pannell, D, Wilkinson, R, Dolling, P & Ouzman, J 2013, *ADOPT: the Adoption and Diffusion Outcome Prediction Tool (Public Release Version 1.0, June 2013) [Computer software]*, CSIRO, Adelaide, SA, <www.csiro.au/ADOPT>.

Kwak, H, Lee, C, Park, H & Moon, S 2010, 'What is Twitter, a social network or a news media?', paper presented to Proceedings of the 19th international conference on World wide web.

Lakhal, S, Khechine, H & Pascot, D 2013, 'Student behavioural intentions to use desktop video conferencing in a distance course: integration of autonomy to the UTAUT model', *Journal of Computing in Higher Education*, pp. 1-29.

Lakoff, G & Johnson, M 1980a, 'Metaphors We Live By', in *The Production of Reality: Essays and Readings on Social Interaction*, University of Chicago Press, Chicago, pp. 124-34.

---- 1980b, 'Conceptual metaphor in everyday language', *The journal of Philosophy*, vol. 77, no. 8, pp. 453-86.

---- 1980c, 'The metaphorical structure of the human conceptual system', *Cognitive Science*, vol. 4, no. 2, pp. 195-208.

Lamb, DW, Frazier, P & Adams, P 2008, 'Improving pathways to adoption: Putting the right P's in precision agriculture', *Computers and Electronics in Agriculture*, vol. 61, no. 1, pp. 4-9.

Lamban, RJ, dela Cerna, AK, Montiflor, MO, Bacus, RG, Concepcion, SB, Batt, PJ & Murray-Prior, RB 2011, 'Factors affecting farmers' adoption of natural farming technologies in New Albay, Maragusan, Compostela Valley, Philippines.', *Acta Horticulturae*, vol. 895, pp. 153-8.

LaRose, R, De Maagd, K, CHEW, H, Tsai, H-YS, Steinfield, C, Wildman, SS & Bauer, JM 2012, 'Measuring sustainable broadband adoption: an innovative approach to understanding broadband adoption and use', *International Journal of Communication*, vol. 6, pp. 2576-600.

Lee, Y, Kozar, KA & Larsen, KR 2003, 'The technology acceptance model: past, present, and future', *Communications of the Association for Information Systems*, vol. 12, no. 1, p. 50.

Leeuwis, C 2008, *Communication for rural innovation: Rethinking agricultural extension*, John Wiley & Sons.

Legris, P, Ingham, J & Collerette, P 2003, 'Why do people use information technology? A critical review of the technology acceptance model', *Information & management*, vol. 40, no. 3, pp. 191-204.

Levi-Strauss, C 1966, *The savage mind*, University of Chicago Press, Chicago.

Li, C & Bernoff, J 2008, *Groundswell: winning in a world transformed by social technologies*, Harvard Business School Publishing, Massachusetts.

Li, JP & Kishore, R 2006, 'How robust is the UTAUT instrument?: a multigroup invariance analysis in the context of acceptance and use of online community weblog systems', paper presented to Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges & the future.

Liao, S, Marshall, P & Swatman, P 2012, 'Beyond the Farmgate: Identifying Tasmanian Farmers Web 2.0 use in Agri-Food Supply Chain', paper presented to IADIS International Conference on Internet Technologies & Society (ITS 2012), Perth.

Likert, R 1932, 'A technique for the measurement of attitudes', *Archives of psychology*, vol. 22, no. 140, pp. 1-55.

Limayem, M, Hirt, SG & Cheung, CM 2007, 'How habit limits the predictive power of intention: the case of information systems continuance', *MIS Quarterly*, pp. 705-37.

Lin, P-C, Lu, H & Liu, C 2013, 'Towards an education behavioral intention model for e-learning systems: An extension of UTAUT', *Journal of Theoretical and Applied Information Technology*, vol. 47, no. 3, pp. 1120-7.

Lincoln, Y 2001, 'An Emerging New Bricoleur: Promises and Possibilities - A Reaction to Joe Kincheloe's "Describing the Bricoleur"', *Qualitative Inquiry*, vol. 7, no. 6, pp. 693-705.

Lincoln, YS & Guba, EG 1985, *Naturalistic inquiry*, Sage Publications, Beverly Hills Calif.

Lindner, R 1987, 'Adoption and diffusion of technology: an overview', paper presented to Technological Change in Postharvest Handling and Transportation of Grains in the Humid Tropics, Bangkok, Thailand.

LinkedIn, 2009, 'LinkedIn: 50 million professionals worldwide', *LinkedIn*, <http://blog.linkedin.com/2009/10/14/linkedin-50-million-professionals-worldwide>.

---- 2014, *A brief history of LinkedIn*, viewed 11 March 2014, <http://ourstory.linkedin.com/>.

Lionberger, HF 1960, *Adoption of new ideas and practices*, Iowa State University Press, Ames.

Llewellyn, R, Pannell, D, Lindner, R & Powles, S 2005, 'Targeting key perceptions when planning and evaluating extension', *Australian Journal of Experimental Agriculture*, vol. 45, pp. 1627-33.

Llewellyn, RS 2007, 'Information quality and effectiveness for more rapid adoption decisions by farmers', *Field Crops Research*, vol. 104, no. 1, pp. 148-56.

Llewellyn, RS, Vanclay, F & Pannell, D 2011, 'Identifying and targeting adoption drivers', *Changing Land Management: Adoption of New Practices by Rural Landholders*, p. 87.

Lunden, I, 2012, 'Analyst: Twitter Passed 500M Users In June 2012, 140M Of Them In US; Jakarta 'Biggest Tweeting' City', *Tech Crunch*, <http://techcrunch.com/2012/07/30/analyst-twitter-passed-500m-users-in-june-2012-140m-of-them-in-us-jakarta-biggest-tweeting-city/>.

Madden, M & Fox, S 2006, 'Riding the waves of "Web 2.0."', *Pew Internet & American Life Project*, pp. 1-6.

Madden, TJ, Ellen, PS & Ajzen, I 1992, 'A comparison of the theory of planned behavior and the theory of reasoned action', *Personality and social psychology Bulletin*, vol. 18, no. 1, pp. 3-9.

Manfreda, K, Bosnjak, M, Berzelak, J, Haas, I & Vehovar, V 2008, 'Web surveys versus other survey modes', *International Journal of Market Research*, vol. 50, no. 1, pp. 79-104.

Mangiafico, SS 2013, 'Using R-project for free statistical analysis in Extension research', *Journal of Extension*, vol. 51, no. 3.

Manning, P & Cullum-Swan, B 1994, 'Narrative, content and semiotic analysis', in N Denzin & Y Lincoln (eds), *Handbook of Qualitative Research*, Thousand Oaks: Sage Publications, pp. 463-77.

Manstead, ASR & Semin, GR 2001, 'Methodology in social psychology: tools to test theories', in M Hewstone & W Stroebe (eds), *Introduction to Social Psychology*, 3rd edn, Blackwell, Oxford, pp. 81-122.

Marsh, S, Pannell, D & Lindner, R 2000, 'The impact of agricultural extension on adoption and diffusion of lupins as a new crop in Western Australia', *Animal Production Science*, vol. 40, no. 4, pp. 571-83.

Marsh, SP, Pannell, D & Lewellyn, R 2007, 'Economics and extension', paper presented to Australiasia Pacific Extension Network National Forum.

Marshall, C & Rossman, GB 2006, *Designing qualitative research*, 4th edn, Sage Publications, Thousands Oaks Calif.

Marslen, T 2014, *Declining Research and Development Investment: A Risk for Australian Agricultural Productivity*, Future Directions International, Dalkeith, Western Australia.

Mashable, 2009, 'Facebook adds 50 million users in 3 months', <http://mashable.com/2009/07/15/facebook-250-million-users>.

Mason, R 2013, 'David Cameron's No 10 Twitter messages deleted without being read', *The Telegraph*, 2 May 2013.

Mathieson, K 1991, 'Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior', *Information Systems Research*, vol. 2, no. 3, pp. 173-91.

Mathison, S 1988, 'Why triangulation?', *Educational Researcher*, vol. 17, no. 2, pp. 13-7.

Maunder, A 1972, *Agricultural Extension. A Reference Manual*, Food and Agriculture Organisation of the United Nations (FAO), Rome, Italy.

Mayer, ME, Gudykunst, WB, Perrill, NK & Merrill, BD 1990, 'A comparison of competing models of the news diffusion process', *Western Journal of Communication (includes Communication Reports)*, vol. 54, no. 1, pp. 113-23.

Mayrath, MC, Traphagan, T, Heikes, EJ & Trivedi, A 2011, 'Instructional design best practices for Second Life: a case study from a college-level English course', *Interactive Learning Environments*, vol. 19, no. 2, pp. 125-42.

McCarney, R, Warner, J, Iliffe, S, van Haselen, R, Griffin, M & Fisher, P 2007, 'The Hawthorne Effect: a randomised, controlled trial', *BMC Med Res Methodol*, vol. 7, p. 30, NLM, item: 17608932.

Merriam, S 1998, *Qualitative research and case study applications in education*, 2nd edn, Jossey-Bass Publishers, San Francisco.

Meyer, G 2004, 'Diffusion Methodology: Time to Innovate?', *Journal of Health Communication*, vol. 9, no. sup1, pp. 59-69, viewed 2014/09/08.

Michell, J 1986, 'Measurement scales and statistics: A clash of paradigms', *Psychological Bulletin*, vol. 100, no. 3, p. 398.

Miles, MB & Huberman, A 1994, *Qualitative data analysis: an expanded sourcebook*, 2nd ed. edn, Thousand Oaks: Sage, California.

Moore, G & Benbasat, I 1991, 'Development of an instrument to measure the perceptions of adopting an information technology innovation', *Information Systems Research*, vol. 2, no. 3, pp. 192-222.

Moore, GA 2002, *Crossing the chasm: Marketing and selling high-tech products to mainstream customers*, Revised edition edn, Harper Collins, New York.

Moore, H 2013, 'Twitter heads for stock market debut by filing for IPO', *The Guardian*, 13 September 2013.

Moore, T 2012, 'First wave: 200 fisheries, agriculture and forestry jobs axed', *Brisbane Times*, 9 August 2012.

Mowery, D & Rosenberg, N 1979, 'The influence of market demand upon innovation: a critical review of some recent empirical studies', *Research Policy*, vol. 8, no. 2, pp. 102-53.

Murphrey, TP & Coppernoll, S 2006, 'Facilitating the Adoption of an Online Conferencing System--A Recipe for Success', *Journal of Extension*, vol. 44, no. 3, pp. 239-44.

Murray-Prior, RB 2005, *Agribusiness systems framework for participatory extension*, International Dateline Hotel, Nuku'alofa, Kingdom of Tonga, November 2005.

Murray, W & Overton, J 2003, 'Designing development research', in R Scheyvens & D Storey (eds), *Development Fieldwork*, Sage Publications, London, pp. 17-36.

Murugesan, S 2007, 'Understanding Web 2.0', *IT professional*, vol. 9, no. 4, pp. 34-41.

---- 2010, 'Web X.0: A Road Map', in S Murugesan (ed.), *Handbook of Research on Web 2.0, 3.0, and X.0: Technologies, Business, and Social Applications (2 Volumes)*, IGI Global, Hershey, PA, USA, pp. 1-1116.

Murugesh-Warren, A, Mashayekhi, S, Nnajiuba, U, Abdel-Gadir, S, Dubb, S, Saeed, A, Sudbury, D, Cox, B & Caris, J 2013, 'An extension of the UTAUT 2 in a healthcare context'.

National Farmers' Federation 2012, *Farm Facts 2012*, viewed 6 March 2013, <http://www.nff.org.au/farm-facts.html>.

Nelson, LS 2011, 'Towards Evidenced-Based Practice: A Comparison of Webinar to Classroom Instruction in Undergraduate Nursing Students', paper presented to Sigma Theta Tau International 41st Biennial Convention. Transcending Boundaries in Nursing Education: Evidence-Based Research on the Efficacy of Three Online Technologies, Grapevine, Texas, USA.

Nettle, R, Brightling, P & Hope, A 2013, 'How Programme Teams Progress Agricultural Innovation in the Australian Dairy Industry', *The Journal of Agricultural Education and Extension*, vol. 19, no. 3, pp. 271-90, viewed 2014/07/27.

Nguyen, V, Llewellyn, R & Miyan, M 2007, 'Explaining adoption of durum wheat in Western Australia', *Studies*, vol. 5, no. 06, p. 2509.

Nielsen, 2009, 'Twitter's tweet smell of success', <http://blog.nielsen.com/nielsenwire/online_mobile/twitters-tweet-smell-of-success>.

Norman, DA 1999, *The invisible computer: why good products can fail, the personal computer is so complex, and information appliances are the solution*, The MIT press.

Nossal, K & Gooday, P, *Raising productivity growth in Australian agriculture*, 2009, ABARE.

O'Reilly, T 2007, 'What is Web 2.0: Design patterns and business models for the next generation of software', *Communications & Strategies*, vol. 1, pp. 17-37.

Obama, B 2009, *Transparency and Open Government*, viewed 9/5/2013, <http://www.whitehouse.gov/the_press_office/TransparencyandOpenGovernment>.

Open Government Partnership 2013, viewed 21 July 2013, <http://www.opengovpartnership.org/>.

Opsahl, A 2011, *Web 3.0 Could Lead to E-Government That Anticipates Citizens' Needs*, viewed 21 July 2013, <http://www.govtech.com/e-government/Web-30-Could-Lead-to-E-Government-That-Anticipates-Citizens-Needs.html>.

Osgood, CE 1956, *Method and theory in experimental psychology*, Oxford University Press, New York.

Pannell, D, 2012, 'Predicting adoption of new farming practices', *pannelldiscussions*, <http://www.pannelldiscussions.net/2012/01/203-predicting-adoption-of-new-farming-practices/>.

----, 2014, 'Behaviour change comes in pairs', *pannelldiscussions*, <http://www.pannelldiscussions.net/2014/10/273-behaviour-change-comes-in-pairs/>.

Pannell, D, Marshall, G, Barr, N, Curtis, A, Vanclay, F & Wilkinson, R 2006, 'Understanding and promoting adoption of conservation practices by rural

landholders', *Australian Journal of Experimental Agriculture*, vol. 46, no. 11, pp. 1407-24.

Pannell, DJ & Vanclay, F 2011, *Changing land management: Adoption of new practices by rural landholders*, CSIRO PUBLISHING.

Patton, E & Appelbaum, SH 2003, 'The case for case studies in management research', *Management Research News*, vol. 26, no. 5, pp. 60-71.

Patton, MQ 1990, *Qualitative evaluation and research methods*, 2nd ed. edn, Sage Publications, Newbury Park Calif.

Pearson, K 1901, 'LIII. On lines and planes of closest fit to systems of points in space', *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, vol. 2, no. 11, pp. 559-72.

Pence, HE 2007, 'Preparing for the real web generation', *Journal of Educational Technology Systems*, vol. 35, no. 3, pp. 347-56.

Peng, G & Mu, J 2011, 'Technology adoption in online social networks', *Journal of Product Innovation Management*, vol. 28, no. s1, pp. 133-45.

Perry, C 1998, 'A structured approach for presenting research theses', *Australasian Marketing Journal*, vol. 6, no. 1, pp. 63-86.

Pew Research Center 2014, *The Web at 25 in the U.S.*

Pillutla, MM & Thau, S 2013, 'Organizational sciences' obsession with "that's interesting!" Consequences and an alternative', *Organizational Psychology Review*, vol. 3, no. 2, pp. 187-94.

Pingdom, 2013, 'Internet 2012 in numbers', <http://royal.pingdom.com/2013/01/16/internet-2012-in-numbers/>.

Plano Clark, V, Creswell, J, O'Neil Green, D & Shope, R 2008, 'Mixing quantitative and qualitative approaches: An introduction to emergent mixed methods research', in S Hesse-Biber & P Leavy (eds), *Handbook of Emergent Methods*, Guilford Press, New York, NY, pp. 363-87.

Power, D, 2008, 'So what is eExtension?', *THINKeEXTENSION*, <http://thinkeextension.com/eextension/so-what-is-eextension/>.

Prensky, M 2001, 'Digital natives, digital immigrants part 1', *On the horizon*, vol. 9, no. 5, pp. 1-6.

Press Association 2012, 'David Cameron gets 100,000 Twitter followers days after starting account', *The Guardian*, 9 October 2012.

Primary Industries Standing Committee – R&D Sub-Committee 2010, *National Beef Production RD&E Strategy*.

Productivity Commission 2005, *Trends in Australian agriculture*, Canberra.

---- 2011, *Rural Research and Development Corporations, Productivity Commission Inquiry Report*, Canberra.

Pynoo, B, Devolder, P, Tondeur, J, Van Braak, J, Duyck, W & Duyck, P 2011, 'Predicting secondary school teachers' acceptance and use of a digital learning environment: A cross-sectional study', *Computers in Human Behavior*, vol. 27, no. 1, pp. 568-75.

Queensland State Archives 2010, *Recordkeeping and Web 2.0 Survey Report*.

Rai, A, Ravichandran, T & Samaddar, S 1998, 'How to anticipate the Internet's global diffusion', *Commun. ACM*, vol. 41, no. 10, pp. 97-106.

Raman, A & Don, Y 2013, 'Preservice teachers' acceptance of Learning Management Software: An application of the UTAUT2 model', *International Education Studies*, vol. 6, no. 7, p. p157.

Randall, DM & Gibson, AM 1991, 'Ethical decision making in the medical profession: An application of the theory of planned behavior', *Journal of Business Ethics*, vol. 10, no. 2, pp. 111-22.

Reavley, NJ, Mackinnon, AJ, Morgan, AJ, Alvarez-Jimenez, M, Hetrick, SE, Killackey, E, Nelson, B, Purcell, R, Yap, MB & Jorm, AF 2012, 'Quality of information sources about mental disorders: a comparison of Wikipedia with centrally controlled web and printed sources', *Psychological medicine*, vol. 42, no. 8, pp. 1753-62.

Rhoades, E & Aue, K 2010, 'Social agriculture: Adoption of social media by agricultural editors and broadcasters', paper presented to Proceedings of the Annual Meeting of the Southern Association of Agricultural Scientists.

Richter, F, 2013, 'Half of the World's Online Population Uses Facebook', *Statistica*, <http://www.statista.com/topics/1164/social-networks/chart/1103/top-10-social-networks-in-q1-2013/>.

Rivera, WM & Rasheed Sulaiman, V 2009, 'Extension: object of reform, engine for innovation', *Outlook on agriculture*, vol. 38, no. 3, pp. 267-73.

Robinson, J 2009, "Director of digital engagement' named', *The Guardian*, 13 May 2009.

Robinson, L 2006, 'Moving beyond adoption: Exploring the determinants of student intention to use technology', *Marketing Education Review*, vol. 16, pp. 79-88.

Rodriguez, JM, Molnar, JJ, Fazio, RA, Sydnor, E & Lowe, MJ 2009, 'Barriers to adoption of sustainable agriculture practices: Change agent perspectives', *Renewable Agriculture and Food Systems*, vol. 24, no. 1, p. 60.

Rogers, E 1958, 'Categorizing the adopters of agricultural practices', *Rural Sociology*, vol. 23, no. 4, pp. 345-54.

---- 1962, *Diffusion of innovations*, Free Press of Glencoe, New York.

---- 1983, *Diffusion of innovations*, 3rd edn, Free Press, New York.

---- 1995, *Diffusion of innovations*, 4th edn, Free Press, New York.

---- 2003, *Diffusion of innovations*, 5th edn, Free Press, New York.

Rogers, E & Shoemaker, F 1971, *Communications of innovations: A cross-cultural approach*, Free Press, New York.

Rogers, EM 2004, 'A prospective and retrospective look at the diffusion model', *Journal of Health Communication*, vol. 9, no. sup1, pp. 13-9.

Röling, N 2009, 'Pathways for impact: scientists' different perspectives on agricultural innovation', *International journal of agricultural sustainability*, vol. 7, no. 2, pp. 83-94.

Russell, DB, Ison, RL, Gamble, DR & Williams, RK 1989, *A Critical Review of Rural Extension Theory and Practice*, Faculty of Agriculture & Rural Develoment, University of Western Sydney, Sydney, N.S.W.

Ruttan, V 1996, 'What happened to technology adoption-diffusion research?', *Sociologia Ruralis*, vol. 36, no. 1, pp. 51-73.

Ryan, B & Gross, N 1943, 'The diffusion of hybrid seed corn in two Iowa communities', *Rural Sociology*, vol. 8, pp. 15-24.

Ryan, GW & Bernard, HR 2000, 'Data management and analysis methods', in NK Denzin & YS Lincoln (eds), *Handbook of qualitative research*, 2nd edn, Sage, pp. 769-802.

San Martín, H & Herrero, Á 2012, 'Influence of the user's psychological factors on the online purchase intention in rural tourism: Integrating innovativeness to the UTAUT framework', *Tourism Management*, vol. 33, no. 2, pp. 341-50.

Savile, A 1965, *Extension in rural communities: a manual for agricultural and home extension workers*.

Schaefer, DR & Dillman, DA 1998, 'Development of a standard e-mail methodology: Results of an experiment', *Public Opinion Quarterly*, pp. 378-97.

Schultz, D & Schultz, SE 2010, *Psychology and work today*, Prentice Hall, New York.

Scoones, I & Thompson, J 1994, *Beyond farmer first: rural people's knowledge, agricultural research and extension practice*, Intermediate Technology Publications Ltd.

---- 2009, *Farmer first revisited: Innovation for agricultural research and development*, Practical Action Pub.

Shanshan, Z 2011, 'Microblogs gaining political weight', *Global Times*, 12 April 2011.

Sheppard, BH, Hartwick, J & Warshaw, PR 1988, 'The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research', *Journal of consumer Research*, vol. 15, no. 3, pp. 325-43.

Shin, E, Johnson, TP & Rao, K 2012, 'Survey mode effects on data quality: Comparison of web and mail modes in a US national panel survey', *Social Science Computer Review*, vol. 30, no. 2, pp. 212-28.

Simmons, R 2001, 'Questionnaires', in N Gilbert (ed.), *Researching social life*, 2nd edn, Sage, London, pp. 85-104.

Slade, EL, Williams, M & Dwivedi, Y 2013, 'An extension of the UTAUT 2 in a healthcare context'.

Sonnenwald, DH, Maglaughlin, KL & Whitton, MC 2001, 'Using innovation diffusion theory to guide collaboration technology evaluation: Work in progress', paper presented to Enabling Technologies: Infrastructure for Collaborative Enterprises, 2001. WET ICE 2001. Proceedings. Tenth IEEE International Workshops on.

Spil, TA & Schuring, R 2006, *E-health Systems Diffusion and use*, IGI Global.

Stake, R 1994, 'Case studies', in NK Denzin & N Lincoln (eds), *Handbook of Qualitative Research*, Sage, Thousand Oaks, California.

State Extension Leaders Network 2006, *Enabling change in rural and regional Australia: The role of extension in achieving sustainable and productive futures*.

Stephenson, G 2003, 'The somewhat flawed theoretical foundation of the extension service', *Journal of Extension*, vol. 41, no. 4.

Stevens, SS 1955, 'On the averaging of data', *Science*, vol. 121, pp. 113-6.

Sulaiman, V & Davis, K 2012, *The New Extensionist; Roles, Strategies and Capacities to Strengthen Extension and Advisory Services*.

Swanson, BE & Rajalahti, R 2010, *Strengthening Agricultural Extension and Advisorty Systems: Procedures for Assessing, Transforming, and Evaluating Extension Systems*, Agriculture and Rural Development, World Bank.

Tan, M & Teo, TS 2000, 'Factors influencing the adoption of Internet banking', *Journal of the AIS*, vol. 1, no. 1es, p. 5.

Tapscott, D & Williams, A 2006, *Wikinomics: How mass collaboration changes everything*, Atlantic Books, London.

Taylor, S & Todd, PA 1995, 'Understanding information technology usage: A test of competing models', *Information Systems Research*, vol. 6, no. 2, pp. 144-76.

Teddlie, C & Tashakkori, A 2003, 'Major issues and controversies in the use of mixed methods in the social and behavioral sciences', in A Tashakkori & C Teddlie (eds), *Handbook of Mixed Methods in Social & Behavioral Research*, SAGE, Thousand Oaks, CA, pp. 3-50.

---- 2011, 'Mixed methods research: Contemporary issues in an emerging field', in N Denzin & Y Lincoln (eds), *Handbook of Qualitative Research*, 4th edn, SAGE, Thousand Oaks, CA, pp. 285-300.

The Hon. Barnaby Joyce MP 2014, *$100 million in agricultural R&D keeps Aussie farmers at cutting edge*, viewed 8 September 2014, <http://www.maff.gov.au/Pages/Media%20Releases/$100-million-in-agricultural-rd-keeps-aussie-farmers-at-cutting-edge.aspx>.

The University of Texas at Austin 1995 *Factor Analysis Using SAS PROC FACTOR*, viewed 8 June 2014, <http://www.ats.ucla.edu/stat/sas/library/factor_ut.htm>.

Thomas, H 2011, 'Diffusion of innovation through video mediated social networks: influencing sugar cane farming practices applying evidence-of-adoption strategies', PhD/Research, Unpublished thesis, University of Southern Queensland.

Thomler, C, 2011, 'Can microblogging save or destroy governments?', *eGov AU*, <http://egovau.blogspot.com.au/2011/08/can-microblogging-save-or-destroy.html>.

Thompson, RL, Higgins, CA & Howell, JM 1991, 'Personal computing: toward a conceptual model of utilization', *MIS Quarterly*, pp. 125-43.

Thurstone, LL 1928, 'Attitudes can be measured', *American journal of Sociology*, pp. 529-54.

Thysen, I 2000, 'Agriculture in the Information Society', *Journal of Agricultural Engineering Research*, vol. 76, no. 3, pp. 297-303.

Time 2010, 'Person of the Year 2010 Mark Zuckerberg', *Time*.

Townsend, JT & Ashby, FG 1984, 'Measurement scales and statistics: The misconception misconceived'.

Twitter, 2010, 'Measuring tweets', *Twitter*, <http://blog.twitter.com/2010/02/measuring-tweets.html>.

United Nations 2001, *Millennium Report - Technology Briefing Paper*.

Valente, TW & Rogers, EM 1995, 'The origins and development of the diffusion of innovations paradigm as an example of scientific growth', *Science communication*, vol. 16, no. 3, pp. 242-73.

Vanclay, F 1992, 'Barriers to adoption: a general overview of the issues', *Rural Society*, vol. 2, no. 2, pp. 10-2.

Vanclay, F 2004, 'Social principles for agricultural extension to assist in the promotion of natural resource management', *Australian Journal of Experimental Agriculture*, vol. 44, no. 3, pp. 213-22.

Vanclay, F & Lawrence, G 1995, 'Agricultural extension as social welfare', *Rural Society*, vol. 5, no. 1, pp. 20-33.

Vehovar, V & Manfreda, KL 2008, 'Overview: online surveys', in N Fielding, RM Lee & G Blank (eds), *The SAGE Handbook of Online Research Methods*, SAGE, London, pp. 177-94.

Veldkamp, A, Van Altvorst, A, Eweg, R, Jacobsen, E, Van Kleef, A, Van Latesteijn, H, Mager, S, Mommaas, H, Smeets, P & Spaans, L 2009, 'Triggering Transitions Towards Sustainable Development of the Dutch Agricultural Sector: Trans Forum's Approach', in *Sustainable Agriculture*, Springer, pp. 673-85.

Venkatesh, V & Davis, FD 2000, 'A theoretical extension of the technology acceptance model: four longitudinal field studies', *Management Science*, vol. 46, no. 2, pp. 186-204.

Venkatesh, V & Bala, H 2008, 'Technology acceptance model 3 and a research agenda on interventions', *Decision sciences*, vol. 39, no. 2, pp. 273-315.

Venkatesh, V, Thong, JYL & Xu, X 2012, 'Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology', *MIS Quarterly*, vol. 36, no. 1, pp. 157-78, EBSCOhost, bth, item: 71154941.

Venkatesh, V, Morris, M, Davis, G & Davis, F 2003, 'User acceptance of information technology: Toward a unified view. ', *MIS Quarterly*, vol. 27, no. 3, pp. 425-78.

Verkasalo, H, López-Nicolás, C, Molina-Castillo, FJ & Bouwman, H 2010, 'Analysis of users and non-users of smartphone applications', *Telematics and Informatics*, vol. 27, no. 3, pp. 242-55.

Verma, A & Singh, A 2010, 'Webinar–Education through Digital Collaboration', *Journal of Emerging Technologies in Web Intelligence*, vol. 2, no. 2, pp. 131-6.

von Bertalanffy, L 1973, *Théorie générale des systèmes (General System Theory)*, Dunod, Paris.

Webb, ET, Campbell, DT, Schwartz, RD, Sechrest, L & Grove, JB 1981, *Nonreactive measures in the social sciences*, 2nd edn, Houghton Mifflin, Dallas, TX.

Wickramasinghe, N, Davey, B & Tatnall, A 2013, 'Web 2.0 Panacea or Placebo for Superior Healthcare Delivery?', in R Bali, I Troshani, S Goldberg & N Wickramasinghe (eds), *Pervasive Health Knowledge Management*, Springer New York, pp. 317-30.

Wiecha, J, Heyden, R, Sternthal, E & Merialdi, M 2010, 'Learning in a virtual world: experience with using second life for medical education', *Journal of medical Internet research*, vol. 12, no. 1.

Wikipedia 2013a, *Phaedrus (dialogue)*, viewed 31 December 2013, <http://en.wikipedia.org/wiki/Phaedrus_(Plato)>.

---- 2013b, *GCpedia*, viewed 21 July 2013, <http://en.wikipedia.org/wiki/GCPEDIA>.

---- 2013c, *Diffusion of Innovations*, viewed 26 June 2013, <http://en.wikipedia.org/wiki/Diffusion_of_innovations>.

---- 2013d, *Facebook*, viewed 3 December 2013, <http://en.wikipedia.org/wiki/Facebook>.

---- 2013e, *Twitter*, viewed 3 December 2013, <http://en.wikipedia.org/wiki/Twitter>.

---- 2013f, *Survey data collection*, viewed 9 December 2013, <http://en.wikipedia.org/wiki/Survey_data_collection>.

