

**Curtin Business School
Graduate School of Business**

**Behavioural determinants of the adoption of forward contracts by
Western Australian wool producers**

Elizabeth Louise Jackson

**This thesis is presented for the Degree of
Doctor of Philosophy
of
Curtin University of Technology**

January 2008

Declaration

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

.....

Elizabeth Louise Jackson

13 October 2008

Dedication

This work is for Mr Noel Day who started me along this marvellous path and for Mr John Hicks who nurtured the journey. My thanks to both of these splendid gentlemen for welcoming me into their world.

Acknowledgements

Sincere thanks go to my supervisors: Professor Mohammed Quaddus, Dr Nazrul Islam and Associate Professor John Stanton for selecting me to be a part of their ARC-Linkage project. Working with these supervisors, along with financial support from the Australian Research Council, Department of Agriculture and Food Western Australia, Curtin University and the Australian Wool Education Trust, gave me the opportunity and encouragement to publish much of this research in peer-reviewed journals and present at numerous conferences. Publication and presentation of my research has been the most invigorating part of the journey.

Staff members of Curtin University's Graduate School of Business were exceptional in their support of my study. Associate Professor Peter Galvin, Dr Margaret McCabe, Dr Therese Jefferson, Professor Alison Preston and Professor Alma Whiteley were always available at a moment's notice to happily provide advice and support for the duration of my study. I am eternally grateful to each for their support and their unlimited encouragement for publishing this research.

I would also like to thank past and present staff of Curtin University's Muresk Institute who took such an interest in my research and also provided me with excellent opportunities to gain teaching experience whilst completing this PhD. Professor Murray McGregor, Dr Christine Storer, Dr Roy Murray-Prior, Dr Gary Hepworth, Dr Fay Rola-Rubzen, John Connell and Associate Professor Martin Bent are particularly thanked for all their support.

Thanks must also be extended to the members of my study group: Janet Sutherland, Rebecca McCabe and Jane Pritchard. I am grateful to these dear friends for being such wonderful listeners and providers of well-balanced advice – from a research and personal point-of-view.

My thanks go to all the Western Australian farmers who participated in this research. This research would not have been possible without the farming community's enthusiasm for contributing to knowledge. More than 300 wool producers took the time to be surveyed, interviewed or participate in focus groups; this participation was much appreciated.

I am enormously grateful to Dr Winston Chiu who took a keen interest in the development of my research. His wisdom, kindness and carefully chosen stories provided valuable encouragement during difficult periods. His constant faith in my ability never faltered.

This piece of work would not have been possible without the unconditional support of my family. My parents, Jan and Kevin Jackson, and my extended family were always interested in the progress of my research and never missed the opportunity to enthusiastically celebrate the numerous, small milestones of success achieved throughout my PhD experience. My family's unequalled love and support have been appreciated beyond description.

Table of Contents

Declaration.....	i
Dedication	ii
Acknowledgements.....	iii
Table of Contents	v
List of Figures.....	ix
List of Tables	x
Abstract.....	xii
Chapter 1 Introduction	1
1.1. Overview of the Thesis.....	1
1.2. Australian Wool Industry Overview: Its History and Selling Systems.....	2
1.3. Theoretical Overview	6
1.4. Focus of this Research.....	7
1.5. Significance.....	8
1.6. Structure of the Thesis	8
Chapter 2 Literature Review	11
2.1. Introduction.....	11
2.2. The Australian Wool Industry and its Selling Systems.....	12
2.2.1. Wool Production and Marketing in Australia.....	12
2.2.2. Characterising Factors of Australian Farmers	16
2.2.2.1. Challenges facing Australian wool producers	16
2.2.2.2. Farming styles and types.....	18
2.2.2.3. Attitudes, values and goals	20
2.2.2.4. Attitudes and risk management strategies.....	22
2.2.2.5. Attitudes to technology adoption.....	25
2.3. Australian Wool Selling Systems.....	28
2.3.1. Auction	29
2.3.2. Forward contracts.....	32
2.3.3. Futures	34
2.3.4. Other selling methods	36
2.4. Theoretical Background.....	37
2.4.1. Theory of Reasoned Action (TRA).....	38
2.4.2. Theory of Planned Behaviour (TPB)	42
2.4.3. Diffusion of Innovations	46
2.5. Review of Relevant Studies.....	52
2.5.1. Theory of Reasoned Action.....	52
2.5.2. Theory of Planned Behaviour.....	53
2.5.3. Diffusion of Innovations	57

2.6.	<i>Summary</i>	59
Chapter 3	Research Questions and Research Model	61
3.1.	<i>Overview</i>	61
3.2.	<i>Research Questions</i>	61
3.3.	<i>Research Objectives</i>	61
3.4.	<i>The Preliminary Research Model</i>	62
3.5.	<i>Summary</i>	64
Chapter 4	Research Methodology and Design	66
4.1.	<i>Introduction</i>	66
4.2.	<i>Research Paradigm and Method</i>	66
4.3.	<i>The Research Process</i>	69
4.3.1.	Qualitative Field Study	70
4.3.1.1.	Sample selection.....	70
4.3.1.2.	Data collection.....	71
4.3.1.3.	Data analysis.....	71
4.3.2.	Empirical Pilot Study	71
4.3.2.1.	Developing the questionnaire	71
4.3.2.2.	Sample selection and data collection.....	72
4.3.2.3.	Data analysis.....	72
4.3.3.	State Survey.....	72
4.3.3.1.	Sample selection and data collection.....	72
4.3.3.2.	Data analysis using Structural Equation Modelling	73
4.3.4.	Case studies	74
4.3.4.1.	Sample selection.....	74
4.3.4.2.	Interview guide development	75
4.3.4.3.	Data collection and analysis	75
4.4.	<i>Summary</i>	75
Chapter 5	Field Study and Modified Research Model.....	77
5.1.	<i>Introduction</i>	77
5.2.	<i>Operationalisation of the Field Study</i>	78
5.2.1.	Qualitative Research Paradigm	78
5.2.2.	Sample	78
5.2.3.	Data Collection.....	79
5.3.	<i>Data Analysis</i>	80
5.4.	<i>Results and Discussion</i>	82
5.4.1.	Factors and Variables of Forward Contract Adoption	82
5.4.2.	Causal Links Among Factors	88
5.5.	<i>Conclusion</i>	94
Chapter 6	Hypotheses and Questionnaire Development	95
6.1.	<i>Overview</i>	95
6.2.	<i>Hypothesis Development</i>	95
6.2.1.	Hypotheses Related to Factors External to the Farm Business.....	95

6.2.2.	Hypotheses Related to Factors Internal to the Farm Business	102
6.2.3.	Hypotheses Related to the Perceptions of Using Forward Contracts	107
6.3.	<i>Questionnaire Development</i>	112
6.3.1.	Adoption and Diffusion Questionnaire	112
6.3.2.	Measurement Instrument Development	114
6.3.2.1.	Questionnaire section 1	115
6.3.2.2.	Questionnaire section 2	122
6.4.	<i>Summary</i>	122
Chapter 7	Data Analysis Using Structural Equation Modelling	124
7.1.	<i>Introduction</i>	124
7.2.	<i>Survey Pre-testing</i>	125
7.3.	<i>Sample Population Demographics</i>	126
7.4.	<i>Selection of Estimation Method</i>	132
7.4.1.	Estimation Methods	132
7.4.2.	Sample Size	133
7.4.3.	Data Examination	134
7.5.	<i>Model Assessment</i>	135
7.5.1.	Two-step Model Assessment Structure	135
7.5.1.1.	Assessment of the measurement model	136
7.5.1.2.	Assessment of the structural model	146
7.6.	<i>Hypothesis Testing</i>	152
7.6.1.	Factors External to the Farm Business	154
7.6.2.	Factors Internal to the Farm Business	157
7.6.3.	Perceived Usefulness of Using Forward Contracts	159
7.6.4.	Perceived Subjective Norms Associated with Using Forward Contracts	160
7.6.5.	Perceived Behavioural Control Associated with Using Forward Contracts	161
7.7.	<i>Summary</i>	161
Chapter 8	Results, Interpretation and Discussion	164
8.1.	<i>Overview</i>	164
8.2.	<i>Discussion of data analysis results</i>	164
8.2.1.	Factors External to the Farm Business	164
8.2.2.	Factors Internal to the Farm Business	168
8.2.3.	Perceived Usefulness of Using Forward Contracts	171
8.2.4.	Perceived Subjective Norms Associated with Using Forward Contracts	175
8.2.5.	Perceived Behavioural Control Associated with Using Forward Contracts	176
8.3.	<i>Summary</i>	177
Chapter 9	Case Studies	180
9.1.	<i>Introduction</i>	180
9.2.	<i>Research questions</i>	180
9.3.	<i>Method</i>	181
9.3.1.	Concurrent Triangulation Strategy	181
9.3.2.	Sample	182
9.3.3.	Interviews	182

9.3.4.	Data Collection.....	183
9.3.5.	Data Analysis.....	184
9.4.	<i>Results and Interpretations.....</i>	<i>185</i>
9.4.1.	Perceptions of Risk.....	186
9.4.1.1.	Price Differential	186
9.4.1.2.	Other Concerns.....	189
9.5.	<i>Sources of risk.....</i>	<i>190</i>
9.5.1.	Farm Profits	190
9.5.2.	The Whole Farm System	191
9.5.3.	Media Publications.....	193
9.5.4.	Social Pressures.....	195
9.6.	<i>Managing the Risks</i>	<i>197</i>
9.6.1.	Operational Strategies	197
9.6.2.	Marketing Strategies	199
9.7.	<i>An Explanation of Complexity</i>	<i>200</i>
9.8.	<i>Summary.....</i>	<i>201</i>
Chapter 10	Conclusions and Future Directions	203
10.1.	<i>Introduction.....</i>	<i>203</i>
10.2.	<i>Summary of Research.....</i>	<i>203</i>
10.3.	<i>Contributions</i>	<i>204</i>
10.3.1.	To the Literature	204
10.3.2.	To Agribusiness	205
10.4.	<i>Research Limitations</i>	<i>206</i>
10.5.	<i>Future Research.....</i>	<i>208</i>
10.6.	<i>Summary.....</i>	<i>210</i>
Reference List.....		211
Appendix 1	Geographic Locations of Focus Groups.....	241
Appendix 2	Forward Contract Adoption Questionnaire.....	242
Appendix 3	WSA Geographic Locations	250
Appendix 4	Case Study Interview Guide	251

List of Figures

Figure 2.1: Major Western Australian wool markets 2004/05	12
Figure 2.2: Wool prices based on eastern market indicator	13
Figure 2.3: The apparel wool supply chain	16
Figure 2.4: The futures and basis environment	35
Figure 2.5: Basic path model for the Theory of Reasoned Action	39
Figure 2.6: Path model for the Theory of Planned Behaviour	43
Figure 2.7: Willingness to the development of clean technologies	46
Figure 2.8: Technology adoption cycle	47
Figure 2.9: The S-shaped cumulative Diffusion curve and adopter categories	47
Figure 2.10: Diffusion as a linear process	50
Figure 2.11: Fliegel's approach to the adoption of agricultural innovations	50
Figure 3.1: Preliminary combined TRA/TPB/Diffusion model	63
Figure 4.1: Mixed-method research approach	68
Figure 4.2: Major steps in the process of the study	69
Figure 5.1: Combined factors and variables for explaining forward contract adoption	85
Figure 5.2: Combined model to explain forward contract adoption	91
Figure 6.1: Illustration of hypothesised relationships	96
Figure 7.1: The two-step PLS analysis approach	124
Figure 7.2: Structural model estimation	147
Figure 7.3: Analysis of the structural model	151

List of Tables

Table 2.1: Wool outlook for Australia	14
Table 2.2: Farming styles labels.....	19
Table 5.1: Factors and variables of forward contract adoption.....	82
Table 5.2: Incorporation of raw variables with theoretical independent variables.....	90
Table 5.3: Justification of factors and variables within the behavioural model.....	93
Table 6.1: Survey instrument items related to the Australian wool industry	115
Table 6.2: Survey instrument items related to factors internal to the farm business	116
Table 6.3: Survey instrument items related to perceived usefulness.....	117
Table 6.4: Survey instrument items related to perceived subjective norms	119
Table 6.5: Survey instrument items related to perceived behavioural control.....	120
Table 6.6: Survey instrument items related to intention to adopt.....	121
Table 6.7: Survey instrument items related to sample demographics	122
Table 7.1: Survey respondents by gender.....	126
Table 7.2: Survey respondents by age	127
Table 7.3: Survey respondents by principal farm location	127
Table 7.4: Survey respondents by stage in family cycle	128
Table 7.5: Survey respondents by education level	128
Table 7.6: Survey respondents by years of involvement with the farm business	128
Table 7.7: Survey respondents by farm size.....	129
Table 7.8: Survey respondents by farm production type	129
Table 7.9: Survey respondents by numbers of sheep per property.....	130
Table 7.10: Survey respondents by number of wool bales per property.....	130
Table 7.11: Survey respondents by wool average fibre diameter production.....	131
Table 7.12: Survey respondents by earnings from wool production.....	131
Table 7.13: Survey respondents' experience with using forward contracts.....	132
Table 7.14: Survey respondents' frequency of using and auction and forward contracts.....	132
Table 7.15: Assessment of item reliability	138
Table 7.16: Assessment of internal consistency and AVE	140
Table 7.17: Correlation of latent variables and the square root of AVE.....	141
Table 7.18: Loading and cross loading matrix	143
Table 7.19: Revised assessment of item reliability and internal consistency.....	144
Table 7.20: Revised correlation of latent variables and the square root of AVE.....	144
Table 7.21: Revised loading and cross-loading matrix	145
Table 7.22: R ² values	146

Table 7.23: Bootstrap path co-efficients and their t-values	150
Table 7.24: Summary of hypothesis testing (Factors external to the farm business)	152
Table 7.25: Summary of hypothesis testing (Factors internal to the farm business)	153
Table 7.26: Summary of hypothesis testing (Perceived behavioural control)	154
Table 7.27: Summary of hypothesis testing (Perceived subjective norms)	154
Table 7.28: Summary of hypothesis testing (Perceived behavioural control)	154
Table 9.1: Descriptive information of interview candidates.....	185
Table 9.2: Summary of case study results	187

Abstract

Australian wool traders and researchers have little knowledge of the incomplete adoption of the price risk management strategies that are available to stabilise wool producers' incomes. Auction is by far the most popular method of selling wool in Australia with an adoption rate of about 85%. However this system exposes users (wool producers and buyers alike) to highly volatile prices and non-specific knowledge of supply and demand. Furthermore, it places differentiated wool types in the same commodity market as mass-produced, homogeneous wool types.

In order to address these issues, a mixed-method research design was used to develop and test a behavioural model of wool producers' intentions to adopt the use of forward contracts; a selling method alternative to auction. In the simplest terms, a forward contract is a binding agreement between a buyer and a seller that stipulates price, quality, quantity and delivery date of a product.

The behavioural model developed for this research was based on the Theory of Reasoned Action, Theory of Planned Behaviour and Diffusion of Innovations as well as some farm-level constructs that were raised in focus groups with Western Australian wool producers. The focus groups were pivotal in adding a unique, farm-level decision-making dimension to the behavioural model by the inclusion of various factors external and internal to the farm business.

Based on the behavioural model, 28 hypotheses were developed and tested. Data was collected via a telephone survey of 305 Western Australian wool producers and analysis was conducted using the Partial Least Squares (PLS) approach to Structural Equation Modelling (SEM).

A key finding of this analysis, contrary to the initial indications of focus group discussions, is that the current selling and marketing structure of the Australian wool industry, including the dominance of the auction system, is an important but not a limiting factor associated with the adoption of forward contracts for the sale of raw wool. Similarly, some other factors internal to the farm business, such as past experiences with selling wool, level of dependence on wool to earn a living and commitment to producing wool, were also found not to limit the adoption of forward contracts.

The main factor limiting the adoption of forward contracts was identified as the wool producers' perceptions of risk and uncertainty. Farmers' perceptions of risk and uncertainty and their perceptions and attitudes in general are known to be important influences on farmers' adoption decisions.

While the majority of the hypotheses tested within the model were explained by the data, further data were collected to solve the issues associated with why farmers perceive forward contracting as being subject to risk and uncertainty. Additional research was conducted in the form of four case studies with Western Australian wool producers who had varying commitments to using forward contracts. Results showed that profit-raising, the whole farm system as a basis for decision making, the mass media and social pressures are important behavioural factors that are limiting the adoption of forward contracts by Western Australian wool producers.

Overall, the results of the study indicate that the current structure of the Australian wool industry and various factors internal to the farm business account for farmers' attitudes towards the use of forward contracts to sell their wool. More importantly, from an agribusiness point of view, it is the perceived risk associated with price that principally accounts for the incomplete adoption of forward contracts in the wool industry.

The conclusions of this study resulted in the development of new research questions that focus on the study's theoretical framework, the impact of supply chain dynamics on the adoption of forward contracts and the empirical testing of additional behavioural determinants such as trust, habit and social cohesion.

Based on the results of this study, several contributions have been made to the literature and agribusiness. The study showed that variables from the Diffusion of Innovations model played a significant part in this research. However, the more substantial finding was that the Theory of Reasoned Action is likely to be a superior theoretical framework for modelling wool producers' adoption behaviours related to forward contracts than the Theory of Planned Behaviour. This claim is based on the finding that perceived behavioural controls are not a significant factor in the intention of wool producers to adopt the use of forward contracts. In terms of the contributions to agribusiness, information and extension initiatives that explain and demonstrate the benefits of forward contracts may be necessary if farmers' perceptions of the riskiness and uncertainty surrounding these contracts are to be altered.

Chapter 1 Introduction

1.1. Overview of the Thesis

Wool is predominantly sold by auction in Australian. However some producers find this method of selling inefficient because it does not accurately reflect international demand signals, nor does it put any special value on differentiated wool types that are being produced for specific markets. Alternative selling methods are available to wool producers, such as forward contracts and futures, but it seems that these alternatives have been overlooked (Woods, Hood & Couchman 2005). Only 15% of Australia's wool is sold by methods other than auction (Australian Wool Innovation n.d.). It is therefore the purpose of this research to understand this problem and investigate the behavioural determinants surrounding the non-adoption of forward contracts by Western Australian wool producers.

A three-phase, mixed-method approach (Teddlie & Tashakkori 2003; Creswell 2003) was used to develop and test a behavioural model based on the theoretical frameworks of the Theory of Reasoned Action (Ajzen & Fishbein 1980), Theory of Planned Behaviour (Ajzen 1991) and Diffusion of Innovations (Rogers 1995). Results of four focus groups were combined with adoption literature to build the behavioural model that tested 28 hypotheses using the Partial Least Squares (Barclay, Higgins & Thompson 1995; Gefen, Straub & Boudreau 2000) approach to Structural Equation Modelling. Finally, four case studies were developed to further explain some of the finer details that arose from analysis of the behavioural model.

This thesis is a deep description and analysis of the aforementioned research process. The thesis opens with an overview which is then followed by an extensive literature review of the Australian wool industry and its selling systems, the theoretical background of the research and a review of relevant studies. Research questions and methodologies are then described in detail and are followed by a description and analysis of four focus groups that were conducted to add factors specific to Western Australian wool production to the behavioural model. Thereafter analysis of the focus groups, development of hypotheses and the survey instrument are discussed and then quantitative data analysis is conducted on data from 305 surveys collected via telephone interviews. Results, interpretations and a discussion of the data analysis are provided and then details of the case studies are discussed. The thesis closes with a summary of the study and a description of

contributions made to the literature and agribusiness. Finally, the limitations of the study and topics for future research are offered.

1.2. Australian Wool Industry Overview: Its History and Selling Systems

Australia is by far the world's largest supplier of apparel wool (Lowe 2005). The industry earned the nation A\$2.5 billion of export income in the 2005/06 financial year (Wood 2006). Year to year this national wool clip income is impacted upon by a number of significant forces. In recent years, severe droughts throughout the country have seen national wool sales decline and prices rise due to buyer fear of not being able to source the commodity into the future (Bolt 2007). Yet, competition from other fibres (cotton and synthetics) throughout the world has curbed the upward activity of wool prices (Ashton 2003). In terms of Western Australia, there is the expectation that the region that contributes 26% to the national wool clip (Stanton 2007) will increase its supply due to increasing consumption by the state's biggest customer - China (Stanton 2004). Wilcox (2004) comments on the expected variability of wool prices early in 2004 and says that this is principally derived from the extreme fragility of market confidence, and the possibility of unexpected shocks in the demand side of the market. Fluctuating wool prices are still being experienced as a result of the push and pull forces of demand and supply in the world textile market (Bolt 2007).

Since 1989 the decline in wool prices has seen woolgrowers' incomes suffer and specialist wool growers have experienced negative farm-business profits (Kingwell, Bathgate & O'Connell 1999; Shafron, Martin & Ashton 2002). Kingwell, Bathgate and O'Connell (1999) give three reasons for this price decline: 1) the increased storage of wool either on-farm or in brokers' sheds, 2) the economic crisis experienced by so many Asian economies in the late 1990s and 3) the price-competitive nature of substitute products.

The Reserve Price Scheme that existed in the Australian wool selling industry until July 1991 held substantial regulatory power over sellers, that is, farmers (Richardson 2001). There were numerous consequences of the Scheme's removal, one of which was the realisation of how dependent the industry had become on the auction system of selling wool. Stemming from this came the understanding that the industry had basically become structured around a somewhat inflexible system (Wool Industry Review

Committee 1993). The industry found itself comfortable, to the point of rigidity, with the auction system and unwittingly discouraged less price-risk, alternative selling systems to farmers (Wool Industry Review Committee 1993; Musser, Patrick & Eckman 1996).

Some 13 years after the Reserve Price Scheme's demise and despite efforts to introduce electronic and other selling alternatives to the industry (Bolt 2004a; Liddle 2004), about 85% of the Australian wool clip is still sold through open-cry auction (Bolt 2004a) with 15% being sold by alternative means. These alternatives include, but are not limited to: Sale by Tender, Retained Ownership Programs, Forward Contracts, Tops Auction, Laser Matched Interlots, Charging Structure, Premier Wool Newcastle, Offer Boards, Broker Exchange Desk (available through Elders [www.elders.com.au] or Landmark [www.landmark.com.au]) and Futures and Options Contracts (www.sfe.com.au).

The Australian industry took a backward step to enhancing selling alternatives for growers in August 2004 when its principal futures broker, Macquarie Bank, closed its wool futures service. The main reason given for this move was that there was no incentive for growers to hedge. This lack of incentive was said to be due to the fact that the forward market tends to yield lower prices than the spot market and was therefore not supported by growers. It was suggested that at least 20% of the national clip has to be forward sold before healthy prices can be achieved in order to resume more fluid trading (Cumming 2004).

Interestingly, despite warnings of increasing commodity price fluctuations and encouragement for farmers to better manage their price risk (Kingwell 2000; Barnard & Nix 1979), the past 15 years has seen the total percentage of the Australian wool clip being sold at auction increase from 80% (Piggot 1993; Teasdale 1991) to 85% (Bolt 2004a). The opposite has occurred in New Zealand where Champion (2004, p. 18) reports that "the proportion of forward contracts has dramatically increased over the past 5 years..."

A further anomaly is that of the destiny of the wool sold by forward contract. Teasdale (1991) reports that a percentage of the wool sold by private treaty, that is, by means other than at auction, is resold by the buyer at auction, a view supported by Stanton, Curtis and Dolling (2003). So the popularity of the Australian wool auction is being perpetuated by the industry.

The Wool Industry Review Committee (1993, p. 75) declared the somewhat anti-competitive and regulated-in-nature Australian wool auction system to be “defective due to volatility, [exposed to] possible manipulation, [have] unpredictable time constraints and [be] an unnecessary intermediary participation in the communication channel”. These claims were supported by the citing of research from 1992 that showed 31% of wool growers were dissatisfied with the auction system.

More recently, the chairman of a key national wool body, The Woolmark Company, has been reported to say that Australia urgently needs a better price discovery system than that of auction as this parochial selling method fails to reflect the supply and demand situation of wool at any given time (Liddle 2004).

Champion and Fearn (2001a) also claim that the industry is slow to respond to change. Their research found that the auction system has led to the creation of “functional silos” (p. 237) that limit communication between members of the industry which can only be remedied by a vertically co-ordinated supply chain. It is the use of alternative selling mechanisms, such as forward contracts, that will allow this free flow of information between supply chain players, as found by the New Zealand wool industry where some 60% of wool is sold by direct supply contract (Brakenridge 2004; Champion 2004). The Tasmanian wool industry has also experienced a similar outcome with the wide adoption of forward contracts for selling wool (Courtney 2007; Page 2007).

The New Zealand Merino Company, which sells 60% of New Zealand’s clip (Champion 2004), states that forward contracts guarantee a known supply of wool to buyers, enable processing companies to communicate their needs directly to growers, build personal bonds with growers and provide up-to-date development, training and technical support to their commodity suppliers (Brakenridge 2004).

This leads to the fundamental focus of this research project: the adoption of the forward market by Australian wool producers.

What is a forward contract? The Wool Industry Review Committee (1993, p. 76) defined a forward contract as “A binding contract specifying the price (or price formula), quality and quantity of a product to be delivered at some specified date. The quantity may be expressed in units of output or as the production from a specified area. The contract usually specifies penalties to be exacted from each party for particular kinds of non-fulfilment.” Further, Barnard and Nix (1979) give a British agribusiness definition of

forward contracts and aptly describe them as a tool of turning price uncertainty into price certainty. What can be gleaned from these definitions is that no matter how one considers a forward contract, such a selling mechanism is characterised by a set price and set delivery date for a specified commodity.

The principal benefits of forward contracts to farmers discussed in the literature are based on the concepts of the uncertainty associated with price risk management and income stabilisation (Barnard & Nix 1979; Miller 1986; Musser, Patrick & Eckman 1996; Fraser 1997; McLeay & Zwart 1998; Coad 2000; Kingwell 2000; Champion & Fearn 2001b; Brakenridge 2004; Cuming 2004; Liddle 2004). Many authors discuss the risk-averse nature of farmers (Bond & Wonder 1980; Pluske & Fraser 1995; Coad 2000; Pannell, Malcolm & Kingwell 2000) and comment on the benefit of forward contracts in terms of income stabilisation.

Further to these advantages, Goss (1987, p. 225) points out the benefits of forward contracts to industry. He advocates that this form of selling possesses informational efficiencies for industry in that markets which efficiently project their prices into the future can have “unbiased anticipations of subsequent spot prices”. In turn, this enables markets to perform to their optimum in terms of price discovery and also assists these markets in minimising the adjustment costs of industry-specific agents who offer forward contracts.

This view is supported by the New Zealand Merino Company (Brakenridge 2004) and Roberts Pty Ltd of Tasmania (Courtney 2007; Page 2007) which have made public the benefits of forward contracting to industry as being guaranteed supply of wool to processors, superior quality control by processors and, most importantly, the building of relationships with wool growers.

Despite these benefits to growers and industry, it was found by Coad (2000) that only 11% of producers sell their wool by forward contract in Australia. It is therefore the aim of this research to understand the behavioural determinants of wool producers for the adoption of the forward market. In addressing this aim it will be revealed if producers are fully cognisant of the forward market, or that it exists? If so, why is it utilised so sparingly?

1.3. Theoretical Overview

The Theory of Reasoned Action (Ajzen & Fishbein 1980), the Theory of Planned Behaviour (Ajzen 1991) and Rogers' (1995) Diffusions of Innovation theory are the principal theoretical frameworks used for this research based on their foci of behavioural and attitudinal factors associated with human decision making.

The Theory of Reasoned Action (TRA) suggests that personal ('attitude toward the behaviour') and social ('subjective norms') factors are the determinants of a person's intention to perform a particular behaviour. It also suggests that social pressures associated with both the personal and social elements, termed normative beliefs, will influence intentions (Ajzen & Fishbein 1980; Willock et al. 1999a; Burton 2004).

The Theory of Planned Behaviour (TPB) is an extension of the TRA and has been described as extending "the boundary conditions of pure volitional control specified by the TRA." (Madden, Scholder Ellen & Ajzen 1992, p. 4). It is the same as TRA but has the 'perceived behavioural control' construct added in order to more fully account for intention to adopt a behaviour (Madden, Scholder Ellen & Ajzen 1992). However, both theories are based on the notion "that people distinguish between beliefs about the consequences of performing a behaviour and beliefs about the opinions of important others toward performing that behaviour" (Trafimow & Fishbein 1995, p. 257).

Madden, Scholder Ellen and Ajzen (1992), Willock et al. (1999a) and Burton (2004) discuss the wide application of the TRA as a tool for the prediction of behavioural intention or adoption behaviour. However, examining the literature exposes the extensive use of the TRA in the field of agribusiness. Beedell and Rehman (1999 & 2000) used the TPB to explain farmers' land conservation behaviours while Burton (2004) has undertaken some more recent work using the TRA to test how well 'attitude' studies are adapted to policy-making in agricultural studies.

It is clear that the TRA and TPB are both suitable for the type of research undertaken herein, yet another research tradition exists that has been widely used in rural sociology research since the 1940s: Rogers' (1995) Diffusion of Innovations. Elements from this theory ('relative advantage', 'compatibility', 'complexity', 'trialability', 'observability' and risk) will be used in this research to guide exploration of the TRA/TPB 'perceived usefulness' construct.

While the concept of adoption, as portrayed in the TRA/TPB models, is concerned with the internal decision-making process of an individual (Fisher et al. 2000), Diffusion is concerned with the “process by which an innovation is communicated through certain channels over time among members of a social system” (Rogers 1995, p. 5). While the TRA and TPB are the dominant theoretical frameworks for this research, the importance of communication and social dynamics from Diffusion of Innovations are highlighted when considering norms associated with selling wool by forward contract.

1.4. *Focus of this Research*

As the title suggests, this research is principally a behavioural study. Burton (2004, p. 360) characterises behavioural studies as “a broad range of studies that employ actor-orientated quantitative methodologies to the investigation of decision-making.” He goes on to discuss how this form of study has been used in the fields of economics, geography and sociology. Burton separates behavioural approaches in agriculture by stating that it is in this field that such studies seek to understand the decision-making behaviours of individual farmers or land managers. These studies not only focus on regular psychological constructs (like ‘attitudes’, ‘values’ and ‘goals’) but also generate information on factors like farm size, farm economic situation and successional status. The final point made by Burton is that associated with the extensive use of quantitative methodologies with particular reference to psychometric scales in agriculture-based behavioural studies. It is the use of this kind of measure that allows for non-economic factors that contribute to decision-making to be realised.

Despite reported hardships associated with wool production in Australia (Wilcox 2004) and fluctuating cash flows (Kingwell 2000), farmers persist with selling their wool using a system that has been said to be inefficient in terms of price discovery and market signal communication (Wool Industry Review Committee 1993). It is therefore the focus of this research to identify the characteristics of the wool systems that currently exist in Australia and define the behaviours that determine why and how producers sell their wool.

From this knowledge, the following objectives have been developed:

1. To investigate the behavioural determinants of using forward contracts to sell wool in Western Australia via an extensive literature review and focus groups.

2. To develop an adoption model of wool forward contracting based on the behavioural determinants found in (1).
3. Conduct a state-wide survey to test the reliability and validity of the adoption model and its corresponding hypotheses.
4. Conduct in-depth case studies to further confirm the findings of (3).
5. To add to the knowledge held by wool producers and the broader agribusiness community of forward contracting as a method of selling wool.

1.5. Significance

The elements of significance surrounding this project have theoretical and practical implications.

Investigating the behavioural determinants of the adoption of forward contracts by wool producers will require the development of a theoretical model that will be the research's theoretical contribution to knowledge. This model will be a combination of Ajzen and Fishbein's (1980) TRA and TPB and will incorporate some elements from Rogers' (1995) Diffusion of Innovation theory.

A great deal of work has been carried out to understand the determinants of farmers' land conservation (Beedell & Rehman 1999 & 2000) and environmentally-orientated behaviour (Willock et al. 1999a). The factors affecting choice of sales method for selling grain is also understood (McLeay & Zwart 1998), but there is an absence of research to determine why farmers choose to sell their wool by any particular method.

In terms of the practical applications of this research, three key industry stakeholders will benefit from this knowledge. Results will be principally used by the Department of Agriculture and Food Western Australia (DAFWA) for wool policy-making initiatives and agribusiness consultants, and their clients, will also benefit as it will be understood what factors are inhibiting farmers from selling wool by more efficient means than auction.

1.6. Structure of the Thesis

Following this introductory chapter, the main body of the thesis begins with a review of the literature associated with this research. The literature review in Chapter 2 gives a situational analysis of the Australian wool industry, provides details of the theoretical

frameworks used for the research, reviews relevant studies associated with these theoretical frameworks to show their practical application and, finally, a preliminary research framework (based on the findings from the literature review) is shown. The aim of the literature review is to identify a gap in the current research in order to ensure this study provides a truly unique addition to current knowledge on farmer behaviour. A range of books, journal articles, newspaper articles, conference proceedings, press releases and web sites are reviewed for this chapter.

The literature review is followed by Chapter 3 that specifies the research questions proposed herein and provides an updated research model. Chapter 4 gives a detailed description of the research methodology, method and design. This chapter covers the research paradigm and presents how the data were collected using qualitative and quantitative methods. Also covered in Chapter 4 are the methods planned for data analysis (content analysis for the exploratory qualitative phase, structural equation modelling [partial least squares approach] for the confirmatory quantitative phase and cross-case analysis for the confirmatory, qualitative phase) and why such methods were chosen.

Chapter 5 provides an in-depth description of the field study that was undertaken to provide a practical component to the research model. The field study comprised a series of focus groups conducted in regional Western Australia. Content analysis was used from inductive and deductive perspectives to identify farm-level issues that needed to be incorporated into the TRA/TPB/Diffusion framework.

Once the final model had been developed, relationships between the constructs needed to be hypothesised for subsequent reliability and validity testing. Chapter 6 provides details of the hypotheses' development and gives extensive justification as to how each came about; whether that be from literature findings or findings of the field studies. The statement of hypotheses led to the development of a questionnaire for gathering data to test the reliability and validity of the research model. Chapter 6 also provides details on the development of the questionnaire and the development of measures.

Chapter 7 focuses on the data analysis of the pre-test survey and the final telephone survey. Demographic information about the sample population is provided, as well as simple descriptive statistics from the data set. Most of this chapter specifies how Structural Equation Modelling (Partial Least Squares approach) was used to analyse the

survey data and gives details of the study's data examination, exact sample size and estimation methods. Model assessment and hypothesis testing are also presented here.

Results of data analysis are presented in Chapter 8 where each hypothesis is individually considered and an analysis of the model is conducted. In this chapter comments are made about the implications of each hypothesis to the literature and agribusiness.

Analysis and discussion of the data for this study revealed the need to conduct further research in order to more deeply explore the research questions proposed in Chapter 3. In response to this observation Chapter 9 reports on four case studies that were carried out, principally to better understand the perceived risks and complexities associated with using forward contracts.

Finally, conclusions from the research are drawn. Chapter 10 begins with a summary of the research and its limitations. Future directions for the research are identified and the contributions of this study are summarised.

The thesis is concluded with a list of references used throughout and a number of appendices used as supporting evidence within the document.

Chapter 2 Literature Review¹

2.1. Introduction

Studies of farmer behaviour gained popularity in the 1940s when Ryan and Gross (1943) undertook research to understand the diffusion process of hybrid corn among Iowa farmers. Since then, numerous investigations have been undertaken to understand why farmers behave in particular ways (for examples see Burton 2004; Gasson 1973; Willock et al. 1999a; Willock et al. 1999b; Austin et al. 1998a; Austin et al. 1998b; Fairweather & Keating 1994; Kerridge 1978; Kingwell 2000; Austin, Deary & Willock 2001; Barrett & Martin 2003; Bond & Wonder 1980; Machum 2005). While these studies use a broad range of qualitative and quantitative frameworks to understand farmer behaviour, the present research incorporates the principles of the TRA (Fishbein & Ajzen 1975), the TPB (Ajzen 1991) and Rogers' (1995) Diffusion of Innovations to understand the behavioural determinants associated with the adoption of forward contracts by farmers to sell wool. This research provides a new dimension to the existing knowledge of farmer behaviour as, to the best of the researcher's knowledge, the aforementioned theories have not been specifically used to understand the selling behaviour of wool producers. Studies of farmers' land conservation behaviours using the TRA/TPB frameworks are numerous (for examples see Beedell & Rehman 1999 & 2000; Gorrard 1991, 1992 & 1993), as are studies that attempt to understand the decision-making processes of wool producers (for examples see Murray-Prior 1994 & 1996; Murray-Prior & Wright 2001 & 2004; Champion & Fearn 2001a; Coad 2000; Duke, Hanrahan & O'Neill 2002). The following sub-sections of this chapter provide details of the Australian wool industry, the findings of studies that attempt to characterise Australian farmers, the selling systems available to Australian wool producers, the theories that make up the basis of the theoretical framework proposed herein and, finally, a review of relevant studies.

¹ The findings from this chapter have been published by the researcher in the following peer-reviewed publications:

'Hybrid vigour of behavioural theories in the agribusiness research domain. Is it possible?', *Journal of International Farm Management*, 2006, vol. 3, no. 3, Available from: www.ifmaonline.org/pdf/journals/Vol3Ed3_Jackson_%20etall.pdf

'A literature review of selected behavioural theories for application to agribusiness research', *Proceedings of Curtin Business School Doctoral Colloquium*, 27-28 April, 2006, Perth.

2.2. The Australian Wool Industry and its Selling Systems

2.2.1. Wool Production and Marketing in Australia

Sheep production began in Australia with the British establishment of the colonies in the late 1700s (Cottle 1991), with the only market for Australian wool being located in London until the 1870s (Kaine-Jones 1988). Since the inception of its wool industry, Australia has become the world's largest supplier of apparel wool (Lowe 2005; Stephens & Campbell 2005; Goss & Avsar 1992) and earned the nation approximately A\$2.5 billion worth of export income in the 2005/06 financial year (Wood 2006). Figure 2.1 shows that China is by far the largest purchaser of wool from Western Australia. Perry (2005) cites research by Australian Wool Innovation that shows China buys some 65% of Australia's wool clip.

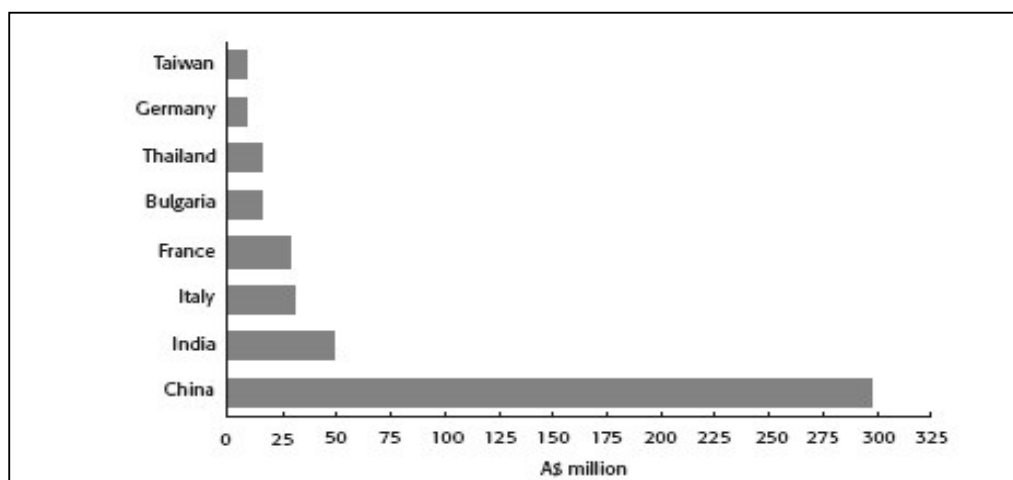


Figure 2.1: Major Western Australian wool markets 2004/05 (Source: Stanton 2005)

Wool supply in Australia has been described as “quite inelastic” (Bardsley 1994, p. 1091) as it is largely governed by the biological constraints associated with changes to the size of the national sheep flock and seasonal conditions (Islam 2004a; Fisher & Wall 1990; McKay, Lawrence & Vlastuin 1983; Vincent, Dixon & Powell 1980). Supply of wool in Australia is adjusted in the medium to long term, largely in response to grain prices as the majority of wool producers split their income with grain production (Wood & Ashton 2007).

Severe drought throughout the country in 2002-2003 saw quantities of national wool sales decline and prices slightly rise due to buyers' fear of not being able to source the commodity into the future. However, competition from other fibres (cotton and

synthetics) throughout the world has suppressed the potential upward activity of wool prices (Ashton 2003); as shown in Figure 2.2 where the Eastern Market Indicator (EMI), fine wool (19 μ) and broad wool (28 μ) prices are falling. A 4% growth in wool productivity over the last 20 years has been identified (Islam, Stanton & Kopke 2005; Islam 2004b) and producers are attempting to re-stock their properties for meat production after the last drought (O'Donnell et al. 2005). Therefore while sheep and lamb numbers are expected to rise, wool cut per head is expected to decrease (O'Donnell et al. 2005; Perry 2005); as illustrated in Table 2.1. More recent findings are even less optimistic. Bolt (2006a) reports on the grim state of the nation's wool industry and says that the national clip is forecast to reach a 50-year low and that, despite positive price movements, more activity is needed before producers make any significant shifts back into wool production. Davison (2006) is not quite so pessimistic and says that although fleece weights have reached a 20-year low, the present drought that impacted from about 2005 is worse than that of 2002-2003 because it has affected the entire country (not just isolated areas) so global demand should respond to the nation's lack of supply.

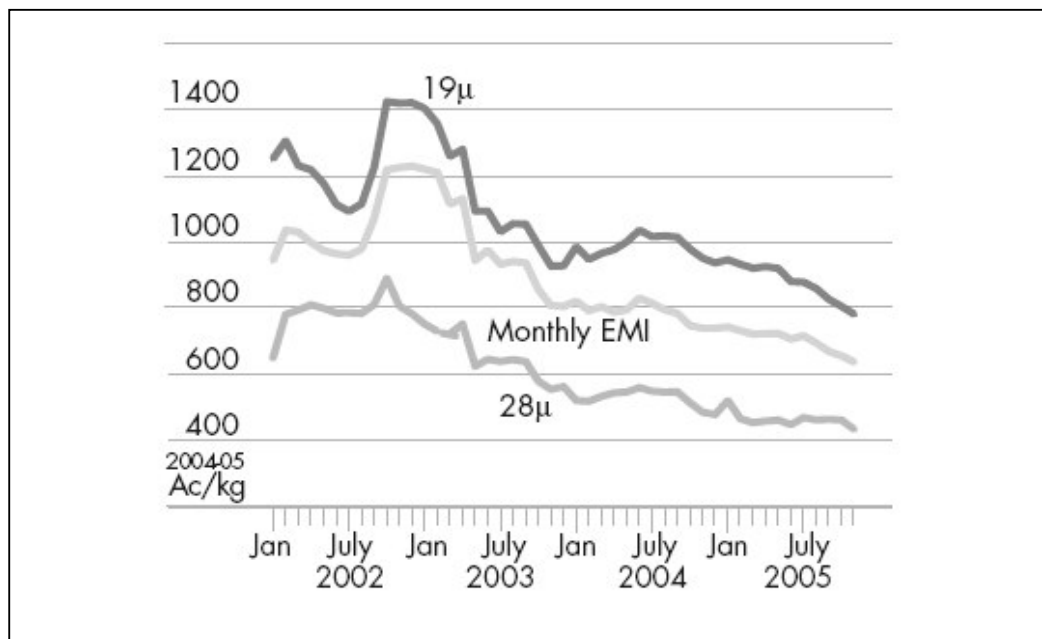


Figure 2.2: Wool prices based on eastern market indicator (Source: O'Donnell et al. 2005)

Table 2.1: Wool outlook for Australia (Source: O'Donnell et al. 2005)

	Units	2003/04	2004/05	2005/06	% change
Sheep numbers	Million	101	103	105	1.9
Sheep shorn	Million	105	108	108	0.0
Wool production (greasy)					
- shorn	kt	475	475	470	-1.1
- other	kt	48	50	52	4.0
- total	kt	523	525	522	-0.6
Total closing stocks					
- greasy weight	kt	156	157	169	7.6
Wool exports (balance of payments basis)					
- volume (greasy equivalent)	kt	475	515	510	-1.0
- value	A\$m	2,778	2,838	2,461	-13.3
Market indicator (clean ²)					
- eastern	Ac/kg	820	746	670	-10.2
- western	Ac/kg	792	724	650	-10.2
Auction price (greasy ³)	Ac/kg	533	485	436	-10.1

In terms of Western Australia, there is the expectation that the region that contributes 26% to the national wool clip (Stanton 2007) will increase its supply due to increasing consumption by its biggest customer - China (Stanton 2004b & 2005). Wilcox (2004) comments on the expected variability of wool prices early in 2004, principally derived from the extreme fragility of market confidence, and the possibility of unexpected shocks in the demand-side of the market.

Decline in wool prices since 1989 has seen woolgrowers' incomes suffer and specialist wool growers experience negative farm-business profits (Kingwell, Bathgate & O'Connell 1999; Shafron, Martin & Ashton 2002). The Woolmark Company (2005a) has said that price declines are due to such factors as poor economic conditions in continental Western Europe, a dip in Japan's economic growth, declining value share in women's wear and low cotton prices. Further to this, a lack of improvement in demand for wool has been attributed to the predicted slow-down in the global economy and difficult economic conditions in Western Europe. Perry (2005) predicts that there is no

² Clean wool: Wool that has been washed and scoured to remove all impurities.

³ Greasy wool: Unwashed wool that contains natural fat (lanolin) and any other impurities.

joy in sight for wool prices due to the increase in sheep, and hence wool, production and the continuing decline in world demand. Bolt (2007) more recently reports that Australian wool prices are expected to reach a four-year high but these prices will be transitory as a result of declining demand and unfavourable currency fluctuations.

Today, there are various selling alternatives available to wool producers with the most technologically advanced being the sale of wool via the internet on such sites as Wooltrade Australia Pty Ltd (www.wooltrade.com.au) and e-wool™ (www.e-wool.com.au). Other means of selling wool include: Sale by Tender, Retained Ownership Programs, Forward Contracts, Tops Auction, Laser Matched Interlots, Charging Structure, Premier Wool Newcastle, Offer Boards, Broker Exchange Desk (available through Elders [www.elders.com.au] or Landmark [www.landmark.com.au]) and Futures and Options Contracts (www.sfe.com.au). A detailed description of these selling systems is provided in Section 2.3. Figure 2.3 is adapted from research by Champion and Fearn (2001a) and shows a model of the linear relationship of the Australian wool industry.

Not only does this model show the interpersonal, marketing and communication flows of the Australian wool supply chain, it also maps the physical and financial movement of wool from the farm gate. Of all the relationships presented in Figure 2.3, it is the communication flows within the wool supply chain that have come under most criticism. Authors such as Champion and Fearn (2001a) and the Wool Industry Review Committee (1993) have advocated that the complexity of this model inhibits the fluid flow of information amongst members.

Among other factors, the present research considers the first element of this supply chain, the growers, and how other elements of the supply chain influence decisions to sell wool. Another element to consider, the importance of which cannot be underestimated, is the contribution that wool brokers and wool buyers make to the wool supply chain. Kaine-Jones (1988) discusses the pivotal role wool brokers and buyers have played in the development of the Australian wool industry. He also explains the importance of these roles in blending wool types in order to fill contracts for processors because most wool that leaves Australia is sold by forward contract between the broker and the processor.

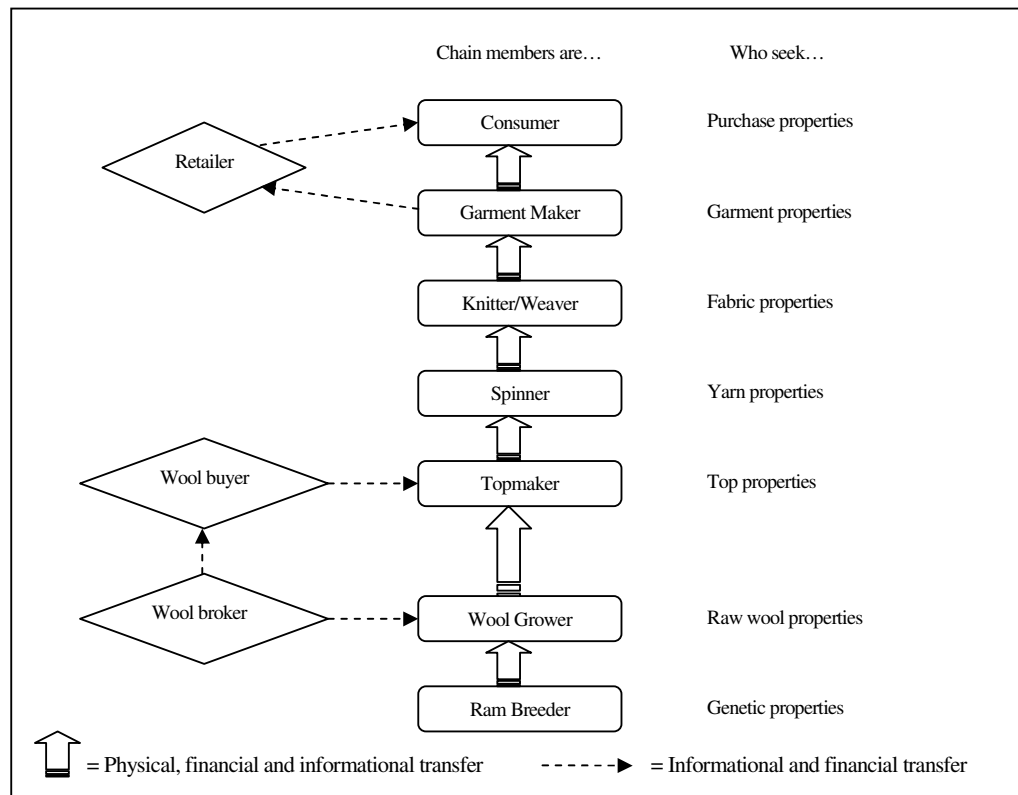


Figure 2.3: The apparel wool supply chain (Source: Champion & Fearn 2001a)

Despite much negativity surrounding the Australian wool industry, a long-term forecast by Land and Water Australia has described an exciting scenario for 20 years into the future. Wool is described as being able to successfully survive as a product that is socially responsible and sustainable due to its production on land that has succumbed to climatic variability and is unsuitable for cropping. Wool is expected to continue as a highly desirable fabric despite its increased exposure to synthetic substitute products. Finally, advances in sheep genetics will give rise to higher wool yields, despite total flock numbers falling (Cribb 2006).

2.2.2. Characterising Factors of Australian Farmers

2.2.2.1. Challenges facing Australian wool producers

In the most recent national survey of Australian wool producers, Curtis (2007) showed that New South Wales is the state with by far the majority of wool producers (35.6% of survey respondents). Victoria had the second most survey respondents (21.9% of survey respondents) while Western Australian followed closely with 20.3% of survey respondents. The difference between the number of Victorian and Western Australian

wool producers seems marginal since the Australian Wool Innovation Production Forecasting Committee (2007) showed that while more Victorians participated in their survey, Western Australian had a higher state weighting.

It appears that farmers across the nation are experiencing below average on-farm conditions with 89% of survey respondents rating that their farms are experiencing 'below average' (23%) or 'drought' (66%) conditions; a finding supported by the Australian Wool Innovation Production Forecasting Committee (2007). Curtis' (2007) interpretation of this survey data was generally pessimistic about Australian wool production. Curtis' (2007) analysis showed that sheep numbers shorn (-2.5%), average cut per head (-5.5%) and shorn wool production (-8.0%) were all forecast to decrease from 2005/06 to 2006/07. The reason for this decline in every aspect of production was principally attributed to the nation-wide drought conditions (Australian Wool Innovation Production Forecasting Committee 2007).

Since this study focuses on Western Australian wool production and marketing, it is logical to briefly investigate the issues this state group is facing. No current information exists that specifically reports on Western Australian wool production forecasts. However, Curtis (2007) found that Western Australian wool producers reported the lowest percentage of producers experiencing 'drought' conditions (36%), but 46% of survey participants considered conditions to be 'below average'. Despite national production being forecast to decrease, it is also forecast that Western Australian production mixes (for example wool-grain, prime lamb-grain) remain unchanged. In fact, the Australian state expected to change enterprise mixes in favour of wool production is Tasmania. While Curtis (2007) does not account for this expected change, a possible explanation is that primary producers are responding to the innovative wool marketing initiatives being undertaken by Tasmanian-based wool buyers Roberts, in conjunction with Lempriere (Courtney 2007; Page 2007). These organisations are offering forward contracts to Tasmanian wool producers in an effort to re-engineer the state's wool supply chain. It was said that this will provide wool producers with clear quality and quantity specifications that will be delivered to processors.