---- 2013g, *Hype cycle*, viewed 11 August 2013, <http://en.wikipedia.org/wiki/Hype_cycle>.

---- 2013h, *Short Message Service*, viewed 3 December 2013, <http://en.wikipedia.org/wiki/Short_Message_Service>.

---- 2013i, *Web page*, viewed 3 December 2013, <http://en.wikipedia.org/wiki/Web_page>.

---- 2013j, *Blog*, viewed 3 December 2013, <http://en.wikipedia.org/wiki/Blog>.

---- 2013k, *Foursquare*, viewed 9 February 2013, <http://en.wikipedia.org/wiki/Foursquare>.

---- 2014a, *Wikipedia Statistics*, viewed 8 January 2014, <http://en.wikipedia.org/wiki/Special:Statistics>.

---- 2014b, *Second Life*, viewed 9 January 2014, <http://en.wikipedia.org/wiki/Second_life>.

Wilkins, D & Boahen, G 2013, *Critical Analysis Skills For Social Workers*, McGraw-Hill International.

Williams, B, Brown, T & Onsman, A 2010, 'Exploratory factor analysis: A five-step guide for novices', *Journal of Paramedicine*, vol. 8, no. 3, pp. 1-13.

Wired 2007, *Facebook Got Its $15 Billion Valuation - Now What?*, viewed 8 March 2011, <http://www.wired.com/techbiz/startups/news/2007/10/facebook_future>.

Witter, M 2012, *Reading Without Limits: Teaching Strategies to Build Independent Reading for Life*, John Wiley & Sons.

Woiceshyn, J & Eriksson, P 2014, 'How innovation systems in Finland and Alberta work: Lessons for policy and practice', *Innovation: Management, Policy & Practice*, vol. 16, no. 1, pp. 19-31.

Wolcott, HF 1994, *Transforming qualitative data: description, analysis, and interpretation*, Sage Publications, Thousand Oaks Calif.

Wu, J-H & Wang, S-C 2005, 'What drives mobile commerce?: An empirical evaluation of the revised technology acceptance model', *Information & management*, vol. 42, no. 5, pp. 719-29.

Wu, M-Y, Chou, H-P, Weng, Y-C & Huang, Y-H 2008, 'A Study of Web 2.0 Website Usage Behavior Using TAM 2', paper presented to Asia-Pacific Services Computing Conference, 2008. APSCC'08. IEEE.

Wu, W-W 2011, 'Developing an explorative model for SaaS adoption', *Expert Systems with Applications*, vol. 38, no. 12, pp. 15057-64, viewed 2011/12//.

Wuensch, KL 2005, *What is a Likert Scale? and How Do You Pronounce "Likert?"*, East Carolina University, viewed 2 February 2014, <http://core.ecu.edu/psyc/wuenschk/StatHelp/Likert.htm>.

Yin, R 2003, *Case Study Research: Design and Methods*, 3rd edn edn, vol. 5, 31 vols., Sage Publications, Thousand Oaks, CA.

YouTube 2013, *Statistics*, viewed 3 December 2013, <http://www.youtube.com/t/press_statistics>.

Yu, C-S 2012, 'Factors Affecting Individuals to Adopt Mobile Banking: Empirical Evidence from the UTAUT Model', *Journal of Electronic Commerce Research*, vol. 13, no. 2, pp. 104-21.

Zickuhr, K 2013, *Who's not online and why*, <http://pewinternet.org/Reports/2013/Non-internet-users.aspx>.

Zimmerman, J, Tomasic, A, Garrod, C, Yoo, D, Hiruncharoenvate, C, Aziz, R, Thiruvengadam, NR, Huang, Y & Steinfeld, A 2011, 'Field trial of Tiramisu: crowd-

sourcing bus arrival times to spur co-design', paper presented to Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

Zucker, DM 2009, *How to Do Case Study Research*.

This page deliberately left blank.

Appendices

Appendix 1a. eExtension project baseline survey – Questionnaire

This survey will help us analyse the long-term impact of the eExtension project. It should only take a few minutes to complete. Thanks for your assistance!

This first section asks some general questions about Web 2.0.

1. General background

1. The Internet is changing. Since 2003 it has been moving from a static storage of information (web pages) to an interactive, collaborative platform (referred to as Web 2.0). Welcome to the world of wikis, blogs and podcasts! [1. Not at all; 4. Moderate, 7. Very much]

- ☐ How aware are you of this
- ☐ How relevant do you think this change is to your work?
- ☐ How open are you to using some of these technologies in your work when appropriate?

2. How familiar you are with these Web 2.0 tools? [1. Not at all; 4. Moderate, 7. Very much]

- ☐ Blogs
- ☐ eBooks
- ☐ eLearning
- ☐ eSurveys
- ☐ Instant Messaging
- ☐ Mobility Tools (or Mobile Devices that help you work out of the office)
- ☐ Podcasts
- ☐ RSS Feeds
- ☐ SMS by Computer
- ☐ Social Networking
- ☐ Targeted Emails (e.g. using Vision6 or MailChimp to send multiple personalised emails)
- ☐ Web Conferencing
- ☐ Wikis

Further comments (if required)...

2. Experience

This section asks about your experience with Web 2.0 tools.

It appears repetitive because it looks at your usage across two dimensions, as a reactive user (receiver) and as a proactive user (initiator).

Please hang in there because this information will help us measure the before and after change for the project.

3. How much experience have you had with each of these technologies as a reactive user
(at work or home)? [1. None at all; 4. Moderate, 7. Very much]

For example, someone else has created an eSurvey and sent you the link so you can complete the survey they created.

- ☐ Blogs
- ☐ eBooks
- ☐ eLearning
- ☐ eSurveys
- ☐ Instant Messaging
- ☐ Mobility Tools (or Mobile Devices that help you work out of the office)
- ☐ Podcasts
- ☐ RSS Feeds
- ☐ SMS by Computer
- ☐ Social Networking
- ☐ Targeted Emails (e.g. using Vision6 or MailChimp to send multiple personalised emails)
- ☐ Web Conferencing
- ☐ Wikis

Further comments (if required)...

4. How much experience have you had with each of these technologies as a proactive user (at work or home)? For example, you created an eSurvey and sent it to other people to complete. [1. None at all; 4. Moderate, 7. Very much]

- ☐ Blogs
- ☐ eBooks
- ☐ eLearning
- ☐ eSurveys
- ☐ Instant Messaging
- ☐ Mobility Tools (or Mobile Devices that help you work out of the office)
- ☐ Podcasts
- ☐ RSS Feeds
- ☐ SMS by Computer
- ☐ Social Networking
- ☐ Targeted Emails (e.g. using Vision6 or MailChimp to send multiple personalised emails)
- ☐ Web Conferencing
- ☐ Wikis

Further comments (if required)...

5. How much has your work benefited from your use of these technologies (with either internal or external clients)? [1. Not at all; 4. Moderate, 7. Very much]

- ☐ Blogs
- ☐ eBooks
- ☐ eLearning
- ☐ eSurveys

- □ Instant Messaging
- □ Mobility Tools (or Mobile Devices that help you work out of the office)
- □ Podcasts
- □ RSS Feeds
- □ SMS by Computer
- □ Social Networking
- □ Targeted Emails (e.g. using Vision6 or MailChimp to send multiple personalised emails)
- □ Web Conferencing
- □ Wikis

Further comments (if required)...

6. If you've had moderate to high experience with one or more eTools, please specify the eTool and tell us about how it has helped you.

3. Your details

We need to know some of your details to help us analyse the data and in case we need to follow up with you.

7. Your first name.

8. Your surname.

9. Your email address.

10. Your work location (name of town/ city).

11. The postcode of that town/ city.

12. The DAFF business group you belong to.

- □ Agriculture, Food and Regional Services
- □ Corporate Relations
- □ Business Operations
- □ Planning, Performance and Capacity
- □ Employment and Economic Development
- □ Mines and Energy
- □ Coordinator General

Other:

13. The percentage of your work role that is RD&E (Research, Development and Extension).

14. The percentage of your RD&E role that is extension?

Definition: ‘Extension is the process of enabling change in individuals, communities and industries involved in the primary industry sector and with natural resource management’ SELN 2006 (http://seln.org.au).

15. In what way does eExtension interest you?

16. Finally, are there any other comments you'd like to make?

Thanks for taking the time to complete this survey.

Please click ‘Done’ to submit your answers.

Appendix 1b. eExtension project baseline survey – Quantitative data

Table 31. Regional distribution of respondents across surveys.

Region	Location	2009	2012	Total
North Queensland	Cairns	1	2	3
	Mareeba	2	5	7
	Kairi	3		3
	Townsville	4	6	10
	Ayr	2	1	3
	South Johnstone	1	3	4
	Charters Towers	3	4	7
	Cloncurry		3	3
	Mackay	5	2	7
	Bowen	2	1	3
	North Queensland Total	23 (17.7%)	27	50
Central Queensland	Rockhampton	4	5	9
	Emerald	4	3	7
	Longreach	3	2	5
	Barcaldine		1	1
	Biloela	1	3	4
	Central Queensland Total	12 (9.2%)	14	26
Greater Brisbane area	Bundaberg	5	7	12
	Gympie	1		1
	Nambour	5	6	11
	Kingaroy	1		1
	Brisbane	42	21	63
	Cleveland	1	4	5
	Gatton	2	3	5
	Ipswich	1	1	2
	Greater Brisbane area Total	58 (44.6%)	42	100
South and south-west Queensland	Toowoomba	14	14	28
	Dalby	1	2	3
	Pittsworth	2		2
	Warwick	1	1	2
	Applethorpe		1	1
	Miles	1		1
	Roma	3	1	4
	Charleville	2	2	4
	St George	1		1
	Goondiwindi	2		2
	Cunnamulla		1	1
	South and south-west Queensland Total	27 (20.8%)	22	49
Unknown	(blank)	10	14	24
	Unknown Total	10 (7.7%)	14	24
Grand Total		130	119	249

Table 32. Contingency tables for regional distribution of respondents across surveys.

Observed

	North Queensland	Central Queensland	Greater Brisbane area	South and South-West Queensland	Unknown	Total
2009	23	12	58	27	10	130
2012	27	14	42	14	14	111
Total	50	26	100	41	24	241

Expected

	North Queensland	Central Queensland	Greater Brisbane area	South and south-west Queensland	Unknown
Yes	26.97095	14.0249	53.94191	22.11618	12.94606
No	23.02905	11.9751	46.05809	18.88382	11.05394

Chi-square probability = 0.173557496 not significant

Table 33. Analysis of Awareness, Relevance and Openness data.

Data from all respondents (n=119)

	SurveyFprob	mean2009	mean2012	[Fprob from both]	
Q1a_AwareWeb2	0.08551414	3.8	4.2	0.002736	diff
Q1b_WorkRelevant	0.009725609	5.1	4.6	0.760177	diff
Q1c_OpenToUsing	0.03230845	5.9	5.6	0.109504	diff

Data from respondents to both surveys (n=39)

	Respondent	SurveyFprob	mean2009	mean2012
Q1a_AwareWeb2	0.00565318	0.002736255	4.0	5.0
Q1b_WorkRelevant	0.07441262	0.7601773	5.0	4.9
Q1c_OpenToUsing	0.007013371	0.1095043	5.8	6.1

Table 34. Analysis of Familiarity with Web 2.0 tools.

AovFprobs.Surveys	**SurveyFprob**	**mean2009**	**mean2012**	**[fprob from both]**	
Q2a_Blogs	0.8847736	4.0	4.0	0.164332	agree
Q2b_eBooks	0.09903983	4.1	4.4	0.001965	diff
Q2c_eLearning	0.8775357	4.6	4.5	0.000862	diff
Q2d_eSurveys	0.009976419	4.9	5.4	0.000611	agree
Q2e_InstantMessaging	0.7143527	4.0	4.1	0.074671	agree
Q2f_MobilityTools	0.000546469	2.6	3.4	6.36E-05	agree
Q2g_Podcasts	0.1896281	3.8	4.1	0.056659	agree
Q2h_RSSFeeds	0.7356362	2.8	2.9	0.010732	diff
Q2i_SMSComp	0.2502452	3.1	3.4	0.001524	diff
Q2j_SocialNet	0.000169477	3.6	4.6	0.000188	agree
Q2k_TargetedEmails	0.2228738	3.7	3.4	0.948776	agree
Q2l_WebConf	0.000205288	3.8	4.6	0.001984	agree
Q2m_Wikis	0.6539591	3.4	3.3	0.07661	agree

Table 35. Analysis of Familiarity with eSurveys.

AovFprobs.Surveys	SurveyFprob	mean2009	mean2012	[fprob from both]	
eSurveys	0.009976419	4.9	5.4	0.000611	agree

Table 36. Analysis of Familiarity with Web conferencing.

AovFprobs.Surveys	SurveyFprob	mean2009	mean2012	[fprob from both]	
WebConf	0.000205288	3.8	4.6	0.001984	agree

Table 37. Analysis of Experience as a reactive user.

AovFprobs.Surveys	SurveyFprob	mean2009	mean2012	[fprob from both]	
Q3a_Blogs	0.797163	3.2	3.2	0.682547	agree
Q3b_eBooks	0.3704716	2.9	3.1	0.051321	agree
Q3c_eLearning	0.7174941	4.0	3.9	0.231292	agree
Q3d_eSurveys	0.001467502	4.6	5.3	0.000171	agree
Q3e_InstantMessaging	0.5829969	3.2	3.0	0.403169	agree
Q3f_MobilityTools	0.01365433	1.9	2.5	0.013542	agree
Q3g_Podcasts	0.2802905	2.9	3.2	0.011601	diff
Q3h_RSSFeeds	0.9676066	2.3	2.3	0.923837	agree
Q3i_SMSComp	0.5418674	2.2	2.4	0.041194	diff
Q3j_SocialNet	1.24709E-05	2.8	4.0	2.77E-05	agree
Q3k_TargetedEmails	0.6341059	3.4	3.3	0.743711	agree
Q3l_WebConf	0.000112698	3.0	3.9	3.67E-05	agree
Q3m_Wikis	0.5144859	2.7	2.5	0.213952	agree

Table 38. Analysis of Experience as a reactive user of eSurveys.

AovFprobs.Surveys	SurveyFprob	mean2009	mean2012	[fprob from both]	
Q3d_eSurveys	0.001467502	4.6	5.3	0.000171	agree

Table 39. Analysis of Experience as a reactive user of web conferencing.

AovFprobs.Surveys	SurveyFprob	mean2009	mean2012	[fprob from both]	
Q3l_WebConf	0.000112698	3.0	3.9	3.67E-05	agree

Table 40. Analysis of Experience as a proactive user.

AovFprobs.Surveys	SurveyFprob	mean2009	mean2012	[fprob from both]	
Q4a_Blogs	0.682337	2.1	2.0	0.267771	agree
Q4b_eBooks	0.4824007	1.8	1.9	0.110269	agree
Q4c_eLearning	0.609188	2.2	2.1	0.603534	agree
Q4d_eSurveys	0.005353229	2.7	3.5	0.000785	agree
Q4e_InstantMessaging	0.7484387	2.4	2.5	0.73684	agree
Q4f_MobilityTools	0.01353564	1.6	2.2	0.048558	agree
Q4g_Podcasts	0.6825264	1.7	1.8	0.277152	agree
Q4h_RSSFeeds	0.176775	1.7	1.5	1.000000	agree
Q4i_SMSComp	0.4358468	1.7	1.9	0.129775	agree
Q4j_SocialNet	9.47089E-05	2.3	3.5	0.012488	agree

Q4k_TargetedEmails	0.2293912	2.9	2.6	0.941955	agree
Q4l_WebConf	0.000535529	2.1	3.0	1.45E-05	agree
Q4m_Wikis	0.04702375	2.1	1.7	0.625251	diff

Table 41. Analysis of Experience as a proactive user of eSurveys.

AovFprobs.Surveys	SurveyFprob	mean2009	mean2012	[fprob from both]	
Q4d_eSurveys	0.005353229	2.7	3.5	0.000785	agree

Table 42. Analysis of Experience as proactive user of web conferencing.

AovFprobs.Surveys	SurveyFprob	mean2009	mean2012	[fprob from both]	
Q4l_WebConf	0.000535529	2.1	3.0	1.45E-05	agree

Table 43. Analysis of work place benefit from eTools.

Least significant difference t-test
Mean Square Error: 2.143501

eTool	combVariable	std.err	replication	LCL	UCL
Blogs	2.256881	0.17748	109	1.908698	2.605063
eBooks	2.100917	0.156925	109	1.793060	2.408775
eLearning	2.750000	0.187957	108	2.381262	3.118738
eSurveys	3.909091	0.196952	110	3.522709	4.295473
InstantMessaging	1.738318	0.125512	107	1.492087	1.984549
MobilityTools	2.112150	0.167616	107	1.783318	2.440981
Podcasts	1.682243	0.122858	107	1.441219	1.923267
RSSFeeds	1.522936	0.112577	109	1.302081	1.743790
SMSComp	1.816514	0.150977	109	1.520326	2.112702
SocialNet	2.358491	0.186320	106	1.992966	2.724015
TargetEmails	2.777778	0.210627	108	2.364567	3.190989
WebConf	3.448598	0.209640	107	3.037324	3.859872
Wikis	1.788991	0.136751	109	1.520710	2.057271

alpha: 0.05 ; Df Error: 1283
Critical Value of t: 1.961815
Least Significant Difference 0.3907442
Harmonic Mean of Cell Sizes 108.0649

Group	eTools	mean	trt order	sub order
a	eSurveys	3.909091	4	1
b	WebConf	3.448598	12	2
c	TargetEmails	2.777778	11	3
c	eLearning	2.75	3	4
d	SocialNet	2.358491	10	5
d	Blogs	2.256881	1	6
de	MobilityTools	2.11215	6	7
de	eBooks	2.100917	2	8
ef	SMSComp	1.816514	9	9

ef	Wikis	1.788991	13	10
ef	InstantMessaging	1.738318	5	11
f	Podcasts	1.682243	7	12
f	RSSFeeds	1.522936	8	13

Appendix 1c. eExtension project baseline survey – Qualitative data

Table 44. Thematic analysis of comments from 2012 survey relating to awareness, relevance and openness.

Category	Awareness	Relevance	Openness	Comments
Department support (8)	4	5	6	Dept very restrictive i.e. where do you host podcasts etc - the FutureBeef site should make inroads here I hope.
	7	6	6	We've wanted to use blogs for years but have been hampered by dept requirements.
	4	5	6	It would be nice if DAFF moved with the times and started by updating their Microsoft Office software and internet browser!
	7	6	6	It would be nice if our DAFF hardware/software was upgraded! Windows XP just doesn't cut it or Office 2003!
	7	6	7	Lack of access to platforms has stymied our development in this area.
	6	5	5	Put off by all the Queensland Government red tape involved and doubts about 'approvals'. Would probably take it off-site onto an industry website if I were doing any Web 2.0 work.
	7	7	7	It is extremely important that senior managers understand the use of this Internet platform in order to enable and support staff in using interactive tools.
	7	5	6	Web 2.0 is great as long as there is managerial support for the staff labour required to maintain interactive sites at the level of postings/updates expected by the client. Static web page reviews/updates have often been assigned a low priority in the past.
Extension (4)	3	4	2	I am a believer of face-to-face contact as I work directly with landholders and local government officers working on the ground. The internet doesn't build a 'relationship' with stakeholders
	3	4	4	I am not really doing extension anymore. Also I find that some of the new social media can be a bit time wasting I still think that it is hard to beat personal contact if you really won't take make an impact.
	4	3	6	I work primarily with grain producers, who are time short and as a generalisation have limited computer skills or literacy. The reach of some 2.0 tools is thus limited and I feel compelled to continue less technological means of communication (fax, phone and face-to-face) to reach a larger proportion of farmers.
	4	2	4	Only use if there is a clear advantages. Too many people take up new tech without really assessing if it is a genuine improvement for the clients.
Use of eTools (2)	7	4	4	I am not an extension officer so I really don't have need to use Web 2 technologies in my own role. However, I would be open to using them if necessary.
	6	6	6	We use wikis / blogs as interaction forums - a second information source above newsgroups.

Need for training (6)	4	5	7	Time needed to learn about and actually implement is what will hinder me
	2	5	7	My rating of relevance may change as I find out more!
	4	6	6	Would need training and practice
	4	3	6	need better training in their use and how to integrate them into our work environment
	1	2	3	do not know enough
	1	1	1	I'm confused...

Table 45. Comments on familiarity of eTools from the 2012 survey.

Category	Comments on familiarity
Department support (1)	Mobility devices would be beneficial - once again seems too difficult for the Dept to approve
Unfamiliar with terminology (5)	Sorry, I am a dinosaur of the era 'baby boomers'.
	Might know more of them but unaware of terminology.
	Some of them I haven't heard of.
	No longer in an extension role - hence limited exposure to most of the above in work environment
	Not sure what targeted emails means (but could be using them)
Comments on survey wording (2)	familiar = moderate= aware, interacted with
	Had trouble with the word 'familiar'. Familiar as in knowing about it or Familiar as in using it?

Table 46. Feedback regarding eSurveys.

Category	Feedback on eSurveys from respondents with high levels of experience
Getting feedback (12)	eSurveys - used to obtain feedback as well as finding out what requirements are for workshops etc.
	eSurveys - we create in-house surveys to get feedback on our training sessions.
	eSurveys allow us to easily capture evaluation data after an event.
	eSurveys are an easy and cost effective way to gain feedback after an event
	eSurveys for feedback - easily set up and easy for people to respond.
	eSurveys in monitoring and evaluation work.
	eSurveys: able to evaluate customer satisfaction
	Have used eSurveys for market research and project evaluation
	I have used eSurveys to gather information from clients - they are helpful when you forget to hand out evaluation sheets after a workshop/meeting.
	eSurveys have been critical in evaluation with both internal and external stakeholders.
	eSurveys - used to evaluate webinars and collaborate data from hard copy evaluations
	An eSurvey was used to benchmark farmer practices in 2011, so in 3 years time we

	can redo the survey to gauge the level of practice change. This way every farmer in the district had the opportunity to contribute. However we had a poor return to the eSurvey and had to print out copies of the survey and 'volunteer' 40 farmers and sit down with them and get them to fill them out. The eSurvey may not have been personal enough to encourage farmers to complete and it is very easy for a farmer to ignore or forget an email or fax with the link on it.
Getting information (2)	eSurveys - linking our work with DERM's work (user friendly)
	Webinars, eSurveys, eBooks plus Remote access with mobile phone puts me in contact just about anywhere at anytime with work. The technology is critical for the sheep industry due to the scattered population of the industry
Ease of use (7)	eSurveys are a quick and easy way of acquiring feedback/opinion, and often have a higher rate of response (particularly when combined with a targeted hard copy survey) than hard copy alone.
	SurveyMonkey - quick turn around response
	eSurveys - cheaper to produce and execute, easier to use and collate results.
	eSurveys - intuitive, simple to use and quick. Saves money and time. Very easy to review results.
	eSurvey - improved efficiency in completing surveys as 'postal' component not required. Nominated as preferred method for survey by subsection of clients.
	Used SurveyMonkey successfully
	Very successfully use eSurveys

Table 47. Feedback regarding web conferencing.

Category	Feedback on web conferencing from respondents with high levels of experience
Resource effective (7)	Web conferencing - efficient & effective, able to participate in events that I would otherwise not be able to attend.
	Web conferencing - excellent collaboration tool. Simple to use. Save time, less travel and work/life balance
	Web conferencing has meant less travel to meetings and some training events.
	Web conferencing - enabled cost and time efficient means of participating from remote location.
	Good value out of Citrix GoToMeeting, i.e. it has saved me some travel, also useful for video calling in preference to audio phone call.
	Webinars ESurveys eBooks plus Remote access with mobile phone puts me in contact just about anywhere at any time with work. The technology is critical for the sheep industry due to the scattered population of the industry
	Webinars have been marvellous in saving time and engaging with a much wider and spread out audience. I will use this again and again.
Better contact (6)	Web conferencing has been a great way to keep in contact with the team. Being able to see the other people is really useful and much better than a teleconference.
	Web conferencing allows us to reach a wide audience in a timely manner and using expert presenters for little cost.
	Web conferencing in work meetings across distances and disciplines.
	Web conferencing - allows us to connect with vendors in Melbourne/ Sydney for training, rather than having them fly to Brisbane to visit and train us.
	Web conferencing for project team meetings.
	Web conferencing - really helped to draw an audience of diverse backgrounds to

	discuss e.g. Pimelea - helped get the message to those really interested and also useful later down the track to be able to refer people to the recorded version. Very helpful for summarising project results and increasing awareness of those results and best practice management techniques. Hopefully leading to better cattle management and fewer deaths from Pimelea poisoning!
Training (3)	Library staff have received training via web conferencing, and soon hope to be delivering our training this way.
	Used web conferences for to attend national events
	Webinars - used to provide producer information sessions
General (2)	I have used webinars a lot in the past but not for a while now in my current role
	SMS by computer and Webinars have been my main use and are both excellent. I pay $1,000 a year for GoToMeeting where Skype is free. I feel the Department is wasting money.

Table 48. Comments on ways eExtension interests the respondents.

Category	Ways eExtension interests respondents
Communication (16)	A great tool for getting the message to our major stakeholders
	As a new means for engaging with our audiences.
	As another method of being able to initiate interest in a topic, get messages to clients and also to provide follow up to keep interest.
	Communicating with clients.
	Enabling better communication with R&D collaborators internationally
	Extension is our direct link to all stakeholders involved in Pest Management.
	It keeps us in regular contact with the stakeholders and we can provide information in a format that can enable producers to decide what and when they can change in their businesses
	It significantly increases the capacity to communicate and engage with clients and consequently the potential for greater impacts from our projects
	Some tools are quite useful and a good way of getting information and feedback from industry
	Working collaboratively with industry & producers to improve production and sustainability through best management practice is critically important and satisfying.
	Working with groups and individual landholders, show displays and field days
	Improve efficiency of communication and improve client access to information.
	Need to explore opportunities for collaboration, partnerships, coordination etc.
	finding new ways to communicate information to industries and the public, in a modern and progressive way.
	Potential for novel and effective ways to communicate (both ways) with clients
	As an integral part of the future interactions with colleagues and clients - internal or external; but not the only type and therefore part of my required skill set.
Information (8)	Having information at your fingertips e.g. documents, images
	Make better use of our resources and products
	Providing clients with information more efficiently.
	The potential to make contact with people and spread information

	To better connect with clients and provide more timely information.
	Use of electronic technologies to reach our customer base and provide material in a way that is useful to them and convenient to access when it suits them.
	Improving the marketing capacity of farming and food businesses contributes to industry and regional development. eLearning is critical for that development given distances in Queensland.
	Particularly interested in eLearning - design and content input.
Greater access to audience (9)	Easier way to target more people.
	Enabling to get our research and management techniques presented out to as many producers as possible in a way that they can use it on farm and they can understand it.
	Enabling us to reach remote clients 24/7
	Getting messages through in busy lifestyles and achieving interaction across distances and time.
	I am interested in how people in agricultural businesses access information. Does eExtension engage or exclude them?
	I am leading mango extension for the whole of Australia and am in fact the only DAFF employee in the project. I have to deliver information products for growers from Gin Gin (WA) round the top of Australia to the Riverina (seriously) and eExtension is the only way to do this. I also intend to develop, with the Creative group in DAFF, iPhone and iPad pest and disease problem solver apps.
	I work Australia wide so better communication with remote groups would be useful. I'd also like to learn how other tools can help access a broader audience to encourage not just increased awareness, but behaviour change.
	I'm interested in eExtension's ability to reach a much bigger audience than just the people that show up at field days and workshops.
	Instant access to audience - no time lags. Can reach a wide audience - including international subscribers. Easy to use, responses are easy to collate e.g. eSurveys
Effective & resource saving (9)	New tools to improve the efficiency and effectiveness of our work
	Opportunities for innovative, cost effective and far reaching delivery of services and information and alternative forms of client engagement.
	Flexibility, directness vs having to engage intermediaries to extend information (maintaining control of the process and the message), variety of tools available, cost effectiveness, time efficient. Can look great, enjoyable to engage with.
	Being able to get producers to engage in learning without having to inconvenience them with travel time
	Being able to make better use of my time and spread the message further
	Communication over distance using Webcam
	Delivery of information in quick fashion
	Efficiency and effectiveness of creating and delivering learning experiences to achieve change
	If it makes work simpler, more efficient
Technology - achieve outcome (4)	Increasing reliance on web promoted as means to achieve extension outcomes
	It will be critical in delivering our message to our customers and measuring the impact.
	New tools to allow me to do my job better. Improve communication and improve the timeliness of information and communication.

	Finding more efficient ways to do things we already do and new ways of doing this we couldn't do previously.
Technology - as a tool (10)	Not at all. However, I can see that it may be a good tool for those involved in extension work.
	Possible tool
	If I were in an extension role now these tools provide additional avenues for working with clients and industry
	Easily accessible, available, updateable, targetable, and flexible. The potential, particularly in multi-media information provision, is enormous.
	Webinars are pretty good. Probably don't use them enough
	Tools that will be useful for growers
	It has been really useful to have had a project promoting E tools and mechanisms as they can be really appropriate in our work with the primary industry sector.
	Working on a web based program so there is huge potential for eExtension.
	We were interested in the project outcomes - with the hope of piggybacking any advances that saw eTools pushed out to the wider dept
	From the perspective of the technology tools that are being used.
Technology - reaching users of the Internet (19)	My job is to help enable businesses use new technologies available by the digital economy and high speed broadband
	Only where it is of genuine benefit to the industry clients I work with.
	Being able to keep up with technology and communicate with our clients in a manner that suits them.
	How we work with technology to enable real change amongst those we work with; we make our work remain relevant in the current technological media and ensure we move with the times so we can stay relevant
	I am not doing much extension myself these days, but am working with a team that is. I think it is very important to be aware of and start using new tools and techniques to engage with producers - even if the uptake by producers is slow at least we can start trying and learning new techniques.
	As a new way to recruit and engage with clients in peri-urban areas. It has been hard to find funds or time to look at some of these options though.
	Maintaining skills to remain effective in a constantly changing/evolving society
	By finding ways to tap into the general public, into audiences we cannot get to by conventional methods of extension. Still a big proportion of older landowners who do not access computers but they are getting more smart phones.
	Avenues for communicating with younger beef producers
	Clearly a cost effective way to move forward. Clients are expecting it. Can be run in real time. YouTube can be used to illustrate farming techniques that are otherwise difficult to convey. Smart phones are increasingly common and younger farmers are expecting farming apps.
	Increase uptake of use by clients of internet/email. No great demand or interest for the newer tools but I assume this will come with increased download speeds and younger generations entering the industry.
	More people are coming internet literate and we must move with the times to be able to deliver our resources and information.
	New alternative. Challenge to convert the beef industry into using the technology.
	Somewhat - time consuming and hard to associate with grazing population

	The speed at which today's Social Media technology is changing (e.g. Facebook, YouTube, Twitter,...) to create new collaboration platforms and the ability to engage with clients/stakeholders rapidly, conveniently and efficiently.
	The way of progressing change and assisting client base
	Utilising up-to-date ICT tools to efficaciously deliver development-extension activities and to keep up with the 'Joneses' (i.e. commercial / business world).
	Very much offers opportunity with my clients, the app market and other mobile opportunities interest me as every client has a mobile
	We have to find a way of re-engaging with our clients. Current 'group extension' methods don't work. Growers are not attending workshops. Perhaps some of the new media will provide opportunities.
Need training (4)	I'm about to conduct a customer survey of users of Biosecurity Veterinary Testing laboratories and probably would be interested in using eSurvey. Thus far, I haven't been able to find information on the DAFF intranet site on how to go about this. I would particularly be interested in any training or guidance in using the tool. (I travel to Toowoomba on a regular basis so can meet with you to discuss).
	Learning about new technologies and how we can use them to benefit us internally and our clients
	Like to know more, like to see it actually working
	Need to understand for future relevance
Other (2)	Mobile office unit
	Totally professionally

Table 49. Other comments from the respondents.