While most Australian wool production is concentrated in New South Wales, the Western Australian flock has the highest proportion of pure Merino sheep. This proportion is almost half adult sheep (49%); close to that of South Australia and New South Wales. In Western Australia, 40.8% of sheep are adult Merino ewes. The next most populated

category comprised Merino ewe lambs that made up 14.4% of respondents' flocks (Curtis 2007). This indicates that Western Australian wool producers are mostly growing wool from adult Merino ewes and also turning over a high number of Merinos as prime lambs.

2.2.2.2. Farming styles and types

Several methods have been identified that can be used to describe farming styles and types. Farming Styles Theory (van der Ploeg 1994) appears to be dominant in the farming styles research paradigm while other attempts have been made to categorise farming style in terms of entrepreneurship (Austin et al. 1996; Knudson et al. 2004), goals and management (Gasson 1974; Gasson & Errington 1993; Fairweather & Keating 1994; Brodt et al. 2004) and political and economic orientation (Whatmore et al. 1987). In all these studies, focus groups and case studies are most commonly used as methods of data collection.

Noted for its ability to “present a specific unity of farming discourse and practice” (van der Ploeg 1994, p. 18), Farming Styles Theory has been used to predict and explain farmer behaviour in many rural sociology studies (Howden & Vanclay 2000; Vanclay, Mesiti & Howden 1998; Howden et al. 1998; Thomson 2002). The theory posits that farming style is a combination of farmer strategies that involve notions, values and insights of a particular group of farmers, their cultural repertoire that leads them to structure their farming activities in a particular way, and finally, the interaction of the farm and its external agribusiness environment.

The original Farming Style Theory of van der Ploeg (1994) did not provide any descriptive labels that specify farming styles, however later work by Howden et al. (1998) and Howden and Vanclay (2000) used focus groups to identify and label various farming styles in eastern Australia. The latter research yielded the following results (Table 2.2):

Table 2.2: Farming styles labels (Source: Howden & Vanclay 2000)

Major styles	Minor styles		Poorly defined styles
Innovative	Autocrat	Old rich	Committee person
Middle of the road	Developer	Opportunist	Lucky
Progressive	Diesel burner	Organic	Mediator
Resource limited – personal	Doom & gloom	Perfectionist	Safety-net farmer
Resource limited – structural	Expansionist	Risk taker	
Traditional	Grazing emphasis	Secret farmer	
	Hard driver	Skite	
	Lazy	Tinkerer	
	Lifestyler		

While no research has been found to contradict these styles, Thomson (2002) conducted similar research in eastern Australia that yielded 10 farming styles (based on finance, business, tradition, knowledge, labour, land, planning risk and technology innovation), although these styles were not given labels. In terms of international research, Knudson et al. (2004) defined four categories of entrepreneurs within the North American agri-food system: master entrepreneur, innovative entrepreneur, entrepreneurial innovator and master innovator. Gasson and Errington (1993) also cite literature in which farm management styles were identified in terms of profit orientation and another study that distinguished three farming styles based on goals, strategies and criteria of success.

Thomson (2002) tested Farming Styles Theory on Australian wool producers and found that a mixed-method approach was effective in predicting farmer behaviours by understanding attitudes, motives and beliefs. His research recommended this theory as having potential to assist agribusiness organisations with communication to diverse audiences, influence the behaviour of land managers and monitor the participation behaviour of stakeholder groups in decision-making processes.

In absolute contrast, Howden et al. (1998), Vanclay, Mesiti and Howden (1998) and Howden and Vanclay (2000) all found that while Australian broadacre crop farmers were receptive to van der Ploeg's farming styles categories during focus groups, there were considerable ambiguities when farmers started to describe themselves in these terms; the ambiguities principally resulting from a lack of definition of each farming style. This reveals that although van der Ploeg's farming style categories adequately describe Australian farmers, the categories are not as tangible or applicable in this country as in

others. Two reasons are given for this discrepancy. Howden et al. (1998) say that it is because the farming style categories lack sufficient definition while Vanclay, Mesiti and Howden (1998) say that it is because Australian farmers are not aware of the farming styles listed by van der Ploeg.

In conclusion, while methods have been found to define farming types and styles of Australian farmers, there is insufficient agreement between the studies to suggest that this is a robust enough paradigm on which to base the present research.

2.2.2.3. Attitudes, values and goals

There is substantial evidence to suggest that farmers undertake their occupation for reasons other than financial gain (Austin, Deary & Willock 2001; Austin et al. 1996; Islam 2003; Smith 2001; Gillmor 1986; Frank 1997; Gasson 1969; Mann 1991). Therefore, other factors that exist need to be considered when understanding farmers' behaviour. While understanding attitude will not solely provide knowledge on behaviour, it is a necessary construct of the behavioural theories used in this research.

Because this research is based on the TRA/TBP, Fishbein and Ajzen's (1975) concise definition of 'attitude' can be used herein: a person's salient beliefs towards performing a behaviour. In addition to this, definitions of associated terms are necessary. Kerridge (1978) makes the distinction between goals and values from a farmers' perspective. It is said that goals, alternatively known as objectives or aspirations, are frequently changed over time according to family pressures, personal development, career satisfaction and the environment. They are conditions that an individual wishes to achieve and can be ends in themselves or lead to higher goals. Values, on the other hand, are said to be less tangible and are born from reason, morals and aesthetic judgement. They are more permanent than goals and contribute to the regularity of behaviours because they are states of being that cannot easily be satisfied. Honesty, progress, success and freedom are given as examples. As the present research progresses, it will be seen that 'attitude' plays an important role in the development and interpretation of the behavioural model (see Chapter 4 and 5).

Much of the literature is dominated by understanding attitudes, values and goals based on Gasson's (1973) research in which values in the farming occupation were grouped under four headings of orientation: instrumental, social, expressive and intrinsic. Gasson (1973) explains that instrumental orientation focuses on maximising financial and economic

gains of the farm business while social orientation indicates that those farming with this social value predominantly do so for the benefits of interpersonal relationships of the occupation. Expressive values indicate a desire in farming to gain personal fulfilment and self-expression from work, and intrinsic orientation focuses on the unique qualities of farming. Many sociological studies have used this framework to identify goals, attitudes and values of farmers under specific circumstances (see Austin et al. 1996; Kerridge 1978; Gillmor 1986; Gasson 1974; Gasson & Errington 1993).

While various research has successfully used Gasson's four-values orientation to understand behaviours, Austin, Deary and Willock (2001) and Grolleau, Mzoughi and Thomas (2006) argue that farmers' motivations, values and attitudes should be assessed by understanding the type of activities that contribute to the successful running of a farm business. These authors focused on the farmers' land conservation behaviours and the thrust of their research idea is that behavioural studies should be conducted from an applied, practical point of view.

In terms of farmer attitudes towards available selling systems, very few studies were found that can provide insight into behaviours of farmers; the lack of common themes among findings was also noted. The dearth of literature in this field is mainly due to the focus of most research being on the closely-related topic of farmers' attitude towards risk.

Turvey and Baker (1990) found that interest rates will affect farmers' usage of hedging with futures and options while Kerridge (1978) found that age, family relationships and farming experience will contribute to Australian farmers' values. An American study on the behavioural attitudes of futures-contracts usage (Pennings & Leuthold 2000) supported Kerridge's findings in that family and other members of the farmers' decision-making unit have an influencing role on the adoption of futures contracts. The only other common theme identified in the literature was the relationship between size of cropping enterprise and farmers' propensity to take out forward or futures contracts (McLeay & Zwart 1998; Musser, Patrick & Eckman 1996; Makus et al. 1990; Vergara et al. 2004).

In contrast to these studies, Fraser (1997) concluded that Australian wheat producers would not support the introduction of premiums and discounts associated with forward contracts due to the fact that seasonal variability would have the affect of essentially decreasing the value of their land. Another study on Australian grain producers (Patrick, Musser & Eckman 1998) showed that farmers' understanding of futures and options were

inconsistent with the theoretical characteristics of these systems, such as ‘risk management’ and ‘price enhancement’.

A further contrast was found in a study on the Dutch hog industry (Pennings & Leuthold 2001) which showed that farmers were most concerned with the following factors associated with futures usage: entrepreneurship, performance and ease of use. This study also confirmed that one of the reasons futures contracts are taken out is to improve the freedom of business processes.

Finally, recent developments in the Western Australian agricultural industry have yielded some fascinating attitudinal factors relating to farmers. The recent study by The Merino Company (2006) showed that while a selling system based on forward contracts for the New Zealand wool industry showed outstanding results, Australian producers are not ready for such a change and remain content with the current and traditional auction-dominated selling system. The Australian grain industry has been faced with more cogent needs for change with recent allegations of mass international corruption. The Federal Government is restructuring the nation’s monopoly grain marketing organisation (AWB Ltd) to improve the methods by which grain is acquired, sold and marketed to international customers. This idea has come under massive scrutiny by Western Australian producers who are adamant that they want “the current wheat marketing arrangements left alone” (Ladyman, 2006, p. 1).

These two cases reflect the attitude that Australian farmers are averse to change. Further, the literature has shown that farmers’ attitudes and goals to selling systems, family relationships and size of enterprise will be the main influencing factors for undertaking some method of forward selling. It can also be said that entrepreneurship, performance, ease of use and perceptions associated with land value will be the attitudes farmers adopt towards methods of forward selling.

2.2.2.4. Attitudes and risk management strategies

Hardaker et al. (2004, p. 5) state that “risk is imperfect knowledge where the probabilities of the possible outcomes are unknown”. These authors go on to admit that this is not necessarily a useful definition since outcome probabilities are rarely known, and because people put subjective values on risks. Kingwell (2000, p. 1) provides a basic definition of risk: “Risk refers to a range of uncertainties (upside and downside) that affect a person’s welfare”. A plethora of literature exists on the topic of risk management strategies for

farmers. Essentially, the major risk-management mechanisms can be summarised by the following categories: on-farm risk-management strategies (such as enterprise diversification), the utilisation of financial instruments (such as forward contracts, futures or insurance), the exploitation of government policies like price stabilisation and underwriting schemes, drought relief policies and farm management deposits (Chambers & Quiggin 2004).

Drynan (1981) describes how Australian farmers can be categorised in terms of the decision maker's willingness to pay for the avoidance of risk. It is explained that decision makers who consistently pay high financial or opportunity costs to avoid risk can be termed "risk-averse" while those who take advantage of opportunistic, yet uncertain, conditions can be called "risk-preferring". Those who undertake a combination of these choices when faced with risk are termed "risk-neutral".

Research by Bond and Wonder (1980) suggests that Australian farmers are best described as risk averse. However Australian farmers' pursuit of investment strategies suggests that their behaviour is better characterised as being risk-neutral. This finding somewhat contrasts that cited by Willock et al. (1999b) and the opinion held by Barnard and Nix (1979) who suggest that farmers are risk averse and predominantly show attitudes such as an abhorrence of debt which, in turn, has the implications of leading to the slow adoption of new technology and limited innovation. These authors advocate that a range of financial tools are used to manage risk, as well as utilising opportunities of farm sustainability and having off-farm employment.

Probably the most pertinent research related to this study is by Murray-Prior and Wright (2001 & 2004). These authors studied the use of decision rules and strategies used by farmers to manage the risk associated with producing wool and selling wool in Australia. The 2001 study focused on the behavioural reactions to operating in an industry that is fraught with so much ambiguity (in terms of pricing). In accordance with Drynan's (1981) definition of risk, Murray-Prior and Wright (2001 & 2004) found that the frequency of price changes will actually contribute to lags in wool production. It was also said that these lags would be exacerbated by lags caused by attitude to risk, adjustment of price expectations and various business costs (such as transaction, adjustment, learning and information costs).

Murray-Prior and Wright's later study (2004) was more related to the risks associated with selling wool in Australia and how producers dealt with such risks. The 2001 study showed the reactionary behaviour of farmers to wool prices, while the 2004 paper detailed the methods used by farmers when faced with making a selling decision. It was found that Australian producers react to risks depending upon their response to the given situation at the given time and hence may be multifaceted.

The issue of risk associated with time of selling wool was discussed in Murray-Prior and Wright's (2004) study and the findings showed that farmers did not attempt to predict future wool prices so would sell when the wool was ready (that is, after shearing) or at the same time every year when experience dictated that a price rise would occur. Influence of beliefs and strategies on choice of sale method were also examined. On this issue it was principally found that auction is the favoured method of selling because it creates an instant forum of pricing competition, offers a larger arena for a broader range of wool types that are not offered by private sales, provides transparent price knowledge for buyers, is a method that guarantees payment and is the most logistically efficient method of selling wool because wool sold any other way ultimately goes through the auction.

While these issues contributed to the sale of wool at auction, it was the negative perceptions of selling wool by any other method that inhibited any diversity that producers may have considered. Murray-Prior and Wright (2004) found that wool producers will consult with brokers to deal with price uncertainty and did not want to try any private methods of selling because of the risk involved with pricing their own wool, and the information disparity that may come about with a lack of knowledge in regards to the value of their wool when negotiating price with a broker.

Despite the findings of Murray-Prior and Wright (2001 & 2004), there is a good deal of evidence to suggest that the use of forward and futures contracts are an efficient means of stabilising income and managing price risk (Barnard & Nix 1979; Miller 1986; Pennings & Leuthold 2000; Musser, Patrick & Eckman 1996; Fraser 1997; McLeay & Zwart 1998; Coad 2000; Kingwell 2000; Champion & Fearn 2001b; Bolt 2004b; Brakenridge 2004; Cuming 2004; Vergara et al. 2004; Blank, Carter & McDonald 1997; Liddle 2004). Research by The Merino Company (2006) showed that 58.3% of the wool producers surveyed used forward contracts because of the associated stability and risk management characteristics, although auction was still the preferred method of selling wool.

Coad (2000) and Woods, Hood and Couchman (2005) identified risk management strategies that Australian wool producers actively use at auction: setting reserve prices, spreading sales over time and holding stocks when prices are judged to be low. In contrast to this finding, Mitchell (2003) did not include any form of auctioning strategies as methods of price risk management for wool producers. Alternatively, his recommendation for managing price risk were cash contracts, forward physical purchase and sale contracts, futures contracts and options contracts.

There is a contradiction in the literature regarding the types of farmers who will take out forward and futures contracts. Willock et al. (1999b), Barnard and Nix (1979) and Ramsden and Wilson (2006) all state that farmers with averse attitudes to risk will attempt to stabilise their income by taking out forward and futures contracts. However, findings by authors such as McLeay and Zwart (1998), Blank, Carter and McDonald (1997), Kingwell (2000) and Patrick, Musser and Eckman (1998) show that farmers shy away from using forward marketing systems for various economic, financial and operational reasons..

This section has focused on the attitudes of farmers to risk and the management strategies available to them to counteract down side risk. It was found that there are a number of risk management strategies that are available to Australian farmers (including wool producers) such as enterprise diversification, use of forward selling mechanisms and government policy initiatives. Despite the availability of these strategies there is an anomaly in the literature that provides evidence to suggest that farmers are not utilising the opportunities available to them.

2.2.2.5. Attitudes to technology adoption

Diffusion of Innovations research is a dominant methodology used for understanding attitudes to technology adoption in rural communities. This method of research, applications of its use and major empirical findings are detailed in a subsequent chapter. This section, however, focuses on farmer attitudes to technology adoption with emphasis on the attitudes held by Australian farmers.

Attitude to technology adoption is largely influenced by ‘age’, ‘education’, ‘farm size’ and ‘income’ (Rogers 1995; Fliegel 1993). However Upadhyay et al. (2003, p. 29) simplify the complexity of the adoption issue by stating that “farmers adopt new practices as a result of success stories from their respected and more risk-tolerant neighbours”.

Although on a broader scale, Feder and Umali (1993) find that technology adoption will be based on the type of technology, market structure and the nature and duration of government policy intervention.

There is a broad literature on technology adoption focuses on farmer conservation behaviours (see Upadhyay et al. 2003; Burton, Rigby & Young 2003; Beedell & Rehman 1999 & 2000; Pampel & van Es 1977; Ervin & Ervin 1982; Rahm & Huffman 1984; Lee & Stewart 1983; Saltiel, Bauder & Palakovich 1994; Frost 2000; Nowak 1987).

Attitudes to the adoption of this type of technology were found to be influenced by perceived profitability (Saltiel, Bauder & Palakovich 1994), beliefs about net economic returns (Saltiel, Bauder & Palakovich 1994; Nowak 1987; Frost 2000; Kislev & Shchori-Bachrach 1973), size of tenure and income (Hall 2006; Bergevoet et al. 2004; Dumas 1987; Lee & Stewart 1983; Rahm & Huffman 1984; Fisher et al. 2000), farm-specific characteristics such as rotations, agronomic properties (Rahm & Huffman 1984; Harper et al. 1990) and farmer-specific details such as 'age', 'education', 'family situation', 'social pressure' and 'membership of advisory groups' (Cross & Franks 2007; Rehman et al. 2007; Beedell & Rehman 1999 & 2000; Frank 1997; Hall 2006; Duke, Hanrahan & O'Neill 2002; Dumas 1987; Burton, Ribgy & Young 2003; Rahm & Huffman 1984; Batz, Peters & Janssen 1999; Harper et al. 1990; Upadhyay et al. 2003; Feder & Umali 1993; Wilkening & Guerrero 1969; Ervin & Ervin 1982).

In contrast, Pampel and Es (1977) and Feder and Umali (1993) contradicted some of these findings and suggested that demographic variables and farmer-specific details had no or low significance technology adoption. However, the seminal author on Diffusion, Rogers (1995), maintains that these variables are still worth including in adoption studies.

It was also found that farmers' perceptions of a technology would influence adoption. For example, Batz, Peters and Janssen (1999) found that characteristics of a particular technology ('relative complexity', 'relative risk' and 'relative investment') would influence speed of adoption while Flett et al. (2004) found that 'perceived usefulness' and 'perceived ease of use' were both highly significant indicators of technology acceptance and usage. Fliegel and Kivlin (1962) found that 'complexity', 'time-saving' and 'similarity to existing procedures' were factors that most quickly adopted technologies while 'cost', 'trialability' and 'mechanisation' were not necessary to increasing speed of adoption.

There is also sufficient evidence to suggest that information flow will affect the adoption of agricultural innovations. Fischer, Arnold and Gibbs (1996) found that availability of reliable information was an important determinant of speed of innovation adoption. Further to this, Lindner (1986) posits that enhancing communication channels could be a method of speeding the adoption process of farmers. This notion is supported by Longo (1990) and Copp, Sill and Brown's (1958) findings that the method of information transfer (such as mass media and interpersonal communication) will be a determining factor on farmers' decisions to adopt agricultural innovations.

In terms of the adoption behaviour of Australian farmers, it appears there is a range of factors that contribute to the adoption of an innovation or an innovative behaviour. Frank (1997) found that attitudes were influenced by the concept of social acceptance related to conservation behaviours and maintaining a satisfying lifestyle. Duke, Hanrahan and O'Neill (2002) found that good management practices and involvement in a particular agriculture extension program yielded improvements to productivity levels of Victorian wool producers, while Fischer, Arnold and Gibbs (1996) found that it was the growth rate of effective information that was important for the speed of innovation.

More recently, research has been conducted in Australia surrounding the adoption of conservation-related farm practices. D'Emden, Llewellyn and Burton (2006) found support for one of Abadi Ghadim, Pannell and Burton's (2005) conclusions that the switching costs or changes to farm profitability would influence the adoption of a new innovation. Pannell et al. (2006) offered a broader range of attributes linked with the achievement of economic, social and environmental goals that characterise a successfully adopted innovation. These authors found that two aspects of Diffusion: 'relative advantage' and 'trialability' are the key determinants of adoption of an agricultural innovation. The final study of note is by Marsh, Burton and Pannell (2006) about farmers' monitoring of water tables for salinity management. This study showed that the behaviour of monitoring water tables would increase if the information being collected was able to be used for decision making in other aspects of the farm business.

What can be gleaned from this section is that understanding attitudes towards technology adoption is a highly complex issue and that factors for the successful adoption of an innovation will often be specific to the innovation in question.

2.3. Australian Wool Selling Systems

The concept that brokers are the dominant link between wool producers and the rest of the supply chain was introduced in Section 2.2.1. Evidence suggests that while there are some 40 registered wool brokers in Australia, the two largest (Elders [owned by Futuris Corporation Limited] and Landmark [owned by AWB Limited])⁴ handle 60% of production and the largest 10 brokers handle 90% of the clip, indicating that brokers have considerable control over the wool selling system (Ward 1998; Champion & Fearn 2001a). It is from this group that growers mostly receive advice on the best methods of selling wool at the time of decision making.

Champion and Fearn (2001a) outline the general process of selling wool in Australia and the importance of brokers to the system in the following list.

1. Receive wool from the grower.
2. Provide technical and financial services to the grower.
3. Arrange the auction.
4. Store wool until sold.
5. Assemble bales into lots, each lot averaging from six to seven bales and typically between three and nineteen bales.
6. Arrange for wool testing.
7. Appraise the wool subjectively.
8. Sell wool on behalf of the grower and invoice buyer.
9. Provide feedback to the grower on the quality of the wool and the market appraisal.
10. Possibly store wool after sale at a cost to the buyer.
11. Deliver wool to the dump (storage house) or the local processor.
12. Guarantee payment.

While this list implies that all wool is auctioned, later discussion will show that auction is the dominant, but not the only, selling system in Australia.

⁴ Retrieved September 27, 2007, from <http://www.ibisworld.com.au/industry/retail.aspx?indid=340&chid=1>

2.3.1. Auction

The wool auction system has operated in Western Australia since December 1920 (“Flashback” 2004) and is described on DAFWA’s WoolDesk web site as follows: “Farm wool is mainly sold through open-cry auctions in Australia. These auctions are conducted by Australian Wool Exchange (AWEX) on behalf of the Australian wool producers, the wool brokers and the buyers.”⁵

It is by far the most dominant system for selling wool in Australia (The Merino Company 2006; Sharman 2006a; Connors 2006; Champion & Fearn 2001b; *Wool pool to help Tas growers* 2006) with greater than 85% of producers utilising this system (Bolt 2004b). Popularity has grown in last 15 years when it was estimated that 80% of producers use the auction system to sell their wool (Simpson 2002; Piggot 1993; Teasdale 1991). The popularity of the auction system seemed to peak between 1988/89 and 1990/91 when over 90% of the national clip was sold by this method (Seale 1996).

Sale by auction was initially conducted by opened bales being inspected by buyers prior to bidding for lots. In 1973 this system changed and the process of “sale by sample” was introduced, whereby core samples are taken from the bales and displayed prior to the auction commencing; this allowed buyers to view a representative sample from each bale before making a bid (Teasdale 1991). The auction system also dominates in Britain, South Africa and, until recently, New Zealand (Simpson 2002).

The benefits of auction are in terms of commerce and price communication. The auction system allows for competitive bidding and efficient price formation with price information generated that is transparent and readily available to industry users (Teasdale 1991; Lubulwa et al. 1997; Champion & Fearn 2001a). If allowed to operate freely, auctioning is also said to be an effective system of spot market selling (Wool Industry Review Committee 1993). In terms of wool producers’ thoughts on the benefits of the auction system, research by The Merino Company (2006, p. 39) yielded eight factors that were nominated by farmers for using the auction system: best alternative, best possible price, competition/price discovery, simplicity/understanding, tradition, broker

⁵ Retrieved September 21, 2007, from www.agric.wa.gov.au/servlet/page?_pageid=213&_dad=portal30&_schema=PORTAL30

relationship, no other options and maximise profit. Interestingly, no reasons were provided for wool producers not using the auction system.

Despite these benefits and its popularity amongst producers the auction system has been the subject of much criticism. The most widely published disadvantage is the volatility of prices (Mitchell 2003; Lubulwa et al. 1997; Seale 1996; Woods, Hood & Couchman 2005) with other deficiencies listed as price being subject to the extent of buyer competition on the auction day and the low average lot size (approximately 6.6 bales per lot) (Seale 1996).

Further to these disadvantages, research by the Wool Industry Review Committee (1993) revealed the somewhat anti-competitive and regulated nature of the Australian wool auction system. This research declared the auction system to be “defective due to volatility, [exposed to] possible manipulation, [have] unpredictable time constraints and [be] an unnecessary intermediary participation in the communication channel” (p. 75). These claims were supported by the citing of research from 1992 that showed 31% of wool growers were dissatisfied with the auction system. While Champion and Fearn (2001a, p. 244) state that “auction systems do not represent complete communication vacuums”, these authors strongly argue that communication channels are significantly inhibited by the dominance of the auction system and result in the creation of functional silos within supply chain.

More recently, the chairman of a key national wool body, The Woolmark Company, was reported to say that Australia urgently needs a better price discovery system than that of auction as this parochial selling method fails to reflect the supply and demand situation of wool at any given time (Liddle 2004).

In response to such comments, a scoping study on wool marketing and risk management (Woods, Hood & Couchman 2005) concluded that the auction system impedes the process of change in farm business risk management strategies and, when compared to the grain and cotton industries, is a costly process in terms of inefficiencies associated with cash transfers. These findings were, however, contradicted by a study conducted by The Merino Company (2006) which concluded that Australian wool producers are satisfied with the dominance of the auction system and their subsequent reliance on it. This study also showed that familiarity with the system is also a key determinant of its popularity.

The dominance of the wool auction system in Australia is derived from the termination of the Reserve Price Scheme in July, 1991 (Richardson 2001). There were numerous consequences of the scheme's removal, one of which was the realisation of how dependent the industry had become on the auction system of selling wool. Stemming from this came the understanding of how the industry had basically become structured around this some-what inflexible system (Wool Industry Review Committee 1993). The industry found itself comfortable, to the point of rigidity, with the floor-pricing system and unwittingly discouraged farmers to use selling systems alternative to auction (Wool Industry Review Committee 1993; Musser, Patrick & Eckman 1996). The Reserve Price Scheme gave producers an unrealistic expectation regarding the value of their wool, an example of this occurred in 1987 when the Australian dollar fell and the wool industry set an unsustainably high floor price. This continued until 1989 when the national price of wool fell and had to be saved by market intervention (Bardsley 1994).

Some 13 years after the Reserve Price Scheme's demise and despite efforts to introduce electronic and other selling alternatives to the industry (Bolt 2004b; Liddle 2004), the open-cry auction remains the dominant wool selling system in Australia (Bolt 2004b).

The Australian industry took a backward step to enhancing selling alternatives for growers in August 2004 when its principal futures broker, Macquarie Bank, closed its wool futures service. The main reason for this move was that it was not attractive for growers to hedge due to the fact that the forward market tends to yield lower prices than the spot market (Cuming 2004).

A further anomaly in the popularity of the auction system is that of the destiny of the wool sold on the forward market. Teasdale (1991) reports that a percentage of the wool sold by private treaty (or forward market) is resold by the buyer at auction, a view supported by Stanton, Curtis and Dolling (2003). Thus the popularity of the Australian wool auction is being fed by the industry's selling mechanisms.

Although there have been many criticisms of the current structure of the wool industry, dominated by the auction system, some authors have taken the opportunity to test such criticisms – with satisfying results. For example, Jones, Menezes and Vella (2004) were faced with unexplained price variations in sequential auctions that had critics relishing the notion that auctioneers could be favouring buyers; an idea born from findings that prices were twice as likely to decline as to increase during a wool auction. While Jones,

Menezes and Vella found evidence that the “price decline anomaly” is more likely in wool auctions of longer duration, they categorically found no systematic relationship between the direction of price and the characteristics (such as micron, vegetable matter, yield and net weight) of the wool or the auction.

Another example comes from Stanton, Curtis and Dolling (2003). These authors researched the effect of auction pass-in rates⁶ on wool exports in response to criticisms made by the International Wool Textile Organisation that the high frequency of pass-in rates negatively influence the flow of raw wool into the processing sector. This research also yielded the pleasing result that pass-in rates cannot be responsible for changes in export levels as there were no quantifiable changes to raw wool exports and new wool sales on a monthly basis.

2.3.2. Forward contracts

Forward contracting was first used in Australia in the wool export industry in the 1950s and remains the dominant method of selling export wool (Kaine-Jones 1988). This method of selling wool is defined by the Wool Industry Review Committee (1993, p. 76) as “A binding contract specifying the price (or price formula), quality and quantity of a product to be delivered at some specified date. The quantity may be expressed in units of output or as the production from a specified area. The contract usually specifies penalties to be exacted from each party for particular kinds of non-fulfilment”.

The most widely accepted benefits of forward contracts (for the trading of any commodity) are the management of price risk and the stabilisation of income (Barnard & Nix 1979; Miller 1986; Musser, Patrick & Eckman 1996; Fraser 1997; McLeay & Zwart 1998; Coad 2000; Kingwell 2000; Champion & Fearn 2001a; Bolt 2004b; Brakenridge 2004; Cuming 2004; Hardaker et al. 2004; Liddle 2004). Further to these two benefits are those reported by The Merino Company (2006, p. 39). The Merino Company’s (2006) report specified six reasons why wool producers use forward contracts: stability, risk management, maximisation of profit, dissatisfaction with other options, price and low cost. Additional benefits to producers are that payment is often received sooner than

⁶ Wool that is ‘passed-in’ is wool that is voluntarily removed from auction by its owner because it has failed to achieve a reserve price.

when wool is sold at auction and there are savings made on transport and commissions (Teasdale 1991).

The New Zealand Merino Company, which sells 60% of New Zealand's clip (Champion 2004), states that forward contracts not only guarantee a supply of wool to buyers but also enable processing companies to communicate their needs directly to growers, build personal bonds with growers and provide up-to-date development, training and technical support to their commodity suppliers (Brakenridge 2004).

Further to these advantages, Goss (1987) points out the benefits of forward contracts from an industry perspective. He advocates that this form of selling possesses informational efficiencies for industry in that markets that efficiently project their prices into the future can have "unbiased anticipations of subsequent spot prices" (p. 225). In turn, this has the advantage of enabling markets to perform to their optimum in terms of price discovery and also assists in minimising the adjustment costs of industry-specific agents who offer forward contracts. In contrast, Seale (1996) and Kaine-Jones (1988) suggest that the auction system acts as a security mechanism for filling highly specific contracts, thus giving traders the ability to blend large quantities of various wool types from a geographically dispersed base.

This view is supported by the New Zealand Merino Company (Brakenridge 2004) which has made public the benefits of forward contracting to industry as being guaranteed supply of wool to processors, superior quality control by processors and, most importantly, the building of relationships with wool growers. Roberts Pty Ltd is also seeking these benefits by introducing forward contracts to Tasmanian wool producers to market their commodity directly to Japan and North America (Harris 2006).

Finally, the advantages of forward contracts are highlighted by the known adoption rate of this selling method: two-thirds of all cotton is sold by forward contract in Australia (Woods, Hood and Couchman 2005) and more than 60% of New Zealand wool is sold via this method (Champion 2004). There is also evidence to suggest that forward contracts are gaining popularity beyond the farm gate. Primaries, Lempriere (both Australian wool marketing organisations) and the Department of Agriculture and Food Western Australia have been identified as espousing the benefits of forward contract (Connors 2006; Sharman 2006b; Cuming 2006), while this type of buying has been

suggested as a strategy that will save a Western Australian beef processing company, Harvey Beef (*Forward contracts: Similar route for Harvey Beef* 2006).

Despite these benefits to both growers and industry, as well as the fact that most wool is exported (that is from brokers/buyers to processors) by forward contracts (Kaine-Jones 1988), it was found by The Merino Company (2006) that up to 85% of Australian wool producers had never used forward contracts to sell wool. Reasons for this lack of adoption were given as: variability of production and wool attributes, lack of availability of contracts and no additional financial returns/price premiums paid (p. 39). In contrast, Seale (1996) attributes this non-adoption of forward contracts to the wool industry's stock pile as a result of the Reserve Price Scheme's collapse. Another view, held by Woods, Hood and Couchman (2005), suggests the uptake of forward contracts is inhibited by the inefficient transfer of cash through the auction system. The Merino Company (2006) found that threats associated with seasonal variation, lack of understanding, lack of availability and poor perceptions about the returns of forward contracts were the main factors contributing to their poor level of adoption. Seale (1996), Teasdale (1991) and Lubulwa et al. (1997) also caution producers not to expect premium prices from forward contracts as the price risk is transferred from the producer to the broker. Similarly, producers are warned that erring on the side of risk management should not overshadow opportunities for immediate cash sales when market circumstances are favourable.

2.3.3. Futures

Futures contracts have been available for trade in Australia on the Sydney Futures Exchange since the early 1960s (Mitchell 2003) and reached peak popularity in 1973 when turnover of contracts averaged 15,500 lots per month (Goss & Avsar 1992). Research cited by Kingwell (2000) showed that only 4% of Australian farmers are utilising the futures market to trade their wool; this had increased to 10% by 2004 (equating to about 3 – 5% of the national wool clip) (Cuming 2004). The poor adoption rate of wool futures has been attributed to the price stability offered by the Reserve Price Scheme and the price gap that exists between futures and auction (Teasdale 1991; Mitchell 2003).

Trading of futures must be conducted through a broker and is mostly carried out via the internet whereby traders access the Sydney Futures Exchange web site via their broker's web site (Mitchell 2003). Koch (2006) diagrammatically presents the range of futures

products available in the Australian agricultural industry and how they can be optimised (Figure 2.4). Figure 2.4 illustrates the types of forward selling products (Basis contract, Bank swaps, Managed basis contract) that can be used under various market conditions for trading agricultural commodities. For example, Koch (2006) suggests that when the Futures market is weak and the Basis is strong then it is advisable for a Basis contract to be taken out.

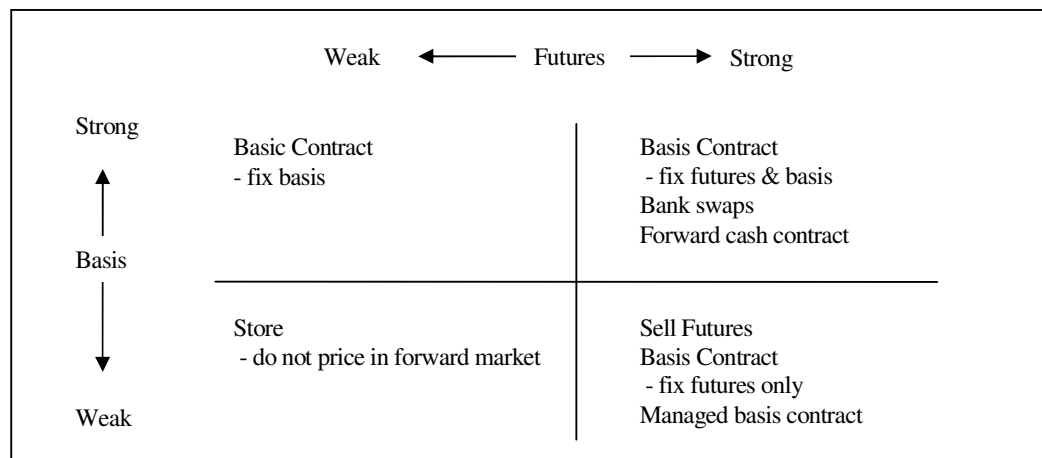


Figure 2.4: The futures and basis environment (Source: Koch 2006)

The futures market and forward contracts provide similar opportunities for traders in stabilising the price volatility of the auction system in terms of setting price and commodity delivery details for a date in the future (The Merino Company 2006; Koch 2006; Teasdale 1991; Mitchell 2003; Cuming 2004). The one defining element of a futures contract that separates it from a forward contract is that futures contracts are standardised and operate through the Sydney Futures Exchange so are more complex than an agreement between a farmer and wool buyer. This standardisation allows for reductions in the costs of negotiating futures contracts because the terms and quality limits are set by the Exchange (Lubulwa et al. 1997).

The benefit of futures, as with forward contracts, is that they are a method of managing price risk (Mitchell 2003). The futures market also provides wool buyers with a forum to offset the price risks associated with taking out forward contracts with producers (Lubulwa et al. 1997). This was the greatest disadvantage of Macquarie Bank's withdrawal from the wool futures market, as it meant that Australia's 40 registered wool traders (Champion & Fearne 2001a) lost one of the strongest agents for securing against the risk of significant market price movements (Cuming 2004).

A further characteristic that futures and forward contracts share is the cost they incur by offsetting price risk. It has been said that producers cannot expect to be paid the premiums offered at the auction as forward contracts required buyers to carry a degree of risk (Hardaker et al. 2004; Seale 1996; Teasdale 1991; Lubulwa et al. 1997). This also holds true for futures contracts. In fact, Cuming (2004) reports that the difference between an auction and futures price can be up to 200 ¢/kg.

There is ample information about the benefits of using futures to sell wool, in terms of risk management, providing the best possible price and a mechanism of maximising profit. On the other hand, it has also been found that futures are not readily used due to the perception that they do not offer any additional financial returns or price premiums, there is a lack of availability, there is a lack of confidence with them as a selling system and there is a lack of understanding on how they operate as a selling system (The Merino Company 2006, p. 39).

2.3.4. Other selling methods

Other wool selling methods available to producers include tender, private selling, electronic selling, direct to mill and options. With auction accounting for 85% of Australia's wool sales (Bolt 2004b) and forward contracts accounting for 11% (Coad 2000), it can be deduced that only 4% of the national clip is sold by a combination of all of these methods.

Seale (1996) describes the advantages of selling wool by tender to be: reasonable buyer competition, less restrictive than auction in terms of preparation of standards and 'rules', and that the wool is mostly all specified. Disadvantages of selling by tender are listed as less buyer competition than at auction, progressive bidding method is less effective and the classing standards can be inferior.

Private selling is defined as when the producer bypasses the auction system and sells directly to a buyer's store door. Advantages are said to be that the producer is actively involved in the price negotiation, it can be competitive when demand is strong and the quantity being sold is large enough to attract prospective buyers, there can be earlier receipt of payment and there can be savings in administrative and freight costs. Disadvantages are said to be a lack of wool quality information (length and strength tests are not required), penalties and discounts can be more severe than with other selling

methods, security of payment is less secure (Seale 1996) and there is the possibility of the seller not realising the full market value of the wool (Lubulwa et al. 1997).

Electronic selling is available through e-wool™ and Wooltrade Australia Pty Ltd. In mid-2006, 19 Australian wool brokers and 65 global wool buyers were actively selling this way (Sharman 2006c). Electronic selling allows for trade to be carried out purely on objective quality measures (no viewing of samples), there is no need to involve a broker, it is available 24 hours a day, there are no holiday breaks (as at auction) and buyers can easily search for suitable lots. However, there is the possibility of buyers losing interest because sellers set unreasonable reserve prices and quite often there are only small quantities on offer from individual producers (Seale 1996).

Producers who sell their wool direct to a mill can expect the advantages of saving on administrative, production (shed and classing) and freight costs, improved feedback systems on wool quality and the benefits of a shortened wool supply chain. These advantages, however, can be offset by mills' needs for very large quantities due to economies of scale, limited buyer competition, delayed payment and negotiations of whoever responsible for tops manufacture (Seale 1996).

Finally, wool can be sold by Options Contracts. Options were first introduced to the Sydney Futures Exchange in February 1996 and a total of 41 contracts were traded in the first six months. Like futures, they allow traders to minimise price risk but have the added advantage of allowing a futures contract to remain open until a peak occurs in the market by the construction of hedges. Futures traders are able to secure a minimum price and leave the contract open until more favourable circumstances arise (Lubulwa et al. 1997). The disadvantages of options contracts are their complexity in terms of the amount of attention that needs to be paid to the market and the premiums charged for their use as a result of the relative illiquidity of the futures market (Ward 1998). The more traders there are in the futures and options market, the cheaper the premiums become (Mitchell 2003).

2.4. Theoretical Background

Described herein are the three theoretical models on which this research is based. A definition of a theoretical model is given by von Bertalanffy (1975, p. 104): "A theoretical model is a conceptual construction, reflecting in a clear simplification certain aspects of a natural phenomenon and permitting deductions and predictions which may be tested".

This author also notes that environmental influences are primary determinants of human behaviour and also that one of the fundamental traits of a good theoretical framework is in its interdisciplinary nature. It is for these reasons that the Theory of Reasoned Action (TRA) (Fishbein & Ajzen 1975), the Theory of Planned Behaviour (TPB) (Ajzen 1991) and the Diffusion of Innovations (Rogers 1995) are the behavioural theories that have been chosen for the basis of this research. The following discussion will demonstrate how the three behavioural theories incorporate the impact of the external environment on a decision-making situation, and also have been successfully used in a wide range of disciplines to predict and understand human behaviour. Most importantly, evidence is provided on the theories' successful application in agribusiness research.

2.4.1. Theory of Reasoned Action (TRA)

Fishbein and Ajzen's (1975) seminal text on the TRA developed a "cumulative body of knowledge in the attitude area" (p. 520) and provides a clear distinction between beliefs, attitudes, intentions and behaviours. Despite much criticism (Bagozzi 1986; Charng, Piliavin & Callero 1988; Sheppard, Hartwick & Warshaw 1988), the TRA remained a powerful tool for predicting individual's behavioural intention or behaviour (Madden, Scholder Ellen & Ajzen 1992) within its specified limits (Sheppard, Hartwick & Warshaw 1988).

Fishbein and Ajzen (1975, p. 511) propose that 'attitude' and 'subjective norms' will provide an indication of intention and are said to be the "the primary determinants of behaviour". The TRA therefore posits that 'attitude' and 'subjective norms' are mediated by 'intention' to predict any given behaviour of an individual; as shown in Figure 2.5. Ajzen and Fishbein (1980) later went on to develop a more complex model that included external factors such as demographic variables, attitudes towards targets and personality traits.

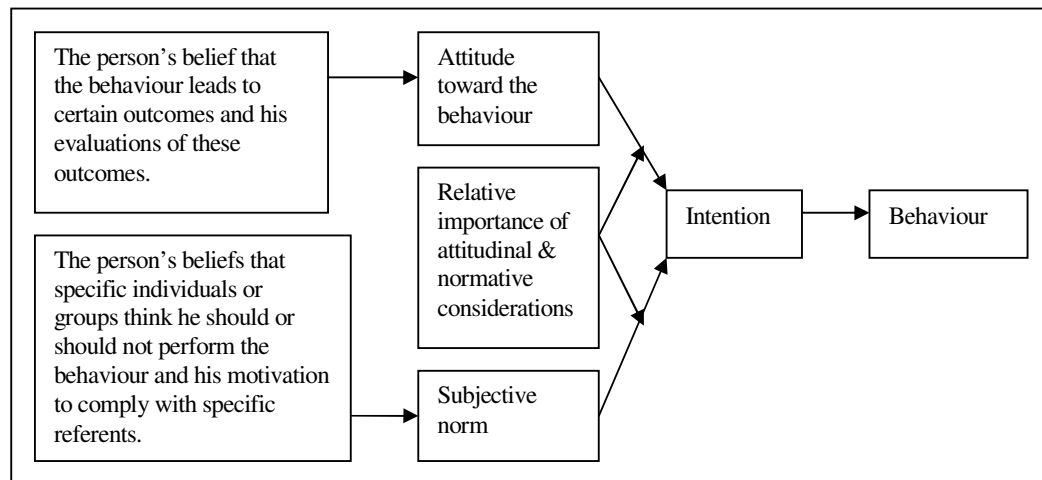


Figure 2.5: Basic path model for the Theory of Reasoned Action (Source: Ajzen & Fishbein 1980)

The theory takes its name from a critical assumption made by the authors that “human beings are usually quite rational and make systematic use of information available to them” (Ajzen & Fishbein 1980, p. 5). It also needs to be explained that this theory is based on the deciding influences of an individual, rather than a group of people, and that an individual considers actions before engaging – with thoughtfulness and rational motives (Ajzen & Fishbein 1980).

Researchers of behaviour and attitude frequently open their writing by discussing the breadth and diverse applicability of the TRA. For example, Ryan (1982, p. 263) writes “Fishbein’s model of behavioral intentions has spawned extensive research investigating both the theory and its applications in a number of disciplines”. Oliver and Bearden (1985) discuss their support of the TRA in the fields of social psychology and marketing while Sheppard, Hartwick and Warshaw (1988, p. 325) concur that the model has “received considerable and, for the most part, justifiable attention within the field of consumer behaviour”. Thompson and Vourvachis (1995) cite the successful application of this model for consumer studies in the food and beverage industry, however, it is Bagozzi (1992) who argues that the tell-tale sign of any theory is its longevity. Bagozzi (1992, p. 178) states that the TRA has “achieved due recognition as a fundamental model for explaining social action”.

A thorough review of the literature has yielded numerous studies where the TRA has successfully been used to predict behavioural intentions related to: purchase of toothpaste brand (Wilson, Mathews & Harvey 1975), coupon usage (Shimp & Kavas 1984), the adoption of olive oil in domestic kitchens (Thompson, Haziris & Alekos 1994), the

consumption of various alcoholic drinks (Thompson & Vourvachis 1995; Thompson & Thompson 1996), issues surrounding dairy farmers' choice of cattle feed (Thompson & Panayiotopoulos 1999) and the role of attitudes and objectives in terms of environmentally-orientated behaviours of farmers (Willock et al. 1999a).

Despite the vast range of research applying, testing and praising the TRA, some authors have found sufficient grounds on which to criticise this seemingly flawless model. It must be noted that, before any criticism can be made, Fishbein and Ajzen (1975, p. 380) specify three boundary conditions that can influence the strength of the relationship they postulate between intentions and behaviour:

1. The degree to which the measure of intention and the behavioural criterion correspond with the respect to their levels of specificity.
2. The stability of intentions between time of measurement and performance of the behaviour.
3. The degree to which carrying out the intention is under volitional control of the individual.

With this knowledge, works can be examined that have shown room for improvement with the TRA. Bagozzi, Baumgartner and Yi (1992) engaged in a study to understand more about the moderating variables of the TRA when predicting behaviour on coupon usage. Their study was partly based on the notion that the TRA does not take into account the concept of favourable attitudes and 'subjective norms' leading to intentions to act. Similarly, Bagozzi (1992) undertook an independent study in which he claimed that so much of the research that tested the TRA, in which new sequences and interactions were considered among the existing variables, failed to produce any substantive results. He sought to test that 'attitudes' and 'subjective norms' are not effective determinants of intentions and that 'intention' is an inadequate determinant of final action. In so saying, it is Bagozzi's opinion that developments in this behavioural theory have yielded weak results due to the fact many only address one, or sometimes two, of the three relationships of the TRA (either attitude-intention, subjective norm-intention or intention-behaviour).

Another study on using the TRA to predict coupon usage outlines more assumptions of the model. Shimp and Kavas (1984) empirically tested eight behavioural models, their analysis found that the TRA resulted in the best goodness-of-fit. However, analysis within the model showed that it was only able to partially predict the actual adoption of

behaviour since relationships associated with ‘attitude toward the behaviour’ and ‘subjective norms’ had better fits than relationships associated with ‘actual adoption’. The conclusion of this research questioned four fundamental assumptions of the TRA: that cognitive (1) and normative (2) structures are unidimensional, that (3) attitudinal and normative influences are dependent and that (4), behavioural intentions are only ever influenced and mediated by attitudinal and normative factors.

Interestingly, Thompson and Panayiotopoulos (1999) were completely satisfied that the TRA is an accurate predictor of dairy farmers’ behaviour in the United Kingdom. In terms of correlation strength between the variables, the conclusion was drawn that ‘attitude’ was found to be a better predictor of behaviour than that of ‘subjective norms’. This was due to the fact that the normative measure failed to improve the predictive power of the model regardless of presence, absence or polarity of the suspect motivational component.

Research by Ryan (1982), Shimp and Kavas (1984) and Oliver and Bearden (1985) introduced the argument of interdependency among the variables of the TRA as a result of conclusions being drawn about the simplicity of the model. Ryan’s research was born from his hypothesis that greater utility will be derived by an individual when attitudinal and normative variables can be shown to have different effects on behaviour within the context of the model. This work was extended by Shimp and Kavas (1984) and then further by Oliver and Bearden (1985) to include the concept of what they termed the ‘cross-over effect’ of variables within the TRA. While Shimp and Kavas found assumptions within the model that were additional to those initially proposed by Ajzen and Fishbein (1975), these assumptions opened the way for more in-depth research to be conducted on the operation of these effects when moderated by varying conditions; such effects include confidence, familiarity, innovativeness, involvement and demographic considerations like age and gender.

A flaw in the TRA was identified by Charng, Piliavin and Callero (1988) who raised the point that while past testing on this model might have produced good support for prediction of intentions and behaviours for a one-off type of behaviour, such as using a coupon or political voting preferences, there was little evidence to show that the TRA was useful for predicting repeated behaviours, such as continuation of smoking or continuation of therapy. This research, conducted on the repeat behaviour of blood donors, found that the TRA provided the best results when supported with variables from

identity theory such as role-person merger, social relations and habit. They also found that as an individual increases performance of the behaviour, or “career” as it was termed, then frequency of the behaviour will be improved.

In terms of observations made over time on the robustness of the TRA, authors such as Thompson and Thompson (1996), Sarver (1983) and Bagozzi (1992) claim that vital elements have been omitted from the TRA. These authors gave support for Fishbein and Ajzen’s (1975) initial flaw of the TRA in that it fails to take into account situations where behaviour is not completely under the individual’s control. While so many studies in the past had failed to prove the TRA to be inadequate or incomplete in using intentions to predict behaviour, it was this fundamental idea that gave rise to next major development in the life of attitude and behavioural studies: the creation of Ajzen’s Theory of Planned Behaviour.

2.4.2. Theory of Planned Behaviour (TPB)

An extended model of Fishbein and Ajzen’s 1975 TRA, the TPB was first published by Ajzen in 1985 in a book edited by Kuhl and Beckmann and was later independently published again by its creator in 1991. As can be seen from Figure 2.6, while ‘intention’ is still the central construct of the theory, the construct of ‘perceived behavioural control’ has been added. This enables the measurement of the extent to which an individual believes the outcomes of a behaviour can be controlled (Burton 2004). The addition of this new construct was born from criticism of the TRA that it failed to account for behaviours associated with incomplete volitional control (Ajzen 1991; Madden, Scholder Ellen & Ajzen 1992). In essence, the theory uses the ‘knowledge of attitudes’, ‘subjective norms’ and ‘perceived behavioural control’ to understand beliefs and thus predict behaviour. It is important to note, however, that the TPB uses ‘perceived behavioural control’ to predict behaviour in two ways:

1. Through motivational factors and the intention to perform the behaviour (via the ‘intention’ construct);
2. Through actual control via the direct link between the ‘perceived behavioural control’ and ‘behaviour’ (Madden, Scholder Ellen & Ajzen 1992).

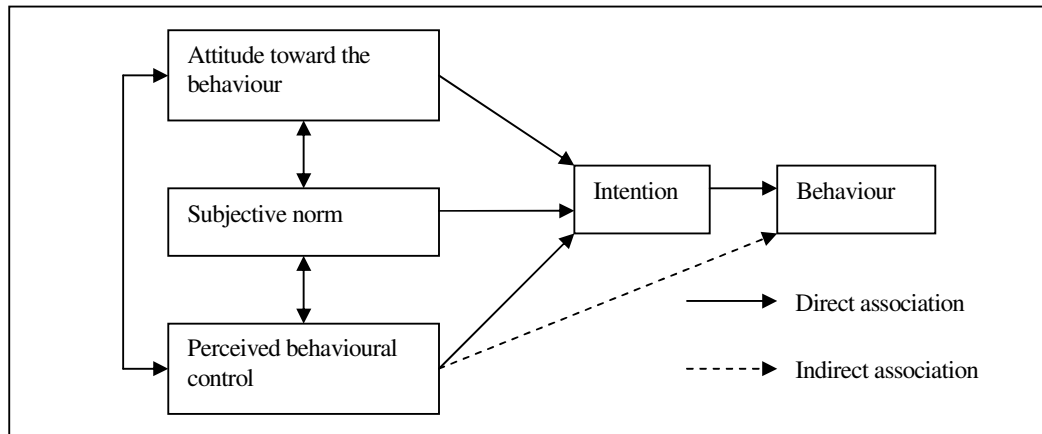


Figure 2.6: Path model for the Theory of Planned Behaviour (Source: Ajzen 1991)

Given the previous detailed explanation of the TRA, the pivotal points of discussion on the TPB are those revolving around the concept of volitional control and the construct of ‘perceived behavioural control’; of which the two go hand-in-glove.

While the issue of perceived behavioural control is a key point of interest in the TPB, Ajzen (1991) firmly argues that it is only achievable if the behaviour is under volitional control, that is, the individual has freedom to choose whether or not to perform the behaviour. It is stated that the performance of most behaviours will, in fact, involve some element of non-motivational factors (like exposure to opportunities and resources) hence making ‘perceived behavioural control’ different from actual control (Lynne, Casey, Hodges & Rahmani 1995). Thompson and Thompson (1996) make the point that it is inappropriate to include involuntary acts in studies on behaviour. To illustrate their point, these authors give examples of behaviours required by social convention, such as the decision to go to work, and those compelled by prior commitment, such as the decision to put fuel in your car.