Category	Other comments
Audience (6)	'Simplicity is the ultimate in sophistication'. Keep it simple and others will embrace it and use it.
	All landowners and managers not just rural.
	It is critical that landholders are informed of issues relating to pests. From my experience landholders like to talk face-to-face with a local person and build a level of trust with the departmental officer. I am a firm believer that the on-line way of delivering services is not going to build our 'relationship' with stakeholders. It is impersonal.
	The usefulness of eTools will depend primarily on the willingness and ability of my clients (farmers) to take-up and use the technology. No matter how good or poor I think a tool is, or the great potential a tool offers, if my clients are not adopting it, then the tool will remain 'potential' and not enter the realm of useful. For some of my clients, the current limitations of their e-infrastructure (often copper wires and long distances from exchanges) limits the amount of data they can download in acceptable time frames; hopefully this limitation will reduce as better infrastructure becomes available but currently this could be limiting the use of some more data intense eTools.
	I don't know many growers that use this technology.
	'e' anything is a little premature for many fisheries stakeholders, where some sectors of Qld's commercial fisheries do not know how to use a computer nor have access to one.
Content (3)	Approach and material needs to be carefully thought through - not just technology for technology's sake. Mobile device use is also increasing dramatically - I'm not sure how much of our material translates easily to those platforms.
	Biggest challenge is people, time and money to create content i.e. write publications. These new tools still depend on content
	With all these eTools, I think one of the most important long term questions to ask is who is going to be putting the 'up-to-date', 'regionally appropriate', 'good quality'

	information onto these eTools (Blogs etc) that clients are looking for' . eTools are 'Tools'. They are useless unless appropriate experience staff are interacting directly with identified clients in industry plus R&D teams. If staff are employed to do this, then the quality & usefulness of information available via eTools (plus hard copy Fact sheets & media articles) is high and considered valuable by industry. A good long term outcome. Unfortunately some in high places may have the idea you do not need staff based near industry & interacting directly with clients. (less staff saves lots of $$) You just have a central base putting any old stuff from the www onto eTools. Maybe a call centre in India could do it all ? (save more $$). CONCLUSION.... eTools, they will have a role, but they are only one of many appropriate relationship/ information exchange methods to see change/ improvements taken up by industry.
Extension tool (5)	It works well in conjunction with tradition extension methods - just another tool in the bag.
	Leading Sheep could not survive without using the technology such as webinars, GoToMeeting and remote access computers
	We require it to effectively delivery on our objectives.
	I think the eCommunication systems are a high priority for delivery of information where and when it is required in a readily accessible format.
	I am a Farm Financial Counsellor whose main role is dealing one on one with primary producers needing help with the management of their finances. I have little need for most of the interactive tools offered by Web 2.0.
Lack of departmental support (7)	Government departments are too slow to develop (consistent) policies to facilitate ready adoption of tried and tested/ mainstream ICT/ tools (never mind adoption of novel ICT/ tools) to expedite delivery of key services to clients and industry.
	If we could access Skype we would have access to SMS by computer web conference I.M. and other tools all in the same format - with ease of access.
	Need technical support/ permissions to introduce this technology more freely into the workplace. Keep up the good work John and Greg.
	One of the biggest problems is the time and effort it takes to get access to technology through the DAFF system - and the cost associated with doing so. e.g. $1300 p.a. for mobile internet access through a laptop when most of my peers in other organisations are doing this via Smartphone (and have been for several years). A lack of access to even basic technology makes it hard to know what eExtension options are out there at times.
	Technologically we are falling behind due to our really restrictive IT policies.
	The DAFF web is part of the problem - not part of the solution. If you compare what is happening in NSW and Victoria, Qld is in the 'dark ages' - see - http://www.dpi.nsw.gov.au/agriculture/resources/climate-and-weather/variability/climatedogs
	We need to be up-to-date on all the tools so that we can interact effectively with the public and industry members. We need to also be able to use these tools freely and easily without prohibitive costs required from project funds etc, and without compatibility issues with existing departmental systems or processes.
Other	We have just begun using time-lapse cameras to capture pasture growth, sediment movement and stock movement. We have 4 cameras within our team with solar panels- it may be something other groups could look at as the whole kit of 4 cameras and solar panels only cost $1036
	Constant high workload and limited training opportunities in regions means difficult to up skill
	Appreciate what you are trying to do John but it's a tough battle
	John, I would be interested to know what information we have about how rural business people are using the new technologies.
	Really grateful to John for pioneering and persisting with the development of eTools and eLearning within the Dept. It has made a huge difference to the reception we get to

	ideas when we are not the lone voice.
	As a Librarian, not extension worker, not sure if I fit your 'survey' group.
	I am not sure how much 'percentage' wise that is extension. Library staff certainly provide information to 'individuals, communities and industries' but I am not sure if it is in the same way as Extension officers do. Therefore I hope my feedback is applicable and has not confused the results. [name withheld]
	Not sure I understand exactly what you' mean by ‘mobility tools’ so this may affect some of my responses.
	Receiver proactive user ideas on how we use technology I still am confused about also a mobile tool is that a blackberry??
	Sorry I was late in completing the survey!

Appendix 2a. Impact of Web Conferencing – Questionnaire

Help us understand how web conferencing may have helped you with your work. It is anonymous and should take less than five minutes to complete.

Introductory questions

1. Approximately how many web conferences have you been involved with in the last year...
    - as the webinar host
    - as a webinar participant

2. What proportion of these webinars...
- replaced the need to have face-to-face meetings? [percentage]
- were additional meeting opportunities that would not have happened as face-to-face meetings? [percentage]

3. What proportion of your web conferences are with internal (DAFF staff) versus external participants?
    - Internal [percentage]
    - External [percentage]

4. How important were the following reasons for you signing up to use WebEx? (1=Not important; 7=Very important)
    - Reduces the need to travel away from home
    - Allows more regular contact with participants
    - Saves time for the webinar organiser/ participants
    - Saves money for the webinar organiser/ participants
    - Saves the environment (less CO2 emissions)
    - My supervisor encourages the use of webinars
    - I've seen my colleagues use webinars successfully

Further comments (including any other reasons)...

5. Have you hosted your own web conference yet?
    - Yes indeed I have
    - No, not yet actually

6. To what extent has web conferencing helped you to... (1=Very low; 7=Very high)
    - better engage with your clients/ colleagues
    - be more responsive to your clients/ colleagues needs
    - be more innovative with your work
    - save time (reduced travel time)
    - save money (reduced travel expenses)

Further comments (including other ways webinars have helped you)...

7. Tell us a brief story about how web conferencing has helped you do something useful or important...

Not yet hosted a webinar

8. How important are the following reasons for you not yet hosting a webinar? (1=Very low; 7=Very high)

- Target audience doesn't have suitable access to the Internet
- Target audience isn't confident using the Internet
- It seemed too hard to learn how to use the system
- I prefer to use face-to-face interaction
- It seemed too expensive to use
- It seemed a good idea at the time to sign up for WebEx, but I just never got around to using it
- My colleagues ended up hosting the webinars I was thinking of running
- My work role changed so I no longer needed to run webinars

Further comments (including any other reasons)...

9. To which DAFF Area do you belong?
- Strategic Relations and Communications
- Finance and ICT
- Office of the Chief Operating Officer
- Employment and Economic Development
- Mines and Energy
- Science, Agriculture, Food and Regional Services
- Coordinator-General

10. If you are involved with RD&E (Research, Development and Extension), what percentage of your time is spent on extension?

11. Which category below includes your age?
- younger than 20
- 20 to 29
- 30 to 39
- 40 to 49
- 50 to 59
- 60 or older

12. What is your gender?
- Male
- Female

13. Any final comments...

Thank you for taking the time to complete this survey. Your responses will help us evaluate the benefit of web conferencing to DAFF.

Please click ‘Done’ to submit your answers.

Appendix 2b. Impact of Web Conferencing – Quantitative data

Table 50. Quantitative analysis of data for Reasons for signing up to use WebEx.

Analysis of Variance Table

Response: combVariable

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	Signif
Individ	53	650.11	12.266	5.1016	< 2.2e-16	***
Question	6	222.89	37.148	15.45	1.68E-15	***
Residuals	309	742.96	2.404			

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

	combVariable	std.err	replication	LCL	UCL
Colleague	4.433962	0.290774	53	3.861814	5.00611
Contact	5.365385	0.259116	52	4.85553	5.875239
Envir	4.000000	0.252707	53	3.502756	4.497244
Money	5.169811	0.258015	53	4.662123	5.6775
Supervisor	3.365385	0.289365	52	2.796009	3.93476
Time	5.574074	0.254384	54	5.07353	6.074618
Travel	5.442308	0.283287	52	4.884892	5.999723

Groups	Treatments	Means
a	Time	5.574074
a	Travel	5.442308
a	Contact	5.365385
a	Money	5.169811
b	Colleague	4.433962
b	Envir	4
c	Supervisor	3.365385

Table 51. Quantitative analysis of Extent web conferencing has helped.

Analysis of Variance Table

Response: sqrt(combVariable)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	Signif
Individ	42	30.6929	0.73078	9.1039	<2e-16	***
Question	4	0.5375	0.13439	1.6741	0.1585	
Residuals	162	13.004	0.08027			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Count of responses to Extent web conferencing has helped

Score	Engage	Responsive	Innovative	Time	Money
1	2	3	3	3	2
2	2	2	2	2	2
3	2	2	2	1	2
4	2	4	2	2	1
5	6	13	6	1	5
6	13	10	16	12	8
7	16	9	11	21	19
Total	**43**	**43**	**42**	**42**	**39**
>=4	37	36	35	36	33
%	86%	84%	83%	86%	85%

Table 52. Quantitative analysis of Reasons for not yet hosting a webinar.

Analysis of Variance Table

Response: combVariable

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	Signif
Individ	9	72.562	8.0625	2.8166	0.007589	**
Question	7	28.788	4.1125	1.4367	0.206717	
Residuals	63	180.338	2.8625			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 53. Quantitative analysis of Effect of business group.

> AovFprobs

	BusinessGroup
Q1aNWebConfHost	0.839603
Q1bNWebConfParticipant	0.726808
Q2aPCReplaceFaceToFace	0.132095
Q2bPCExtraToFaceToFace	0.184159
Q3aInternal	0.098417
Q4aReduceTravel	0.364179
Q4bMoreContact	0.180622
Q4cSavesTime	0.467215
Q4dSavesMoney	0.458925
Q4eSavesEnvironment	0.995026
Q4fSupervisorEncouragement	0.594248
Q4gColleaguesSuccess	0.465047
Q6aEngage	0.613361
Q6bMoreResponsive	0.217310
Q6cMoreInnovative	0.996175
Q6dSaveTime	0.966991
Q6eSaveMoney	0.585609
Q10PCExtension	0.064755

Table 54. Quantitative analysis of Effect of age.

> AovFprobs

	Age
Q1aNWebConfHost	0.865550
Q1bNWebConfParticipant	0.921548
Q2aPCReplaceFaceToFace	0.472301
Q2bPCExtraToFaceToFace	0.463852
Q3aInternal	0.212584
Q4aReduceTravel	0.690445
Q4bMoreContact	0.905347
Q4cSavesTime	0.571058
Q4dSavesMoney	0.160728
Q4eSavesEnvironment	0.051754
Q4fSupervisorEncouragement	0.449883
Q4gColleaguesSuccess	0.855148
Q6aEngage	0.858491
Q6bMoreResponsive	0.692652
Q6cMoreInnovative	0.766714
Q6dSaveTime	0.859376
Q6eSaveMoney	0.649786
Q10PCExtension	0.717119

Table 55. Quantitative analysis of Effect of gender.

> AovFprobs

	Gender
Q1aNWebConfHost	0.764896
Q1bNWebConfParticipant	0.291006
Q2aPCReplaceFaceToFace	0.145919
Q2bPCExtraToFaceToFace	0.180477
Q3aInternal	0.153568
Q4aReduceTravel	0.756506
Q4bMoreContact	0.463217
Q4cSavesTime	0.848257
Q4dSavesMoney	0.366562
Q4eSavesEnvironment	0.161095
Q4fSupervisorEncouragement	0.995483
Q4gColleaguesSuccess	0.465183
Q6aEngage	0.735265
Q6bMoreResponsive	0.887854
Q6cMoreInnovative	0.125315
Q6dSaveTime	0.252542
Q6eSaveMoney	0.548634
Q8aAccessInternet	0.917643
Q8bConfidenceInternet	0.951663
Q8cTooHardLearn	1.000000
Q8dPreferFaceToFace	0.212180
Q8eTooExpensive	0.549271
Q8fNotGotAroundToIt	0.266706
Q8gColleaguesDidIt	0.283563
Q8hChangeRole	0.687688
Q10PCExtension	0.371928

Appendix 2c. Impact of Web Conferencing – Qualitative data

Table 56. Qualitative analysis of Reasons for signing up for WebEx.

Comments on the reasons for signing up to use WebEx	Sharing documents	Geographically dispersed participants	Saves travel/ money	Good tool	Cost of WebEx	Need more info on using WebEx	Miscellaneous
Ability to share and edit documents Access to expertise	✓						
Allows me regular contact with geographically dispersed staff		✓					
As a participant in an international project, being able to get all the team together from NSW, Vic and Laos on a regular basis to go over planning and implementation strategies is vitally important and WebEx just does it!		✓					
At times I need to share and discuss the details of documents with other staff across the state. It a great tool that saves on travel expenses and the time associated with travel.	✓	✓	✓	✓			
Being able to use webinars removes some of my travel time which I can then use in my project work. A well prepared and delivered webinar can reduce the time spent in meetings/ workshops etc.			✓	✓			
Essential tool for our clients and staff. Not sure how we will survive without a similar product				✓			
I am a strong believer that web meeting should take place more often. Saves a lot of money			✓	✓			
It may have been possible to hold most of the meetings as teleconferences. However, they would have been much less effective and more time consuming as it would have been more difficult to share documents, presentations, etc.	✓			✓			
It was very effective but way too expensive for ongoing use. I wouldn't say it saves money because it is quite the opposite. It saves time for travel and has got me out of sticky situations. I would like to see more cost effective options become available for DAFF use			✓	✓	✓		

None of the above, I just wanted to try it.							✓
Our work group predominantly relies on teleconferencing. I initially liked the idea of webinar and tried to set up one or two but was put off by getting charged when I was simply experimenting with the options.					✓		
Signed up because multiple participants in multiple locations could work together on a common document. I moved out of the department for 6 months and since returning haven't yet hosted my own conference. Not sure that I understand how to do it - hence the delay.		✓				✓	
The main reason I signed up to WebEx was so that I could present and discuss data and experimental plans with international collaborators in the midst of experiments, when it was not possible to meet face-to-face with them.		✓					
The only WebEx session attended to date has been the training session. Issues with this session were to be rectified, as yet, no further information received on the use of this system. Teleconferences are the main/only source of technology used in this office.						✓	
The use of the webinar has allowed increased engagement with the industry funding body via short interactive meetings where document have been developed , reviewed and emails within 1	✓						
There has been no mention about the efficiency or effectiveness of the meetings. As all participants can see the working document, there is time saving compared to sending and retrieving documents whilst in the meeting. As all participants change the single document the meetings are more affective, i.e. you can have fewer meetings with greater outcomes. I have only recently joined DAFF, and found WebEx very beneficial, & had intended to continue using it in the future. But unfortunately, I cannot afford to use WebEx on an individual basis; but I would continue to use it if we had a general licence for DAFF.	✓			✓	✓		
Trying new technology and getting producers to adapt to this technology							✓
Used for the DAFF Policy Community							✓
Using WebEx saved us so much time and resources. It enabled us to work on reports together rather than our usual inefficient email and track changes method. Our team are located in regional centres so we were able to meet together without travel.	✓	✓	✓				
Very expensive. Difficult to use. Took a long time to learn how to use it. Most functions are unnecessary and offensive e.g. raising hand to ask permission to talk, emoticons. Could have the same result with conference phone					✓		✓

and a .ppt presentation. It will never be the same as face-to-face communication. The emoticons and raising hands rubbish detracted from interaction							
We need to keep these types of facilities for all the reasons in question 4 above. It will become more and more important as organisations strive to reduce communication costs and improve the quality of teleconferencing				✓			
We used webinars to deliver Business webinars to DAFF customers, to increase the equity of access to DAFF business education and to provide our customers with a more time & cost effective alternative to traditional 3 hour face-to-face workshops.			✓				✓
WebEx is expensive, but a valuable tool. Could/ should be cheaper.				✓	✓		
Total mentions	6	6	6	9	5	2	5

Table 57. Qualitative analysis of Comments on how web conferencing has helped.

Category	Comments on extent web conferencing has helped
Attend meetings	Able to attend meetings I wouldn't otherwise been able to
Training	Allows me to build up training resources from webinars to use as just in time training
Effective	Make teleconferencing more effective and reduce teleconference time
Geographic distribution	Bring the best presenter to the audience. Clients are very scattered so we can reach people who would not be able to participate at face-to-face.
Skill to use WebEx	It is necessary to learn how to use them well both the technology of the provider and the specialist skill needed to facilitate other's contributions and learning...and it is not difficult to learn how to do these things.
	We need to encourage others to become more confident in using WebEx. The more you use it the better you become at running a session and the more exposure given to others who participate the more likely they are to run their own sessions. It helps eliminate the unnecessary waffle we sometimes have to sit through at face-to-face meetings.
Costs	I used it the once, and found it to be very expensive, with the cost centred on one collector, the flip side is that everybody would have travelled to a central place, with no overnight and the cost would have been spread across all participants.
Didn't like web conferencing	They have not helped me at all. They are time consuming, expensive and unnecessary. The control exerted by the host was very offensive. It detracted from interaction. I tried them with an open mind. I did the tutorial webinar and hosted one myself. Waste of time and money. Just use a conference phone and PPT.
Miscellaneous	I only organised one web seminar but the communication was not good. I still believe in the system.
	Travelling was never an option, so the response to 6.4 and 6.5 should be n/a.

Table 58. Qualitative analysis of brief stories about how web conferencing has helped.

Category	Brief stories about how web conferencing has helped
Overcoming geographic distribution	As part of an interstate project team, it's not always convenient to have all team members in the same room. Web conferencing has allowed me to run training for the rest of the project team with a much lower time and money requirement.

(8)	Assisted me in communicating a workshop with clients across the state.
	Connect with the regions
	Face-to-face contact with colleagues and suppliers in multiple cities
	Great for team meetings, particularly where team members spread over several locations and organisations.
	We were able to have a meeting with people based all over the state, which would have otherwise cost a lot of money in travel.
	We were able to liaise with our Victorian counterparts and share demonstrations of software in real time, something that only a face-to-face meeting would have been able to achieve. It was as good as being in the same room, even though we were thousands of km's away.
	Our project leader was in Poland for our webinar and other collaborators were in Perth, Sydney and Melbourne. This technology saved a lot of travelling time and meant we could meet project milestones even though staff were overseas. I loved the fact that all participants could view slides and presentations, that you could control the crowd and keep the discussion on track. I would love to continue using this technology!
Networking (10)	During the write-up phase of our Laos fishways project, all project participants were able to collaborate on-line, sharing documents and providing active discussion while editing. We were then able to propose a new follow-on project, workshop the ideas behind this project and draw up the appropriate documentation for submission. This has resulted in our project being extended for 5 years, with $2M of funding, well worth the cost of WebEx.
	Hearing information I wouldn't have otherwise done and learning about issues and what other states and groups are doing.
	I have negotiated a whole-of-Government contract with a contractor in the US. Web conferencing allowed us to more quickly and easily negotiate changes by ensuring we are talking about the same wording on the same page in a large suite of contract documentation.
	I used Web conferencing in the development of the Reef Education and Extension Strategy, both with the project working group which was situated across all Reef Catchments as well as a 'synthesis forum' which allowed previous participants in focus group type discussions at various locations in the state to come together to analyse and review the combined results of all those sessions. It was a very valuable additional step in the engagement process which would not have been feasible to do in a single point conference due to budget and time constraints. I have also used it in operational planning meetings for my work team who come from across various centres in the SE Region.
	Monitoring and evaluation is more easily achieved when tools and data storage are done systematically. As a major part of my field of work new resources which support the development and use of these two items are highly valued. In June 2011, I was able from Longreach, to host a webinar with Animal Science colleagues from Townsville, Brisbane, Toowoomba and Charleville to have a provider demonstrate an example of how they do this for a project in the south of Australia. Colleagues saw a demo of the resources, asked questions of its application and were able to assess the resource as an option for future project use.
	Share data and experimental plans with international collaborators in the midst of experiments to get feedback. Meeting face-to-face at these times would not have been possible.
	The use of webinar has allowed improved project management of interstate and intrastate project team members. Significant improvement in efficiencies and industry engagement . This is only the start of technological advancement the dept needs to implement to ensure we remain innovative.
	Very useful for interacting with my work and study supervisors at the same time.
	Web conferencing has been critical in the finalisation of self-assessable codes where policy officers need technical input from regional officers on a regular basis - not

	necessarily extended meetings, just a few minutes but where all involved can be present to ratify any changes there and then. Please can we have it back?
	Worked on project milestone, final reports, rebids and proposals using a team effort rather than individual.
Transfer information quickly (3)	Ability to get information out to flood affected producers very quickly and particularly when they could not leave their homes.
	Enabled us to quickly develop and deliver business recovery webinars in response to State wide natural disasters.
	Provide impromptu regional training for OLGR COGS releases.
Training (6)	Have used web conferencing to provide technical updates to staff. Have also used the recorded webinar to send to interested clients.
	Used to hold monthly training for staff
	I ran a number of training sessions for staff when demonstrating how to navigate various screens in Clarity.
	Provided an opportunity to capture on-line presentations and commentary with the view of offering an on-going information source to clients and/or colleagues.
	Web conferencing helped organise beef business workshops across northern Australia through discussions and peer learning with the workshop organisers i.e. the web conferences were used for planning the days held with industry.
	With five team members editing documents and reports is usually a nightmare. However with web conferencing we were able to all work on one document together which saved a lot of time without the need for a face-to-face meeting. As we became more confident with using web conferencing we thought it would be great for delivering training to irrigation growers located in a variety of locations without the need to hold training sessions at multiple centres.
Save money (1)	Has allowed me to get recognised presenters for zero cost.
Didn't like WebEx (1)	As above [They have not helped me at all. They are time consuming expensive and unnecessary. The control exerted by the host was very offensive. It detracted from interaction. I tried them with an open mind. I did the tutorial webinar and hosted one myself. Waste of time and money. Just use a conference phone and PPT.]

Appendix 3a. Impact of eSurveys – Questionnaire

Help us determine how eSurveys have helped you with your work. It is anonymous and should take less than five minutes to complete.

Introductory questions

1. On average, how many surveys would you conduct in a year?
   - Paperbased
   - Telephone
   - Electronic

2. What proportion of your surveys are sent to internal (DAFF staff) versus external participants?
   - Internal [percentage]
   - External [percentage]

3. Have the number or the type of surveys you conduct changed in recent times? If so, tell us about that...

4. How important were the following reasons for you signing up to use SurveyMonkey? (1=Not important; 7=Very important).
   - Saves time for the survey creator
   - Saves time for the survey respondent
   - Saves money (for the survey creator)
   - Saves the environment (no paper wasted)
   - Easy for respondents to use
   - No need to decipher hand written responses
   - Can quickly see and analyse results

Further comments (including any other reasons)...

5. Have you created a survey using SurveyMonkey yet?
   - Yes, indeed I have
   - No, not yet actually

Use of SurveyMonkey

6. How well has SurveyMonkey helped you do the following... (1=Very poor; 7=Very good)
   - create a survey
   - collect responses
   - analyse results

Further comments (including any deficiencies you've found with SurveyMonkey)...

7. To what extent have you found SurveyMonkey... (1=Very poor; 7=Very good)
   - easy to use for the first time
   - provides a sufficient range of
   - question types
   - online support helpful

Further comments (if required)...

8. If a shared corporate SurveyMonkey licence was no longer available, how likely is it that your area would purchase its own licence ($299/yr)? (1=Very unlikely; 7=Very likely)
Further comments (if required)...

9. To what extent have eSurveys helped you to... (1=Very low; 7=Very high; N/A)

- be more efficient (saving time and effort)
- gather feedback after an event
- seek feedback from your clients (not related to an event)
- make better informed decisions
- be more responsive to your client needs
- be more innovative

Further comments (including other ways eSurveys have helped you)...

10. Tell us a brief story about how eSurveys have helped you do something useful or important...

Not yet used SurveyMonkey

11. How important are the following reasons for you not yet using SurveyMonkey? (1=Not important; 7=Very important)

- Target audience doesn't use the Internet
- Prefer to hand out printed survey at end of event
- Too hard to learn how to use the software
- Printed surveys give better quality results
- Timid respondents need face-to-face encouragement
- Respondents need assistance in completing survey questions
- It seemed a good idea at the time, but I just never got around to it
- My colleagues ended up creating the eSurveys I was thinking of doing
- My work role has changed, so I no longer need to create eSurveys

Further comments (including any other reasons)...

12. To which DAFF Area do you belong?

- Strategic Relations and Communications
- Finance and ICT
- Office of the Chief Operating Officer
- Employment and Economic Development
- Mines and Energy
- Science, Agriculture, Food and Regional Services
- Coordinator-General

13. If you are involved with RD&E (Research, Development and Extension), what percentage of your time is spent on extension?

14. Which category below includes your age?

- younger than 20
- 20 to 29
- 30 to 39
- 40 to 49
- 50 to 59

- 60 or older

15. What is your gender?
    - Male
    - Female

16. Any final comments...

Thank you for taking the time to complete this survey. Your responses will help us evaluate the benefit of SurveyMonkey to DAFF. Please click ‘Done’ to submit your answers.

Appendix 3b. Impact of eSurveys – Quantitative data

Table 59. Quantitative analysis of Number of surveys conducted in a year.

Paper-based

> summary(Survey9a$Q1aPaperBased[Survey9a$Q1aPaperBased<29]) # summary removing 280

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
0	0	1.5	2.097	3	10	15

> summary(Survey9a$Q1aPaperBased)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
0	0	1.5	10.78	3.25	280	15

Telephone

> summary(HistQuestion)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
0	0	0	0.8621	1	8	18

Electronic

Note that the result of 500-600 was changed to 12

> summary(Survey9a$Q1cElectronic)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
0.5	1.5	2	3.464	3	20	5

	Number of zeros/blanks	
Paper-based	26	55%
Telephone	34	72%
Electronic	5	11%

Analysis of Variance Table

Response: combVariable

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	Signif
Individ	44	660.19	15.0043	3.3586	1.37E-05	***
Question	2	53.12	26.5612	5.9455	0.004596	**
Residuals	55	245.71	4.4675			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Q2aInternal	Total	%
0	18	38%
2	1	2%
10	4	9%
20	3	7%
25	2	4%
50	4	9%
100	14	30%
Grand Total	46	

Table 60. Quantitative analysis of Reasons for signing up to use SurveyMonkey.

Analysis of Variance Table
Response: sqrt(combVariable)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	Signif
Individ	46	48.751	1.05981	4.7222	< 2.2e-16	***
Question	6	6.125	1.0208	4.5484	0.000204	***
Residuals	273	61.269	0.22443			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

	combVariable	std.err	replication	LCL	UCL
Creator	5.106383	0.3550013	47	4.407495	5.805271
Decipher	6.255319	0.2244699	47	5.813407	6.697231
Easy	5.913043	0.3090051	46	5.304708	6.521379
Envir	4.574468	0.3477756	47	3.889805	5.259131
Money	5.382979	0.3380758	47	4.717412	6.048546
Quick	6.066667	0.2954196	45	5.485077	6.648257
Resp	5.468085	0.3479171	47	4.783144	6.153027

alpha: 0.05 ; Df Error: 273
Critical Value of t: 1.968692

Least Significant Difference 0.193298
Harmonic Mean of Cell Sizes 46.55979
Means with the same letter are not significantly different.

Group	Treatment	Mean
a	Decipher	6.255319
ab	Quick	6.066667
b	Easy	5.913043
c	Resp	5.468085
c	Money	5.382979
d	Creator	5.106383
e	Envir	4.574468

Table 61. Quantitative analysis of Extent eSurveys helped.