Ajzen (1991, p. 183) defines ‘perceived behavioural control’ as “people’s perception of the ease or difficulty of performing the behaviour of interest” and goes to great lengths to point out the raft of similar concepts within the field of behavioural studies, like the perceived locus of control, perceived self-efficacy and the expectancy of success. It is Ajzen’s definition of perceived behavioural control that allows this construct to fit neatly in his model. This is the case for two reasons. Firstly, Ajzen states that a behaviour will come to a successful conclusion if an individual has a greater perception of behavioural control. Secondly, it is also stated that perceived behavioural control is often used as a substitute measure for determining actual control.

In terms of agriculture and farming, Burton (2004) discusses the importance of the 'perceived behavioural control' construct in this field of study due to the physical, economic and political fluctuations experienced in the agricultural environment. He comments that perceived ability to withstand change within the farm business has been identified with issues such as agricultural strategy, women's participation in farm work and woodland management initiatives. Further to this, Lynne et al. (1995) identified the importance of financial variables in understanding farmers' perception of control. They use the Theory of Derived Demand to justify their opinion that if farmers' behaviour is a function of their total capital base (made up of approximately equal commodity prices and technological resources) then financial position must be an indicator of the level of control held in their decision making.

The first criticism of the TPB comes from the author himself (Ajzen 1991) in his seminal paper in which he admits that, at the time of publication, the strength of correlation between the constructs was not as strong as desired in terms of "global measures". It was also said that while the relations between the theory's constructs had been proven, their exact form was unknown. It was not long after the theory's release that empirical studies were undertaken to prove that it is a reliable, standardised tool for predicting and explaining behaviour (Ajzen & Driver 1991). However, as recently as 1995, Bagozzi and Kimmel conducted a comparison of the TRA, TPB, the Theory of Self-Regulation and the Theory of Trying and concluded that these leading instruments of predicting behaviour were incomplete. They found that 'perceived behavioural control' failed to predict both 'intentions' or 'behaviour' and that 'subjective norms' did not contribute to intentions. This study specifically observed behaviours with a low level of perceived behavioural control (exercise and dieting) among a group of students. It provides some good, cautionary insights into the weakness of the aforementioned theories although cannot necessarily be used to disregard the theories in agribusiness research as so many such studies have showed the importance of each TRA/TPB construct (see Tutkun & Lehmann 2006; Beedell & Rehman 1999 & 2000; Lynne et al. 1995).

Since the TPB was first published, research has been conducted to show that not only are there significant relationships between the theory's constructs but that it is possible to include situation-specific factors in the theory. Ajzen (1991) had the foresight to predict that this would be the case and, more than 10 years later, Burton (2004) cites studies that have successfully integrated additional factors into the TPB on an "as needed" basis.

Such factors were listed as habit, moral obligation and self-identity, although it was only the construct of identity that Burton (2004) nominates worth using in farming-based social psychological research. Other authors have found that including constructs related to past behaviours will also improve the statistical significance of a model based on the TPB (see Bagozzi & Kimmel 1995; East 1993). Venkatesh et al. (2003) go so far as to recommend that future research using TRA and TPB frameworks should focus on adding non-traditional constructs to determine intention and behaviour.

Following on from the findings of Burton (2004), Bagozzi and Kimmel (1995) and East (1993), Corral (2002) showed how complex the TPB could become by adding extra constructs. Corral conducted an extensive literature review on the adoption or rejection of new environmental technologies and constructed a sizeable model that included numerous constructs that are not traditional to the TPB (Figure 2.7).

Despite any criticisms, research by Beedell and Rehman (1999 & 2000) and Gorddard (1991 & 1993) prove the TPB to be a suitable tool for measuring farmer behaviour in two ways: to discover if all farmers behave in the same way and if not, are the differences in their beliefs explained by differences in their behaviours? The TPB was also successfully used by Lynne et al. (1995) in predicting the technology adoption behaviour of strawberry farmers. Details of these studies will be expanded upon in Section 2.5.2.

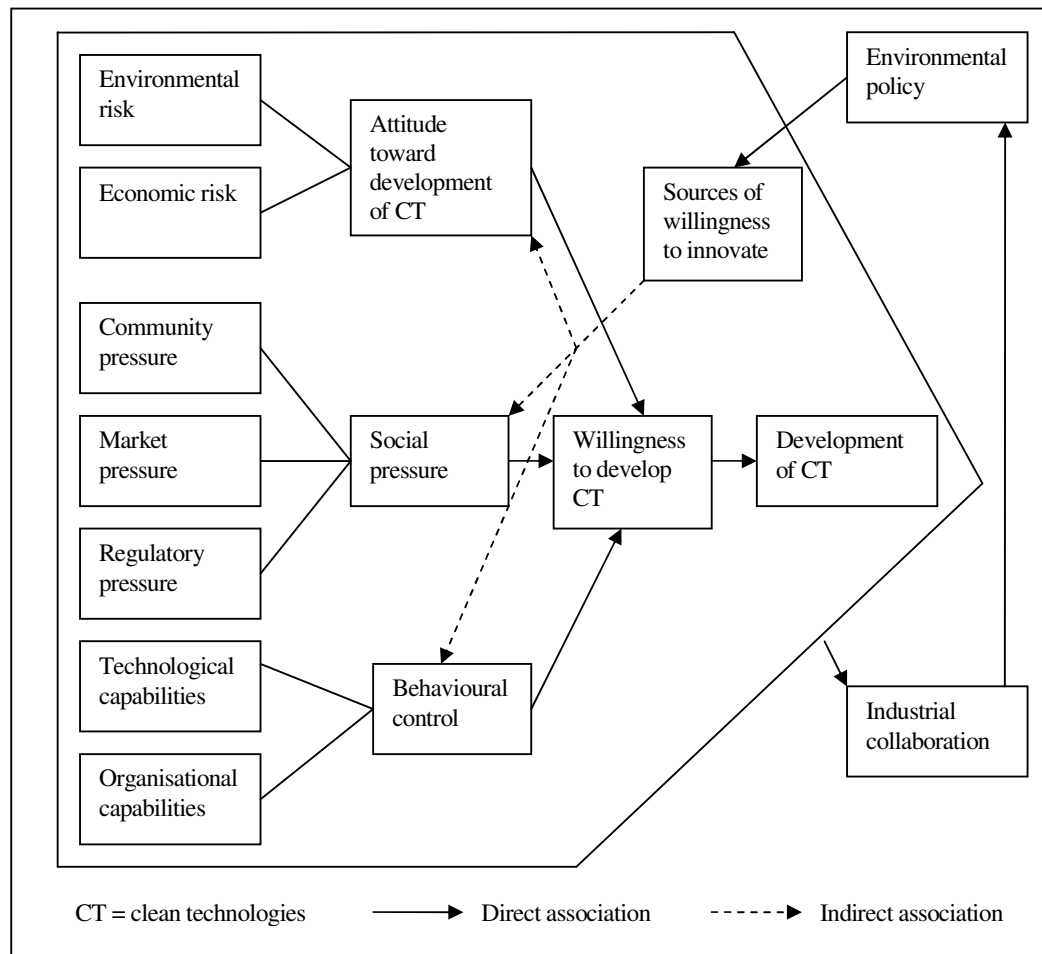


Figure 2.7: Willingness to the development of clean technologies (Corral 2002)

2.4.3. Diffusion of Innovations

Diffusion is defined by Rogers (1995, p. 5) as “the process by which an innovation is communicated through certain channels over time among members of a social system”. The concept of Diffusion has successfully been applied in rural contexts since the 1940s (Fliegel 1993) with the focus being on the adoption of agricultural ideas such as weed sprays, hybrid seed and fertilisers (Rogers 1995). Fisher et al. (2000) explain that Diffusion is different from adoption in that it is the process by which new technologies are spread among users whereas adoption is said to be an individual, internal decision.

Rogers (1958 & 1995) and Fliegel (1993) often refer to the seminal research by Ryan and Gross (1943) who studied the diffusion of hybrid corn through Iowa communities in the USA. It was this study that provided the early fundamental characteristics of the theory: the classical “Diffusion of Innovations” paradigm. This study promoted the significance of communication as a construct in the Diffusion model and provided the generic bell-

shaped (Figure 2.8) and sigmoid (Figure 2.9) curves of adoption on which a plethora of research on rural sociology has been based.

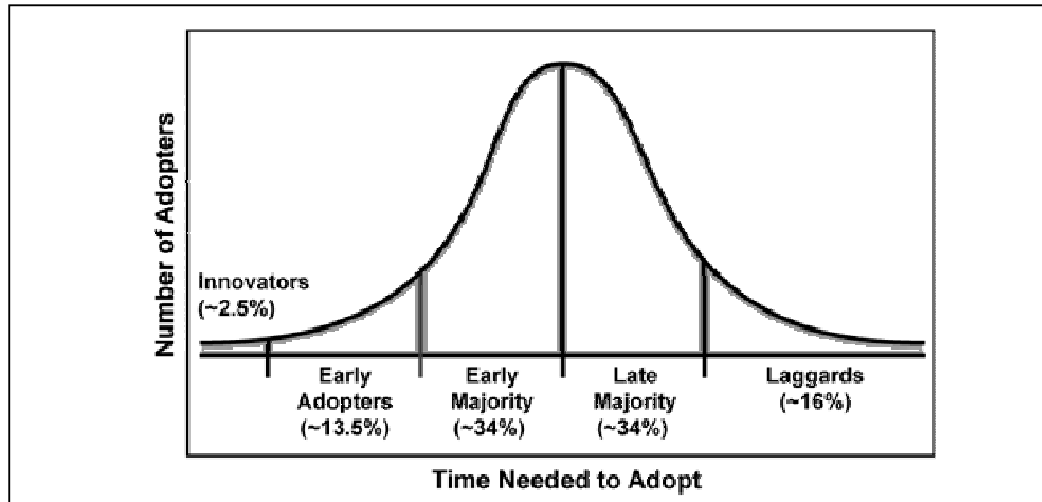


Figure 2.8: Technology adoption cycle

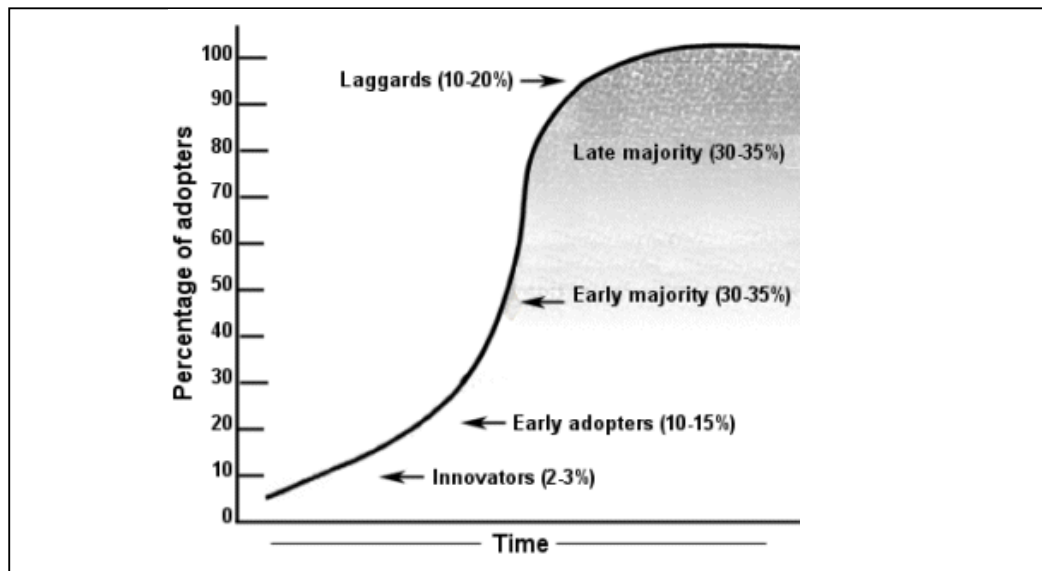


Figure 2.9: The S-shaped cumulative Diffusion curve and adopter categories

Rogers (1958), supported by Feder and O'Mara (1982), confirm the normal distribution of adoption practice and the sigmoid, or S-shaped, curve when adoption is presented on a cumulative basis. The concept of the normality of adoption frequency distribution was the basis for characterising adopters of technology. Rogers used the mean \pm multiples of the samples' standards deviation to form brackets of adopters with already established percentages of the population used to quantify the size of each group (as shown in Figure 2.8).

As with Farming Styles Theory (discussed in Section 2.2.2.2), descriptive labels have been applied to each of these brackets, or categories, of adopters; as shown in Figure 2.8. In terms of the statistics of a normal distribution curve, the category of Innovators begins at less than -2 standard deviations from the mean. In more conceptualised terms, Innovators are the most venturesome and radical of adopters. Rogers (1995) characterises them as going outside their communities in order to seek out and understand new innovations and are not discouraged by the occasional set backs associated with unsuccessful new technologies. The population of Early Adopters lies between -1 and -2 standard deviations from the mean, thus making up about 13% of the population. This group is described by Rogers (1995, p. 264) as “the embodiment of successful, discrete use of new ideas”. They generally work with new ideas and innovations within their communities and decrease uncertainty by using interpersonal networks to convey their subjective experiences of the innovation.

The next group from Rogers’ adopter categories are the Early Majority. On the normal distribution curve, this group lies between -1 standard deviation and the mean and makes up about 34% of the population. They are characterised as adopting new ideas just before the average individual. They frequently interact with their peers to pass on their experiences but do not have the leadership qualities of Early Adopters. They are also characterised by taking more time to adopt a new idea than the Innovators or Early Adopters.

Like the Early Majority, the Late Majority make up a significant part of the Diffusion environment: 34%. This category lies between the population’s mean and one standard deviation from the mean. Late Majority people are generally sceptical of adopting new ideas and will do so just after the majority of people when there is ample information about the idea, when there is an economic necessity and/or when there is increasing network pressures for adoption (Abrahamson & Rosenkopf 1993). Finally, the Laggards, who make up 16% of the system’s population, form the far right tail end of the normal distribution curve. They are traditionalists in the sense that their point of reference for new ideas is what has occurred in the past. This group has almost no respect for leadership of ideas in their environment, in that they are suspicious of innovations and change agents, and will rarely venture beyond their system’s boundaries by seeking new innovations – almost to the point of isolation. Laggards are quite often restricted in terms

of the level of resources they have at their disposal to adopt a new idea and will take inordinately extended periods to adopt (Rogers 1995).

One of the recurring themes in Rogers' (1995) description of each category of adopter was that of communication. Among other characteristics, Rogers constantly described members of each category in terms of the extent of their communication activities with other members of their environment and how far they reached outside the boundaries of their system in order to access information on a new idea. For example, the term "cosmopolite" (p. 263) was used to describe the vast geographic distances between communication networks of innovators, whereas adopters more towards the middle of the bell-shaped curve were described as "localities" (p. 264-5). This term describes how the information networks of Early Adopters, Early Majority and Late Majority people are restricted more to seeking information from sources in their local area. Laggards were described as being the most fervent of localities, and those whose adoption behaviour fits at the far right of the bell-shaped curve were termed to be "near isolates in the social network" (p. 265). This means that their point of reference for the adoption of a new idea is not associated with social networks at all, but rather with how behaviours were carried out in the past.

Communication is so important to the Diffusion of Innovations process, as identified by Ryan and Gross (1943), that Rogers (1995) provides a definition immediately after his definition of Diffusion: "Communication is a process in which participants create and share information with one another in order to reach a mutual understanding." (p. 5-6).

So far, communication has been discussed in terms of social networks. However, there is a great deal of literature on the importance of information networks that aid the Diffusion of Innovations. Research published as early as 1950 (Wilkening 1950) reports on the importance of agricultural agencies and mass media as conduits for information diffusion. Research has continued to find support for these methods ever since (Longo 1990; Saltiel, Bauder & Palakovich 1994). However, the most important means of information transfer has been found to be the importance of peer relationships (Chiffolleau 2005; Longo 1990; Saltiel, Bauder & Palakovich 1994; Copp, Sill & Brown 1958; Wilkening 1950), with social class and size of land holding to be influencing factors of information up-take (Feder & Slade 1984; Wilkening 1950). The importance of communication inefficiencies as a factor suppressing information flow within the wool supply chain is emphasised by Champion and Fearne (2001a).

Many authors who have studied the empirical nature of Diffusion (such as Ajzen & Fishbein 1980; Quaddus & Xu 2005; Ryan & Gross 1943) take a classic, linear view to the process in that external factors contribute to perceptions which, in turn, give rise to diffusion. Rogers (1995) presents a version of this linear model of the diffusion process within agriculture (Figure 2.10).

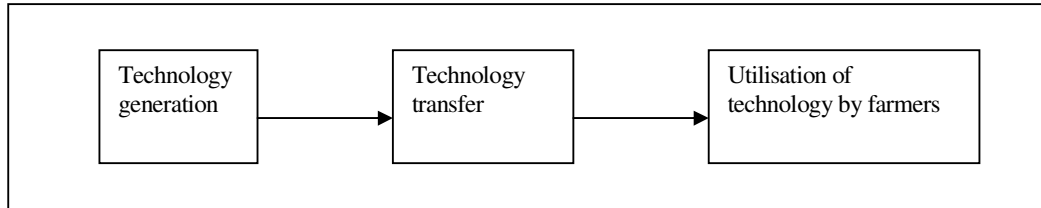


Figure 2.10: Diffusion as a linear process (Source: Rogers 1995)

However, Fliegel (1993), with support from Feder and Umali (1993), illustrates a more widely accepted approach to the adoption of agricultural innovations. Fliegel (1993) argues that the linear approach tends to restrict the process of diffusion as a rational, planned process that relies on the developments of institutions such as government departments, rather than viewing the farmer as a passive individual who responds to more random forces related to social participation and communication (Figure 2.11).

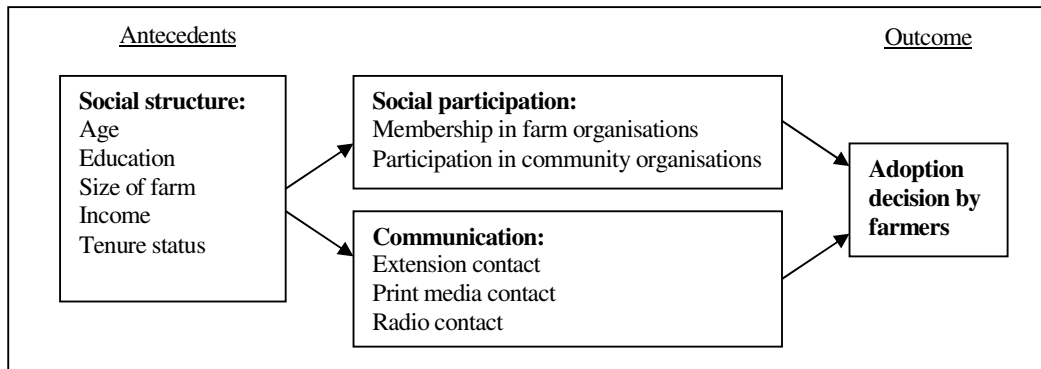


Figure 2.11: Fliegel's approach to the adoption of agricultural innovations (Source: Fliegel 1993)

Figure 2.11 is the model chosen for the basis of this research as it better aligns with the environment in which farmers choose methods to sell their wool; that is, an environment relatively free of restrictions imposed by government policies or regulated trading conditions.

In terms of Diffusions of Innovations in agriculture and rural sociology, a survey of the literature was conducted by Rogers (1995) who reviewed some 3,890 publications and found rural sociology to have contributed the greatest percentage of research to the

broader field of diffusion. Some 845 rural sociology publications were identified, with the next greatest contribution coming from the area of marketing and management with 585 publications; thus proving the importance and dominance of agriculture to this research tradition. It was said that Diffusion of agricultural technologies provided useful leads to agricultural scientists to have their work used by farmers.

Rogers (1995) and Ruttan (1996) claim that surplus food production and the farm crisis in the USA prompted the demise of Diffusion research in rural sociology after about the 1970s. However, a resurgence in popularity of agricultural Diffusion research is evident in recent trends in the literature discussing the adoption of modern farming systems in developing countries (Masters 2005; Abdulai & Huffman 2005; Weir & Knight 2004; Munshi 2004; Rahman 2003; Neill & Lee 2001; de Sousa & Busch 1998; Mishra & Hossain 2000), the adoption of land conservation practices in farming (Pampel & van Es 1977; Forte-Gardner et al. 2001; Feder & Umalí 1993) and the adoption of biotechnology in farming systems of developed countries (Hategekimana & Trant 2002; Stewart, Harding & Day 2002) – or both the adoption of land conservation practices and biotechnology (Qaim & De Janvry 2005; Pelaez & Schmidt 2002). Research has also re-emerged on the diffusion of grain-growing technology (Walburger, Klein & Folkins 1999; Forte-Gardner et al. 2004; Rajesh & Varadarajan 2000).

Despite the apparent popularity of this concept, criticism has been found on Diffusion theory and its generic bell-shaped and S-shaped models. Major themes of criticism include the variation found in the speed of adoption of various technologies (Fliegel & Kivlin 1962; Lindner 1986; Fisher et al. 2000), its application to agricultural systems in developing nations (Goss 1979; Ruttan 1996) and its narrow application to farmers as individuals, as opposed to agribusiness firms (Jensen 1982 & 2001; van Everdinger & Wierenga 2002; Hausman 2005).

While the S-shaped curve assumes a continuous transition from the adoption of one behaviour from (and to) the disadoption of another behaviour over any given timeframe, it needs to be stated that this research does not aim to demonstrate the disadoption of the auction system to the adoption of forward contracts. Rather, it utilises some elements of the Diffusion of Innovations concept to: 1) ensure a community-based view is considered in terms of the behavioural determinants of wool producers adopting the use of forward

contracts and 2) it incorporates the constructs of agriculture-specific concepts (as shown in Figure 2.11) to underpin those of the TPB.

2.5. Review of Relevant Studies

The theoretical frameworks used in this research are reviewed in this section for their specific application to decision making in farming and agribusiness. The TRA (Fishbein & Ajzen 1975), the TPB (Ajzen 1985) and Diffusion of Innovations (Rogers 1995) have been described and discussed from a technical perspective and will now be explored in terms of their relevance to the present study.

2.5.1. Theory of Reasoned Action

Literature on the TRA is sparse in the field of agribusiness; only a few truly relevant studies were located. Thompson and Panayiotopoulos (1999) tested the TRA in the context of UK dairy farmers and their attitude to buying feed for their herds. Key findings suggest that attitude is the key predictor of behavioural intention ($r = 0.96$) while 'subjective norms' were found not to improve the efficiency of the model ($r = 0.29$). The latter finding was explained by the routine nature of buying cattle feed and also by the level of animal nutrition expertise held by the farmers in question. It was concluded that farmers buying feed for the first time may be more susceptible to complying with the expectations of salient referents than those who had been performing this behaviour for some time.

The aforementioned study concluded that 'attitude' is a better predictor of behavioural intention than 'subjective norms'. This finding was confirmed in another agribusiness-related study on the adoption of olive oil in British kitchens in which Thompson, Haziris and Alekos (1994) found that attitudinal belief was the best predictor of intention to adopt ($r = 0.71$ and $p = <0.001$); a correlation not as strong as Thompson and Panayiotopoulos' results, but nonetheless still quite good. It was also found that including 'subjective norms' as a measure of intention did not add any statistical strength to the model. Interestingly, the authors note that a preliminary study showed that 'perceived behavioural control', like 'subjective norms', did not contribute to the robustness of the model so the TRA was chosen as the research framework, rather the TPB.

Gorddard (1992) also found that 'perceived behavioural control' construct of the TPB did not add any significance to his research on Western Australian farmer conservation

behaviours. Gorddard's research showed significant relationships between all the TRA constructs at the $p \leq 0.10$ level. In this study, Gorddard showed how relationships will change between constructs in the presence or absence of particular variables. It was demonstrated that when 'attitude' and 'subjective norms' are disregarded in the model, behavioural beliefs, such as the influence of various tillage practices on factors such as wheat yield or soil structure, become significant (at $p \leq 0.10$). While constraint beliefs, such as ability to access the organic market, remain significant, other constraint beliefs increase in significance, like the need to use conventional methods for crop establishment.

In another agribusiness-related study on wine consumption, Thompson and Vourvachis (1995) reported results that contrasted those above. They found that, based on the β value, 'subjective norm' ($r = 0.54$, $\beta = 0.39$ and $p = < 0.05$) is a better predictor of intention to drink wine and alcohol-free beer than attitude ($r = 0.51$, $\beta = 0.32$ and $p = < 0.05$). This study showed that the opinions of friends, family and guests were unexpectedly the primary influences of behaviour which aligns with so many farmer-orientated behavioural studies (see Gasson 1973; Gasson & Errington 1993; Kerridge 1978; Wilkening & Guerrero 1969; Albrecht & Albrecht 1996); despite its lack of application to farmer behaviour. The results of this study, however, are in stark contrast to those reported in the aforementioned study by Thompson and Panayiotopoulos' (1999) who found that including 'subjective norms' as a construct in their TRA model of cattle feed purchasing behaviour decreased the r from 0.96 to 0.29.

The findings of Thompson and Vourvachis (1995) are encouraging in that 'subjective norms', as a construct, contribute to the predictive power of a TRA model. However, it is logical to place more emphasis on the findings of Thompson and Panayiotopoulos (1999). The study of Thompson and Panayiotopoulos is more poignant to the present research as it is more concerned with farmer-related behaviours and raises the important point of the repeat behaviours, a factor that needs to be considered when studying the adoption of forward contracts versus auction.

2.5.2. Theory of Planned Behaviour

As mentioned earlier, the TPB is an extension of the TRA in that 'perceived behavioural control' over performing the studied behaviour is added to 'subjective norms' and 'attitude' as constructs for predicting intention. Therefore, while there was contention over the primary predictor of intention in the TRA, 'perceived behavioural control' will

now dominate as the key predictor of intention. While several studies relating to farmer decision making and the TPB were found, research related to agriculture is still sparse.

The TPB has been successfully used to understand farmers' adoption of conservation behaviours. Lynne et al. (1995) studied the conservation behaviour of North American strawberry farmers and found 'perceived behavioural control' to be an important factor of determining intention as adding it as a construct to the model provided a χ^2 of 9.49 and $p = < 0.05$. The analysis of interviews from this study also found that all four constructs of the TPB ('attitude', 'subjective norms', 'perceived behavioural control' and 'intention') are necessary for the practical application of the theory if any farmer behaviours are to be targeted.

Beedell and Rehman (1999 & 2000) also researched farmers' conservation behaviour using the TPB. Their mixed-method study (interviews and survey) compared the hedge-management behaviours of two types of UK farmers (those belonging and not belonging to an advisory group) and found that 'perceived behavioural control' was not a determining factor of behavioural intention.

This study found that social pressure and moral obligation were the determinants of hedge-management behaviours as members of the "Farming and Wildlife Advisory Group" reported a sense of more social pressure to maintain their hedges than the control group. The motivation to comply with five referent groups provided the measure of social pressure. It was found that the most significant levels of pressure came from within the farmers' own group (the Farming and Wildlife Advisory Group) and the local county council.

Of the measures for each TPB construct, it was found that Likert scales of good-to-bad 'attitude', agree-to-disagree for 'subjective norms' and likely-to-unlikely for 'subjective norms' were the only measures that were statistically significant ($\chi^2 = 6.46, 4.63$ and 5.80 respectively where $p = < 0.05$). The measures of most statistical significance were the sums of 'outcome evaluation' and 'belief strength' ($\chi^2 = 11.05$ where $p = < 0.001$) and 'motivation to comply' and 'normative belief' ($\chi^2 = 11.51$ where $p = < 0.001$).

The same authors had similar research published in 2000. This study used the same data set as the previous study but different hypotheses were tested: first, to determine the frequency and intensity of conservation behaviours among the participants and second, to test the efficiency of the TPB in determining behavioural variations among farmers.

The findings were largely the same as those previously described, although there was some variation in the outcomes of the social pressure and moral obligation constructs. While there was evidence of these two constructs being associated, analysis revealed that the main source of pressure experienced by farmers was not from society, but from their individual conscience towards actively pursuing conservation behaviours. Similar to the 1999 study, 'perceived behavioural control' was found not to be a significant influencing factor on intention to perform a conservation behaviour. The two groups in question were neutral in their attitudes towards hedge management, in terms of being very easy or very difficult, and the two groups held very different perceptions of the behaviours being studied. The conclusions of this study were that the TPB is a good method of understanding variations in farmer behaviour but it was interesting to note also that a comment was made regarding the complexity of a TPB questionnaire. It said that the questionnaire must be very precise and individual questions can often be regarded by participants as contorted.

Australian studies on farmer conservation practices by Gorrdard (1991 & 1993) show that the TPB's 'perceived behavioural control' construct adds statistical significance to the TRA/TPB model. Gorrdard's 1991 study showed that adding the 'perceived behavioural control' construct lifted the model's adjusted R^2 value from 0.39 to 0.51 while significance remained at $p \leq 0.001$.

More recent research by Bergevoet et al. (2004) shows how studies using the TPB have developed in complexity. A questionnaire conducted with Dutch dairy farmers used factor analysis and stepwise regression to understand the relationship associated with farm size (measured by milk quota volume) and the individual goals of farmers. The findings of this study largely align with those of other TRA/TPB studies although, unlike much rural sociology work (see Dumas 1987; Lee & Stewart 1983; Makus et al. 1990; Beedell & Rehman 1999 & 2000), 'farm size' as an experimental factor was found to have no relevance to fulfilling farmers' intrinsic, expressive and social goals but is mainly explained by instrumental goals.

Analysis of the data began with testing 'farm size' in association with off-farm income and a breeding enterprise being part of the farm business. There was a highly significant relationship between these variables ($p < 0.001$) although $R^2 = 0.25$. This R^2 value was used to explain that the three test factors explain 25% of the variation in milk quota volume. This R^2 value was increased to 0.38, without decreasing statistical significance,

when the traditional TPB constructs of ‘attitudes’, ‘subjective norms’ and ‘perceived behavioural control’ were added to the model. While these R^2 values are quite low, the study has shown that variation in the amount of milk Dutch dairy farmers are able to produce is explained by the emphasis this group of people put on attitudes, ‘subjective norms’ and ‘perceived behavioural control’.

Like the research of Lynne et al. (1995) and Beedell and Rehman (1999 & 2000) this study concluded that the TPB can be successfully used to understand farmer behaviour and, most importantly, can identify the drivers that influence the decision-making process of farmers. It was found that ‘goals’, ‘attitudes’, ‘perceived behavioural control’ and ‘subjective norms’ influence farmer behaviour so much that people external to the physical farm can target these drivers to influence economic and non-economic-based behaviours. It also showed that barriers imposed by industry and past experiences also influence farmer behaviour.

The most recent and relevant study that warrants review is that of Tutkun and Lehmann (2006) who used the TPB and structural equation modelling (SEM) to explain the conversion behaviour of Swiss farmers to improved animal stabling systems. Like the aforementioned studies of Lynne et al. (1995) and Beedell and Rehman (1999 & 2000), Tutkun and Lehmann (2006) concluded that the TPB model had an adequate goodness-of-fit to the data since all but one of the relationships tested resulted in a $p < 0.001$ level of significance. Further to this, and concurring with the findings of Corral (2002) and Burton (2004), the relationships within the model were found to be improved by adding behavioural factors external to Ajzen’s (1991) original model. In Tutkun and Lehmann’s case (2006), this factor was ‘communication’ which explained an astounding 76% variation in adoption behaviour.

The studies that have been reviewed thus far have been in relation to the TPB and farmer behaviour – both of which are highly relevant to this research. The final study that needs to be considered is that concerning the TPB and financial matters as none of the studies so far reviewed have considered people’s intention to use any type of financial tools. East (1993) used the TPB to gain insight into the factors that influence investment decisions of people to buy shares in recently floated government utilities. Unlike other research considered herein, relationships between variables were strengthened when tested independently. For instance, East’s research concluded that ‘perceived behavioural control’ is an important component of the TPB, not in terms of its influence on actual

investment behaviour, but because of its influence on intention via action. Like the research of Bergevoet et al. (2004), East's research shows support for the inclusion of this variable by an increase in the R^2 values thus providing the validity of using the TPB as opposed to the TRA.

A further similarity between the work of East (1993) and Bergevoet et al. (2004) is the inclusion of a variable on past experience. It appears that this variable had little effect on the behavioural outcomes of applying for shares. However, factors that were found to be more significant were the strong influence of friends and family, the importance of easy access to funds and the financial criteria associated with profit and investment security.

In conclusion, there is general agreement that the TPB is a useful method of understanding behaviour by identifying major influencing factors. While the TPB has found success in many fields of research, both East (1993) and Beedell and Rehman (2000) point out that this research framework is complex to use due to the sophistication of its questionnaire development and analytical requirements.

2.5.3. Diffusion of Innovations

Diffusion of Innovations was born from a study on hybrid corn seed by Ryan and Gross (1943). This study was pivotal in showing the critical nature of the opinions held in the local environment on the adoption of an innovation by farmers.

Ryan and Gross' (1943) seminal study concluded that adoption of technology among North American farmers has a definite pattern and that the most effective methods of diffusing information about the technology in question was via sales and through neighbours. Probably the most important finding of this research, which has been the basis of so many subsequent studies, was that of the time pattern of user acceptance. Ryan and Gross noted that this pattern took on the form of a traditional bell-shaped distribution curve but their findings concluded that the distribution could not accurately be described as normal. This finding was principally attributed to the influencing opinions of the interacting population which has the effect of quickening, and thus skewing, the adoption process.

This research gave rise to another critical study by Rogers (1958) who took Ryan and Gross' comments on the time pattern of distribution and proved it to be a notion true only to their piece of research. Rogers' research, as well as many other behavioural studies of farmers he cited, used more powerful tests of normality (such as Kolmogorov-Smirnov)

than used by Ryan and Gross (chi-square). The two conclusions of this research were that people can be categorised according to their adoption behaviour (as described in Section 2.4.3) and that speed of adoption was an important factor in understanding adoption behaviour. These conclusions are still the bases of much research on adoption behaviours (see Rogers 1995; Fliegel 1993; Fisher et al. 2000; Knudson et al. 2004).

Building on Rogers' (1958) research, Fliegel and Kivlin (1962) considered farm practice attributes in association with adoption rates. This study used correlation analysis to understand how attributes of innovations assist with the speed of adoption in a North American dairy farming community. A literature search revealed a range of attributes that were applicable to the farming community in question: 'initial cost', 'continuing cost', 'rate of recovering cost', 'divisibility', 'mechanical attraction', 'complexity', 'compatibility', 'association of practice with major farm enterprise', 'saving of time', 'saving of physical labour' and 'advantage'. Correlation results show that saving time is the most closely associated attribute to speed of adoption. While the correlation was low ($r = 0.41$), it was the only attribute that showed a statistically significant relationship to speed of adoption. Saving of physical labour was also related to speed of adoption but this relationship was not found to be statistically significant ($r = 0.21$). Other significant relationships of note are 'complexity', 'compatibility' and 'advantage'.

The relevance of this research lies in its findings relating to the attributes that promote speed of adoption. Rogers (1995) uses four of these attributes from a list of five that are key constructs for the diffusion of innovations: 'complexity', 'compatibility', 'relative advantage', 'trialability' and 'observability'.

Until recently, much of the adoption and diffusion research within the rural sociology tradition focused on the uptake of environmental practices in farming (see Pampel & van Es 1977; Ervin & Ervin 1982; Rahm & Huffman 1984; Lee & Stewart 1983; Nowak 1987; Saltiel, Bauder & Palakovich 1994; Feder & Umali 1993) and not much else. Ruttan (1996) found that adoption and diffusion research experienced a dramatic decline in the 1970s and 1980s and has now shifted from being based in rural sociology to a research subject of economics. Evidence of this can be seen in research by Makus et al. (1990).

While the research by Makus et al. (1990) does use traditional adoption/diffusion methods, it also used a probit model to quantify factors that affect the usage of futures or

options amongst US agricultural decision makers. Results of the telephone survey showed eight factors that influence producer decisions regarding the use of futures and options in commodity marketing. Four of these factors were significant at the 1% level: prior use of forward contracts, membership of a marketing club, possession of bachelor's degree or above and gross annual farm sales of US\$100,000 to \$250,000. Factors at the 10% level of significance were gross annual farm sales of \$250,000 to \$500,000 and farm location in the Midwest region of the US. The other significant factor ($p = 0.05$) was gross annual farm sales of $\leq \$100,000$. This study highlights the importance of these factors when considering farmer behaviour about using various option to market commodities.

This review of relevant studies has shown that while history has contributed to the development of the behavioural theories under consideration, there are common themes within each theory that have remained constant since their inception.

Agricultural studies on the TRA are relatively few since the theory was not fully appreciated until it had the 'perceived behavioural control' construct added to become the TPB. Reviews of the TPB showed that each of its constructs are all highly applicable to agricultural research although "past experience" also has a positive effect on TPB model strength.

Finally, studies reviewed on Rogers' Diffusion of Innovation theory showed that the original bell-shaped curve and the categories of adopters are still appropriate for use in modern agricultural research. It was also found that this research paradigm has been successfully applied in agricultural finance and economics fields. This review has yielded some sound conclusions about behavioural determinants regarding farmers' choice of marketing opinions so will therefore be highly applicable to this research project.

2.6. Summary

This chapter has provided a comprehensive review of the literature on the theoretical frameworks used to develop the model for this research: the TRA (Fishbein & Ajzen 1975), the TPB (Ajzen 1991) and the Diffusion of Innovations theory (Rogers 1995). The literature review on these theoretical frameworks justified their part in the present research and presented information to show the variables that will form the basis of the behavioural model developed in subsequent chapters. Factors external to the research model have also been reviewed in detail with literature on the Australian wool industry,

characterising factors of Australian wool producers, and wool selling systems available within Australia used to build a picture of the behavioural types being considered for this research. The chapter concluded with a review of relevant studies that, although not exhaustive, provided a representative view of the literature on behavioural determinants associated with farmer behaviour and selling systems. In conclusion, this chapter essentially demonstrates that while there is much literature that provides a solid basis for the success of this research, a definite gap exists on the subject of behavioural determinants surrounding wool producers' choices to sell using forward contracts.

Chapter 3 Research Questions and Research Model

3.1. Overview

The purpose of this chapter is to document the research questions, the research objectives and a preliminary model that will be used as the basis for understanding the adoption behaviours associated with using forward contracts to sell wool. The literature review in Chapter 2 provided the necessary theoretical background to develop research questions and objectives. More importantly, it highlighted the aspects of the theoretical frameworks that need to be emphasised when understanding farmers' behaviour. In this chapter, justification is given as to how and why the TRA, the TPB and the Diffusion of Innovations are combined to produce a behavioural model relevant to the respective research questions and objectives.

3.2. Research Questions

Despite reported hardships associated with wool production in Australia (Wilcox 2004) and fluctuating cash flows experienced by producers (Kingwell 2000), farmers persist in selling their wool using a system that has been described as inefficient in terms of price discovery and market signal communication (Wool Industry Review Committee 1993). There are two principal research questions of this study.

Question 1: What are the characteristics of the wool auction and forward selling systems that currently exist in Australia?

Question 2: What are the behaviours that determine the adoption, or non-adoption, of forward contracts by Western Australian wool producers?

These questions will be addressed sequentially within this piece of research. Question 1 was principally addressed in the literature review (Chapter 2) and provides the context for Question 2. The remainder of the research is dedicating to addressing Question 2 and drawing conclusions about the forward contract adoption behaviours of wool producers.

3.3. Research Objectives

From these research questions, the following objectives have been developed:

1. To investigate the behavioural determinants of using forward contracts to sell wool in Western Australia via an extensive literature review and focus groups.

2. To create an adoption model of wool forward contracting based on the behavioural determinants found in (1).
3. Conduct a state-wide survey to test the reliability and validity of the adoption model and its corresponding hypotheses.
4. Conduct in-depth case studies to further confirm the findings of (3).
5. To add to the knowledge held by wool producers and the broader agribusiness community of forward contracting as a method of selling wool.

3.4. The Preliminary Research Model

The literature review in Chapter 2 has justified that the theories under consideration have sufficient applicability to agribusiness research. This now allows these theories to be used as a framework for understanding and predicting the behavioural determinants of the adoption of forward contracts by Western Australian wool producers.

The TRA, TPB and Diffusion of Innovations Theory have been combined to produce a preliminary research framework. The literature review also revealed the importance of including additional constructs that are not usually part of the aforementioned theories. Research by Burton (2004), Bagozzi, Baumgartner and Yi (1992), Bagozzi and Kimmel (1995) and East (1993) showed that constructs additional to those proposed by Ajzen (1991) and Rogers (1995) will improve the robustness of behavioural models. Therefore, as shown in Figure 3.1, factors external to the traditional research frameworks have been included.

From reviewing the literature, it is thought that several exogenous variables will boost the significance of relationships within the model. These independent variables have been termed 'external factors' as they are external to those usually included in TPB/Diffusion frameworks. From the Diffusion model proposed by Fliegel (1993), presented in Section 2.4.3, independent variables such as social structure and farm factors (like 'farm size' and 'enterprise diversification') are thought to have an impact on wool producers' perceived usefulness of using forward contracts to sell wool. Likewise, it is thought that farmer-specific details (like 'age', 'education' and 'family cycle'), communication channels and advisory services will have an impact on perceived usefulness of using forward contracts to sell wool, the norms associated with selling wool by forward contract and the

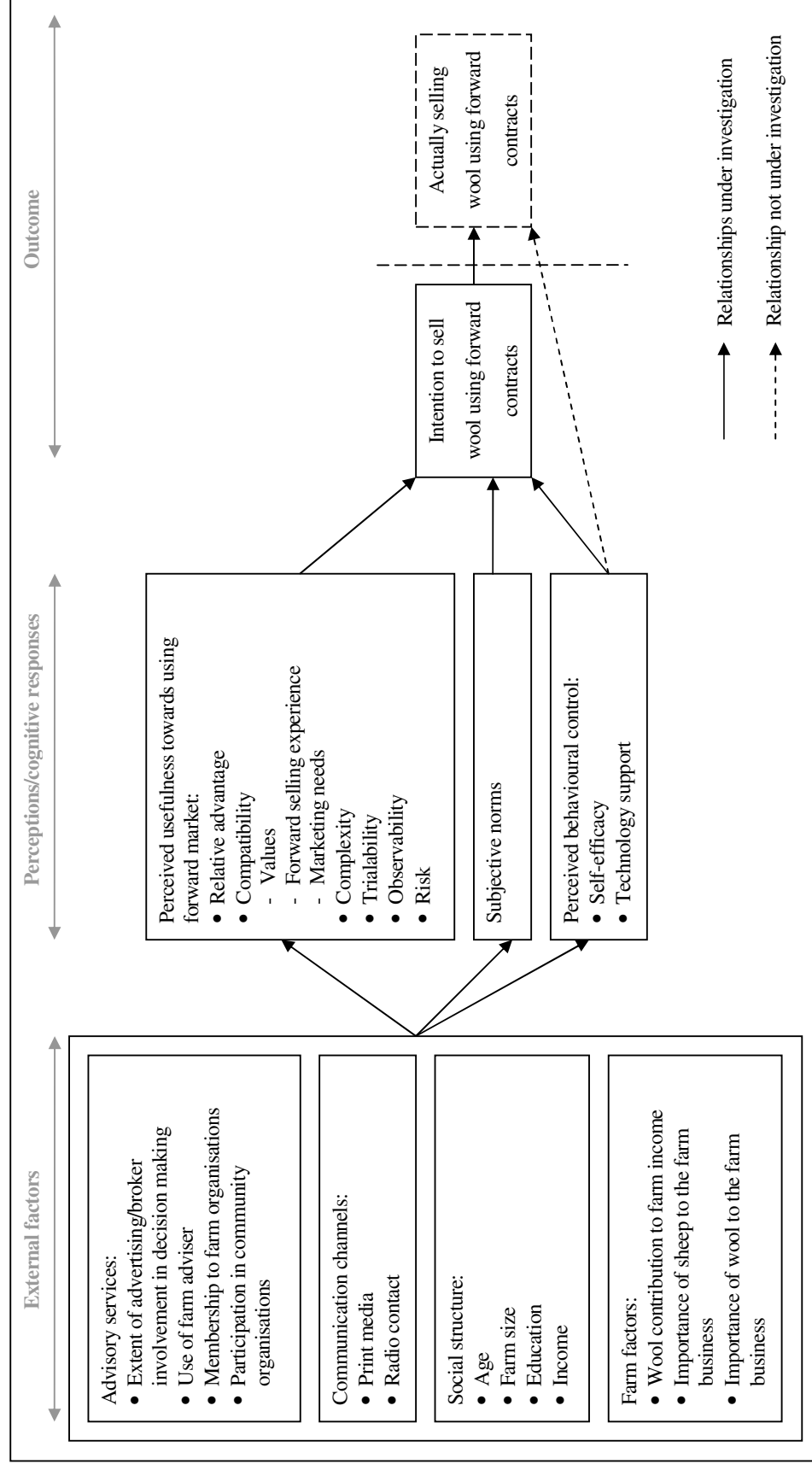


Figure 3.1: Preliminary combined TRA/TPB/Diffusion model

behavioural control held by producers in relation to selling their wool by forward contract. The influence of communication channels and farmers' membership of advisory services are expected to be particularly important as external factors in light of the closely-associated research of Rogers (1995), Fliegel (1993) and Beedell and Rehman (1999 & 2000).

The endogenous variables, or those associated with perceptions or cognitive responses to the exogenous variables, are principally those constructs that make up the traditional TPB ('attitude', 'subjective norms' and 'perceived behavioural control'), all of which are said to have a mediating influence on an individual's intention to perform the behaviour in question (Ajzen 1991). Studies by Xu (2003) and Tan and Teo (2000) showed that the elements from Rogers' (1995) Diffusion of Innovations theory ('relative advantage', 'compatibility', 'complexity', 'trialability', 'observability' and 'risk') can be incorporated into the traditional 'attitude' construct to provide guidance for understanding how producers view the benefits of using forward contracts to sell wool. Similarly, the research of Tan and Teo (2000) is used as the basis for using 'self-efficacy' and the amount of technological support required to measure 'perceived behavioural control'. It is therefore the combination of three constructs ('perceived usefulness', 'subjective norms' and 'perceived behavioural control'), split into various components, that will be used to determine wool producers' intentions to use forward contracts.

Conventionally the TPB then uses 'intention' to perform a given behaviour to predict 'actual' performance of the behaviour. This final step in the TPB will not be included in the present research, as indicated in Figure 3.1 by the dotted lines. The TPB is essentially cut short in this research because of the difficulty associated with measuring the actual adoption of using forward contracts to sell wool. The finite nature of this project makes it impossible to measure if intention will eventuate into actual adoption of forward contracts to sell wool.

The development of this preliminary research framework will guide development of the field study detailed in Chapter 5.

3.5. Summary

Given the lack of understanding about the slow adoption of forward contracts by Western Australian wool producers, the present research aims to contribute knowledge by addressing the research questions that have been outlined in this chapter:

1. What are the characteristics of the auction and forward selling systems that currently exist in Australia?
2. What are the behaviours that determine the adoption, or non-adoption, of forward contracts by Western Australian wool producers?

The research objectives are to use the literature and various field studies to define the behavioural determinants of using forward contracts to sell wool in Western Australia. Based on these findings, a behavioural model will then be built to test hypotheses, using a survey, about the relationships that exist within the model. Quantitative data from the survey will be analysed to draw conclusions about the behaviours that are limiting the adoption of forward contracts by Western Australian wool producers. The research will conclude with a final exploratory study to ensure that all aspects of the behavioural model are fully explained.

A preliminary research framework was developed from the literature reviewed in Chapter 2. This framework combined elements of the TRA, the TPB and the Diffusion of Innovations theory as well as some non-traditional elements that have been used in previous studies. The preliminary research framework suggests that external factors, such as advisory services, communication channels, social structure and farm factors, will influence perceptions about the use of forward contracts. These perceptions are broken down into 'perceived usefulness', 'subjective norms' and 'perceived behavioural control' which are all postulated to influence farmers' intentions to adopt the use of forward contracts to sell wool. An important part of the behavioural model proposed herein is that it departs from traditional models in two ways. Firstly, it includes additional constructs that are thought to influence adoption, and secondly, it does not attempt to examine the actual adoption behaviours associated with using forward contracts. The latter difference is principally due to the time constraints of the present research. In the next chapter, details are provided on research methodology and design for answering the research questions and objectives.

Chapter 4 Research Methodology and Design

4.1. Introduction

The research questions and objectives that were raised in Chapter 3 are now described in terms of the action of this study. This chapter discusses the mixed-method approach (Teddle & Tashakkori 2003) to the research and describes how the qualitative paradigm (using an interpretivist approach) will be combined with the quantitative paradigm (using a positivist approach) culminating in a step-by-step method for conducting the three basic stages of this research: the field study, state survey and multiple case studies.

4.2. Research Paradigm and Method

In discussing the research paradigm and method, it is necessary to reflect on the objectives of the present study. As discussed in Chapter 3, the first objective of this research requires that behavioural determinants of forward contracting wool in Western Australia to be defined. The study then requires a behavioural model to be developed from a combination of behavioural science literature and the real-world opinions of Western Australian wool producers. The behavioural model must be tested for its application to the Western Australian wool industry to ensure that it is an adequate reflection of the environment being studied. Finally, a series of case studies were carried out to further explain relationships within the behavioural model. The case studies also allowed the researcher to address any social intricacies that are often not revealed or accounted for by quantitative methodologies (Eisenhardt & Graebner 2007; Siggelkow 2007). The method of this research is much like that used by Bailey et al. (2006) who used a qualitative → quantitative → qualitative approach to examine the success of government-funded demonstration farms to help farmers adjust to agricultural policy reforms.

Given the objectives of the study outlined in Chapter 3, Teddle and Tashakkori (2003) suggest that a mixed-method approach is taken. These authors say that this approach combines the virtues of qualitative and quantitative methodologies because the qualitative phase answers exploratory questions, while the quantitative phase answers confirmatory questions posed by the study. As concluded in Chapter 2, no behavioural model currently exists to explain the behavioural determinants of wool producers' adoption of forward contracts. A mixed-method research approach allowed for opinions of wool producers to

be gathered (qualitative phase) to answer why this research problem exists and then, once combined with findings from the literature, a model was developed to test inferences about the entire wool-producing population of Western Australia (quantitative phase).

As the title of the research suggests, this project is principally a behavioural study, a type of study which Burton (2004, p. 360) describes as “a broad range of studies that employ actor-orientated quantitative methodologies to the investigation of decision-making”. Interestingly, he goes on to discuss how this form of study has been used in the fields of economics, geography and sociology, but he separates behavioural approaches in agriculture by saying that it is in this field that such studies seek to understand the decision-making behaviours of individual farmers or land managers. Burton says that behavioural-approach studies in agriculture not only focus on regular psychological constructs (like ‘attitudes’, ‘values’ and ‘goals’) but also generate information on factors like farm size, farm economic situation and successional status. The final point made by Burton is associated with the extensive use of quantitative methodologies with particular reference to psychometric scales in agriculture-based behavioural studies. It is the use of this kind of measure that allows for non-economic factors that contribute to decision-making to be realised.

Burton’s comments provide adequate evidence to suggest that taking a mixed-method approach to behavioural studies in the agribusiness field will yield solid results on farmer decision-making. The method for this research is principally mixed as it combines qualitative and quantitative paradigms for the development of the behavioural model and employs two of the three research philosophies described by Saunders, Lewis and Thornhill (2003): positivism and interpretivism. The research method for this study is presented as a schematic in Figure 4.1 and is combination of the method carried out by Xu (2003) and other methods described by Creswell (2003).

Figure 4.1 shows that there are three distinct phases of the research process. The process commenced with a literature review and the development of the research questions, objectives and preliminary research model. Following this, the first qualitative phase (Phase I) of the research consisted of four focus groups with Western Australian wool producers. Focus groups were chosen as the method for conducting the first qualitative phase of the research because they allow for the free-flow of ideas in an uninhibited dialogue environment. The focus groups were largely unstructured to allow for a range of issues based on feelings and experiences to be discovered without bias or obstruction

(Fisher 2004; Sekaran 2003; Zikmund 2003). The results of these focus groups were used to enhance a behavioural model developed from literature based on the TRA, the TPB and Diffusion of Innovations theory. Results of the focus groups were analysed using an interpretivist approach in order “to seek to understand the subjective reality of those that [are being studied] in order to be able to make sense of and understand motives, actions and intentions...” (Saunders, Lewis & Thornhill 2003, p. 84). Phase I was also the point at which hypotheses were developed as well as constructs for the model and the survey instrument for the quantitative phase.