Analysis of Variance Table
Response: sqrt(combVariable)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	Signif
Individ	40	9.6715	0.241788	3.6233	2.56E-09	***
Question	5	1.1115	0.222302	3.3313	0.006743	**
Residuals	172	11.4777	0.066731			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

	combVariable	std.err	replication	LCL	UCL
Decisions	5.684211	0.1999476	38	5.289544	6.078878
Efficient	6.275000	0.1518581	40	5.975254	6.574746
EventFeedback	5.500000	0.3436462	34	4.821693	6.178307
Innovative	5.833333	0.2011870	36	5.436220	6.230447
OtherFeedback	6.242424	0.1847926	33	5.877671	6.607177
Responsive	5.972973	0.1917459	37	5.594495	6.351451

Groups	Treatments	Means
a	Efficient	6.275
a	OtherFeedback	6.242424
b	Responsive	5.972973

c	Innovative	5.833333
d	Decisions	5.684211
e	EventFeedback	5.5

Count of responses to Extent eSurveys helped

Score	Be more efficient (saving time and effort)	Gather feedback after an event	Seek feedback from your clients (not related to an event)	Make better informed decisions	Be more responsive to your client needs	Be more innovative
NA	3	9	10	5	6	4
1	0	4	0	0	0	0
2	0	0	1	1	1	1
3	1	2	0	1	0	1
4	0	0	0	4	2	2
5	5	4	3	8	9	7
6	12	8	10	11	8	13
7	19	13	17	11	15	11
Total	40	40	41	41	41	39
>=4	36	25	30	34	34	33
%	90%	63%	73%	83%	83%	85%

Table 62. Quantitative analysis of Reasons for not yet using SurveyMonkey.

Analysis of Variance Table

Response: sqrt(combVariable)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	Signif
Individ	23	23.062	1.00269	7.0879	1.28E-13	***
Question	8	4.0386	0.50483	3.5685	0.000945	***
Residuals	122	17.2589	0.14147			

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

	combVariable	std.err	replication	LCL	UCL
Assistance	2.375000	0.2811242	24	1.8184866	2.931513
Colleagues	2.250000	0.9464847	4	0.3763390	4.123661
FaceToFace	2.666667	0.3791040	24	1.9161925	3.417141
NoInternet	3.500000	0.4701218	24	2.5693470	4.430653
NotDone	2.750000	1.1814539	4	0.4111940	5.088806
Printed	3.000000	0.4126619	24	2.1830945	3.816905
PrintQual	1.826087	0.2641428	23	1.3031898	2.348984
Role	1.500000	0.2886751	4	0.9285387	2.071461
Software	1.913043	0.2875070	23	1.3438947	2.482192

Groups	Treatments	Means
a	NoInternet	3.5
b	Printed	3
b	NotDone	2.75
bc	FaceToFace	2.666667
cd	Assistance	2.375
de	Colleagues	2.25
ef	Software	1.913043
fg	PrintQual	1.826087
g	Role	1.5

Table 63. Quantitative analysis of Business group.

Q12BusinessGroup	Count	%
Office of the Chief Operating Officer	2	4%
Finance and ICT	3	6%
Strategic Relations and Communications	4	9%
Science, Agriculture, Food and Regional Services	28	60%
Employment and Economic Development	10	21%
Grand Total	47	

	BusinessGrp
Q1aPaperBased	0.4369041
Q1bTelephone	0.872587
Q1cElectronic	0.05002217
Q2aInternal	6.65941E-05
Q2bExternal	6.65941E-05
Q4aCreatorTime	0.04818284
Q4bRespondentTime	0.6047813
Q4cMoney	0.5112962
Q4dEnvironment	0.9669361
Q4eEasyRespondents	0.9127659
Q4fDecipherHandWritten	0.4295692
Q4gQuickAnal	0.7854867
Q6aCreate	0.704962
Q6bCollect	0.6149595
Q6cAnalyse	0.6391967
Q7aEasy	0.786334
Q7bQuestionTypes	0.3110578
Q7cOnlineSupport	0.541982
Q8PurchaseLicence	0.2337714
Q9aEfficient	0.9072147
Q9bEventFeedback	0.3020114
Q9cClientFeedback	0.6990516
Q9dDecisions	0.4457933
Q9eResponsiveClients	0.32564
Q9fInnovative	0.5426171
Q11aNoInternet	0.2954366
Q11bPreferPrinted	0.07350237
Q11cSoftwareTooHard	0.4496172
Q11dPrintedBetter	0.1092647
Q11eNeedFaceToFace	0.6329552
Q11fNeedAssistance	0.2741234
Q11gNotAroundToIt	0.1448139
Q1aOutlierRemoved	0.2929809

Analysis of Variance Table
Response: Q2aInternal

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Q12BusinessGroup	4	37983	9495.7	8.0869	6.659e-05	***
Residuals	41	48143	1174.2			

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

LSD t Test for Survey9a$Q2aInternal
Mean Square Error: 1174.213

Survey9a$Q12BusinessGroup, means and individual (95 %) CI

	Q2aInternal	std.err	replication	LCL	UCL
Office of the Chief Operating Officer	100	0	2	100	100
Strategic Relations and Communications	75	25	4	24.51148	125.4885
Employment and Economic Development	2	1.333333	10	-0.69272	4.692721
Finance and ICT	100	0	3	100	100
Science, Agric, Food and Regional Services	34.51852	7.593927	27	19.18227	49.85476

alpha: 0.05 ; Df Error: 41
Critical Value of t: 2.019541
Least Significant Difference 48.35061
Harmonic Mean of Cell Sizes 4.097117
Means with the same letter are not significantly different.

Groups, Treatments and means

Office of the Chief Operating Officer	100	a
Finance and ICT	100	a
Strategic Relations and Communications	75	ab
Science, Agriculture, Food and Regional Services	34.51852	bc
Employment and Economic Development	2	c

Analysis of Variance Table
Response: Q4aCreatorTime

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Q12BusinessGroup	4	54.437	13.6093	2.6216	0.04818 *
Residuals	42	218.031	5.1912		

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

LSD t Test for Survey9a$Q4aCreatorTime
Mean Square Error: 5.191213
Survey9a$Q12BusinessGroup, means and individual (95 %) CI

	CreatorTime	std.err	replication	LCL	UCL
Office of the Chief Operating Officer	6.5	0.5	2	5.490959	7.509041
Strategic Relations and Communications	5.5	1.190238	4	3.098002	7.901998
Employment and Economic Development	3.1	0.87496	10	1.334259	4.865741
Finance and ICT	6.333333	0.333333	3	5.660639	7.006027
Science, Agriculture, Food and Regional Services	5.535714	0.416213	28	4.695763	6.375666

alpha: 0.05 ; Df Error: 42
Critical Value of t: 2.018082
Least Significant Difference 3.210802
Harmonic Mean of Cell Sizes 4.101562
Means with the same letter are not significantly different.

Groups, Treatments and means

Office of the Chief Operating Officer	6.5	a
Finance and ICT	6.333333	a
Science, Agriculture, Food and Regional Services	5.535714	ab
Strategic Relations and Communications	5.5	ab
Employment and Economic Development	3.1	b

Table 64. Quantitative analysis of Gender.

Q15Gender	Total	%
Male	22	48.9%
Female	23	51.1%
Grand Total	45	

> AovFprobs

	Gender
Q1aPaperBased	0.50421841
Q1bTelephone	0.937109
Q1cElectronic	0.20504992
Q2aInternal	0.66193471
Q2bExternal	0.66193471
Q4aCreatorTime	0.59965657
Q4bRespondentTime	0.17390461
Q4cMoney	0.02337882
Q4dEnvironment	0.04911799
Q4eEasyRespondents	0.09189953
Q4fDecipherHandWritten	0.17934887
Q4gQuickAnal	0.77966475
Q6aCreate	0.99154082
Q6bCollect	0.92706173
Q6cAnalyse	0.38578337
Q7aEasy	0.83763368
Q7bQuestionTypes	0.94982364
Q7cOnlineSupport	0.76914765
Q8PurchaseLicence	0.62965155
Q9aEfficient	0.92090558
Q9bEventFeedback	0.76359434
Q9cClientFeedback	0.87598529
Q9dDecisions	0.72970601
Q9eResponsiveClients	0.84790965
Q9fInnovative	0.24398968
Q11aNoInternet	0.78020597
Q11bPreferPrinted	0.97970995
Q11cSoftwareTooHard	0.90267424
Q11dPrintedBetter	0.24577007
Q11eNeedFaceToFace	0.81654039
Q11fNeedAssistance	0.60200828
Q11gNotAroundToIt	0.0830507
Q1aOutlierRemoved	0.75956687

Table 65. Quantitative analysis of Age.

	20 to 29	30 to 39	40 to 49	50 to 59	60 or older	Total
Observed	4	8	9	4	2	27
Expected	5.4	5.4	5.4	5.4	5.4	27

Chi-square value =	6.518519		
Chi-square prob =	0.163627	not significant	

midpoint	24.5	34.5	44.5	54.5	64.5
multiply by n	98	276	400.5	218	129
Average midpoints	41.53703704				

> AovFprobs

	Age
Q1aPaperBased	2.04E-01
Q1bTelephone	9.57E-01
Q1cElectronic	6.82E-01
Q2aInternal	3.39E-01
Q2bExternal	3.39E-01
Q4aCreatorTime	8.12E-01
Q4bRespondentTime	7.33E-01
Q4cMoney	3.50E-01
Q4dEnvironment	1.41E-02
Q4eEasyRespondents	6.58E-01
Q4fDecipherHandWritten	6.11E-01
Q4gQuickAnal	4.58E-01
Q6aCreate	6.41E-01
Q6bCollect	1.78E-01
Q6cAnalyse	3.97E-01
Q7aEasy	8.37E-01
Q7bQuestionTypes	7.90E-01
Q7cOnlineSupport	2.47E-01
Q8PurchaseLicence	1.84E-01
Q9aEfficient	3.55E-01
Q9bEventFeedback	1.43E-01
Q9cClientFeedback	6.08E-01
Q9dDecisions	5.94E-01
Q9eResponsiveClients	2.24E-01
Q9fInnovative	7.69E-02
Q11aNoInternet	NaN
Q11bPreferPrinted	8.16E-01
Q11cSoftwareTooHard	8.16E-01
Q11dPrintedBetter	8.16E-01
Q11eNeedFaceToFace	8.16E-01
Q11fNeedAssistance	8.16E-01
Q11gNotAroundToIt	5.18E-01
Q11hSomeoneElse	6.47E-01
Q11iNoNeed	1.74E-16
Q13pcExtension	2.92E-01

Q1aOutlierRemoved 3.10E-01

Q14Age	Average of Q4dEnvironment	Count of Q4dEnvironment	
50 to 59	3	4	a
20 to 29	4	4	ab
60+	4	2	abc
40 to 49	5.777778	9	bc
30 to 39	6.5	8	c

Analysis of Variance Table
Response: Q4dEnvironment

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Q14Age	4	44.519	11.13	3.9777	0.01412	*
Residuals	22	61.556	2.798			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Difference in means

Group			50 to 59	20 to 29	60+	40 to 49	30 to 39
	mean		3	4	4	5.777778	6.5
		n	4	4	2	9	8
50 to 59	3	4	0	-1	-1	-2.77778	-3.5
20 to 29	4	4	1	0	0	-1.77778	-2.5
60+	4	2	1	0	0	-1.77778	-2.5
40 to 49	5.777778	9	2.777778	1.777778	1.777778	0	-0.72222
30 to 39	6.5	8	3.5	2.5	2.5	0.722222	0

t-probs

Group	50 to 59	20 to 29	60+	40 to 49	30 to 39
50 to 59	1				
20 to 29	0.406958	1			
60+	0.497217	1	1		
40 to 49	0.011336	0.090823	0.187747	1	
30 to 39	0.00247	0.023174	0.071936	0.38385	1

Appendix 3c. Impact of eSurveys – Qualitative data

Table 66. Qualitative analysis of Comments on changes to number or types of surveys.

Category	Comments on changes to number or types of surveys
Changed from paper to eSurveys (2)	Changed from paper-based to electronic when started using eSurveys
	Electronic surveys have made it a lot easier to canvas people's views as paper ones in the past seem to get lost and are not as convenient.
Electronic surveys (6)	I use electronic surveys exclusively as they are easy to use, allows interim data analysis prior to closing date, final analysis and reporting that is incredibly fast.
	Use of electronic surveys has made it more convenient to conduct surveys and obtain feedback from customers
	Used to do surveys via mail or phone but since the intro of SurveyMonkey they are all electronic. Except if SurveyMonkey cannot easily display the questions/answer options I want to use.
	Using SurveyMonkey a lot more to collate data from hard copy surveys and using it a lot more to do electronic surveys
	We've used SurveyMonkey and few times and assisted others to use it. The monkey makes surveys much easier to do and analyse
	Yes. I now complete more eSurveys because of the value of the 'auto-analysis' of results.
Paper-based surveys (1)	We currently use a paper- based survey and the number over the past year has dropped dramatically. I am unsure why. We also give out say 8000 paper-based surveys each year and only get a couple hundred back.
Event dependent (2)	The number of surveys created and sent out is dependent on the number of events/ seminars run throughout the year.
	The type of survey that we conduct depends on the outcomes of the project and the target demographic. For example, some might be intercept surveys at supermarkets, some might be online surveys in Japan using a research provider data base. Other are as an add on to taste testing that we do on a regular basis.
Increasing number (4)	Have had to do some surveys for a new project and will be required to do more for another new project... so seemingly increasing in number.
	Increasing now with SurveyMonkey and the ease of delivering surveys.
	The number of surveys has increased with the use of SurveyMonkey. This is primarily due to the fact that with SurveyMonkey we get people responding, whereas with paper surveys or phone the response rate was very poor.
	Tend to use more eSurveys now, as technology such as SurveyMonkey becomes available.
Feedback tool (2)	Yes - more requirements to provide documented feedback on effectiveness of policy initiatives undertaken - more requirement for input from stakeholders in policy direction - electronic survey is often best way to reach busy and who are very familiar with current internet & web communication tools.
	Generally surveys are in relation to workshop feedback and not a generalised survey about a particular topic.
Questionnaire (1)	Trying to reduce the need for comments.
Miscellaneous (2)	I have only set one up, however, we haven't used it yet.
	We only did a one off survey of about 35 mostly external parties.
No change (10)	No (x8)

	No, I still use surveys as a way of evaluating workshops, events, trials etc.
	No the number and types of surveys haven't changed, although my job has changed. I've been using SurveyMonkey for about 3 to 4 surveys a year, focusing on staff and internal customer feedback to inform further activities.

Table 67. Qualitative analysis of Comments on the reasons for signing up to use SurveyMonkey.

Category	Comments on reasons for signing up to use SurveyMonkey
Convenient (5)	Has been really great and essential tool to have.
	I couldn't justify the time spent doing a paper-based survey compared to electronic surveys. I find the 'reminder' option invaluable as both a survey creator and a survey respondent.
	Survey is easy to set up.
	The analysis is very valuable.
	Very professional looking and flexible tool.
Limitation of SurveyMonkey (2)	As with most electronic devices, the options in SurveyMonkey are sometimes restrictive in how questions can be presented and also when formatting the survey for printing (e.g. font sizes and line spacing).
	I did find SurveyMonkey limiting in the formatting of the questions.
Documentation (1)	It is essential we do an After Action Review of DAFF participants, so eSurveys are a principal tool for securing feedback which may be called upon by the State Ombudsman, Auditor General or in civil litigation matters.

Table 68. Comments on how well SurveyMonkey has helped.

Category	Comments on how well SurveyMonkey has helped
Creating (1)	Some question formats it cannot cope with e.g. hierarchical questions where the answer to question 1 influences the answer to Q2 etc
Analysis (4)	Getting results into Word format is tedious.
	It's not that intuitive, and I'm not sure how good it is with graphics - i.e. does loading graphics from the respondent side take too long and therefore we lose them? This is something that I will be exploring at some point in the next 12 months.
	Sometimes the report doesn't come out in the way I was envisioning but that's more to do with survey design and my need to build further skills in that area.
	The analysis of results could be easier.
Convenient (1)	No deficiencies. Excellent product for my purpose.
Miscellaneous (3)	Had difficulty the first time I used it because I was not part of the DPI&F system (i.e. I was using the free simplified version). Second (and only other) time I've conducted a SurveyMonkey survey, I was as a fully-fledged user and things were much easier.
	Haven't sent it out yet
	Survey hasn't been released yet.

Table 69. Qualitative analysis of Brief stories on how eSurveys have helped.

Category	Brief stories on how eSurveys have helped
Convenient (4)	I find it useful that SurveyMonkey creates pretty graphs from data results.
	Particularly useful at collating data as responses are collected. It is a real time saver

	as the data entry is completed as you go.
	Having a survey that someone can complete relatively quickly from either their office or their vessel without the need to complete and then post back to us, has helped survey fishers of the unloading facilities. Making it easy to complete and not having to decipher hand writing has saved a lot of time.
	First time I used SurveyMonkey was to gather feedback following the Agronomy/Physiology discipline workshop within HFS. Always intended to gather feedback however suspect it would not have happened due to time limits, work pressures and expected poor response rate if a paper survey was my only option. Found SurveyMonkey easy to use for the first time, obtained a few tips from a colleague who had used SM, quick and generated a surprisingly high response rate. Cannot envisage using a paper survey again, even with clients with a low computer skills/ comfort level.
Feedback from an event (9)	eSurveys were used pre- and post- our webinar series when these were first introduced as part of professional development for staff. This was very effective in determining what staff wanted to hear more / less of and how effective the use of webinars were (very).
	With webinars you can have the survey already developed and insert the link into the webinar program so that at the completion of the webinar, when participants go to leave the survey pops straight up and they can complete it then and there. This improves completion rates compared to emailing a survey at a later date after the event.
	Easy and quick way to collect and analyse feedback from information sessions
	I believe the feedback on our training is more valuable a day or two after the event when producers have had time to think about the information in the context of their own business and what they can do at home.
	It has allowed multiple responses with valuable feedback on processes where would not have previously received feedback
	Our clients are all internal to DAFF. We use eSurveys to get internal feedback and it can be done so simply through SurveyMonkey that we have developed our KPIs around the survey results. We are now able to measure improvements (or otherwise) on a monthly basis and identify areas we could do better.
	Provided a critical assessment tool in assessing the impact of extension on practice change and bench marking
	Results may be called upon by the State Ombudsman, Auditor General or in civil litigation matters. it is essential we do an After Action Review of DAFF participants principal tool for securing feedback
	Within a couple of days of conducting a workshop, I was able to get the survey out to participants and have responses back and analysed within a week. This was much quicker than anything I'd previously experienced, not to mention how easy and convenient the how process was.
Gather information (7)	Recently used it to get rapid feedback from 200 members of a professional organisation with respect to a proposed policy change within the organisation - gave all members an opportunity to have a say, which may not have been possible otherwise.
	It has allowed us to measure the true success of our programs. We have been able to see that 20% of the companies we work with have won over $10M worth of work in the last 6 months, saving these companies from closing. It has also allowed us to identify the areas that clients need help with and develop targeted resources that will increase the 20% to 50%+.
	I was able to send a survey to producers to see what topics they would like covered in a webinar... allowed me to do this easily and they could complete it in their own time
	I am looking forward to using SurveyMonkey because we have a few ideas on how we can use it to gather information but we are just waiting on Managers approval and decision on which way to go.

	I used eSurveys to gather information about staff usage of the intranet, as well as for a staff cultural survey. SurveyMonkey was a great tool which provided much more functionality and was easier to use than the alternative (SharePoint 2007). Having a dedicated eSurvey tool available to me was invaluable. I can't imagine how much work it would've been to create, distribute and analyse the information otherwise.
	Used extensively for Boggo Road and Coopers Plains project to regularly survey the hundreds of people involved in the change process. SurveyMonkey allowed data to be easily compared year to year to track progress.
	We surveyed 400 producers and got a response telling us what they thought were the major issues in the industry and what we needed to concentrate on, it was done by an electronic survey, if we didn't have this program this job would not have been possible.
Saves resources (1)	We worked with seafood industry to gather information on port infrastructure - a traditional paper-based survey that they were considering would have been costly and time consuming.
Training (2)	Allowed me to tailor training to client's needs.
	Collecting pre-workshop information from Central Region staff at each centre on where they were with the DAFF changes enabled us to prepare material relevant to those particular staff... It assisted us greatly with engagement by participants in each workshop.
Miscellaneous (2)	Helped me learn how to use SurveyMonkey to do a survey. Plan to use SurveyMonkey in near future.
	Pretty much standard now.

Table 70. Qualitative analysis of Comments regarding the reasons why not using SurveyMonkey.

Category	Comments regarding the reasons why not using SurveyMonkey
Paper-based (4)	For a face-to-face event option 2 above [prefer to hand out printed survey at end of event] may be more applicable so you get the info then and there rather than having to send something out after the event and then waiting for participants to return it. However you then have to enter and collate all the data manually.
	Target audience may use the internet but prefer to have a hardcopy survey or hardcopy version of a publication that is accompanied by a survey. May not have email address of target audience so can't send link to eSurvey. Sending link on posted letter is not practical
	Still intend to try this. I do find it useful to create an on the spot incentive for feedback forms to be completed at the end of an actual industry event.
	Printed surveys definitely do not give better results. If I hadn't had access to SurveyMonkey I would never have done any surveys (due to lack of time) and the whole process would have suffered.
Still intending to use SurveyMonkey (3)	I have been too busy to get back to the reason for wanting to do the survey - the reason is still current - matter of workload.
	Just signed up as a user and am researching different styles to use for Cyclone YASI Clean Up Survey.
	Survey is incomplete due to other priorities.

Appendix 4a. YouTube video training workshop – Questionnaire

Thanks for attending our YouTube video training workshop. Your answers to the following questions will help us to improve it for future participants, so your honest feedback is appreciated.

1. Regarding video preproduction (planning, storyboards, interviewing, etc), what was your level of... (rating scale 1. Very low to 7. Very high)

- knowledge BEFORE the workshop
- knowledge AFTER the workshop
- skills BEFORE the workshop
- skills AFTER the workshop
- confidence BEFORE the workshop
- confidence AFTER the workshop

Further comments?

2. Regarding video production (shot types, rule of thirds, shot list, filming, directing, etc), what was your level of... (rating scale 1. Very low to 7. Very high)

- knowledge BEFORE the workshop
- knowledge AFTER the workshop
- skills BEFORE the workshop
- skills AFTER the workshop
- confidence BEFORE the workshop
- confidence AFTER the workshop

Further comments?

3. Regarding video postproduction (editing, transitions, titles, music, captions, uploading, etc), what was your level of... (rating scale 1. Very low to 7. Very high)

- knowledge BEFORE the workshop
- knowledge AFTER the workshop
- skills BEFORE the workshop
- skills AFTER the workshop
- confidence BEFORE the workshop
- confidence AFTER the workshop

Further comments?

4. What elements of the workshop content need expanding or more time spent on them?

5. What elements of the workshop content could be cut back, or perhaps be left out?

6. Regarding the workshop delivery, what did you like that we should keep doing?

7. Regarding the workshop delivery, what elements did you like least... and tell us how you'd suggest we do them differently?

8. How would you rate the... (rating scale 1. Very low to 7. Very high)

- workshop venue

- workshop catering
- overall content of the workshop
- overall delivery of the workshop
- overall effectiveness of the workshop

Further comments?

9. If you stayed at one of these motels, how would you rate your overall experience? (Rating scale 1. Very low to 7. Very high)

- Best Western Tuscany on Tor Motor Inn
- Country Gardens Motor Inn
- Bridge Street Motor Inn

Further comments?

10. How many videos do you think you will create in the next 12 months?

11. What are the factors that are encouraging you to create/ use videos?

12. What are the factors that are discouraging you from creating/ using videos?

13. What else do you need to maximise your creation/ use of videos?

14. If the eExtension project hadn't covered your registration costs, how much would you have willingly paid (to cover the tuition, training materials, venue hire and daily catering)?

15. Which of the following workshops did you attend?

- 10, 11 May 2011
- 17, 18 May 2011
- 24, 25 May 2011
- 31 May, 1 June 2011

16. Pop on your creative thinking hat and suggest a sexy name for the online community we are looking at creating. A ‘small prize’ for the best answer!

17. What ‘small prize’ would you like to receive if you win?

- Logitech ClearChat headphones and microphone
- YouTube Tshirt and matching coffee mug
- $50 iTunes card
- The Socialnomics book (that the introductory video was based upon)
- A large tin of Nescafe coffee, personally signed by Jake
- Switch: How to change things when change is hard
- The chance to whack Greg over the head with a tea spoon
- Other (please specify)...

18. So that we can follow up with you if required, please tell us your name

19. Any further comments...

Thank you for taking the time to complete this survey.

Appendix 4b. YouTube video training workshop – Qualitative data

Table 71. Qualitative analysis of Factors encouraging respondents to make videos.

Categories	Factors encouraging respondents to make videos
Confidence (6)	It is not that hard once you have the training, will probably work on a few home videos as practise!
	Improved confidence in my abilities to create professional videos. Good access to equipment and support from you guys and the other participants.
	I now have so much more confidence in being able to create a video and videos will enhance our message to clients.
	The fact that really anyone can do it.
	The knowledge gained from this program has vastly increased my confidence and ability to create suitable videos for the workplace. I am also confident of being able to initially garner support from decision makers in using this medium.
	The workshop is a big factor because I now feel much more confidant in the production of videos. I created a video using Camtasia and used this video for my presentation instead of PowerPoint at the Mango Conference in Darwin last week. The feedback I got was fantastic including one project collaborator saying it was the best presentation he had seen me do. I now have 4 videos production planned to produce for the next 2 months including 'How I like my coffee'.
Alternative to written material (7)	I enjoyed the course, I see a lot of opportunities for DAFF across departments to attract industry, clients and open new markets for Queensland. We have lots of stories to tell and a video is so much better than a website testimonial to read.
	Another way to communicate information that some in the audience may understand/ comprehend better via a visual medium rather than written description.
	They are a great alternative to written case studies and have the potential to be seen by a wider audience.
	I believe that video is a good way of getting messages across to an audience and that it is more engaging and therefore effective than printed fact sheets. In saying that I believe it should be used in conjunction with other extension tools as a package of information.
	More people prefer to watch videos than read through information on a website. YouTube is the second most popular search engine. Google ranks YouTube videos highly so it helps with SEO.
	Using alternative methods and ways to target our audience/s. Ability to reach different audience. Sending out the message/s in small bits rather than paper-based case studies/sheets which are either thrown in a pile or not read.
	Keen to improve delivery of key messages to business clients online compared with existing static web pages. Availability of social media within DAFF
Use of video media (14)	The boom in social media and the fact that a picture tells a thousand words. Need for success stories of businesses (accessible from DAFF website - preferably home page) to inspire others and help them innovate. Gen Y National Broadband Network - as speeds and technology capability increases - we're more able to use this medium to interact with our customers.
	I like the creative side of video production and think it can present our work in a more relaxed and 'digestible' manner.
	Extension direction - web based and reach more people more efficiently.
	Probably more effective in demonstrating, in my case, weed awareness and management information than traditional extension materials and methods i.e. photos and written info on fact sheets and web sites. The use of video may help me

	get my message to more pest management forums, without necessarily travelling and personally presenting at all of them.
	(a) An understanding that we need to use more visual media in communicating with farmers; (b) the perceived success of the Shed Meeting site; (c) some excitement about a new direction in information delivery.
	Can do once and use many times/ target many people. Could really highlight some of the hard work our weed warriors do. Fits nicely as a different media to target different adult learning styles. Flexible delivery - can be viewed when the target audience wants to view it (provided they are keen enough to watch it alone!!). Could complement a face-to-face delivery (using PowerPoint) i.e. bring the field work into the training room.
	Reasonable suggestion that they may be watched by people other than my mother.
	The ongoing need to get messages across to the masses in a succinct and meaningful way - 'a picture tells a thousand words' - to generate a greater uptake of practice change
	Reaching out into the social medium
	Effective means of communicating with target
	They are an interesting source of media and like they say a picture says a thousand words.
	I think they will be very appealing to a target audience (school kids). It is a form of communication which engages multiple senses.
	New exciting medium which will all us to reach new customers
	Better connection and ability to convey/ tell the story, innovation and contemporary approaches.
Training tool (4)	Extension focus. Effective way of providing messages and training to clients.
	Visual learning medium. Don't have the resources to meet with every grower one-on-one and large field walks don't allow quieter growers opportunity to ask specific questions. Also gives the opportunity for growers to passively receive information at any hour of day.
	Client service and training
	Will add a new dimension to our online training.
Meeting milestones/ client demand (4)	Twofold for myself and Lynton. First, we have money from an ACIAR project to record the Australian component of the project in line with what the southeast Asian team members have done. Second, the papaya Agrilink is a little out-dated and we have a desire to create a 'how to' of papaya for new growers and old growers who keep forgetting the answers to the questions they ask. I also see it as an opportunity to engage growers to the extent that they can keep an eye out for future videos and as younger generations of farmers take over they will naturally expect a more tech savvy department.
	Industry requests, costs and (potential) reach (yet to be determined)
	We are funded to produce videos - but primarily the real factor is the encouragement we have had from growers and consultants wanting to access information via video.
	Enthusiasm expressed by clients, support from industry, effectiveness of the medium for extension and milestone deadlines!
Other (1)	Need to explain that, I was there really to know about the possibilities for organisational development. I can see how well this would work and feel far better equipped to include these tools by briefing specialists.

Table 72. Qualitative analysis of Factors discouraging participants to create/ use videos.