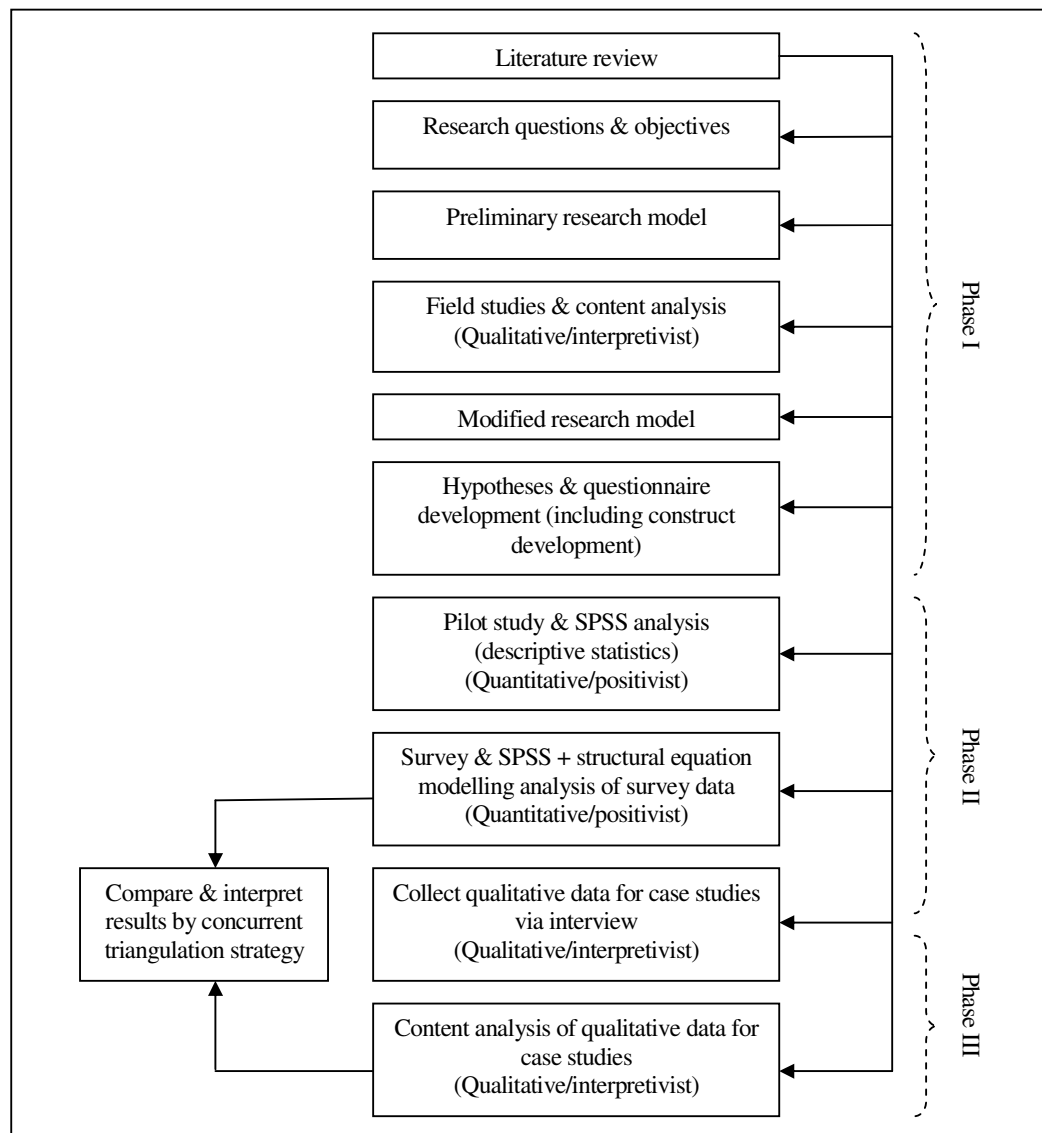


Figure 4.1: Mixed-method research approach

The next step was for a quantitative paradigm to be employed using a positivist approach (Phase II). This research paradigm is described as positivist as it studied the tangible and

intangible aspects of the human world of Australian wool producers in an objective fashion. It resulted in the development of an orthodox behavioural model that was used to predict the intentions of its subjects (Fisher 2004). Subsequent to this, data were collected in a detached manner; data recording systems allowed for quantifiable observations to be made (using Likert scale questions) and analysis was undertaken using descriptive statistics and structural equation modelling techniques (Saunders, Lewis & Thornhill 2003).

The final phase of the research (Phase III) reverted back to the qualitative, interpretivist paradigm that was described for the first qualitative step. While the qualitative paradigm was employed for this phase of the study, a different research strategy was required. The first qualitative phase was exploratory as the researcher aimed to build constructs for subsequent hypothesis testing. In the final phase, the researcher was looking to determine ‘how’ and ‘why’ wool producers behave in order to fill in the gaps that had not been addressed in the state survey (second phase). Due to the nature and purpose of the research questions, a review of the literature showed that case studies were the most appropriate research strategy to use (Yin 2003; Creswell 1998; Eisenhardt 1989).

4.3. *The Research Process*

Figure 4.2 shows specific steps of the research to be carried out. Step 1, ‘Understanding wool selling systems’, was achieved by undertaking a comparative analysis of the industry through literature searches and personal communication with key industry players.

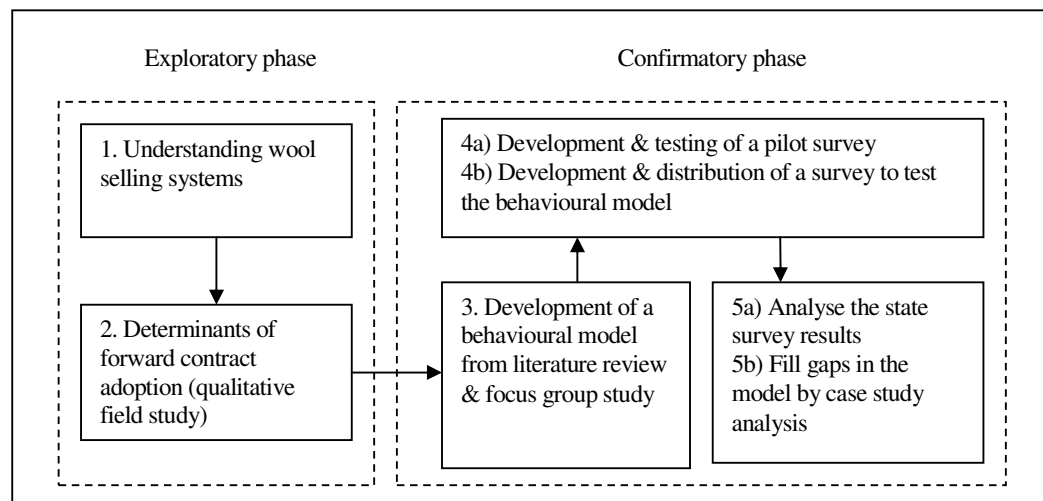


Figure 4.2: Major steps in the process of the study

The second part of the exploratory stage (Step 2) was a qualitative field study. A Mobile Group Support System (MGSS) (Nosek & Mandviwalla 1996) was taken to four regional locations in Western Australia (Northampton, Merredin, Kojonup and Esperance) at which data were gathered from focus groups with wool-producing farmers. Selection of location was based on a stratified sampling procedure with advice from Department of Agriculture and Food Western Australia (DAFWA). Using the MGSS, a facilitator and chauffeur generated, discussed and evaluated information on the determinants of the forward market with each group.

Step 3, the first of the confirmatory stages, developed and formalised the behavioural model for the project.

In Step 4, a pilot survey was conducted on a mini sample population. No changes were made to the survey or the model after conducting the pilot survey so the larger survey was then conducted via telephone when a sample of 310 responses was achieved. After cleaning of the data, the sample set of 305 responses was then analysed to test the reliability and validity of the model and test the hypotheses.

The final part of the research process is Step 5 in which the model results were compared to the results of multiple case studies on farmer wool selling behaviours. It was planned that in-depth interviews would be conducted with four Western Australian wool producers, each of whom had varying levels of commitment to using forward contracts to sell wool.

4.3.1. Qualitative Field Study

4.3.1.1. Sample selection

For the selection of focus group locations and participants, a sampling strategy termed 'the list' by Krueger (1994) was used whereby participants are selected from existing lists of clients, members or employees. Regionally-located DAFWA officers provided lists of potentially interested farmers and invitations to participate were sent to individuals via telephone, fax and e-mail. Additional participants were also selected because they were either recommended by DAFWA regional officers on the basis of local knowledge or were known by the researcher. Participation was on a voluntary basis. The only selection criterion required participants to have experience in selling wool within Australia. Focus groups were conducted in areas of varying capacities of wool production in Western

Australia: Northampton, Merredin, Katanning and Esperance, with participant numbers ranging from two to eight people. Information was collected during the focus groups using Curtin University's MGSS. More detail on the sample selection for the field study is provided in Section 5.2.2

4.3.1.2. Data collection

Prior to conducting the focus groups, a pilot session was run with four colleagues of the researcher and an external facilitator. MGSS technology was used to capture the thoughts and ideas of focus group participants. This method of data collection allowed for participants to type their ideas into their individual, anonymous "play space" after which they pressed the F9 key on their keyboard to capture the data to a central computer. The main benefits of this technology were the anonymity of each participant and the structured approach to collecting the data.

Each focus group was expected to take about two-and-a-half hours. The only anticipated impediment to success was participants' possible unwillingness to use the technology. To overcome this potential problem, a 'test-run' or 'ice-breaker session' was conducted with participants before each focus group commenced, and support staff were on hand to assist with typing. Section 5.2.3 provides a more detailed account of this data collection process.

4.3.1.3. Data analysis

The MGSS was powered by AnyZing 5.0 software (www.anyzing.com/). Since this software does not have data analysis capabilities, data from the focus groups were transferred to ATLAS.ti (www.atlasti.com/index.php) for analysis. In order to organise the data, transcripts from the focus groups were scanned for common themes, which were then used to generate charts that illustrated the relationship between factors, variables and their links established by each focus group. A combined model of all data from the focus groups was then produced; as explained in Section 5.3.

4.3.2. Empirical Pilot Study

4.3.2.1. Developing the questionnaire

A questionnaire based on the previously described research model was developed to collect data for empirical analysis. The questionnaire was structured so that each construct of the research model was scrutinised, using a minimum of three and a

maximum of 10 questions. Demographics of participants were also considered. Each question was given an identification number. While the majority of questions were Likert-style (Mitchell 1969), other open-ended questions gathered frequency-related data. A more in-depth description of the questionnaire is given in Section 6.3.1.

Before the questionnaire was released, approval was sought from Curtin University's Ethics Committee and DAFWA.

4.3.2.2. Sample selection and data collection

Upon receiving University and DAFWA approval, a pilot study was undertaken in two phases. The first stage, or pre-test, used the questionnaire to survey 10 farmers whose contact details were known by the researcher. This phase gave the researcher real-world experience in conducting such research and also tested the survey's practicality. The second phase of the pilot survey was undertaken by a telemarketing company. The company surveyed 113 wool producers to test its practicality. Minor changes to the questionnaire that resulted from the pre-test and pilot survey were made before the main survey was conducted.

The questionnaire was conducted via telephone; each one taking 20 – 25 minutes to complete. Responses from 305 questionnaires were entered into SPSS 14 for descriptive analysis; five incomplete responses were omitted. Therefore, a final sample of 305 responses was achieved.

4.3.2.3. Data analysis

Data analysis of the pre-test and pilot survey was limited to simple descriptive statistics that drew out the major factors and variables of the study and provided insight into the type of data that were gathered from the more comprehensive questionnaire. Any problems found with survey questions relating to analysis were altered at this point. Caution was taken before any dramatic changes were made, as little can be gained from such a small sample size used in the pilot survey.

4.3.3. State Survey

4.3.3.1. Sample selection and data collection

Robson (2002) stresses that telephone surveys take advantage of the benefits of face-to-face interviews but are more efficient in terms of time and resources. Other than

Robson's point of view, the researcher had access to a database of regional Western Australian businesses so a Perth-based professional marketing company was employed to conduct a telephone survey to generate 310 valid responses for this survey in May 2006. This number of valid survey responses was based on an initial strategy of posting the survey to 1,500 Western Australian farmers with an expected response rate of 20%. This sample size was also necessary to maintain the minimum sample size requirements of the chosen data analysis tool of Partial Least Squares (PLS) approach to structural equation modelling (SEM) (Barclay, Higgins & Thompson 1995). The decision to conduct the survey via telephone was made based on anecdotal feedback from the focus groups that mail surveys are a less-effective method of data collection than telephone surveys in Western Australian farming community.

Participants for the survey were randomly selected from a private database of Western Australian wool producers held by DAFWA. The database contained the names and contact details of approximately 11,000 residents of regional Western Australia who were not necessarily primary producers. The people sought to respond to the survey were required to have more than 700 adult sheep, be actively involved in primary production and be active wool producers.

A quota system was employed for carrying out the survey to ensure that the range of responses was proportionate to the distribution of wool production in Western Australia. For example, greater response numbers were required from areas of higher wool production, such as Esperance, Kojonup and Lake Grace, whereas fewer responses were required from shires that are predominantly involved with grain production, such as Wyalkatchem and Westonia. See Section 7.4.2 for further detail.

4.3.3.2. Data analysis using Structural Equation Modelling

Data analysis for the quantitative phase of this study followed the analysis process outlined by seminal authors of SEM theory and application, such as Chin (1998a), Barclay, Higgins and Thompson (1995) and Gefen, Straub and Boudreau (2000), among many others.

Data from the state survey were analysed using the technique of SEM. More specifically, the PLS approach was employed via PLSgraph (www.plsgraph.com). Because this approach to SEM does not assume normality of the data set, the descriptive statistics that are usually used to scrutinise data in the early stages of analysis, such as skewness,

kurtosis or Kolmogorov-Smirnov, were not necessary for this research (Barclay, Higgins & Thompson 1995).

While this data analysis method is described in Section 7.5, it is necessary to note at this point that the conventional two-step approach to data analysis with PLS was undertaken (detailed by Barclay, Higgins & Thompson 1995). This approach first involves using the data to make an assessment of the measurement model and then an assessment of the structural model. The assessment of the measurement model tests for item reliability and internal consistency (which is convergent validity and discriminant validity). Once all the criteria outlined by Barclay, Higgins and Thompson (1995) are met, an assessment of the structural model is made by first testing each construct for the amount of variance explained by the model and then testing relationships for statistical significance. The result is a model that meets all the PLS reliability and validity tests.

4.3.4. Case studies

A research strategy was required that would allow for further exploration of the behavioural models' constructs and that would also fill in the gaps of knowledge that remained after the quantitative analysis was finalised. Extensive reading on various research strategies revealed that case studies were the most appropriate research tactic to adopt for this final phase of the larger project because they principally address research problems that ask 'how' and 'why' types of questions (Yin 2003; Eisenhardt & Graebner 2007).

4.3.4.1. Sample selection

The purpose of conducting the case studies was to answer research questions that had emerged from the quantitative phase of this research and to further explore the relationships between the constructs of the behavioural model. Therefore, the procedure suggested by Miles and Huberman (1994) and Eisenhardt and Graebner (2007) was followed, who say that case studies can take advantage of collecting a range of data from people with extremes of experiences; Eisenhardt and Graebner (2007) nominate this as the 'polar types' approach to theoretical sampling. For this part of the larger study, four wool producers with varying levels of commitment to using forward contracts were selected. Further detail on sample selection for the case studies is provided in Section 9.3.2.

4.3.4.2. Interview guide development

Heeding the advice of Yin (2003), Eisenhardt (1989) and Gladwin (1989), a semi-structured interview guide was developed with the aim of collecting the necessary data to answer the remaining research questions but also to allow for any new issues that had not previously emerged. The interview guide was structured to begin with collecting basic data about the wool producer's farm business that would put the interview candidate at ease with the simplicity of the questions. Questioning then developed into gathering descriptions of the process each candidate went through to sell their wool. Once this was determined, further questions were asked about the risks involved with each method and the candidate's views on the various methods' advantages and disadvantages; as explained in Section 9.3.3.

4.3.4.3. Data collection and analysis

Data for the case studies were collected via face-to-face interviews with four individual wool producers. Prior to the four interviews, a pre-test interview was conducted as a "dress-rehearsal" of the interview situation (Yin 2003), after which the interview guide was slightly altered as a result of feedback from the candidate. The researcher then conducted interviews for data collection purposes in various locations in Perth. The interviews were all recorded on a digital Dictaphone and then transcribed *verbatim* within one month of the interview date (as described in Section 9.3.4).

The raw data in MS Word were loaded into NVivo 7 (a qualitative data analysis software package chosen for its functions of coding and grouping interview data). Analytical methods were principally those recommended by Creswell (1998), Graebner (2004) and Eisenhardt (1989) for analysing case study data. 'Within-case' analysis was used to identify themes within the data. This was followed by 'cross-case' analysis to identify similarities and differences between the cases that would assist with answering the research questions. See Section 9.3.5 for further discussion.

4.4. Summary

This chapter has detailed the philosophical and methodological approaches taken to conducting the present research. This mixed-method study was conducted in three stages (field study, state survey and case studies), the first stage of which was qualitative, followed by a quantitative phase and then concluded with another qualitative phase.

The first stage involved conducting four focus groups in regional Western Australia. These were used to gather data on the thoughts, feelings and experiences of wool producers on selling their wool. The qualitative data were captured using MGSS technology and transferred into ATLAS.ti for content analysis. The findings were used to tailor the previously-discussed frameworks of the TRA, the TPB and Diffusion of Innovations theory to the conditions experienced by Australian wool producers. The result was a behavioural model with eight hypotheses (and various sub-hypotheses) for which a survey was undertaken to collect empirical data. Simple statistical evaluation of the model by pilot testing revealed there were no major changes required so the second stage was undertaken. The second stage gained 305 valid responses from Western Australian wool producers to the questionnaire developed from the research model. Results were analysed using the structural equation modelling (PLS) approach. The third and final stage of the research involved conducting four case studies that principally aimed to further explain the constructs and relationships within the behavioural model. The next chapter of this thesis provides in-depth details of the operationalisation of the first stage of the research: the qualitative field study.

Chapter 5 Field Study and Modified Research Model⁷

5.1. Introduction

The qualitative phase of this research was conducted by running four focus groups in regional Western Australia. This chapter describes the process of this part of the research and its findings. The information generated from these focus groups is not intended to definitively represent the opinions of all Western Australian wool producers, but aims to use qualitative research strategies to construct a model of the selling behaviours of Australian producers, a technique suggested by Morse and Richards (2002). Results are combined with knowledge gained from the literature review on the behavioural determinants and decision-making of farmers (Chapter 2). The literature search and the analysis of the focus groups' data resulted in the development of a behavioural model to understand the reasons behind wool producers' intentions to adopt forward contracts. The behavioural model in this chapter is used to develop a survey. Data from the survey is later empirically analysed by the structural equation modelling approach to the quantitative research.

⁷ The findings from this chapter have been publicly presented by the researcher as the following:

'Selling raw wool by forward contract: A qualitative analysis of pros and cons', *Proceedings of the 50th Australian Agricultural and Resource Economics Society conference*, 8-10 February, 2006, Sydney, Available from: www.aomevents.com/AARES2006/papers/jackson.pdf (not peer-reviewed).

'Adoption and diffusion of selling wool by forward contract: Field studies of factors and variables', *Proceedings of the 80th Agricultural Economics Society conference*, 29-31 March, 2006, Paris, Available from: www.aes.ac.uk/confs_06_docs/papers/papers/JACKSON.doc (not peer-reviewed).

'Farmer-to-farmer advice: What's the best way to sell raw wool in Australia?', *Proceedings of the 26th International Association of Agricultural Economists conference*, 12-18 August, 2006, Queensland, Available from: www.agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=22182&ftype=.pdf

'A multi-disciplinary approach for determining adoption of agricultural price risk management strategies', *Proceedings of the 81st Agricultural Economics Society conference*, 2-4 April, 2007, Reading, Available from: www.aes.ac.uk/conf_07_docs/index.php?path=papers/ (not peer-reviewed).

'Evaluating producers' perspectives on selling raw wool : A field study of behavioural factors and variables', *Journal of Farm Management*, 2007, vol. 12, no 11, pp. 679-707.

'Wool industry stakeholder opinions on the pros and cons of forward contract', *International Journal of Sheep and Wool Science*, 2007, vol. 55, no. 1, pp. 34-47.

5.2. Operationalisation of the Field Study

5.2.1. Qualitative Research Paradigm

It is common in the agribusiness research domain for researchers to take a mixed-method approach to behavioural studies whereby a combination of qualitative and quantitative methods are used within one study (for examples see Bailey et al. 2006; McEachern & Warnaby 2005; Beedell & Rehman 1999).

The research outlined in this chapter describes the first, exploratory, qualitative phase of the enquiry. The aim herein is to develop a comprehensive model of producers' wool selling behaviours that not only takes into account prominent theoretical frameworks but also includes various aspects of farm-level decision-making. Focus groups were identified as an effective method for gathering information on wool producer attitudes towards selling wool in Western Australia (Krueger 1994; Wilkinson 2004; Zikmund 2003). This qualitative research method allowed the opinions of real-life sellers of wool to be gathered in an environment that was flexible and free-flowing for participants whose responses were spontaneous, unstructured and were their genuine ideas and feelings (Sekaran 2003). Focus groups also stimulate discussion and create what Berg (2001, p. 112) cites as the "synergistic group effect" where participants draw from one another's ideas; a phenomenon that is not experienced in one-to-one interviews.

5.2.2. Sample

Four focus groups, a quantity suggested by Krueger (1994) for state-wide data collection, were conducted with wool producers in Kojonup, Merredin, Esperance and Northampton (Appendix 1). Participants were selected using a strategy known as 'the list', as described by Krueger (1994). DAFWA, a sponsor of this research, consistently works with groups of sheep and wool producers in various regional locations in Western Australia. Regional DAFWA staff provided contact lists of the producers involved with such production groups. Local knowledge of DAFWA staff and the researcher were also used as a source to invite potential participants. Participants were invited to attend the focus groups via telephone, fax and e-mail (in which it was explained that participation was entirely voluntary and withdrawal from the exercise was possible at any stage without prejudice). The only selection criterion was that participants had experience in selling wool within Australia.

Participant numbers ranged from two to eight people per focus group; there were a total of twenty-six participants. It was planned that there would be a minimum of eight participants per focus group, however, most participants from Merredin did not attend due to some unforeseen reasons.

5.2.3. Data Collection

This exploratory research is characterised as interpretativist since it attempts to form structures out of the interpretation of opinions. Focus groups are described by Sekaran (2003) and Zikmund (2003) as being unstructured to allow for spontaneous and free-flowing dialogue among the participants. They were used here to seek people's descriptions and experiences of selling wool by forward contract. Focus groups were also used to enhance the concept of human interaction on discussing ideas to develop solid structures about the advantages and disadvantages of forward contracting (Fisher 2004).

It is for these reasons that five, fictional, loosely-structured scenarios were used as the primary vehicle to collect data. The principal use of these scenarios was to conduct a generalised, but not necessarily representative, situational analysis of the thoughts, feelings and opinions of Western Australian wool producers so the behavioural model being developed, based on the literature, would have real-world substance. Prior to conducting the focus groups, a pilot session was run with four members of the research team and an external facilitator.

The four focus group sessions were conducted with wool producers in the previously specified regional locations. For these sessions, Curtin University's Mobile Group Support System (MGSS), installed with AnyZing 5.0 (www.anyzing.com), was used to run the meetings and capture data. This technology allowed focus group participants to electronically record their responses in anonymous "play spaces" that were projected onto a central video screen for further discussion. A computer technician and observer were also part of the research group to assist with computer operation and data collection during the focus groups.

The script format for these sessions used scenarios to encourage participants to express their views. The scenarios revolved around a fictitious character, Bob Smith, an experienced grain producer who had very recently purchased an adjoining property and needed advice on how to sell the wool from the sheep that had been included in the sale of the new farm. Brainstorming was conducted around the simple, broad issue of offering

Bob advice on the processes of selling wool. This strategy aimed to ensure that participants felt comfortable with the topic. Once participants had had the opportunity to discuss their experiences, the discussion was then narrowed down to the issue of forward contracts. The scenarios were presented as follows:

1. What advice would you give Bob with respect to selling his wool?
2. What other ways are there to sell wool in Australia?
3. As far as you are concerned, what are the advantages to Bob (by selling using forward contract)?
4. As far as you are concerned, what are the disadvantages to Bob (by selling using forward contract)?
5. Given what you have heard so far, how would Bob know how much better off he is (by using forward contracts)?

Upon the completion of each scenario, participants were asked to type their ideas into their anonymous “play space” and press F9 on their individual keyboards to record their input. Participants who did not feel confident in typing their thoughts were provided with assistance from the research team. Probing of ideas was provided by all members of the research team. The MGSS technology proved to work efficiently except in cases where participants did not feel confident in asking for assistance to type.

Each focus group ran for about two-and-a-half hours with participants being provided with a copy of the raw data collected in the form of a print-out from the MGSS as a record of the day’s events.

5.3. Data Analysis

A range of techniques are suggested by authors, such as Miles and Huberman (1994), that will assist with the challenging task of analysing qualitative data. Given the objectives of the research and its exploratory, rather than confirmatory, nature, content analysis was the preferred technique for analysing the raw data collected from the focus groups. Content analysis involves the examination of data in a systematic and replicable fashion (Riffe, Lacy & Fico 1998; Wilkinson 2004). It requires transcripts of raw qualitative data to be systematically trawled for recurrent themes. Each theme is then counted throughout the transcripts for replication within the data, thus introducing a quantitative element to the research.

Analysis of the raw data electronically generated from the focus groups was undertaken as a two-phase process that combined inductive and deductive approaches to categorise factors and variables, as described by Quaddus and Xu (2005).

The inductive phase of the content analysis was undertaken as follows:

1. Transfer raw data from AnyZing 5.0 to ATLAS.ti 5.0 (www.atlasti.com/index.php).
2. Scan printed transcripts of the raw data for recurring themes to produce labels/categories.
3. Enter the labels/categories into ATLAS.ti for generation of charts to show the relationship of factors, variables and their links for each focus group.

The deductive phase of the content analysis aimed to integrate the findings of the individual focus groups. This phase produced a combined model of factors and variables uncovered in the focus groups and also took into account elements of the firmly-established TRA (Fishbein & Ajzen 1975), TPB (Ajzen 1985) and Diffusion of Innovations (Rogers 1995). This was carried out as follows:

1. Undertake a review of the literature on the TRA, TPB and Diffusion of Innovation paying particular attention to agribusiness-related research (Chapter 2).
2. Revisit the factors, variables and their links established from the focus groups in Phase 1.
3. Combine all the factors and variables of the four focus groups and develop an integrated flow chart to show the relationship of factors, variables and their links for all focus groups.
4. Add in elements from similar previous studies, as identified in the literature.
5. Develop a combined model of factors and behaviours that will explain wool producers' intention to adopt the use of forward contracts to sell wool.