Categories	Factors discouraging participants to create/ use videos
Time (17)	Time. The effort for post-production and gaining support from management will need consideration. In other words, I would have to carefully select the project to video.
	Time spent in production and pre-production. However this is comparable to producing a fact-sheet or page for a website.
	Time limited.
	The time that it takes to complete a video, especially if I have to create the video on my own. Hopefully with more practice I can speed up the process.
	Lack of resources and time
	Busy with work.
	Time availability - other program priorities
	Time.
	Time - never enough
	Failure to put together a fantastic product... time...
	Time needed to get through the whole process of seeking approval to planning and making the entire video.
	The main factor discouraging the creation of video is the time involved in doing so - however, if the benefit is there it will be time well spent.
	The amount of time required to produce a quality finished product.
	Time (if doing myself) and money (if paying someone else to do it) to create them.
	No factors but amount of time required is a bit daunting.
	Time and resources taken to create them. Also concerned that audience (i.e. farmers) may not access them due to low computer ability and/or poor internet service.
	Substantial time investment (editing etc), some corporate constraints (hardware, software, storage etc).
Confidence (5)	Confidence (that it will be good enough for the DAFF You Tube Channel), time, resources (other people to help on the shoot).
	Possibility of spending a lot of time and still ending up with junk.
	I would say nothing is really discouraging me, except for an appreciation, like anything new, that it requires patience, skill and time, all of which are in somewhat short supply as far as I am concerned!!
	Was my lack of understanding of how to create and edit videos. Now that I have done the training I feel ready to give it a go, but obviously will need to practice. I still need to identify where I could put the videos once created (DAFF website, create new website, Industry website) but will do this as part of my communication planning.
	Nothing discouraging but am experiencing some issues in deciding exactly how to tell the 'papaya' story i.e. interviews, voiceovers etc and the combinations of these things.
Access to equipment/ resources (5)	Not having our own equipment and having to borrow them. In my case, the camera seems to have been treated badly and the components exposed to salt water making them oxidise.
	Lack of access to equipment and appropriate software. Acceptance of the use of

	this media by decision makers and their perception that YouTube is for kids
	At present am a solo operator - no director or cameraman.
	Lack of easy access to a suitable camera and tripod.
	Access to equipment and prior to the course, skills (pre, prod, post).
Departmental constraints (3)	Departmental procedure and approvals sound challenging so external options will probably be pursued
	Approvals and red tape still a barrier within DAFF and lack of awareness about who to contact. In my case I can liaise directly with key people but others in the department would not be aware that permissions are available and what process to follow. Budgets are tight and the department has not fully embraced or is encouraging use of social media for creative solutions.
	Potentially the DAFF approval process - wait and see. I can see now how time consuming it will be to produce a high quality clip - this is not discouraging, just something I will have to manage and plan - I believe the benefits will be worth the effort and possibly save time in future.
Opportunity (4)	Not my core role to actually produce them, more to identify opportunities where videos are the right training tool.
	Content!
	I require a more defined audience, and then a specialised delivery mechanism (i.e. YouTube - national/ international... face-to-face as part of power point presentation... local for identification purposes… or use at field days...). As above I will need to tailor the message (and video) for program awareness, or weed and pest identification, or highlight the effort we put in, or highlight new or emerging technologies employed by the field unit. Time required to develop a video. Uncertainties regarding the video's end use/ destination. Uncertainties regarding the effectiveness of a video to elicit management change in the target audience (though obviously needs to be considered as a part of a coordinated engagement campaign).
	Not much. Only the availability of raw footage right at the moment.

Table 73. Qualitative analysis of Factors needed to maximise creation/use of videos.

Category	Factors needed to maximise creation/use of videos
Time (n=9)	Time
	Time
	Time
	Time.
	Addition of 12 above [Lack of resources and time]
	Time and application.
	Time to practice, topics of interest to our clients, access to equipment.
	There are no more hours in the week but the main need is for a skilled person to work with us in the post-production phase of the video production - hopefully we will be able to use [name removed] for this in the next 12 months.
	Get through slight backlog in other activities in order to have sufficient time
Equipment/ resources (n=13)	Our equipment - need a new camera.
	Our own equipment (maybe next budget LOL)
	Camera access for starters. I will have to look into the booking system for the camera based in FNQ.

	Equipment - possibly borrow video equipment from Rocky office (including tripod, lapel microphone & software for editing)
	Equipment and software. The course provides the skills.
	Access to equipment is handy and some back up on editing software expertise.
	Access to equipment and support from the decision makers. The creation of a user group to share ideas and resources.
	In a perfect world: own camera, improved software, managerial support, corp comms/ web services support, targets (similar to the web training - we need to get this many videos on-line covering these subjects - and we are happy for those who have done the training to go make them).
	Software and time to practice using it. I will also need to purchase a few extras as I go along such as tripod, mike etc.
	With the resources available, I should be able to create videos, however I might purchase better editing software.
	Software and a decent PC (but that's not your problem)
	Possibly a better program than Videopad
	Suitable hardware and more spare time!
Practice/ support (12)	Practice and time. This is a learning and a centralised support helpline/ email address would be good, just thinking long term. (John, in the meantime I will contact you :).
	Practice!
	Practice and more practice! Understanding by my managers that videos are a useful extension medium but to get the best results creators need to have sufficient (realistic) time and resources allocated.
	More practice and software
	I think some support regarding the technical aspects of shooting footage would boast my confidence that there would be a product at the end.
	Probably a workshop or alternative where we could work on our own material using our software would be beneficial in meeting our needs.
	More patience, more skills and more time!!! Plus some inspiration from my colleagues Shane and Paul. Plus some ongoing support and encouragement from the YouTube users group, as we can all learn together.
	Encouragement and enthusiasm from others doing the same thing.
	Inspiration. It would be great to get an email with a really innovative YouTube video every week to keep me inspired & give me new ideas to create my own.
	Probably some indication from corporate communications that these will be supported through to delivery of the finished product. To bite the bullet and get it happening, and let the finer details flow after developing such a good product no one can say no to us using it...
	On-going support from user group and Greg Bath.
	Freedom of expression and trust in and from the Comms people.
Approval (2)	Permissions to do so within my work time.
	PRACTICE! and a better understanding of DAFF restrictions/approvals required for uploading videos and therefore where these would be best located.

Appendix 5a. What motivates you to adopt an innovation – Questionnaire

This survey seeks to determine the factors that motivate you to adopt an innovative technology. It will take about five to ten minutes to complete.

1. Select one of the technologies below that you have decided to use. You'll be focusing on that technology for the rest of this survey. If you have adopted more than one, just choose the one you feel most strongly about.

- eSurveys
- webinars
- YouTube style videos

2. To what degree have you used this technology (1=very rarely to 7=very often)? Further comments (if required)...

3. What did you use to achieve similar outcomes before you adopted the technology you selected above?

4. What were the factors that encouraged (or helped) you to adopt this technology?

5. What were the factors that discouraged (or hindered) you from adopting this technology?

What motivates you to adopt an innovation?
6. Thinking of when you decided to use [Q1]... please rate the following (where 1 is very low and 7 is very high).

To what degree is it better using this innovation compared to how it was done previously?
To what degree is the innovation compatible with the previous approach?
To what degree is this innovation simple to use?
To what degree can the innovation be experimented with while it is being adopted?
To what degree is the use of the innovation visible or noticeable to others?
Further comments (if required) ...

7. Let's now use a different set of questions... Again, thinking of when you decided to use [Q1]... please rate the following (1=very low to 7=very high).

To what degree is the innovation useful in your job?
To what degree does the innovation enable you to accomplish tasks more quickly?
To what degree does the innovation increase your productivity?
To what degree does using the innovation increase your chance of getting a promotion?
To what degree is the innovation clear and understandable to use?
To what degree is it easy to become skillful using the innovation?
To what degree do you find the innovation easy to use?
To what degree is learning to use the innovation easy for you?
To what degree do people who influence your behaviour think that you should be using the innovation?

To what degree do people who are important to you think that you should be using the innovation?
To what degree do senior management support your use of the innovation?
To what degree does the organisation support the use of the innovation?
To what degree do you have the resources necessary to use the innovation?
To what degree do you have the knowledge necessary to use the innovation?
To what degree is the innovation compatible with other systems you use?
To what degree is a specific person (or group) available for assistance with system difficulties?
Further comments (if required)...

Whew... thanks for wading through all of those questions! You are now half way through...

What motivates you to adopt an innovation?
8. Let's now use the third set of questions... Again, thinking of when you decided to use [Q1]... please rate the following (1=very low to 7=very high).

To what degree can you learn from the success of others using the innovation and clone it?
To what degree are the specific steps that you need to take to use the innovation clear to you?
To what degree are the outcomes that will be achieved by using the innovation clear to you?
To what degree are you emotionally engaged with wanting the innovation to succeed?
To what degree can you take small easily achievable steps towards succeeding with the innovation?
To what degree does successfully using the innovation bring you a sense of identity?
To what degree does your physical environment force you to use the new innovation instead of the old way?
To what degree is it easy to make using the innovation a habit?
To what degree is the innovation contagious for others to want to use it?
To what degree is it sustainable to use the innovation in the long-term?
Further comments (if required)...

Whew... thanks for wading through all of those questions! You are now just one click away from the last page of relatively simple questions.

OK, some of those may have seemed a bit strange! There is just one more set of questions, so hold onto your hat and click ‘Next’...

Final questions
9. And now for the fourth and final set of questions... For the last time (thank goodness!), thinking of when you decided to use [Q1]... please rate the following (1=very low to 7=very high).

To what degree is maximising cost efficiency a strong motivation for you?
To what degree is protecting the natural environment a strong motivation for you?
To what degree are you risk averse with your work activities?

To what degree do all of your work activities benefit from the innovation?
To what degree do your work activities have a long-term (greater than 10 years) outlook?
To what degree are your work activities under severe short-term financial constraints?
To what degree can the innovation be trialled on a limited basis before a decision is made to adopt it on a larger scale?
To what degree can the effects of the innovation be easily evaluated?
To what degree is the innovation observable to other potential users?
To what degree are consultants available to provide advice to you about the innovation?
To what degree do you participate in groups where the innovation could be discussed?
To what degree do you need to develop substantially new skills and knowledge to use the innovation?
To what degree are you aware of others using or trialling the innovation?
To what degree is the upfront cost of the investment small in size relative to the potential annual benefit?
To what degree is the adoption of the innovation able to be reversed?
To what degree is the use of the innovation likely to reduce your operating costs?
To what degree is the use of the innovation likely to have additional effects on the future success of your work activities?
To what degree would the effects on future success be quickly realised?
To what degree would the use of the innovation create environmental benefits?
To what degree would environmental benefits be quickly realised?
To what degree would the use of the innovation expose your work to risk?
To what degree would the use of the innovation make the management of your work easier and more convenient?
Further comments (if required)...

OK, you are almost there! We need to know some of your details to help us analyse the data and in case we need to follow up with you.

10. Your name (preferred name and surname).

11. Your email address.

12. Which category below includes your age?
younger than 20
20 to 29
30 to 39
40 to 49
50 to 59
60 or older

13. What is your gender?
Male
Female

14. Would you like a copy of the final report and a description of the four models?

Yes please
No thanks

15. Any final comments...

Thanks for taking the time to complete this survey. I really appreciate that you made it this far!

Please click ‘Done’ to submit your answers.

Appendix 5b. What motivates you to adopt an innovation – Modifications to questions

Some minor modifications to the wording of questions relating to the models for adoption/ behaviour change were undertaken by the researcher, so as to increase the relevance and comprehension. Each question was then assigned a shorthand name and categorised as to whether it primarily related to human or technology factors.

1. Diffusion of innovations by Rogers (1962, 1983, 1995, 2003)

Original question/ concept	Modified question	Shorthand name	Human/ technology
1.1 Relative advantage	To what degree is it better using this innovation compared to how it was done previously?	Better	T
1.2 Compatibility	To what degree is the innovation compatible with the previous approach?	Compatible	T
1.3 Simplicity	To what degree is this innovation simple to use?	Simple	T
1.4 Trialability	To what degree can the innovation be experimented with while it is being adopted?	Experiment	T
1.5 Observability	To what degree is the innovation visible or noticeable to others?	Noticeable	T

2. Unified theory of acceptance and use of technology (UTAUT) by Venkatesh et al. (2003)

Original question	Modified question	Shorthand name	Human/ technology
2.1 I would find the system useful in my job.	To what degree is the innovation useful in your job?	Useful	T
2.2 Using the system enables me to accomplish tasks more quickly.	To what degree does the innovation enable you to accomplish tasks more quickly?	Quick	T
2.3 Using the system increases my productivity.	To what degree does the innovation increase your productivity?	Productive	T
2.4 If I use the system, I will increase my chances of getting a raise.	To what degree does using the innovation increase your chance of getting a promotion?	Promotion	H
2.5 My interaction with the system would be clear and understandable	To what degree is the innovation clear and understandable to use?	Clear	T
2.6 It would be easy for me to become skillful at using the system.	To what degree is it easy to become skillful using the innovation?	Skilful	T
2.7 I would find the system easy to use.	To what degree do you find the innovation easy to use?	Easy to use	T
2.8 Learning to operate the system is easy for me.	To what degree is learning to use the innovation easy for you?	Learning easy	T

2.9 People who influence my behaviour think that I should use the system.	To what degree do people who influence your behaviour think that you should be using the innovation?	Influencers	H
2.10 People who are important to me think that I should use the system.	To what degree do people who are important to you think that you should be using the innovation?	Important people	H
2.11 The senior management of this business has been helpful in the use of the system.	To what degree do senior management support your use of the innovation?	Senior mangt	H
2.12 In general, the organization has supported the use of the system.	To what degree does the organisation support the use of the innovation?	Org support	H
2.13 I have the resources necessary to use the system.	To what degree do you have the resources necessary to use the innovation?	Resources	T
2.14 I have the knowledge necessary to use the system.	To what degree do you have the knowledge necessary to use the innovation?	Knowledge	H
2.15 The system is not compatible with other systems I use.	To what degree is the innovation compatible with other systems you use?	Compatible	T
2.16 A specific person (or group) is available for assistance with system difficulties.	To what degree is a specific person (or group) available for assistance with system difficulties?	Assistance	H

3. Switch: How to change things when change is hard by Chip and Dan Heath (2010)

Original question	**Modified question**	**Shorthand name**	**Human/ technology**
3.1 Find the bright spots	To what degree can you learn from the success of others using the innovation and clone it?	Success of others	H
3.2 Script the critical moves	To what degree are the specific steps that you need to take to use the innovation clear to you?	Clear steps	T
3.3 Point to the destination	To what degree are the outcomes that will be achieved by using the innovation clear to you?	Outcomes	T
3.4 Find the feeling	To what degree are you emotionally engaged with wanting the innovation to succeed?	Emotionally engaged	H
3.5 Shrink the change	To what degree can you take small easily achievable steps towards succeeding with the innovation?	Small steps	T
3.6 Grow the people	To what degree does successfully using the innovation bring you a sense of identity?	Sense of identity	H

3.7 Tweak the environment	To what degree does your physical environment force you to use the new innovation instead of the old way?	Physical envir	T
3.8 Build habits	To what degree is it easy to make using the innovation a habit?	Habit	H
3.9 Rally the herd	To what degree is the innovation contagious for others to want to use it?	Contagious	H
3.10 Keep the change going	To what degree is it sustainable to use the innovation in the long-term?	Sustainable	T

4. ADOPT (Adoption and diffusion outcome prediction tool) model by Kuehne et al. (2011)

Original question	Modified question	Shorthand name	Human/ technology
4.1 What proportion of the target population has maximising profit as a strong motivation?	To what degree is maximising cost efficiency a strong motivation for you?	Cost efficiency	H
4.2 What proportion of the target population has protecting the natural environment as a strong motivation?	To what degree is protecting the natural environment a strong motivation for you?	Natural envir	H
4.3 What proportion of the target population has risk minimisation as a strong motivation?	To what degree are you risk averse?	Risk averse	H
4.4 On what proportion of the target farms is there a major enterprise that could benefit from the innovation?	To what degree do all of your business activities benefit from the innovation?	Work benefit	T
4.5 What proportion of the target population has a long-term (greater than 10 years) management horizon for their farm?	To what degree do you have a long-term (greater than 10 years) outlook?	Long-term outlook	H
4.6 What proportion of the target population is under conditions of severe short-term financial constraints?	To what degree is your enterprise under severe short-term financial constraints?	Financial constraints	T
4.7 How easily can the innovation be trialled on a limited basis before a decision is made to adopt it on a larger scale?	To what degree can the innovation be trialled on a limited basis before a decision is made to adopt it on a larger scale?	Trialability	T
4.8 Does the complexity of the innovation allow the effects of its use to be easily evaluated?	To what degree can the effects of the innovation be easily evaluated?	Easily evaluated	T
4.9 To what extent would the innovation be observable to other	To what degree is the innovation observable to other potential users?	Observability	T

	farmers when it is used in a district?			
4.10	What proportion of the target population uses paid advisors capable of providing advice relevant to the innovation?	To what degree are consultants available to provide advice about the innovation?	Consultants	H
4.11	What proportion of the target population participate in farmer-based groups that discuss farming?	To what degree do you participate in groups where the innovation could be discussed?	Groups	H
4.12	What proportion of the target population will need to develop substantial new skills and knowledge to use the innovation?	To what degree do you need to develop substantially new skills and knowledge to use the innovation?	New skills	H
4.13	What proportion of the target population would be aware of the use or trialling of the innovation in their district?	To what degree are you aware of others using or trialling the innovation?	Aware of others	H
4.14	What is the size of the up-front cost of the investment relative to the potential annual benefit?	To what degree is the up-front cost of the investment small in size relative to the potential annual benefit?	Up-front costs	T
4.15	To what extent is the adoption of the innovation able to be reversed?	To what degree is the adoption of the innovation able to be reversed?	Reversibility	T
4.16	To what extent is the use of the innovation likely to affect the profitability of the farm business in the years that it is used?	To what degree is the use of the innovation likely to increase the profitability of your work?	Reduce operating costs	T
4.17	To what extent is the use of the innovation likely to have additional effects on the future profitability of the farm business?	To what degree is the use of the innovation likely to have additional effects on the future success of your work?	Additional effects	T
4.18	How long after the innovation is first adopted would it take for effects on future profitability to be realised?	To what degree would the effects on future success be quickly realised?	Success quickly realised	T
4.19	To what extent would the use of the innovation have environmental benefits or costs?	To what degree would the use of the innovation create environmental benefits?	Envir benefits	T
4.20	How long after the	To what degree would environmental	Quick envir	T

	innovation is first adopted would it take for the expected environmental benefits to be realised?	benefits be quickly realised?	benefits	
4.21	To what extent would the use of the innovation affect the exposure of the farm business to risk?	To what degree would the use of the innovation expose your work to risk?	Risk exposure	T
4.22	To what extent would the use of the innovation affect the ease and convenience of the management of the farm?	To what degree would the use of the innovation make the management of your work easier and more convenient?	Work easier	T

Appendix 5c. What motivates you to adopt an innovation – Quantitative data

Table 74. Quantitative analysis of participant demographics.

Expected distribution

	Female	Male
20 to 29	4.337349	5.662651
30 to 39	6.072289	7.927711
40 to 49	12.57831	16.42169
50 or older	13.01205	16.98795

Pair-wise comparisons

Comparison	Exp (1)	Exp (2)	Exp (3)	Exp (4)	Chi-square	Prob	Signif
20 to 29 vs 30 to 39	5.833333	4.166667	8.166667	5.833333	0.313469	0.575559	ns
20 to 29 vs 40 to 49	6.153846	3.846154	17.84615	11.15385	0.068082	0.79415	ns
30 to 39 vs 40 to 49	7.813953	6.186047	16.18605	12.81395	0.04233	0.836993	ns
20 to 29 vs 50 or older	3	7	9	21	7.777778	0.005289	**
30 to 39 vs 50 or older	3.818182	10.18182	8.181818	21.81818	3.79871	0.051292	ns
40 to 49 vs 50 or older	10.81356	18.18644	11.18644	18.81356	9.377637	0.002196	**

Table 75. Results of analysis of variance of ratings from Diffusion of innovation model questions.

Question	Technology	Usage (1 to 7)	Technology. Usage	Slope between model and usage ratings
Q6.1 (better)	***	***	ns	0.271
Q6.2 (compatible)	ns	ns	ns	
Q6.3 (simple)	**	**	ns	0.246
Q6.4 (experiment)	***	*	ns	0.180
Q6.5 (noticeable)	ns	ns	ns	

Table 76. Analysis of variance of Diffusion of innovation question responses.

Source	Df	Mean Sq	F value	Pr(>F)	Significance
Question	4	3.713	2.4902	0.04285	*
Technology	2	26.781	17.9592	3.47E-08	***
Usage	1	52.757	35.3786	6.06E-09	***
Question:Tech	8	2.823	1.8932	0.0597	.
Question:Usage	4	0.639	0.4288	0.78782	
Tech:Usage	2	1.389	0.9313	0.39493	
Question:Tech:Usage	8	1.385	0.9286	0.49256	
Residuals	388	1.491			

Table 77. Principal Components Analysis for Diffusion model.

	PC1	PC2	PC3	PC4	PC5
Standard deviation	1.9209	1.4179	1.2511	0.9506	0.76828
Proportion of Variance	42.1%	23.0%	17.9%	10.3%	6.7%
Cumulative Proportion	42.1%	65.1%	82.9%	93.3%	100.0%

Table 78. Absolute size of the loadings relative to each other for Diffusion model.

Loadings	PC1	PC2	PC3	PC4	PC5
Q6.1 (better)	0.477073	-0.1423	0.097162	0.079016	-0.85818
Q6.2 (compatible)	0.194582	0.87775	0.437228	-0.02048	0.010239
Q6.3 (simple)	0.606472	-0.36593	0.464988	0.242018	0.472755
Q6.4 (experiment)	0.456216	0.021968	-0.28928	-0.82937	0.140859
Q6.5 (noticeable)	0.398244	0.273705	-0.70675	0.496894	0.141737

Table 79. Results of analysis of variance of ratings from UTAUT model questions.

Question	Technology	Usage	Technology. Usage	Slope between model and usage ratings
Q7.1 (useful)	ns	***	ns	
Q7.2 (quick)	***	**	ns	0.273
Q7.3 (productive)	ns	**	*	0.034(ns), 0.529, 0.120(ns)
Q7.4 (promotion)	ns	ns	ns	
Q7.5 (clear)	ns	*	ns	0.181
Q7.6 (skilful)	**	**	ns	0.210
Q7.7 (easy to use)	**	***	ns	0.268
Q7.8 (learning easy)	ns	**	ns	0.224
Q7.9 (influencers)	ns	***	ns	0.393
Q7.10 (important people)	*	***	ns	0.371
Q7.11 (senior mangt)	ns	*	ns	0.209
Q7.12 (org support)	ns	ns	ns	
Q7.13 (resources)	ns	ns	ns	
Q7.14 (knowledge)	ns	***	ns	0.252
Q7.15 (compatible)	ns	ns	ns	
Q7.16 (assistance)	ns	ns	ns	

Table 80. Predictions of ratings for each technology.

Question	eSurvey	Webinar	YouTube
Q7.2 (quick)	6.1 a	5.5 b	4.3 c
Q7.6 (skilful)	5.9 a	5.4 b	4.9 c
Q7.7 (easy to use)	6 a	5.4 b	5 b
Q7.10 (important people)	4.7 a	5.1 a	5.6 a

Predictions with the same following letters are not significantly different (within a question).
Note for Q7.10, the difference between eSurveys and YouTube was approaching significance (prob=0.0725).

Table 81. Analysis of variance of UTAUT model.

Source	Df	Mean Sq	F value	Pr(>F)	Significance
Question	15	28.74	15.5602	< 2.2e-16	***
Technology	2	21.369	11.5696	1.05E-05	***
Usage	1	173.05	93.6914	< 2.2e-16	***
Question:Tech	30	3.723	2.0155	0.001007	**
Question:Usage	15	2.375	1.2858	0.203206	
Tech:Usage	2	22.795	12.3413	4.95E-06	***
Question:Tech:Usage	30	1.11	0.6011	0.956786	
Residuals	1205	1.847			

Table 82. Principal Components Analysis for UTAUT model.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Standard deviation	3.2118	2.2146	1.9212	1.6975	1.31826	1.2947	1.21266
Proportion of Variance	32.9%	15.6%	11.8%	9.2%	5.5%	5.3%	4.7%
Cumulative Proportion	32.9%	48.5%	60.3%	69.4%	75.0%	80.3%	85.0%

Table 83. Absolute size of the loadings relative to each other for UTAUT model.

Loadings	PC1	PC2	PC3	PC4	PC5
Q7.1 (useful)	0.159549	-0.17601	0.073204	-0.0551	0.027587
Q7.2 (quick)	0.176074	-0.40922	0.177537	-0.03384	-0.22679
Q7.3 (productive)	0.213452	-0.31568	0.06263	0.179143	0.231795
Q7.4 (promotion)	0.091922	0.252803	-0.22465	0.880973	0.084366
Q7.5 (clear)	0.326185	-0.00342	0.031602	-0.02684	0.097772
Q7.6 (skilful)	0.194699	-0.17938	0.048904	0.126427	-0.19914
Q7.7 (easy to use)	0.269155	-0.16716	0.081646	3.87E-05	0.022743
Q7.8 (learning easy)	0.197396	-0.22383	0.08563	7.36E-05	0.065024
Q7.9 (influencers)	0.251651	-0.06377	-0.59445	-0.08618	-0.0815
Q7.10 (important people)	0.241092	-0.15624	-0.4631	-0.03565	-0.13955
Q7.11 (senior mangt)	0.314941	0.329229	-0.26484	-0.29591	-0.17766
Q7.12 (org support)	0.34704	0.306487	0.047872	-0.20545	0.656651
Q7.13 (resources)	0.315694	0.354873	0.30683	-0.00072	-0.06561
Q7.14 (knowledge)	0.215654	-0.21608	-0.06026	0.077645	0.008434
Q7.15 (compatible)	0.237565	-0.1813	0.253813	0.140439	0.152516
Q7.16 (assistance)	0.30022	0.302432	0.298137	0.081751	-0.56258

Table 84. Results of analysis of variance of ratings from Switch model questions.

Question	Technology	Usage	Technology. Usage	Slope between ratings
Q8.1 (success of others)	ns	ns	ns	
Q8.2 (clear steps)	ns	**	ns	0.187
Q8.3 (outcomes)	ns	ns	ns	
Q8.4 (emotionally engaged)	ns	ns	ns	
Q8.5 (small steps)	ns	**	ns	0.245
Q8.6 (sense of identity)	*	*	ns	0.237
Q8.7 (physical envir)	ns	*	ns	0.321
Q8.8 (habit)	ns	***	ns	0.271
Q8.9 (contagious)	ns	**	**	-0.129(ns), 0.479, 0.226
Q8.10 (sustainable)	ns	ns	ns	

Table 85. Predictions of ratings for each technology.

Question	eSurvey	Webinar	YouTube
Q8.6 (sense of identity)	4.1 a	4.2 a	5.3 b

Note: Predictions with the same following letters are not significantly different (within a question).

Table 86. Analysis of variance of Switch model.

Source	Df	Mean Sq	F value	Pr(>F)	Significance
Question	9	15.39	8.3888	5.25E-12	***
Technology	2	0.877	0.4779	0.62029	
Usage	1	94.513	51.5155	1.67E-12	***
Question:Tech	18	3.544	1.9317	0.01136	*
Question:Usage	9	2.145	1.169	0.31174	
Tech:Usage	2	18.377	10.0168	5.07E-05	***
Question:Tech:Usage	18	0.991	0.5399	0.93952	
Residuals	772	1.835			

Table 87. Absolute size of the loadings relative to each other for Switch model.

Loadings	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Standard deviation	2.7387	1.8433	1.5212	1.24415	1.21039	1.13598	0.95736
Proportion of Variance	37.3%	16.9%	11.5%	7.7%	7.3%	6.4%	4.6%
Cumulative Proportion	37.3%	54.1%	65.6%	73.3%	80.6%	87.0%	91.5%

Table 88. Size of the loadings relative to each other for Switch model.

	PC1	PC2	PC3	PC4	PC5
Q8.1 (success of others)	-0.18619	0.01207	-0.0502	0.173775	-0.14667
Q8.2 (clear steps)	-0.29697	0.253141	0.32063	0.519554	-0.19666
Q8.3 (outcomes)	-0.23713	0.236123	0.256951	-0.02439	-0.5195
Q8.4 (emotionally engaged)	-0.34421	0.225624	-0.17789	-0.47742	-0.45992
Q8.5 (small steps)	-0.32689	0.220706	0.173708	0.344971	0.362357
Q8.6 (sense of identity)	-0.4349	0.010775	-0.778	0.138796	0.090167
Q8.7 (physical envir)	-0.35197	-0.87989	0.147844	0.10131	-0.20095
Q8.8 (habit)	-0.3402	-0.01923	0.23487	-0.23872	0.356147
Q8.9 (contagious)	-0.33342	0.073907	-0.01338	-0.07085	0.319099
Q8.10 (sustainable)	-0.23592	0.015636	0.290436	-0.51068	0.223454

Table 89. Results of analysis of variance of ratings from ADOPT model questions.

Question	Technology	Usage	Technology. Usage	Slope between model and usage ratings
Q9.1 (cost efficiency)	ns	ns	ns	
Q9.2 (natural envir)	ns	ns	ns	
Q9.3 (risk averse)	ns	ns	ns	
Q9.4 (work benefit)	ns	**	ns	0.286

Q9.5 (long-term outlook)	ns	ns	ns	
Q9.6 (financial constraints)	ns	ns	ns	
Q9.7 (trialability)	ns	ns	ns	
Q9.8 (easily evaluated)	*	ns	ns	
Q9.9 (observability)	*	ns	*	-0.244(ns), 0.324, 0.153(ns)
Q9.10 (consultants)	ns	ns	ns	
Q9.11 (groups)	ns	ns	ns	
Q9.12 (new skills)	*	ns	ns	
Q9.13 (aware of other users)	**	*	ns	0.215
Q9.14 (up-front cost)	ns	ns	ns	
Q9.15 (reversibility)	ns	ns	*	0.104(ns), -0.556, 0.089(ns)
Q9.16 (reduce operating costs)	*	ns	ns	
Q9.17 (additional effects)	ns	ns	ns	
Q9.18 (success quickly realised)	ns	*	ns	0.180
Q9.19 (envir benefits)	ns	*	ns	0.200
Q9.20 (quick envir benefits)	ns	**	ns	0.230
Q9.21 (risk exposure)	ns	ns	ns	
Q9.22 (work easier)	*	*	ns	0.227

Table 90. Predictions of ratings for each technology.

Predictions with the same following letters are not significantly different (within a question).

Question	eSurvey	Webinar	YouTube
Q9.8 (easily evaluated)	5.7 a	4.7 b	5.4 ab
Q9.12 (new skills)	3.8 a	3.7 a	4.8 b
Q9.13 (aware of other users)	4.8 a	4.4 a	5.8 b
Q9.16 (reduce operating costs)	4.9 ab	5.8 a	4.6 b
Q9.22 (work easier)	5.5 a	5.4 a	4.3 b

Table 91. Analysis of variance of ADOPT model.

Source	Df	Mean Sq	F value	Pr(>F)	Significance
Question	21	29.965	12.3669	< 2.2e-16	***
Technology	2	2.971	1.226	0.293738	
Usage	1	64.26	26.5207	2.92E-07	***
Question:Tech	42	4.877	2.0127	0.000148	***
Question:Usage	21	2.934	1.2108	0.231158	
Tech:Usage	2	11.935	4.9258	0.007364	**
Question:Tech:Usage	42	2.142	0.8841	0.682861	
Residuals	1659	2.423			

Table 92. Absolute size of the loadings relative to each other for ADOPT model.

Loadings	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
Standard deviation	3.3755	2.3466	2.16562	2.04434	1.85709	1.77502	1.62455	1.55656
Proportion of Variance	22.5%	10.9%	9.3%	8.3%	6.8%	6.2%	5.2%	4.8%
Cumulative Proportion	22.5%	33.4%	42.7%	50.9%	57.7%	64.0%	69.2%	74.0%

Table 93. Size of the loadings relative to each other for ADOPT model.

Loadings	PC1	PC2	PC3	PC4	PC5
Q9.1 (cost efficiency)	-0.22176	-0.00438	0.004541	-0.01203	0.043759
Q9.2 (natural envir)	-0.11712	-0.40788	0.324702	0.072048	-0.04115
Q9.3 (risk averse)	-0.07517	-0.01852	0.259837	0.209861	0.06494
Q9.4 (work benefit)	-0.34207	-0.03636	-0.11402	-0.08494	0.172881
Q9.5 (long-term outlook)	-0.13765	-0.36489	-0.16368	0.087718	-0.14323
Q9.6 (financial constraints)	-0.22923	0.50946	-0.07667	-0.02638	0.080042
Q9.7 (trialability)	-0.20904	0.149103	0.031541	0.194115	-0.2243
Q9.8 (easily evaluated)	-0.32213	0.145455	0.100271	0.115259	-0.1112
Q9.9 (observability)	-0.26556	0.065702	-0.13454	0.162665	-0.24898
Q9.10 (consultants)	-0.27189	-0.0906	-0.30324	0.118665	-0.08626
Q9.11 (groups)	-0.21935	-0.14828	0.132021	0.021292	0.695729
Q9.12 (new skills)	-0.23862	-0.12113	-0.12952	0.153816	0.020508
Q9.13 (aware of other users)	-0.3002	-0.18139	0.064204	0.240605	0.230001
Q9.14 (up-front cost)	-0.23705	0.288497	0.010488	0.066602	-0.15565
Q9.15 (reversibility)	-0.14333	0.273611	0.502521	0.178059	-0.09043
Q9.16 (reduce operating costs)	-0.19217	0.082267	-0.09153	-0.5228	0.090395
Q9.17 (additional effects)	-0.15852	-0.06074	-0.0888	-0.10683	0.093712
Q9.18 (success quickly realised)	-0.19745	-0.01635	-0.12198	-0.15081	0.001804
Q9.19 (envir benefits)	-0.17662	-0.24539	0.187403	-0.30547	-0.28254
Q9.20 (quick envir benefits)	-0.19978	-0.18273	0.263926	-0.4072	-0.30915
Q9.21 (risk exposure)	-0.0465	-0.08857	-0.48306	0.067172	-0.10516
Q9.22 (work easier)	-0.06935	0.208595	0.005383	-0.39276	0.173421

Table 94. Analysis of variance across all models.

Source	Df	Mean Sq	F value	Pr(>F)	Significance
Question	52	26.93	13.1487	< 2.2e-16	***
Technology	2	10.47	5.1133	0.006055	**
Usage	1	352.99	172.3742	< 2.2e-16	***
Question:Tech	104	4.69	2.2911	4.66E-12	***
Question:Usage	52	2.86	1.3961	0.032199	*
Tech:Usage	2	30.91	15.0946	2.94E-07	***
Question:Tech:Usage	104	1.92	0.9361	0.662965	
Residuals	4024	2.05			

Table 95. Absolute size of the loadings relative to each other for all models.

Loadings	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
Standard deviation	4.9325	3.09097	2.55995	2.3595	2.20852	2.11601	2.0317	1.98321
Proportion of Variance	24.5%	9.6%	6.6%	5.6%	4.9%	4.5%	4.2%	4.0%
Cumulative Proportion	24.5%	34.1%	40.7%	46.3%	51.3%	55.8%	59.9%	63.9%

Table 96. Absolute size of the loadings relative to each other.

Question	PC1	PC2	PC3	PC4	PC5
Q6.1 (better)	0.092	0.156	-0.081	0.028	-0.073
Q6.2 (compatible)	0.134	-0.057	-0.011	0.099	0.014
Q6.3 (simple)	0.158	0.248	-0.073	-0.007	0.025
Q6.4 (experiment)	0.106	0.069	0.055	-0.168	0.064
Q6.5 (noticeable)	0.094	-0.077	-0.172	-0.100	0.209
Q7.1 (useful)	0.119	0.002	-0.077	0.122	-0.028
Q7.2 (quick)	0.115	0.137	-0.298	0.045	-0.151
Q7.3 (productive)	0.157	0.008	-0.263	0.107	-0.099
Q7.5 (clear)	0.176	0.194	0.045	-0.093	0.022
Q7.6 (skilful)	0.107	0.110	-0.115	-0.064	-0.162
Q7.7 (easy to use)	0.172	0.175	-0.060	-0.023	-0.068
Q7.8 (learning easy)	0.098	0.163	-0.096	-0.076	-0.073
Q7.9 (influencers)	0.141	-0.034	0.070	-0.290	0.174
Q7.10 (important people)	0.172	-0.062	-0.022	-0.223	0.080
Q7.11 (senior mangt)	0.169	0.109	0.270	-0.186	0.168
Q7.12 (org support)	0.171	0.178	0.276	0.036	0.102
Q7.13 (resources)	0.140	0.233	0.254	0.155	0.126
Q7.14 (knowledge)	0.108	0.088	-0.100	-0.190	-0.064
Q7.15 (compatible)	0.109	0.175	0.024	0.058	-0.164
Q7.16 (assistance)	0.105	0.236	0.207	0.061	0.023
Q8.1 (success of others)	0.081	-0.074	0.056	0.022	-0.085
Q8.2 (clear steps)	0.160	0.075	0.060	0.024	-0.150

Question	PC1	PC2	PC3	PC4	PC5
Q8.3 (outcomes)	0.125	-0.021	-0.022	0.025	-0.053
Q8.4 (emotionally engaged)	0.162	-0.115	0.017	-0.079	-0.017
Q8.5 (small steps)	0.180	0.000	0.111	0.012	-0.049
Q8.6 (sense of identity)	0.222	-0.086	0.089	-0.014	-0.251
Q8.7 (physical envir)	0.209	0.069	-0.001	0.273	0.208
Q8.8 (habit)	0.166	0.127	0.016	0.054	-0.085
Q8.9 (contagious)	0.174	-0.074	0.061	-0.040	0.054
Q8.10 (sustainable)	0.127	0.022	-0.023	-0.037	0.144
Q9.1 (cost efficiency)	0.095	-0.126	-0.049	0.064	-0.237
Q9.2 (natural envir)	0.047	-0.118	0.098	-0.304	-0.154
Q9.3 (risk averse)	0.054	-0.064	0.158	-0.004	-0.222
Q9.4 (work benefit)	0.209	-0.197	-0.079	0.064	-0.164
Q9.5 (long-term outlook)	0.040	-0.194	0.061	-0.231	-0.032
Q9.6 (financial constraints)	0.144	-0.190	-0.223	0.263	-0.084
Q9.7 (trialability)	0.104	-0.171	0.080	0.254	0.232
Q9.8 (easily evaluated)	0.198	-0.176	0.022	0.292	0.216
Q9.9 (observability)	0.079	-0.249	0.015	0.037	0.127
Q9.10 (consultants)	0.191	-0.162	0.012	-0.059	0.002
Q9.11 (groups)	0.144	-0.040	0.282	-0.003	-0.264
Q9.12 (new skills)	0.081	-0.230	0.240	0.035	0.066
Q9.13 (aware of other users)	0.176	-0.176	0.113	-0.088	-0.214
Q9.14 (up-front cost)	0.089	-0.046	0.062	0.200	0.166
Q9.16 (reduce operating costs)	0.155	-0.037	-0.236	0.032	0.097
Q9.17 (additional effects)	0.132	-0.127	-0.047	-0.063	-0.030
Q9.18 (success quickly realised)	0.132	-0.142	-0.057	0.035	0.044
Q9.19 (envir benefits)	0.145	-0.027	-0.279	-0.225	0.199
Q9.20 (quick envir benefits)	0.144	0.008	-0.148	-0.294	0.289
Q9.21 (risk exposure)	-0.064	-0.265	-0.013	-0.084	-0.083
Q9.22 (work easier)	0.129	0.166	-0.199	0.045	-0.102

Table 97. The model of origin of contributing elements to the four new groups.

Question	Originating model	Final group
Q6.1 (better)	DoI	Working smarter
Q6.2 (compatible)	DoI	Noticeable, trialable
Q6.3 (simple)	DoI	Working smarter
Q6.4 (experiment)	DoI	Noticeable, trialable
Q6.5 (noticeable)	DoI	Noticeable, trialable
Q7.1 (useful)	UTAUT	Noticeable, trialable
Q7.2 (quick)	UTAUT	Working smarter
Q7.3 (productive)	UTAUT	Working smarter
Q7.5 (clear)	UTAUT	Working smarter
Q7.6 (skilful)	UTAUT	Working smarter
Q7.7 (easy to use)	UTAUT	Working smarter
Q7.8 (easy learning)	UTAUT	Working smarter
Q7.9 (influencers)	UTAUT	Supporting
Q7.10 (important people)	UTAUT	Supporting
Q7.11 (senior mangt)	UTAUT	Supporting
Q7.12 (org support)	UTAUT	Supporting
Q7.13 (resources)	UTAUT	Supporting
Q7.14 (knowledge)	UTAUT	Working smarter
Q7.15 (compatible)	UTAUT	Working smarter
Q7.16 (assistance)	UTAUT	Supporting
Q8.1 (success of others)	Switch	Noticeable, trialable
Q8.10 (sustainable)	Switch	Noticeable, trialable
Q8.2 (clear steps)	Switch	Noticeable, trialable
Q8.3 (outcomes)	Switch	Noticeable, trialable
Q8.4 (emotionally engaged)	Switch	Noticeable, trialable
Q8.5 (small steps)	Switch	Noticeable, trialable
Q8.6 (sense of identity)	Switch	Contagious
Q8.7 (physical envir)	Switch	Supporting
Q8.8 (habit)	Switch	Supporting
Q8.9 (contagious)	Switch	Contagious
Q9.1 (cost efficiency)	ADOPT	Noticeable, trialable
Q9.2 (natural envir)	ADOPT	Noticeable, trialable
Q9.3 (risk averse)	ADOPT	Contagious
Q9.4 (work benefit)	ADOPT	Contagious
Q9.5 (long-term outlook)	ADOPT	Contagious

Q9.6 (financial constraints)	ADOPT	Noticeable, trialable
Q9.7 (trialability)	ADOPT	Noticeable, trialable
Q9.8 (easily evaluated)	ADOPT	Noticeable, trialable
Q9.9 (observability)	ADOPT	Noticeable, trialable
Q9.10 (consultants)	ADOPT	Contagious
Q9.11 (groups)	ADOPT	Contagious
Q9.12 (new skills)	ADOPT	Contagious
Q9.13 (aware of other users)	ADOPT	Contagious
Q9.14 (up-front cost)	ADOPT	Noticeable, trialable
Q9.16 (reduce operating costs)	ADOPT	Working smarter
Q9.17 (additional effects)	ADOPT	Noticeable, trialable
Q9.18 (success quickly realised)	ADOPT	Contagious
Q9.19 (envir benefits)	ADOPT	Supporting
Q9.20 (quick envir benefits)	ADOPT	Supporting
Q9.21 (risk exposure)	ADOPT	Contagious
Q9.22 (work easier)	ADOPT	Working smarter

Appendix 5d. What motivates you to adopt an innovation – Qualitative data

Table 98. Comments made about the degree of usage.

Technology	Degree of usage	Comment on degree of usage
eSurveys	1	As part of a team
	1	It is a great tool.
	2	Find people respond to survey if instant and they don't have to think too much
	2	Important in benchmarking a wide industry
	2	Just developing first survey using SurveyMonkey now.
	3	One annual client feedback survey in conjunction with annual publication + a few other surveys here and there
	3	Used once in 2011 to conduct a survey of external and internal participants
	4	Used extensively when I wanted to do surveys, but that is not very often.
	4	Whilst in role of Operation Clean Up, for statistical data.
	7	I love SurveyMonkey!
webinars	1	Held a webinar on water quality with the speaker dialling in from Canada
	2	I used a web meeting technology called WebEx to run meetings involving remote participants for a Project. It worked well.
	2	Now use videoconference links
	2	So many technical glitches, and lack of equipment that works with sufficient power to be used effectively, hampered success. Not game to use in important occasions.
	5	Been on the delivery end - rather than delivering... :O)
	6	Lead first project to use webinar technology on www.business.qld.gov.au
YouTube style videos	1	None of our project work has required a video as yet.
	1	Would like to use more but internal bottlenecks make it too hard to publish on gov network
	2	I have only used it privately for mechanical stuff and see the potential to use it as a tool to overcome some of the distance and time pressures that producers experience.
	2	I was able to incorporate a YouTube video clip into a web guide I wrote for the Business and Industry website
	3	On two occasions and am in the process of starting/ commissioning the third
	3	Only just started using
	3	Only used it to make videos as part of a project
	4	I have done personal photo movies.
	4	Just starting to develop videos, have 2 filmed but still editing. Have many topics to do in the future as well
	5	I am starting to develop YouTube training videos for work. I was converted to their usefulness privately.

	5	Our team has completed a number of videos
	6	Technical breakdown of steps in mechanical and house maintenance
	7	Quick and easy way of learning skills.

Table 99. Previous methods used before adopting this technology.

Technology	Degree of usage	Previous methods used
eSurveys	1	Face-to-face discussions, Discussion papers, stakeholder discussion, engagement meetings.
	1	Paper, face-to-face, email
	1	Written surveys emailed out and phone interviews
	2	Didn't use surveys due to lack of resources.
	2	Hard copy survey
	2	Hard copy surveys
	2	Mail-out surveys
	2	Paper and email
	2	Paper-based surveys
	2	Paper survey or email
	2	Paper surveys, phone surveys
	2	paper-based mail outs
	2	Paper-based surveys
	2	Very difficult, samples were taken from regionalised workshop.
	3	Face-to-face interviews. In meeting happy sheets for evaluation. General discussions re client customer feedback and priorities. and avoided asking questions due to lack of anonymity.
	3	Face-to-face Workshops or multiple email requests
	3	Hard copy surveys, distributed by post or in person
	3	Paper survey mailed out, still happening alongside eSurvey
	3	Paper-based surveys
	3	Traditional survey methods, mail, phone etc
	4	Email questions to be addressed.
	4	Not relevant to my substantive position
	4	Paper-based or Word surveys
	4	Paper-based surveys
	4	Paper-based surveys or sent around via word doc on email
	4	Sent out surveys. Surveys in conjunction with evaluation forms at the end of meetings/workshops. Ringing people.
	5	Fax mail phone
	5	Hard copy surveys

	5	Little co-ordinated action due to difficulty in doing manual surveys
	5	Paper-based mail outs
	6	Hard copy evaluation questionnaires to which attendees responded by hand writing; collation; interpretation, summarising
	7	Paper-based surveys
Webinars	1	Nothing. There were no other alternatives
	1	People had to travel to Brisbane or to the regions.
	1	Teleconferences, using traditional telecommunications company solution
	2	Attended in person
	2	Face-to-face meetings/presentations, or straightforward teleconferences.
	2	People had to travel from sites to PIB to attend.
	2	Teleconference
	2	Teleconference - phone call only.
	2	Teleconference, Face-to-face meeting
	2	Telephone calls
	3	Face-to-face presentations, describing over the phone, send CD of presentation and work through on the phone when client had it running in front of them
	3	Teleconference
	3	Teleconferences
	4	Attend product presentations at conferences, site visits by reps, user group meetings
	4	Either very expensive meetings where team members travelled to a central location, or phone conference calls
	4	Face-to-face meetings and teleconferences
	4	Face-to-face meetings.
	4	Phone
	4	Teleconferences
	4	Used teleconferences
	5	Attending workshops in person
	5	Face-to-face meetings or attending costly seminars
	5	Face-to-face workshops / information sessions / seminars
	5	In-person meetings, public speaking forums.
	5	Skype
	6	Face-to-face workshops
	6	Face-to-face workshops
	6	Face-to-face workshops,
	6	Producer focus groups - but able to reach a wider audience geographically with the webinar
	7	Deliver f2f seminar, use of telephone and emails

	7	None
YouTube style videos	1	CD with PPT or html + videos
	1	Newspaper / journal articles of case studies
	1	Nothing
	1	Workshops and case studies.
	1	Written communication
	2	PDF version of hard copy case studies
	2	Static images and text descriptions
	2	Still use property visits and field days and would continue with these to support and supplement the YouTube.
	3	Grower group activities
	3	Nothing - I was for online learning so DAFF don't really do that. I suppose it would have been in field workshops to demonstrate a technology
	3	Written factsheets, 'how to manual' and workshops
	4	Face-to-face and blended learning
	4	Fact sheets, field walks, etc. These will still be used this will just be an additional support tool.
	4	paper source which makes it difficult to follow
	5	fact sheets and blogs
	5	Field days, flyers, articles in industry magazines
	5	Google searches and networks
	5	Mainly face-to-face workshops and traditional hard copy training media, fact sheets, books etc.
	5	PowerPoint, web information, books etc
	5	television commercials - one on one meetings/ group presentations
	5	Written facts sheets etc and photos
	5	Written materials, meetings with clients
	6	Polaroid camera
	7	DVD's or face-to-face
	7	Field days, paddock walks, media releases, interviews, printed fact sheets, e-fact sheets.
	7	Hard copy publications & web sites
	7	Written materials - factsheets, articles in papers, farm walks, field days

Table 100. Factors that encouraged use of technology.

Technology	Degree of usage	Factors that encouraged use of technology
eSurveys	1	Ease of use, higher participation and how the results were provided and summarised
	1	It works, it's efficient
	1	Speed of dissemination of material and response. Analysis tools were also useful in presenting results.
	2	1. Ease of use for users of survey (encourages completion) 2. Reporting tools
	2	Ability to reach a majority of the industry.
	2	Accessibility
	2	Convenience of developing the content, distribution and analysis of responses
	2	Cost-effective distribution and collection of feedback.
	2	Ease of tracking and collation of data.
	2	Ease of use of the SurveyMonkey system
	2	Easy to setup, quick and presented results
	2	Expected to obtain a better response rate with respondents able to complete a lot quicker and submit easier. Also the data collation aspect.
	2	Knowing it was electronic and would be easy to send and collate surveys to a wide group of people.
	2	More efficient. When using tools like SurveyMonkey the results are automatically collated for you - no manual calculations.
	3	Budget, fast results, ease of use, targeted audience group
	3	Cost, ease of data entry
	3	Ease Functionality Free Utility Time saving in result compilation Reduced carbon footprint Ability for respondents to be anonymous Time saving in survey preparation
	3	Increased electronic delivery of annual publication, eSurvey can be attached as link in email
	3	Overall ease of use; major strengths include simplicity of SurveyMonkey including streamlining and collating participant feedback
	3	Reduced cost, simplicity
	4	Ease of use for person sending it out as well as respondents Quick response Collating of replies
	4	Experience in filling out eSurveys and then learning how easy it is to use by speaking to other people and then hearing that there was access available (via you John).
	4	Seemed like it would assist by capturing a lot of information in mass by way of email. And how data was collated without being manually - this was such an assistance with everyone seeming to be ‘TIME POOR’ these days.
	4	Simple. It is a pull out (the current method) push in (the eSurvey method) technology. Easy for respondents to used. Reporting is simple for appropriately coded questions.

	4	That the data was all collated in one area and I didn't have to go through all the answers and analyse it.
	4	Time and cost efficient
	5	Cost and time savings
	5	Ease of use, accessibility and reportability
	5	Easy to use, initial free subscription offered
	5	Quick, low cost, easier for those being surveyed
	6	I heard of an online evaluation tool; we were delivering workshops on line and a link to a survey could be sent to participants; understanding that it offered convenience and reduced effort; seeing the data compiled and ready for interpreting.
	7	Easy to create and distribute
webinars	1	Feedback from the regions and an identified need to better engage with them.
	1	provided more opportunities for interaction and was cost effective
	1	That there were no other available options to having the session
	2	1. I believe that global warming is human-caused and see web meetings as a way to reduce our carbon use. 2. Some members of the user reference group, and of the Project Board, were located in Cairns, Toowoomba and in research sites dotted around Brisbane
	2	Assistance provided by relevant experienced users
	2	Cheaper
	2	Convenience, relative simplicity
	2	Difficulty in getting travel organised - willingness to try new technology.
	2	Flight restrictions
	2	Researching and using it myself, having the time and permission to play with it. Someone to experiment with the technology with
	3	Ability to connect with broad range of people who are geographically isolated and where pictures and graphs were needed
	3	The fact that it add the visual experience in both seeing the people via webcam and showing documents on the computer.
	3	Visual aids
	4	Availability of broadband - cost effective applications like GoToMeeting, WebEx etc - willingness of the company to evaluate such solutions
	4	Budget Cost, Time Constraints to myself and those involved.
	4	Coaching and support
	4	Convenience, budget constraints that limited travel, ability to easily access overseas speakers
	4	Hearing from others about it; first-hand experience - had a 'mock' session with a regular user
	4	The fact that it was interactive and you KNEW that everyone was on the same page
	4	The interaction between staff at a variety of locations was required and this technology allowed this to happen

	5	Could be done quickly. Could be done at very low cost and it was much easier to co-ordinate people because it didn't impinge too much on their time.
	5	The organisations that were delivering the info I wanted started using these, I also changed jobs which now focuses on this technology and so need to know how to use it
	5	Timing. No need to leave office. No travelling time.
	5	Transfer of documents and workplace restrictions (on using Skype)
	5	Tyranny of distance
	6	availability of technology
	6	Cut back on travel expenses for producers and department
	6	Existence of webinar technology licence within DAFF Assistance of the eExtension Officer within the former DAFF.
	6	Reducing time and dollars - we could reach more people for less work and money by using webinars rather than face-to-face events. Staff cuts - we are a team of 4 to cover the whole of Qld Remoteness and spread of producers - we can't hold face-to-face events in every town and this allows producer to participate irrespective of where they are
	7	Ease of use, ability to interact and have two-way communication, No need for extra travel and associated costs, additional environmental savings (less CO_2), better work/life balance, decreasing the problem of distance (e.g. ability to collaborate with a wider geographically located audience, Ability to integrate with fewer f2f meetings.
	7	It was just a need we needed met
YouTube style videos	1	Colleagues in other depts using them at ease. Technology improvements.
	1	I completed a video training workshop to learn how to capture and edit video footage for YouTube videos.
	1	Increasing usage by target audience (growers)
	1	It sounded like fun
	1	Training run at Toowoomba.
	2	As stated in Q1 plus the capacity to use a more visual medium as a learning tool.
	2	It was an option and preferable to what had been used previously (above)
	2	More authentic as you see and hear a customer talking about their project and how they used the business grant. Also, with a video it is something you can engage people on-line with - for example using social media to generate leads into the video - see how XYZ used our business grant. Low cost - the department paid approx $43k for 20 videos over 10 days (Reel Image).
	2	Training.
	3	Cost of gear has become more reasonable, available editing software powerful but relatively user friendly, clients time poor so need to 'take the field activity to them' via video, very useful for instructional stuff - next best to actually being there.
	3	Encouraged to make videos for online training package i.e. I was asked to do it so I said I would
	3	Lower cost, suitability of the medium (i.e. it was engaging), the ability to engage people without being present (i.e. I could have it scrolling at conferences, available on a website)

	4	Diversification of participants. Spread of ages, locations, backgrounds and willingness to use or try different learning experiences.
	4	The ability for the user to pause/stop if following instructions. also easier to watch a video than trawl through paper
	4	Training that I attended in Toowoomba last year, the assistance of John, Greg and also Shane Mulo in terms of what to purchase and how to go about filming. Also received a grant from Terrain, our local NRM group, for $8,000 to purchase the video equipment.
	5	By the Department lowering the restrictions on access to sites such as YouTube, it has allowed staff to access content which provides readily available information/videos i.e. weed identification tutorials.
	5	Had basic skills from private life and QG has adopted this type of technology, to a certain degree, and offered the training
	5	In process of adopting - but as a strategy seems to resonate with clients
	5	Its ease of access, small bites of learning, always there and accessible
	5	Little resource outlay but able to achieve a wider audience and audience able to view information in their own time.
	5	Severe lack of resources, time and money, in projects and the desire to do something different.
	5	The ability to undertake the training within the department and the need to keep up to date with new ways of learning
	5	Workshop and provision of equipment and software
	6	Freeze frame
	7	Low cost, relatively easy to produce, positive feedback from clients
	7	Modest event attendance with graziers becoming more time-poor, us having greater resource limitations (making it difficult to repeat events in multiple locations), grazier feed-back of the convenience of learning in their own time from home via computer, local YouTube video service provider, funds being available.
	7	Quick, easy access and can be done at anytime convenient to me.
	7	The previous approaches being used don't suit everyone - fewer and fewer growers are interested or able to attend field days. YouTube videos can help address this issue (but other approaches still are needed).

Table 101. Factors that discouraged use of technology.

Technology	Degree of usage	Factors that discouraged use of technology
eSurveys	1	Access and cost perceptions. This technology has not yet received endorsement or validation from senior levels or from stakeholders. My main experience has been with eSurvey and I believe that there is a specific skill set in development of survey questions that needs to be developed (and scrutinised) for this to be an accepted way of conducting engagement activity.
	1	Learning how to use it
	1	Learning something for the first time
	2	1. Learn how 2. Asking users to do something new (with uncertain anonymity)
	2	Availability of Dept licence
	2	Did paper questionnaire in 2008-9 because I didn't know about SurveyMonkey.
	2	Don’t need to survey that often
	2	Getting regional participation
	2	Having to learn the new technology, concerns that the email will set in the respondents inbox or deleted
	2	Ignorance. Where to start.
	2	Knowing the response rates maybe low.
	2	Nil
	2	Only suits e-savvy folk. Something new - needed to learn how to format, prepare etc.
	2	The time to learn
	3	always need to do both eSurvey and mail out survey to also reach clients in regional areas
	3	Nil
	3	Resistance from management and technophobes
	3	Sometimes survey respondents prefer traditional methods of engagement (particularly primary producers)
	3	There are some of the SurveyMonkey functions which require payment, which would be useful but have not gone down that track.
	3	Unfamiliarity with the technology
	4	I was not discouraged by anything in eSurveys - it was all positive
	4	Initially it was me being unsure of how to set up surveys.
	4	None
	4	None. It is now a first port of call. Provided I have access.
	4	Nothing from my point of view. Just whether producers would engage in an online survey
	4	Supervisor :)
	5	Internet coverage in region is difficult

	5	Nil
	5	Nil
	5	Nil
	6	Cost; having to learn the use of a new tool
	7	Learning yet another software package.
webinars	1	Availability of equipment. Participants' experience with and ability to use the technology.
	1	Having sufficient confidence / training in how to use it and finding other partners willing to participate
	1	It's a bit difficult at first
	2	Acceptance from managers and the cost of the technology Sometimes the technical side and also the lack of social interaction (when compared to face-to-face contact)
	2	Access to effective software, quality of facial images - whether images appeared to look at me (look natural) rather than looking away (camera not well aligned), size of images - more people lead to tiny faces
	2	New technology
	2	None. It was a good experience and I would do it again.
	2	Price
	2	See answer to 2. Why is it so hard, given I can easily use Skype and video connect etc. at home?
	2	Venturing into the unknown, lack of familiarity with the technology and what to expect
	3	Cost
	3	Not knowing how to use it
	3	The cost.
	4	Can't think of anything
	4	Departmental firewalls,
	4	Hoops to jump thru to get access within the Treasury network.
	4	Lack of personnel/one on one interaction between members of the team.
	4	Perceived 'time' to learn how to use it - particularly from a moderator perspective
	4	The IT policies of the department
	4	Time zones
	5	Cost, and lack support from workplace to use webinars
	5	Didn't realise just how simple it is to be able to communicate with or deliver information.
	5	Is good to have a balance of face-to-face workshops for the networking aspects but good time management for the webinars
	5	Learning the technology! Old dogs/ new tricks comes to mind.
	5	Software setup and use of bandwidth within the departmental system
	6	DAFF ICT Network limitations. WebEx was very expensive compared to other similar webinar platforms.

	6	Non target audience attendance
	6	Not knowing how to fully/best use it. Would producers (ageing) take to it and use it as well
	6	Working out how to use the technology it using it correctly.
	7	Initial fear of the unknown, the required upskilling to accommodate personal technological deficiencies.
	7	None
YouTube style videos	1	Afraid wouldn't have basic knowledge required
	1	Inexperience
	1	Internal bottlenecks - policy, time delays, etc
	1	Still waiting for a training program that will require a filmed demonstration.
	1	The time it takes to put together a video and also whether or not the intended audience would get to see it.
	2	Ease of use. Currently Departmental guidelines on using external contractors a strict. Also, a 2 day course in Toowoomba was not enough for me to feel I had the expert skills to produce an external video - so we'd be looking in-house to see if anyone else could shoot something to a high standard. Time - even if I was given green light to shoot my own video the time it took to 1. provide questions 2. edit 3. go live were considerable so you need a long lead in time to get anything published by Qld Govt.
	2	Lack of confidence with editing
	2	Time, need, equipment.
	3	Needed technical skills in driving video camera etc. I did not have this but another staff member did. I spoke and she filmed me.
	3	Technological know-how, ability of the department to 'handle it'.
	3	Time to develop the skills to do the job competently, a specific need or objective that is answered by this technology, cost of gear, knowledge of software.
	4	Support from senior management who either don't understand or don't care about engagement methodologies.
	4	The knowledge/skill as well as available computer programs
	4	Time and lack of knowledge. Now we have the key people it is much better however still it is a steep learning curve and I think the department could improve this. An example would be to have a group that edits video for all commodity groups. That way we can story board and film but get someone else to edit who is more familiar with the programs and able to do it much more efficiently.
	5	Access permissions.
	5	Access to camera equipment to make decent media
	5	Cost of equipment and software and lack of certainty in on-going employment
	5	N/A
	5	Not all our audience will be confident using or have the ability to use this technology.
	5	Organisational roadblocks and the perception of grower reluctance to adopt the technologies. I'm still not sure how many growers will use it.
	5	Time required to edit. Unsure how and where to best use the technology.

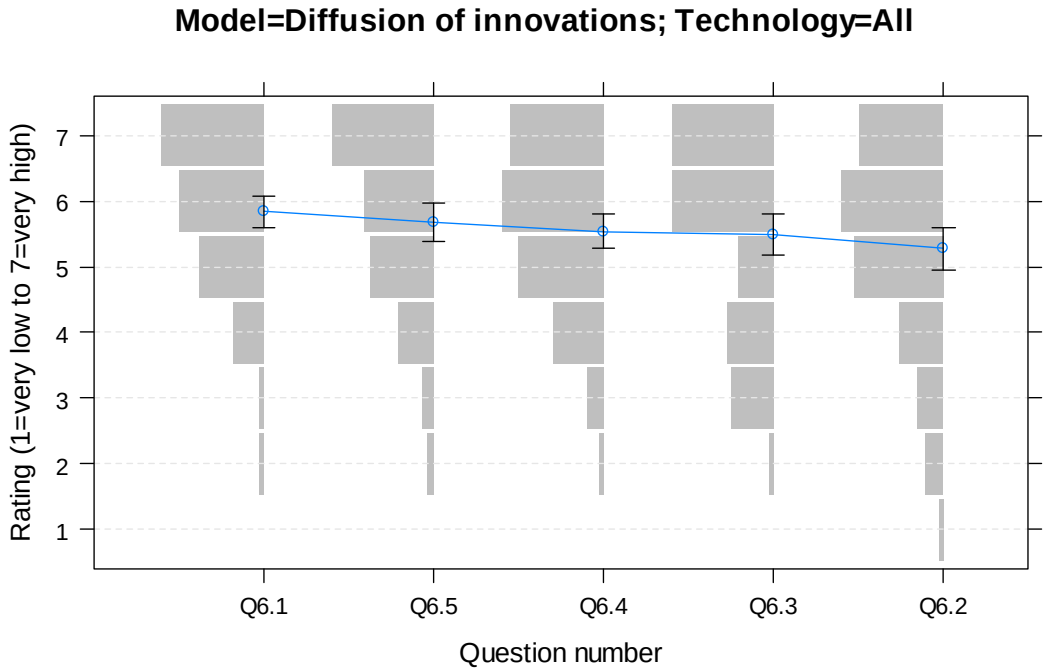
	5	Video editing is something that you need to do frequently in order to keep up your skills
	6	Slow computer
	7	Departmental policy
	7	It is additional effort to produce YouTube videos but well worth it - important to have the editing skills available in our team.
	7	None
	7	Uncertainty if anyone would actually watch the videos, uncertainty how well people learn from watching a video.

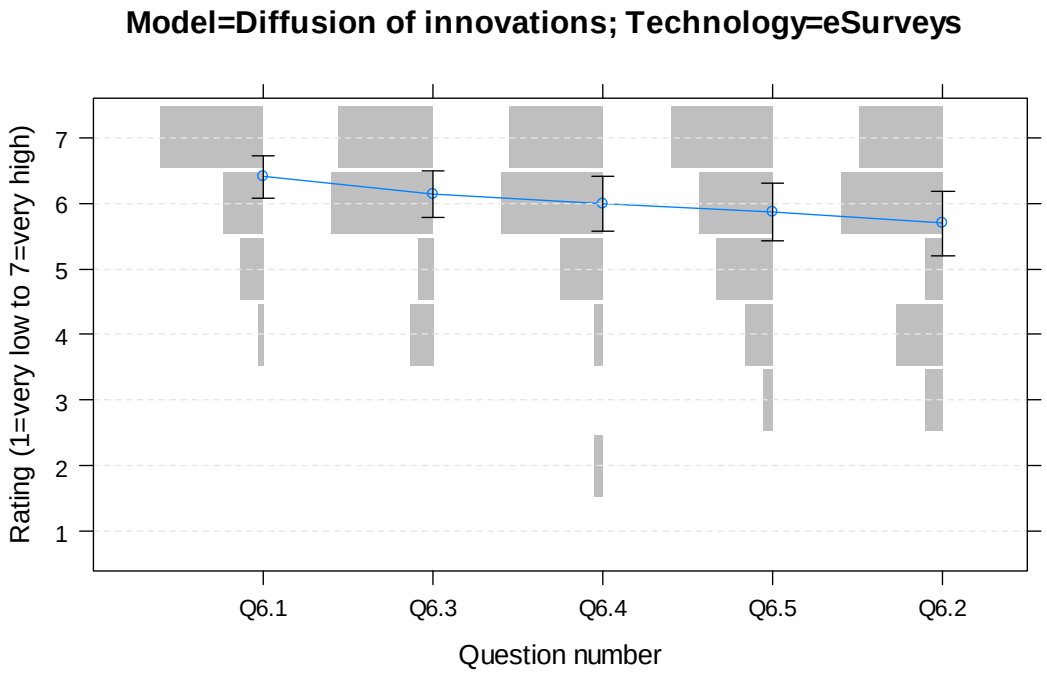
Appendix 5e. What motivates you to adopt an innovation – Average rating analysis

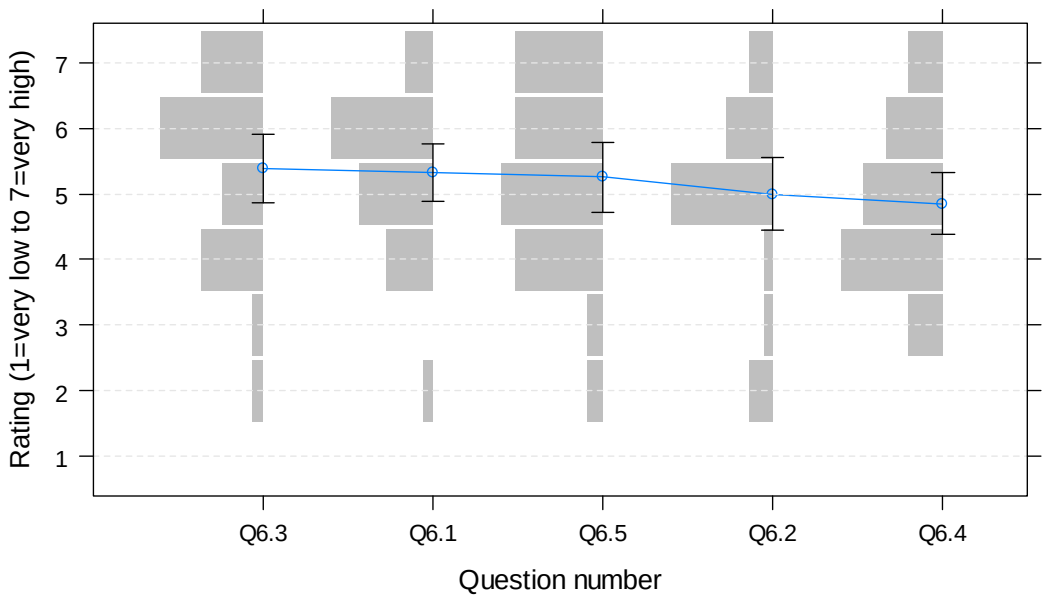
Average rating of each question for a model is plotted with 95% confidence intervals. The frequency of each rating is plotted as bars in the background. The questions have been ranked in descending order based on the average rating, and plots have been repeated to show each technology.

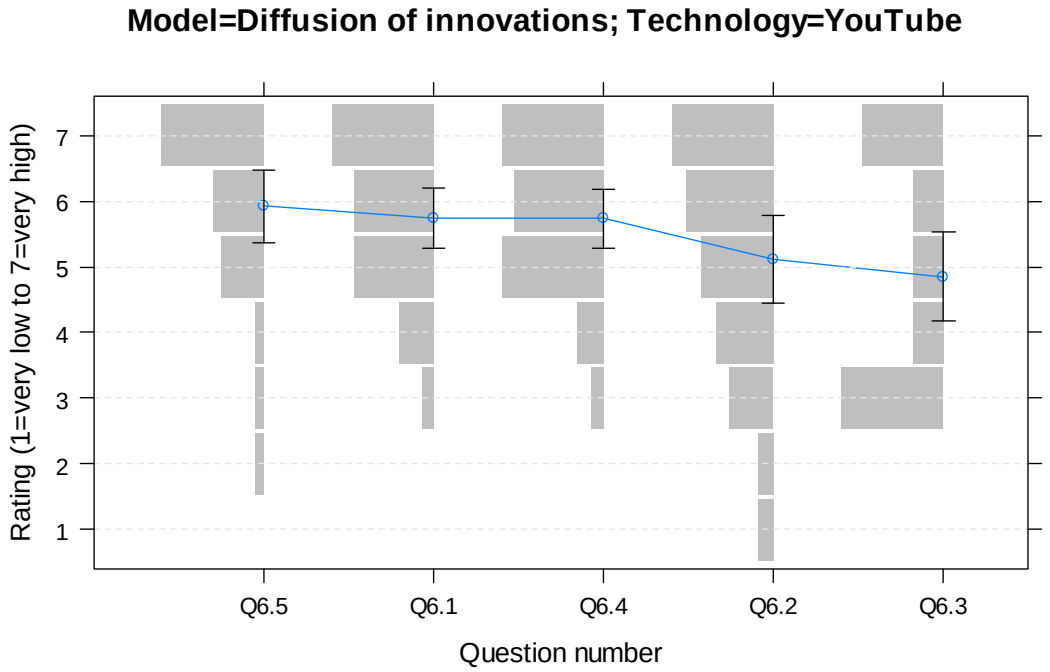
Diffusion of innovations model

The questions asked in the survey for the diffusions of innovations model are:
Q6.1 ‘To what degree is it better using this innovation compared to how it was done previously?’
Q6.2 ‘To what degree is the innovation compatible with the previous approach?’
Q6.3 ‘To what degree is this innovation simple to use?’
Q6.4 ‘To what degree can the innovation be experimented with while it is being adopted?’
Q6.5 ‘To what degree is the use of the innovation visible or noticeable to others?’




Model=Diffusion of innovations; Technology=eSurveys
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q6.1
Q6.3
Q6.4
Q6.5
Q6.2
Question number


Model=Diffusion of innovations; Technology=webinars
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q6.3
Q6.1
Q6.5
Q6.2
Q6.4
Question number



UTAUT model

The questions asked in the survey for the UTAUT model are:

Q7.1 ‘To what degree is the innovation useful in your job?’

Q7.2 ‘To what degree does the innovation enable you to accomplish tasks more quickly?’

Q7.3 ‘To what degree does the innovation increase your productivity?’

Q7.4 ‘To what degree does using the innovation increase your chance of getting a promotion?’

Q7.5 ‘To what degree is the innovation clear and understandable to use?’

Q7.6 ‘To what degree is it easy to become skillful using the innovation?’

Q7.7 ‘To what degree do you find the innovation easy to use?’

Q7.8 ‘To what degree is learning to use the innovation easy for you?’

Q7.9 ‘To what degree do people who influence your behaviour think that you should be using the innovation?’

Q7.10 ‘To what degree do people who are important to you think that you should be using the innovation?’

Q7.11 ‘To what degree do senior management support your use of the innovation?’

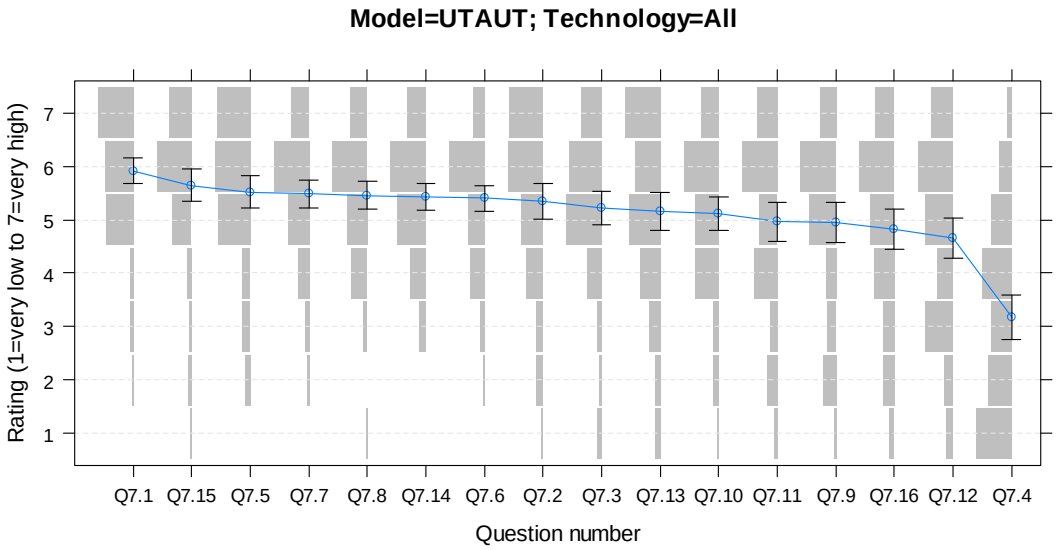
Q7.12 ‘To what degree does the organisation support the use of the innovation?’

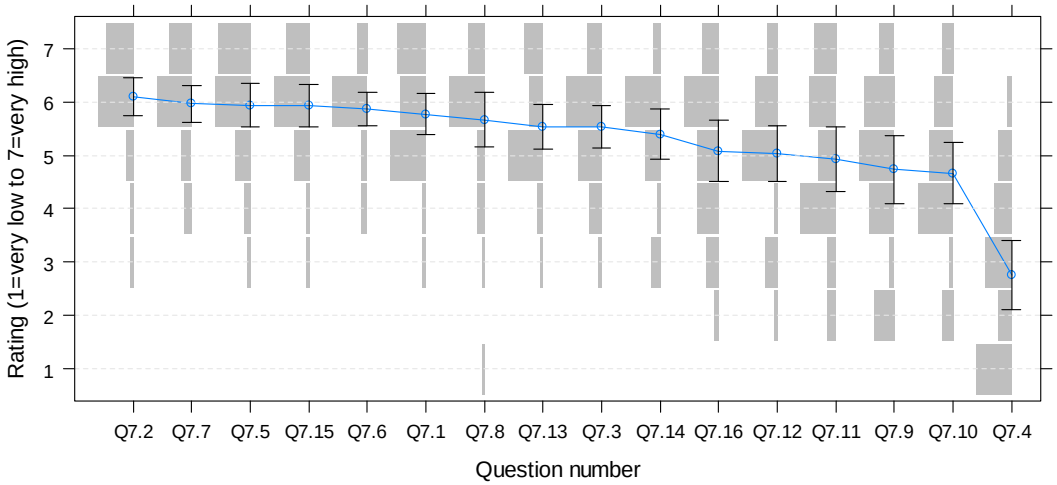
Q7.13 ‘To what degree do you have the resources necessary to use the innovation?’

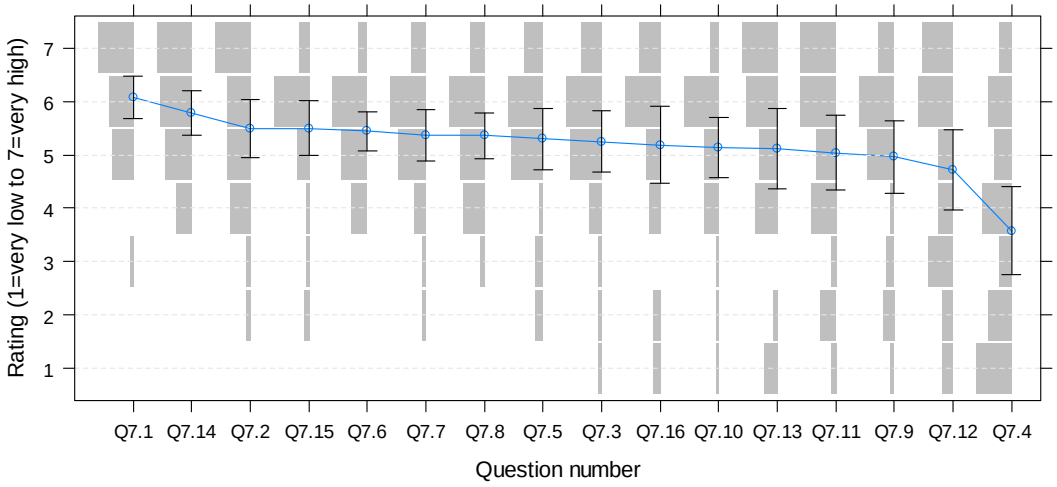
Q7.14 ‘To what degree do you have the knowledge necessary to use the innovation?’

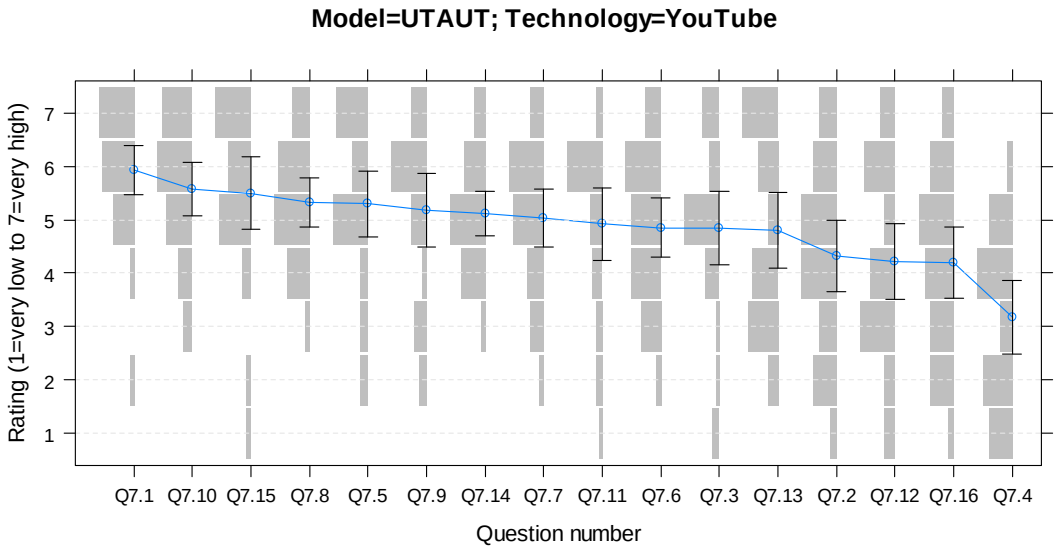
Q7.15 ‘To what degree is the innovation compatible with other systems you use?’

Q7.16 ‘To what degree is a specific person (or group) available for assistance with system difficulties?’


Model=UTAUT; Technology=All
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q7.1 Q7.15 Q7.5 Q7.7 Q7.8 Q7.14 Q7.6 Q7.2 Q7.3 Q7.13 Q7.10 Q7.11 Q7.9 Q7.16 Q7.12 Q7.4
Question number


Model=UTAUT; Technology=eSurveys
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q7.2 Q7.7 Q7.5 Q7.15 Q7.6 Q7.1 Q7.8 Q7.13 Q7.3 Q7.14 Q7.16 Q7.12 Q7.11 Q7.9 Q7.10 Q7.4
Question number


Model=UTAUT; Technology=webinars
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q7.1 Q7.14 Q7.2 Q7.15 Q7.6 Q7.7 Q7.8 Q7.5 Q7.3 Q7.16 Q7.10 Q7.13 Q7.11 Q7.9 Q7.12 Q7.4
Question number



Switch model

The questions asked in the survey for the Switch model are:

Q8.1 'To what degree can you learn from the success of others using the innovation and clone it?'

Q8.2 'To what degree are the specific steps that you need to take to use the innovation clear to you?'

Q8.3 'To what degree are the outcomes that will be achieved by using the innovation clear to you?'

Q8.4 'To what degree are you emotionally engaged with wanting the innovation to succeed?'

Q8.5 'To what degree can you take small easily achievable steps towards succeeding with the innovation?'

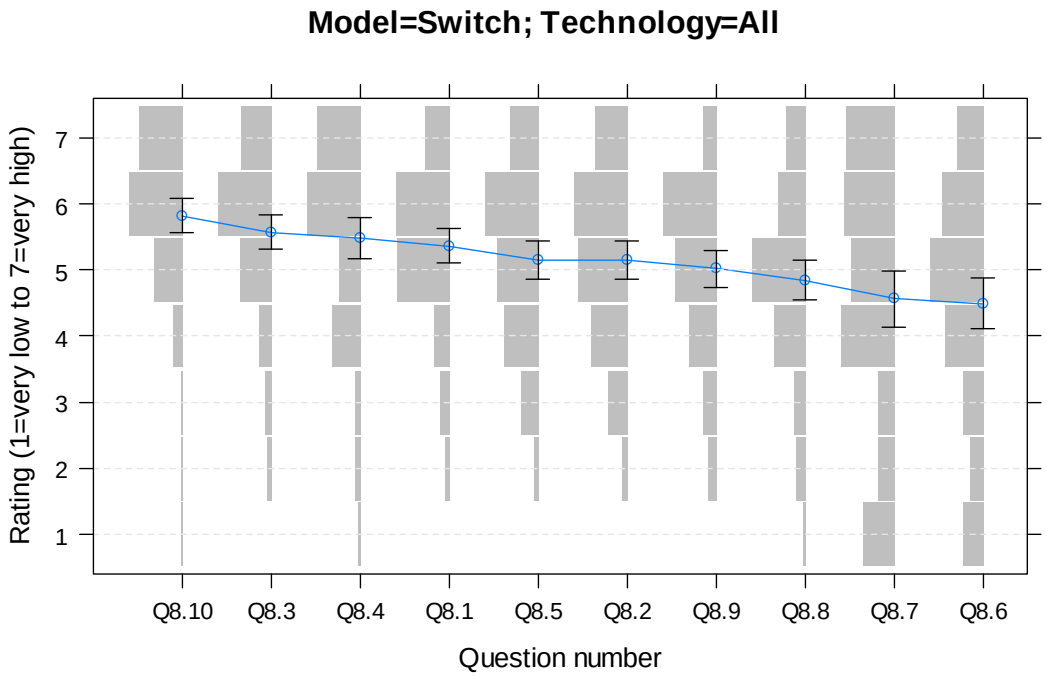
Q8.6 'To what degree does successfully using the innovation bring you a sense of identity?'

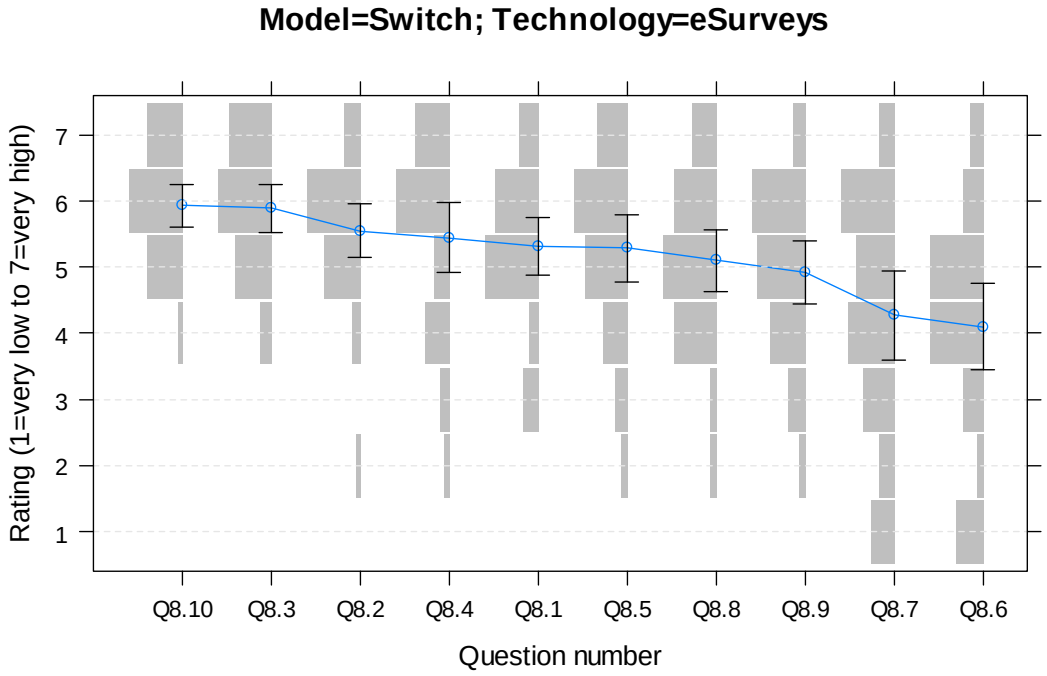
Q8.7 'To what degree does your physical environment force you to use the new innovation instead of the old way?'

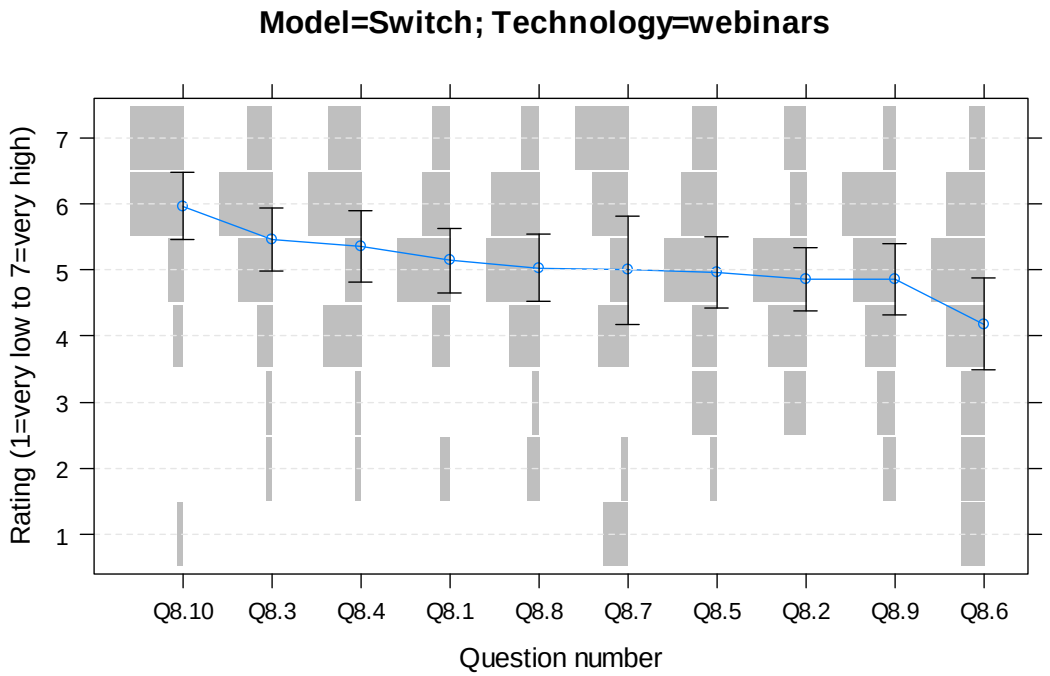
Q8.8 'To what degree is it easy to make using the innovation a habit?'

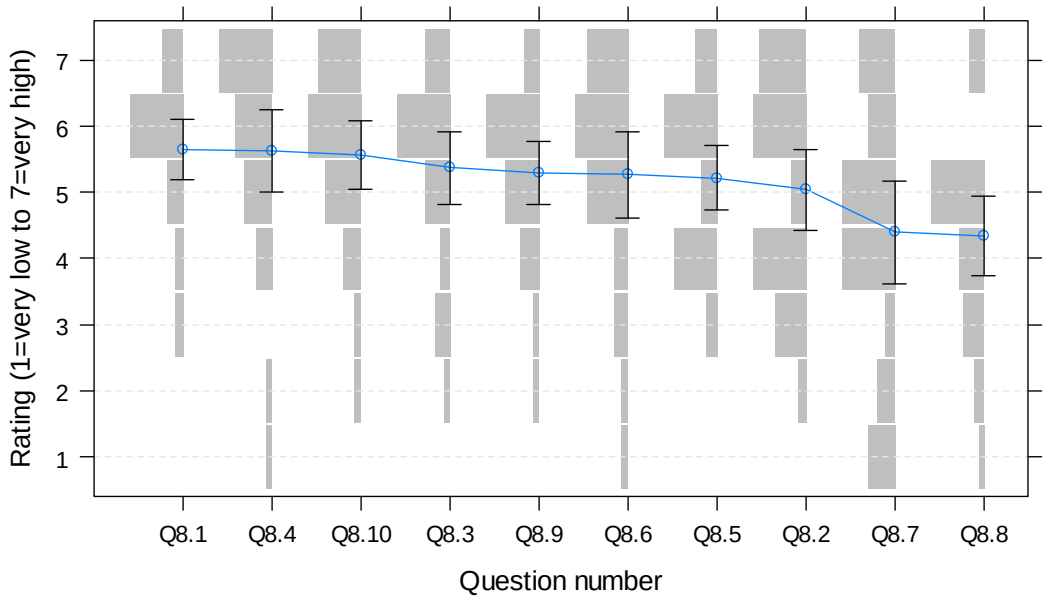
Q8.9 'To what degree is the innovation contagious for others to want to use it?'

Q8.10 'To what degree is it sustainable to use the innovation in the long-term?'


Model=Switch; Technology=All
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q8.10
Q8.3
Q8.4
Q8.1
Q8.5
Q8.2
Q8.9
Q8.8
Q8.7
Q8.6
Question number


Model=Switch; Technology=eSurveys
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q8.10
Q8.3
Q8.2
Q8.4
Q8.1
Q8.5
Q8.8
Q8.9
Q8.7
Q8.6
Question number





ADOPT model

The questions asked in the survey for the ADOPT model are:

Q9.1 'To what degree is maximising cost efficiency a strong motivation for you?'

Q9.2 'To what degree is protecting the natural environment a strong motivation for you?'

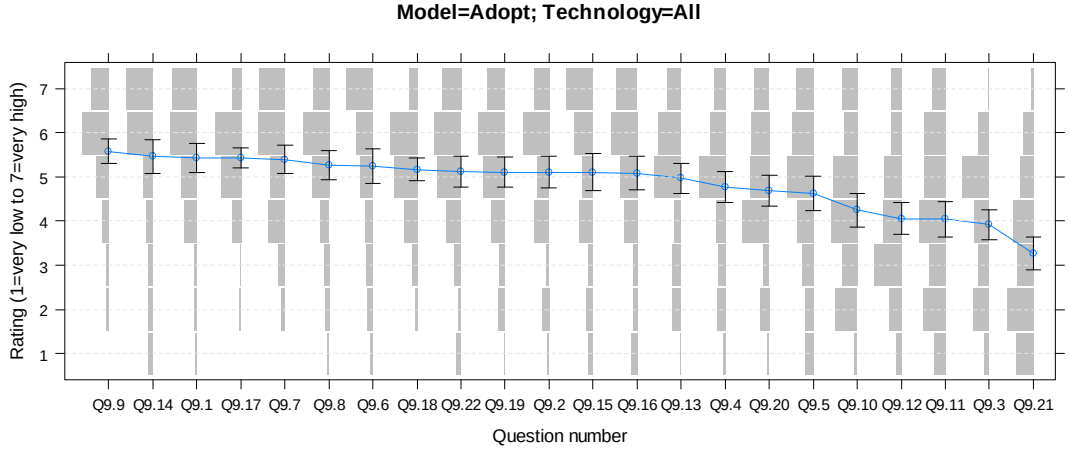
Q9.3 'To what degree are you risk averse with your work activities?'

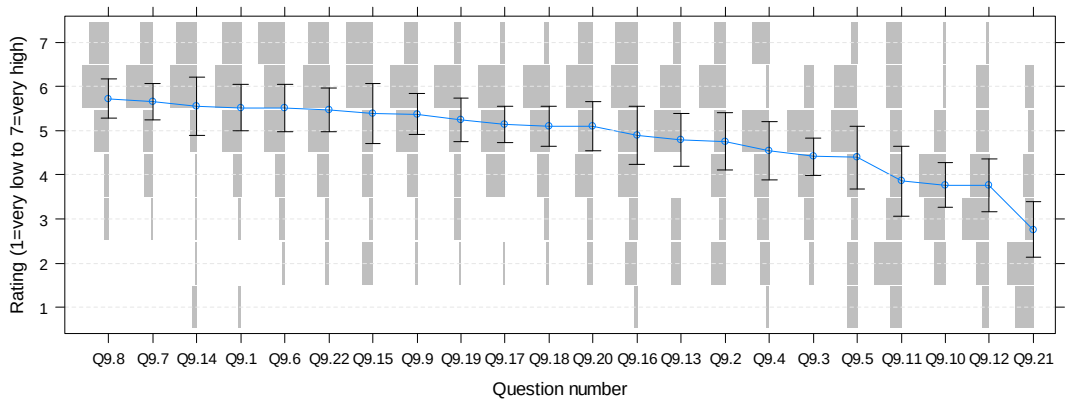
Q9.4 'To what degree do all of your work activities benefit from the innovation?'

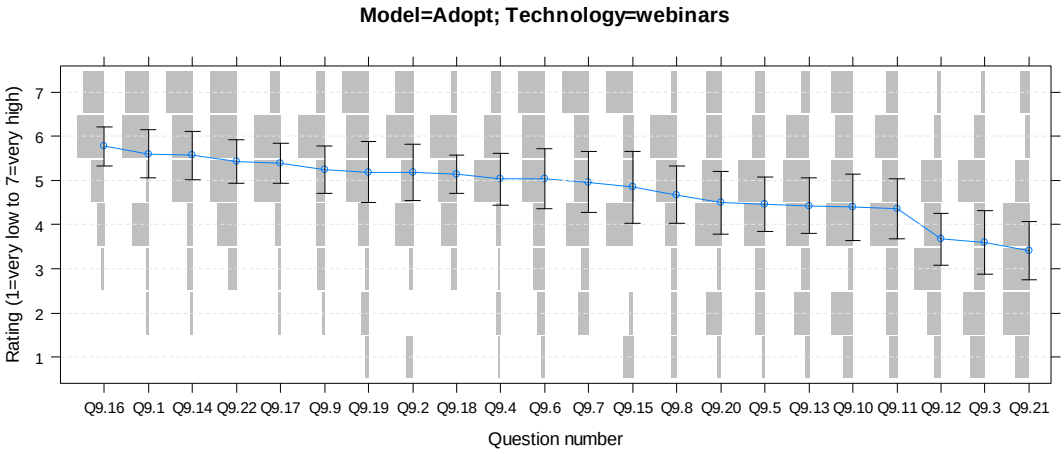
Q9.5 'To what degree do your work activities have a long-term (greater than 10 years) outlook?'

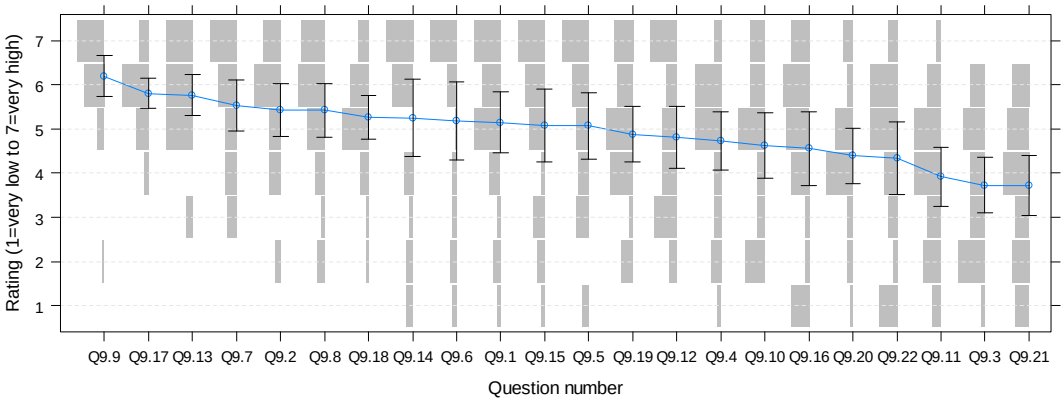
Q9.6 'To what degree are your work activities under severe short-term financial constraints?'

Q9.7 ‘To what degree can the innovation be trialled on a limited basis before a decision is made to adopt it on a larger scale?’
Q9.8 ‘To what degree can the effects of the innovation be easily evaluated?’
Q9.9 ‘To what degree is the innovation observable to other potential users?’
Q9.10 ‘To what degree are consultants available to provide advice to you about the innovation?’
Q9.11 ‘To what degree do you participate in groups where the innovation could be discussed?’
Q9.12 ‘To what degree do you need to develop substantially new skills and knowledge to use the innovation?’
Q9.13 ‘To what degree are you aware of others using or trialling the innovation?’
Q9.14 ‘To what degree is the up-front cost of the investment small in size relative to the potential annual benefit?’
Q9.15 ‘To what degree is the adoption of the innovation able to be reversed?’
Q9.16 ‘To what degree is the use of the innovation likely to reduce your operating costs?’
Q9.17 ‘To what degree is the use of the innovation likely to have additional effects on the future success of your work activities?’
Q9.18 ‘To what degree would the effects on future success be quickly realised?’
Q9.19 ‘To what degree would the use of the innovation create environmental benefits?’
Q9.20 ‘To what degree would environmental benefits be quickly realised?’
Q9.21 ‘To what degree would the use of the innovation expose your work to risk?’
Q9.22 ‘To what degree would the use of the innovation make the management of your work easier and more convenient?’





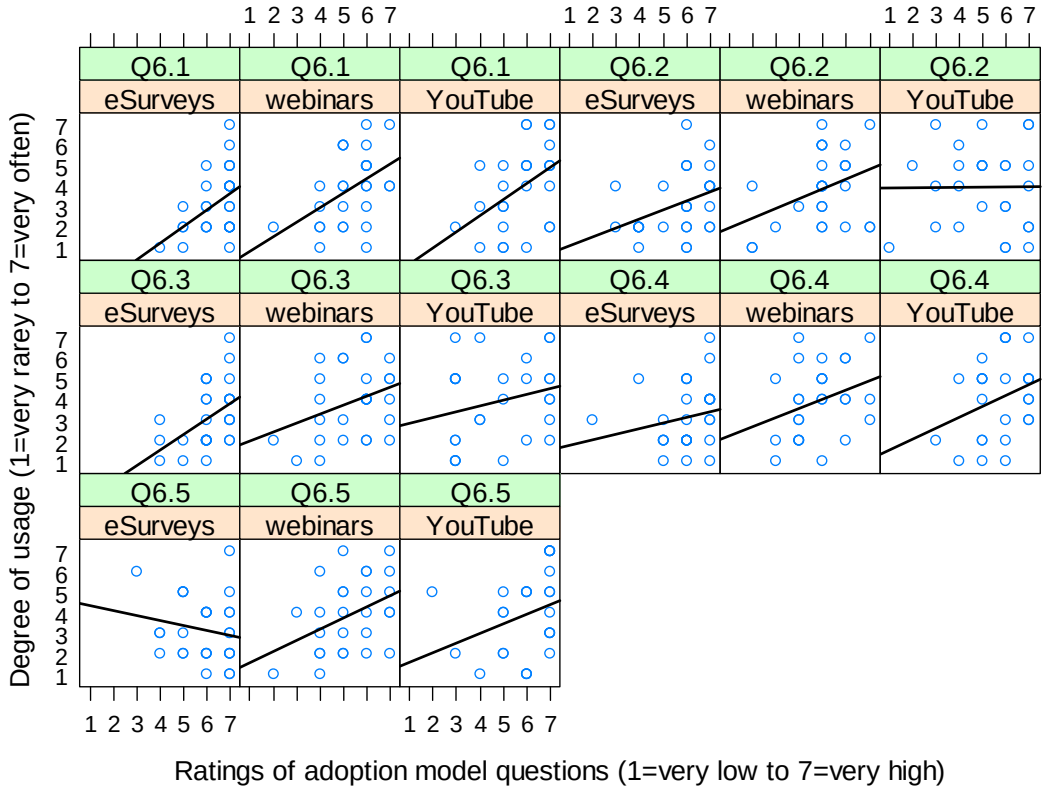

Model=Adopt; Technology=webinars
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q9.16 Q9.1 Q9.14 Q9.22 Q9.17 Q9.9 Q9.19 Q9.2 Q9.18 Q9.4 Q9.6 Q9.7 Q9.15 Q9.8 Q9.20 Q9.5 Q9.13 Q9.10 Q9.11 Q9.12 Q9.3 Q9.21
Question number


Model=Adopt; Technology=YouTube
Rating (1=very low to 7=very high)
1
2
3
4
5
6
7
Q9.9 Q9.17 Q9.13 Q9.7 Q9.2 Q9.8 Q9.18 Q9.14 Q9.6 Q9.1 Q9.15 Q9.5 Q9.19 Q9.12 Q9.4 Q9.10 Q9.16 Q9.20 Q9.22 Q9.11 Q9.3 Q9.21
Question number

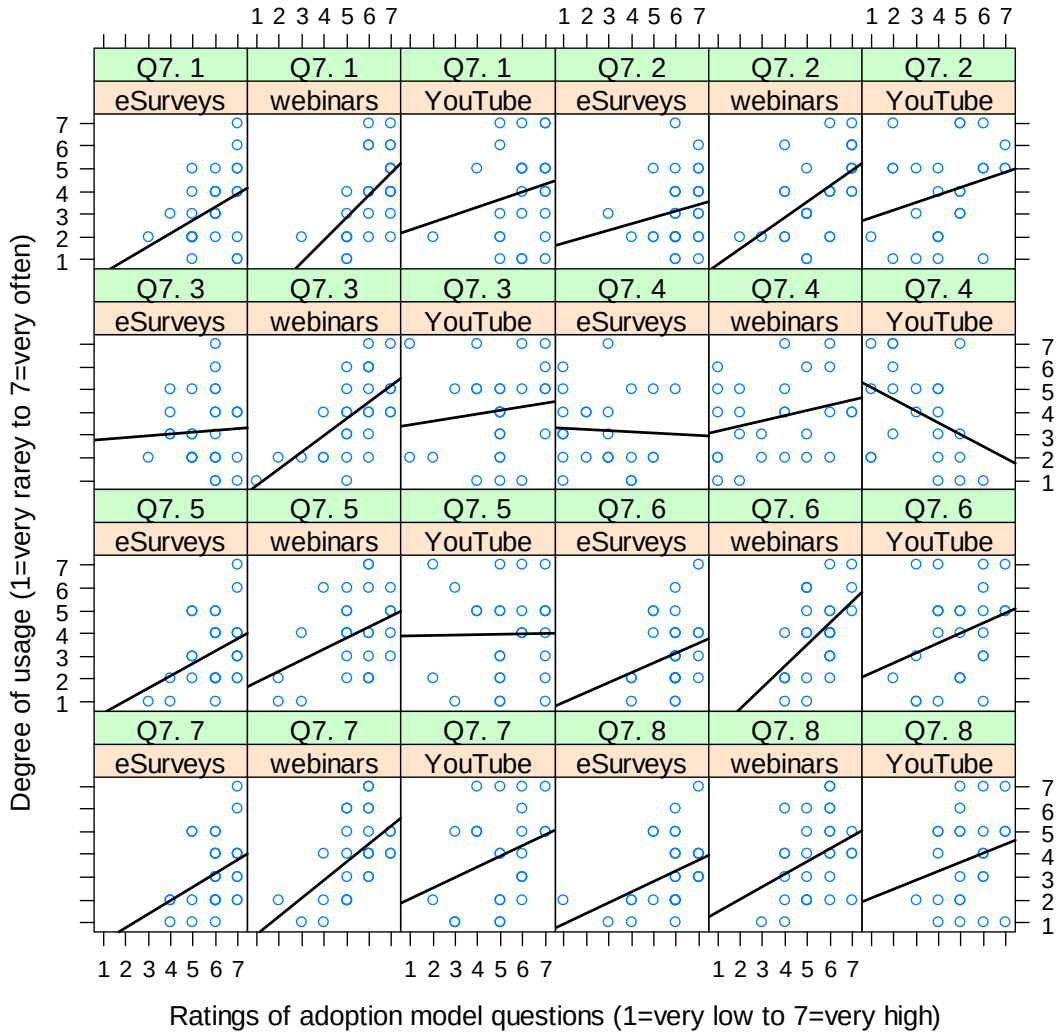
Appendix 5f. What motivates you to adopt an innovation – Ratings versus degree of usage

Ratings for adoption model questions versus degree of usage across technologies. A simple linear regression is fitted.

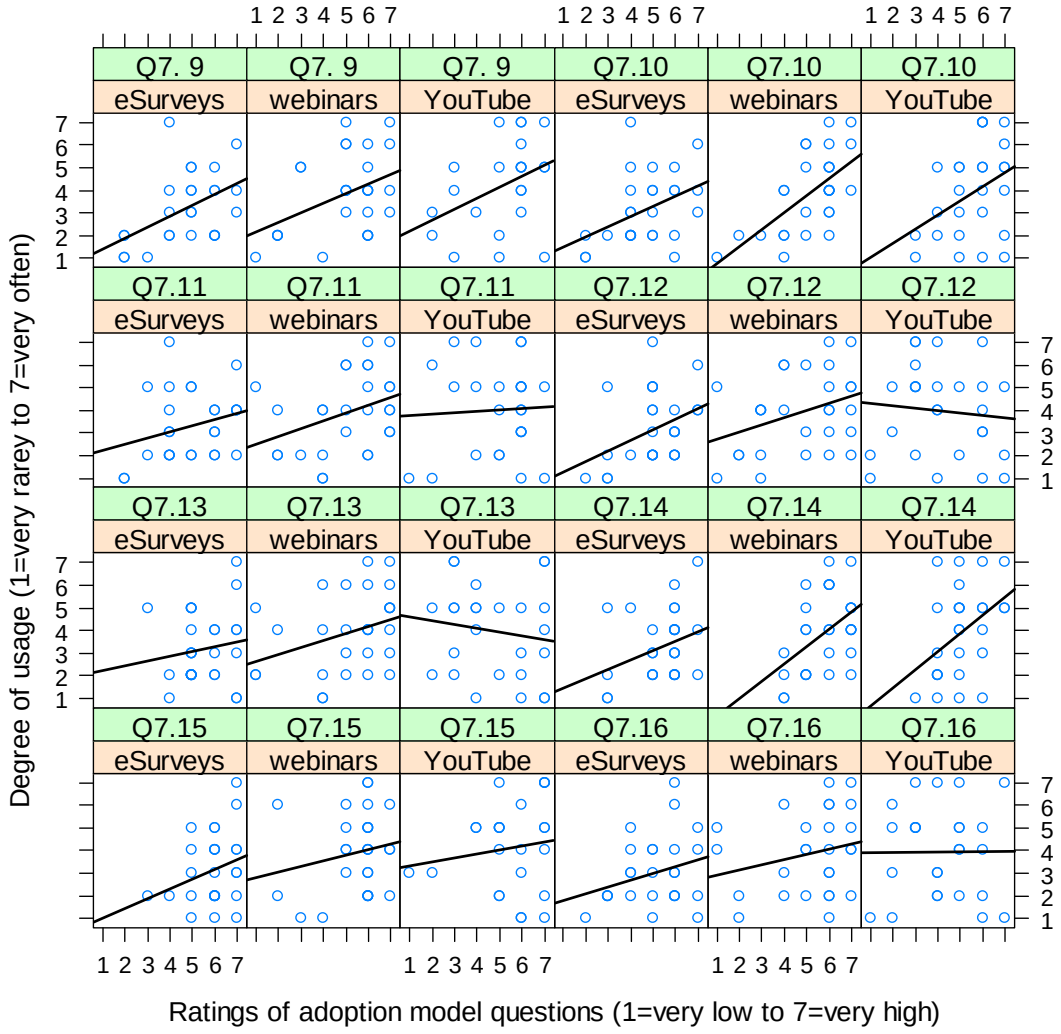
Diffusion of innovations model



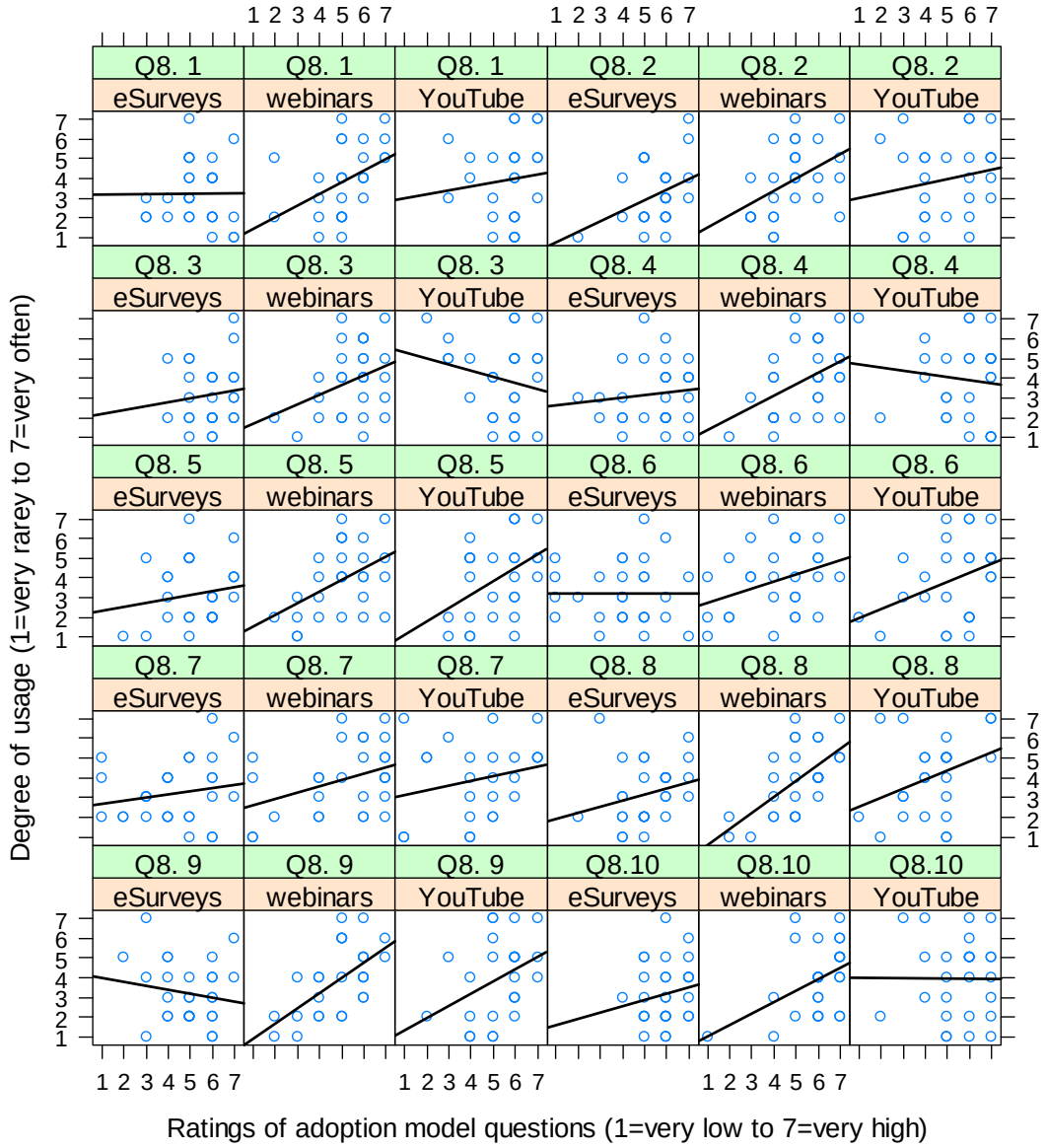
UTAUT model


Q7. 1 eSurveys
Q7. 1 webinars
Q7. 1 YouTube
Q7. 2 eSurveys
Q7. 2 webinars
Q7. 2 YouTube
Q7. 3 eSurveys
Q7. 3 webinars
Q7. 3 YouTube
Q7. 4 eSurveys
Q7. 4 webinars
Q7. 4 YouTube
Q7. 5 eSurveys
Q7. 5 webinars
Q7. 5 YouTube
Q7. 6 eSurveys
Q7. 6 webinars
Q7. 6 YouTube
Q7. 7 eSurveys
Q7. 7 webinars
Q7. 7 YouTube
Q7. 8 eSurveys
Q7. 8 webinars
Q7. 8 YouTube
1 2 3 4 5 6 7
Degree of usage (1=very rarey to 7=very often)
Ratings of adoption model questions (1=very low to 7=very high)

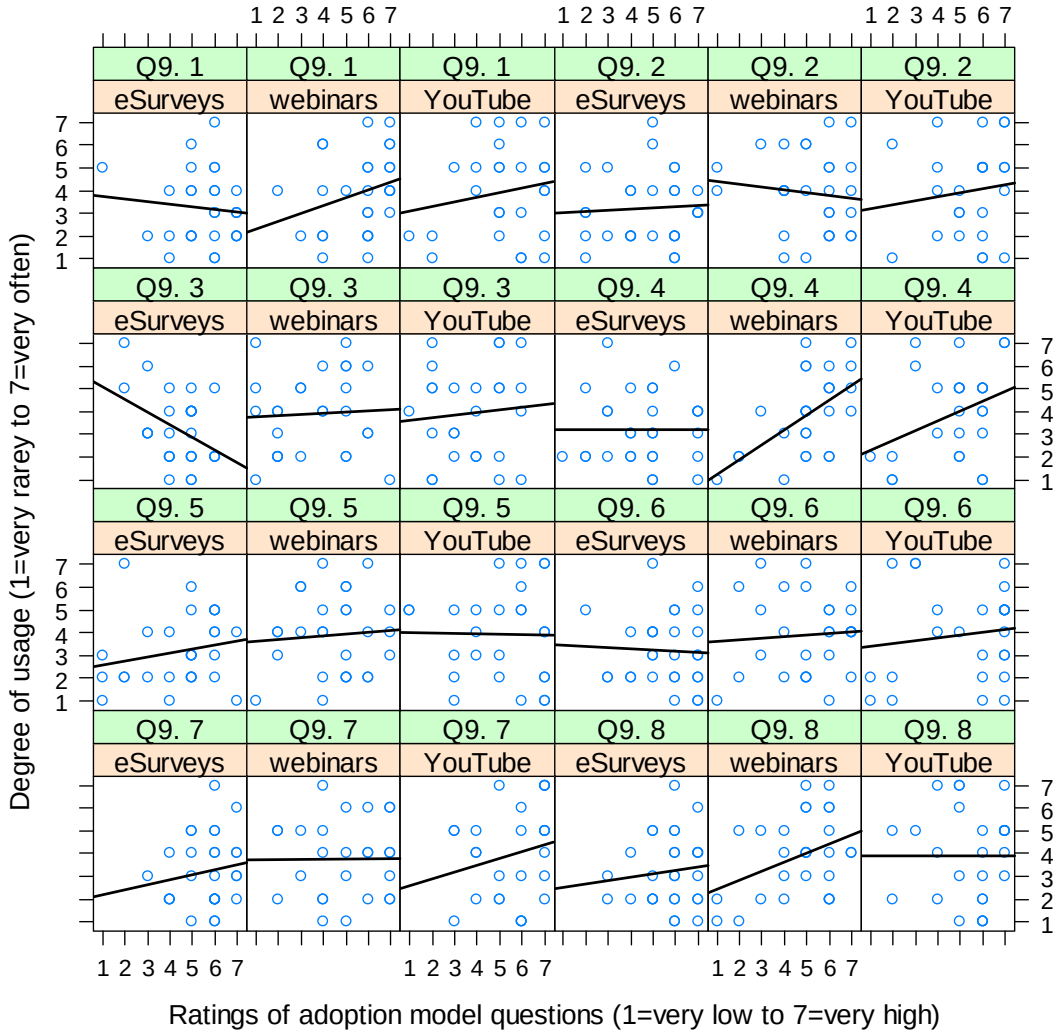
UTAUT model (continued)



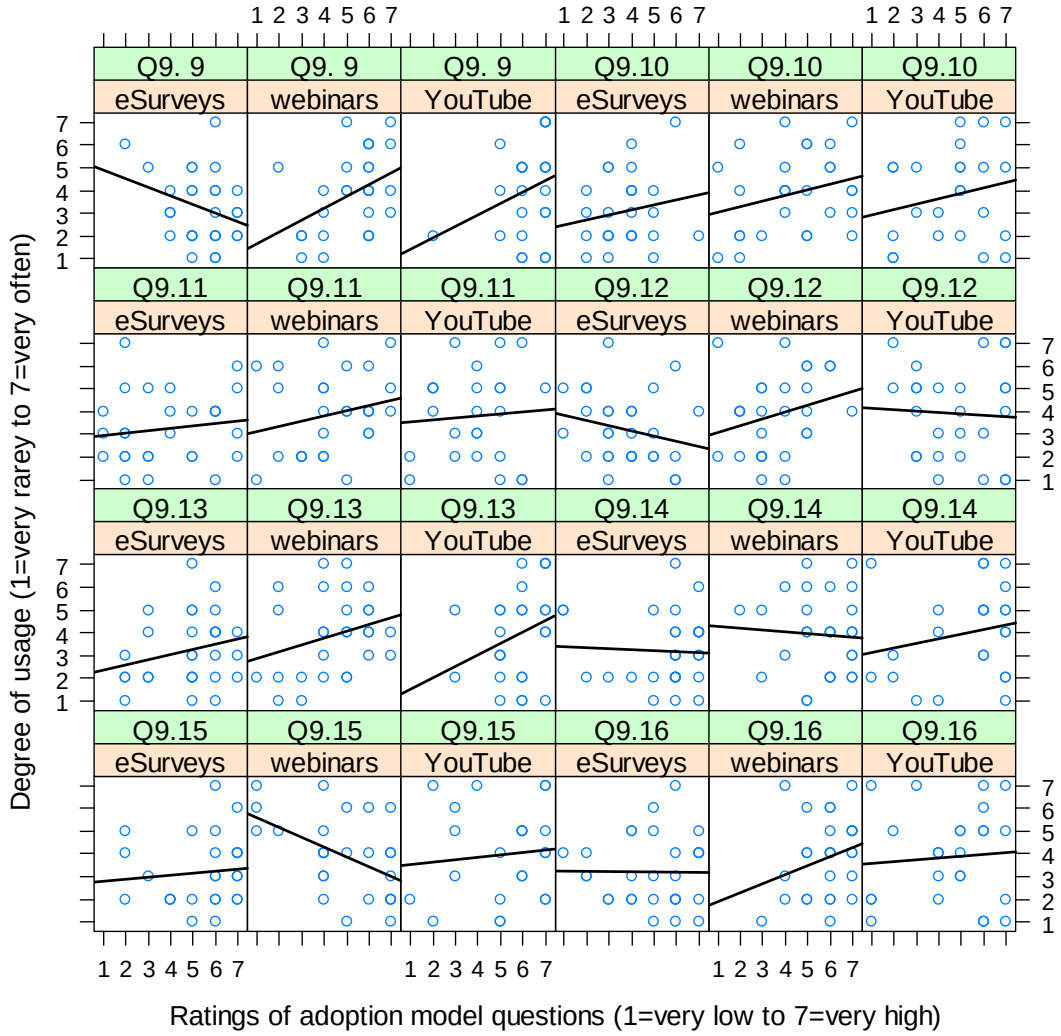
Switch model



ADOPT model


Q9. 1 eSurveys
Q9. 1 webinars
Q9. 1 YouTube
Q9. 2 eSurveys
Q9. 2 webinars
Q9. 2 YouTube
Q9. 3 eSurveys
Q9. 3 webinars
Q9. 3 YouTube
Q9. 4 eSurveys
Q9. 4 webinars
Q9. 4 YouTube
Q9. 5 eSurveys
Q9. 5 webinars
Q9. 5 YouTube
Q9. 6 eSurveys
Q9. 6 webinars
Q9. 6 YouTube
Q9. 7 eSurveys
Q9. 7 webinars
Q9. 7 YouTube
Q9. 8 eSurveys
Q9. 8 webinars
Q9. 8 YouTube
Degree of usage (1=very rarey to 7=very often)
Ratings of adoption model questions (1=very low to 7=very high)

ADOPT model (continued)



ADOPT model (continued)