5.4. Results and Discussion

5.4.1. Factors and Variables of Forward Contract Adoption

Table 5.1 shows the complete list of factors and variables of wool producers' opinions of selling wool in Australia; as generated from the focus groups using content analysis (also see schematic of Table 5.1 presented as Figure 5.1).

The scenario titles used in the focus groups are used as headings in the table and the outcomes of the discussion are shown below each heading. Table 5.1 also shows sub-issues or points of clarification that were raised, but most importantly, it shows from which location the issues arose. The processes and available methods of selling wool are first illustrated and then followed by the factors and variables associated with the adoption of selling wool by forward contract. It is good practice to use a tested framework for categorising or labelling issues from qualitative research. In this case, no such framework could be found, despite an extensive search of the literature, so factors and variables are developed from common themes raised in the focus groups.

Table 5.1: Factors and variables of forward contract adoption

(N = Northampton, K = Kojonup, M = Merredin, E = Esperance)

Issues	Sub-issues	N	K	M	E	Frequency
Methods of selling wool currently						
Auction	Is the dominant system & a good place to start	✓	✓	✓		3
Electronic selling	Wooltrade, e-wool™	✓				1
Hedge			✓	✓		2
Find buyers			✓			1
Find value of wool			✓			1
Wool quality & wool type			✓	✓	✓	3
Understand customer requirements			✓			1
Exchange rate fluctuations			✓			1
Cost of production			✓		✓	2
Forward selling				✓	✓	2
On-farm diversity			✓		✓	2
Fair deal = costs + margin			✓			1
Find a broker	Such as Elders, Landmark	✓	✓	✓	✓	4
Find an agent/private buyer	Such as Primaries, West Coast Wools	✓		✓	✓	3
Appoint a portfolio manager	From Elders or Landmark			✓		1
Sell over an extended period of time				✓	✓	2
Industry research					✓	1
Objective quality testing				✓	✓	2
Set reserve price				✓		1
Alternative systems of selling wool						
Direct to mill		✓	✓		✓	3

... continued next page

Table 5.1 (continued)

'Fibre Direct'			✓			1
Futures		✓	✓	✓		3
Process & sell			✓			1
Advantages of forward contracts						
An idea for profit			✓			1
Be satisfied with the price you get			✓			1
Provides a known & secure income			✓	✓	✓	3
Good for upward market			✓		✓	2
Helps with budgeting			✓	✓		2
Need a stable buyer			✓			1
Forward contract is a regular practice				✓	✓	2
Split between auction & forward contract to minimise price risk				✓	✓	2
Risk management	Spreading contracts over time	✓		✓	✓	3
Ability to set/negotiate price					✓	1
No guess work after the contract is taken out					✓	1
Means of getting a premium price					✓	1
Ability to assess wool					✓	1
Peace of mind		✓		✓		2
Positive experience	Fast, painless, simple			✓		1
Provides ready cash-flow		✓				1
Disadvantages of forward contracts						
Lack of volatility			✓		✓	2
Unprofitable			✓			1
Cost of insurance policy			✓			1
Results in higher cost of production			✓			1
Uncertainty (insecure buyer)			✓	✓		2
Unable to secure a profitable price		✓	✓			2
Uncertainty (not meeting contractual obligations)		✓	✓	✓	✓	4
Creates family problems			✓		✓	2
Uncertainty (missing higher prices)		✓	✓		✓	3
Uncertainties (weather, supply, demand)					✓	1
No economic gain					✓	1
Uncertainty of market conditions		✓			✓	2
Dominance of auction system					✓	1
Dominance of auction price			✓	✓	✓	3
Not a common practice					✓	1
Paper-work					✓	1
Fine print		✓				1
Unfamiliarity		✓				1
No one pushing it		✓				1
Contract rules		✓				1
Obligation to contract more wool than desired				✓		1

... continued next page

Table 5.1 (continued)

Uncertainty of wool value				✓		1
Only available for specific grades				✓		1
Uncertainty (requirement for fast cash)				✓		1
It's about individual judgment				✓		1
Advantages are not clear					✓	1
Other issues						
Benchmark with other farmers	Is anybody getting a better price?		✓			1
Take a strategic, supply chain view			✓			1
Experience & confidence	Market is vital, wool producing experience is vital, start with auction system before trying anything else.	✓		✓	✓	3
Slow market					✓	1
Competitive market					✓	1
Low demand for wool					✓	1
Long supply chain	No feedback on quality				✓	1
Wool is a by-product of meat production		✓				1
Consider your tax/financial position		✓				1
Want to be price makers		✓				1
Proactive		✓				1
Risk management vs making money				✓		1
Price settlement issues				✓		1
Individual judgement				✓		1
Entirely different to futures				✓		1

It can be seen in Table 5.1 that a combination of selling methods and selling behaviours were identified when participants were asked to discuss the ways they currently sell wool and what advice they would give to their fictitious, new neighbour. Figure 5.1 is a schematic of the combined findings of Table 5.1.

The dominant method suggested was selling wool by auction; this was suggested by three of the focus groups. Participants of all focus groups suggested finding either a broker, agent or private buyer to facilitate the process of selling wool at auction. Other dominant suggestions were to sell directly to a mill or selling wool on the futures market. Other selling methods were given as electronic selling (such as e-wool™ or Wooltrade Australia Pty Ltd), hedging, forward selling, 'Fibre Direct' (selling directly to the spinner) or process and then selling. It should be noted that forward contracts were only mentioned as a selling method at half of the focus groups.

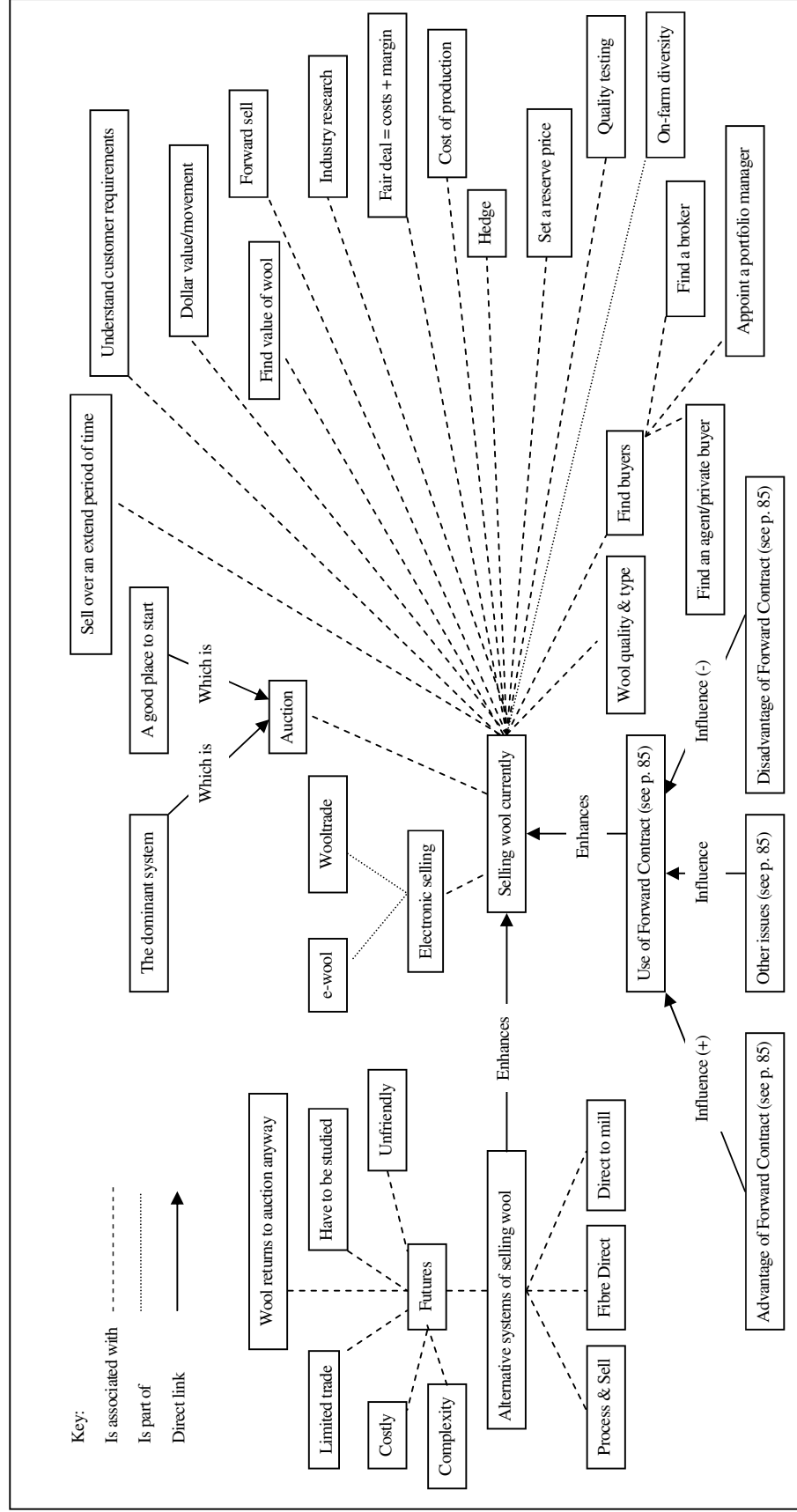
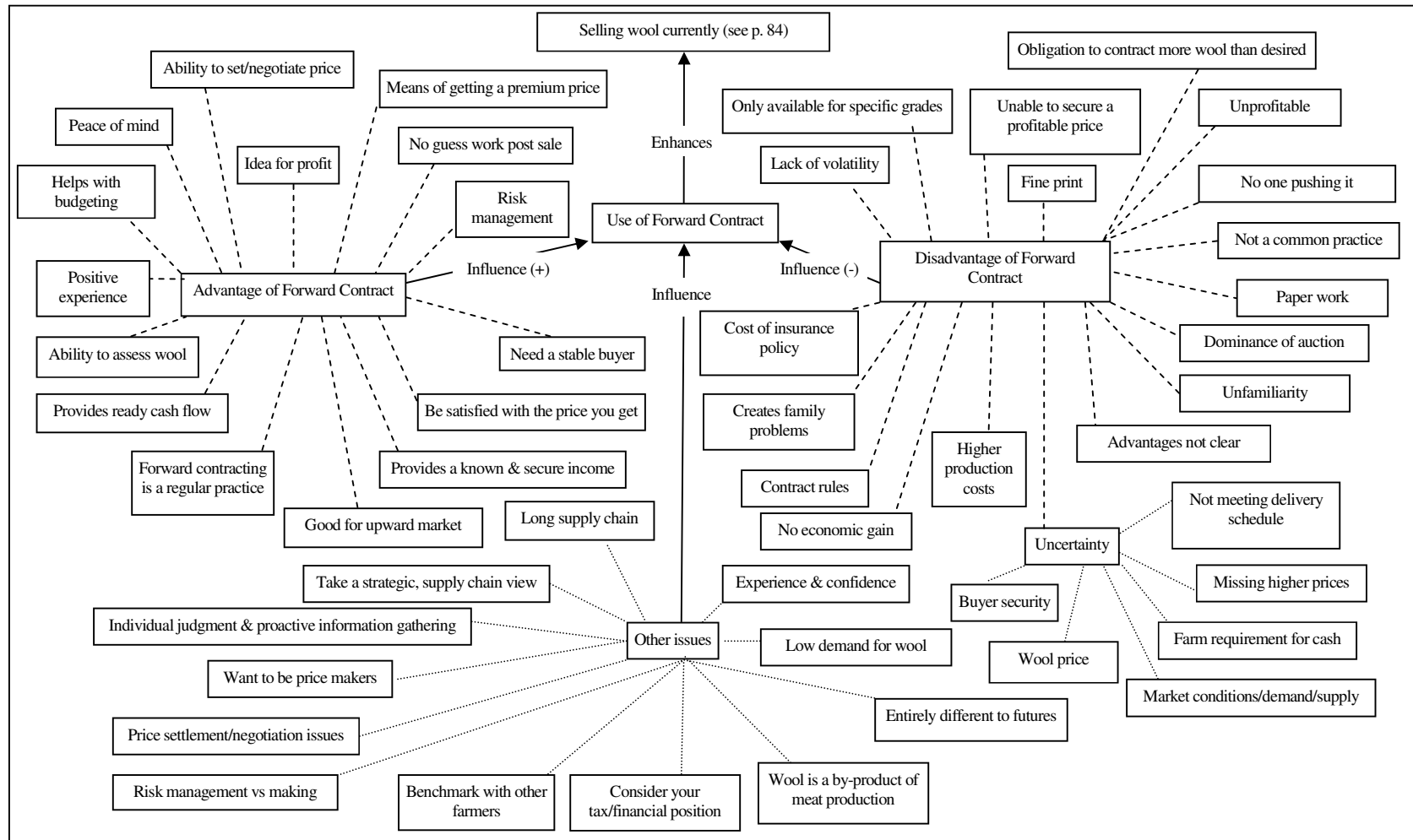


Figure 5.1: Combined factors and variables for explaining forward contract adoption (continued next page)



Most of the discussion on advising Bob how to sell his wool revolved around the processes and behaviours associated with selling wool. The dominant issue was finding a broker or agent who could offer a range of selling methods. Other behaviours involved the knowledge required to sell wool, such as understanding the value of the wool to be sold, setting of a reserve price, understanding the wool quality and quantity for sale, understanding the cost of production, having the wool quality tested, conducting industry research, understanding the movement of the Australian dollar and finding a buyer.

Of the 16 nominated advantages of selling wool by forward contract, the most frequently raised issues were that forward contracts provided a secure income, help with budgeting and were a good risk management tool. These were underpinned by the fact that forward contracts were said to provide an opportunity to diversify the method of selling wool and that they provided peace of mind.

The list of disadvantages was far more extensive than the advantages, with 26 factors raised. Only one theme was discussed by participants of all focus groups – the uncertainty of meeting the contractual obligations; a concern also raised by Blackburn and Ashby (2007). Other dominant issues revolved around the uncertainty associated with taking out a forward contract. Participants discussed missing out on a rise in the market price of wool, the benefits of price volatility offered by the auction system, the difficulty and complexity of negotiating a profitable price with a broker or buyer, the uncertainty of market conditions and the uncertainty of selling wool forward to an insecure buyer. Other identified disadvantages were the perceived amount of paper work, rules and fine print associated with forward contracts, the perception that forward contracts were only available for certain grades of wool and the fear of being obliged to forward contract more wool than desired.

The over-arching issue that arose from the discussion of the disadvantages of forward contracts related to the dominance of the auction system. Aside from production risks and price uncertainties, most of the comments responded to the dominance of the auction system in the sale of wool. Participants from the Merredin, Kojonup and Esperance focus groups said outright that daily auction prices provided the benchmark for their knowledge of the current wool price. They believed that farmers were unfamiliar with the use of forward contracts because no commercial agribusinesses seemed to be pushing their use, and said using forward contracts created family problems because it was not the ‘normal’ method of selling wool. Participants were also adamant that an auction system would

continue to exist. They believe that all wool that is forward sold (that is, either by forward contract or on the futures market) is eventually sold at auction; as are the off-grades of wool that are not able to be sold by forward contract. Interestingly, this notion that all wool eventually finds its way to the auction system was also mentioned by Murray-Prior and Wright (2004).

Other issues raised during the discussions of selling wool by forward contract revolved around the current state of the wool industry as well as issues internal to the farm business. Experience and confidence were discussed during three of the focus groups. It was agreed that using forward contracts involved individual judgment and demanded experience with sheep and wool, as well as having confidence in negotiating a suitable price. Slow and competitive wool markets, the long supply chain and the low global demand for wool were also cited as factors inhibiting growers in using forward contracts.

There were 36 issues raised by the Esperance group, 33 from the Kojonup group, 31 from the Merredin group and 22 from the Northampton group. In all cases, there were far more disadvantages raised about using forward contracts than advantages (26 to 16) with the Esperance group stating the most disadvantages and advantages (12 to nine).

In summary, 42 advantages and disadvantages of selling wool by forward contract were raised. Fifteen 'other' issues were raised, however, these were generally about the current state of the wool industry and how it affects producers' decisions to take out forward contracts. Interestingly, no comments were raised about the differences in selling costs between the various selling methods. Content analysis of the raw data revealed a wide range of issues that influence the use of forward contracts, however, the predominant factors and variables were found to be: 'pricing', 'complexity', 'business process improvement', 'dominance of the auction system' and 'production risks'.

5.4.2. Causal Links Among Factors

Content analysis of the raw data from the focus groups revealed information that could be combined with the concepts used in TPB and Diffusion of Innovations to construct a behavioural model on the intention of Australian wool producers to adopt forward contracts to sell wool. Analysis also showed that modifications need to be made to these traditional frameworks to adequately capture all the dimensions of farm-level decision making.

Such modifications required a search for a reliable and valid theoretical model to accommodate the specific nature of this research. A literature search found a Diffusion model by Xu and Quaddus (2005) that used attitudinal variables as antecedents to a combination of traditional TPB, Technology Acceptance Model (TAM) and Diffusion constructs. With attitudinal variables as antecedents, factors like ‘perceived usefulness’ (from the TAM), and ‘perceived behavioural control’ and ‘subjective norms’ have shifted from being exogenous to endogenous.

Table 5.2 shows how factors and variables from the focus groups have been grouped to align with the independent variables of the TRA/TPB/Diffusion framework outlined in Chapter 2. Figure 5.2 diagrammatically shows these causal relationships (arrows indicate the direction of dependence between variables). Morse and Richards (2002, p. 161) discuss the benefits of mapping and diagramming to aid the analytical process of qualitative research in that this technique allows researchers “to attain an increased level of abstraction [of experimental variables]”.

Figure 5.2 is a progression of Figure 3.1. The updated research model shows how real-world, farm-level decision-making variables revealed from focus groups data have been combined with the theoretical frameworks discussed in Section 2.4.

Table 5.2: Incorporation of raw variables with theoretical independent variables

TPB/diffusion independent variable	Factors and variables from focus groups
Perceived usefulness of using forward contracts	
Relative advantage	Provides a known & secure income
	Helps with budgeting
	Risk management
	Ability to set/negotiate price
	No guess work after the contract is taken out
	Means of getting a premium price
	Ability to assess wool
	Peace of mind
	Positive experience
	Provides ready cash-flow
	Split between auction & forward contract to minimise price risk
Compatibility	Obligation to contract more wool than desired
Complexity	Paper-work
	Fine print
	Unfamiliarity
	Contract rules
Application	Only available for specific grades of wool
	Unfamiliarity
	Risk management versus making money
Risk	Uncertainty of wool value
	Uncertainty (missing higher prices)
	Uncertainties (weather, supply, demand)
	No economic gain
	Uncertainty of market conditions
	Uncertainty (insecure buyer)
	Uncertainty (not meeting delivery schedule)
	Lack of volatility
	Unable to secure a profitable price
Perceived behavioural control surrounding use of forward contracts	
Self efficacy	Experience & confidence
Support	No one pushing it
Subjective norms as a way of using forward contracts	
	Dominance of auction system
	Dominance of auction price
	Creates family problems
	Benchmark with other farmers

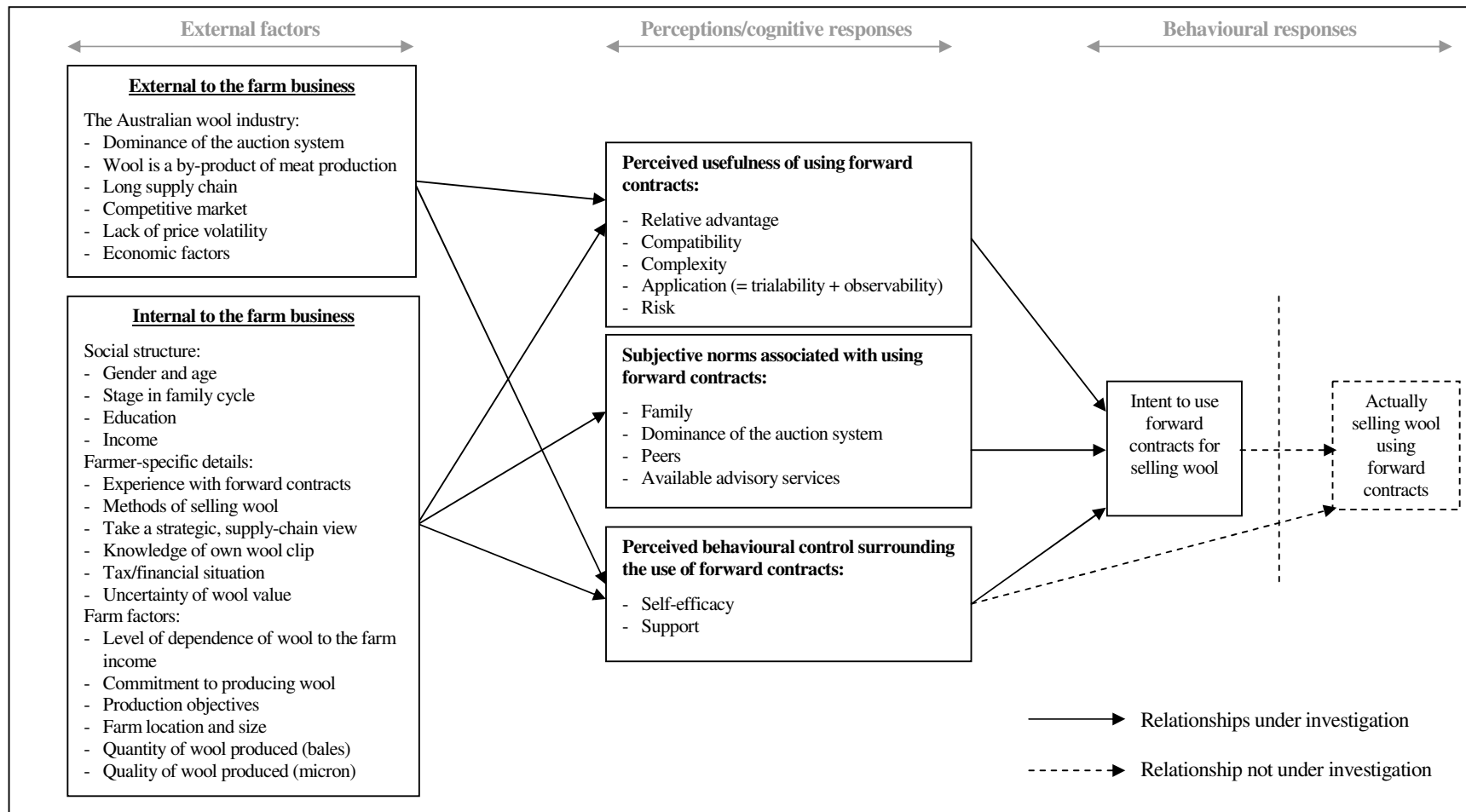


Figure 5.2: Combined model to explain forward contract adoption

One important finding that must be highlighted is the difference between ‘risk’ and ‘uncertainty’. The literature on these two terms is vast but the data from the focus groups aligns nicely with the explanation of Hardaker et al. (2004). As mentioned in Section 2.2.2.4, these authors specify that risk is associated with uncertain consequences of a decision whereas uncertainty refers to imperfect knowledge of a decision situation. The information in Table 5.2 shows that many of the issues linked to risk are actually associated with uncertainty. This anomaly is resolved by the fact that focus group participants were found to compare the financial outcomes of forward contracts to the auction system. It is therefore fair to say that the consequences of taking out a forward contract are uncertain because the derived benefit will be unknown until the auction on the day the forward contract closes.

In addition to the variables presented in Table 5.2, factors also identified from the focus groups are thought to influence the three independent variables of the research’s theoretical frameworks. Research by Beedell and Rehman (1999), Tutkun and Lehmann (2006), Tutkun, Lehmann and Schmidt (2006), Dierks and Hanf (2006) and Mazzocchi, Lobb and Traill (2006) show the successful application of factors external to the TPB model in the agribusiness research domain. In terms of the present research on the adoption of forward contracts for selling wool, content analysis of the focus group data showed that factors external and internal to the farm business affect farmers’ decisions on whether or not to take forward contracts.

While the aforementioned authors have shown that it is possible to extend the traditional the TPB model, this research only uses select constructs of the TPB that have been identified to be suitable for answering the research questions. Indeed, the Diffusion model by Xu and Quaddus (2005) provides a more accurate template for what is trying to be achieved herein. Figure 5.2 shows an adaptation of the discussed adoption models.

In addition to the use of information from the focus groups for the development of a behavioural model, the literature review in Chapter 2 provided justification for inclusion of variables in this behavioural model. Table 5.3 outlines publications that have shown the successful application of specific variables used in this research to test farmer behaviour and adoption of various technologies.

Table 5.3: Justification of factors and variables within the behavioural model

Item	Author	Date
External to the farm business	Willock et al.	1999b
All items taken from focus group information		
Internal to the farm business		
Social structure	Fliegel	1993
Gender	Fliegel	1993
Age	Fliegel Ervin & Ervin Harper et al.	1993 1982 1990
Stage in family cycle	Rogers Carlson & Dillman Wilkening & Guerrero	1995 1983 1969
Education	Gasson Fliegel Ervin & Ervin Harper et al.	1998 1993 1982 1990
Income	Fliegel Beedell & Rehman Rahm & Huffman	1993 1999 & 2000 1984
Farmer-specific details	Willock et al.	1999b
All items taken from focus group information		
Farm factors	Willock et al.	1999b
Farm location	Fliegel	1993
Farm size	Beedell & Rehman Makus et al. Musser et al. Vergara et al.	1999 & 2000 1990 1996 2004
Production objectives	Focus groups	
Quality & quantity of wool produced	Focus groups	
Level of dependence of wool to the farm income	McLeay & Zwart	1998
Commitment to producing wool	Focus groups	
Perceived usefulness		
Relative advantage	Rogers Tan & Teo Fliegel & Kivlin	1995 2000 1962
Compatibility	Rogers Tan & Teo Fliegel & Kivlin	1995 2000 1962
Complexity	Rogers Tan & Teo	1995 2000
Risk	Rogers Tan & Teo Willock et al. Hardaker et al.	1995 2000 1999b 2004
Application (combination of trialability and observability)	Rogers Tan & Teo	1995 2000
Perceived behavioural control		
Self-efficacy	Ajzen Rogers	1991 1995
Support	Tan & Teo	2000
Subjective norms	Focus groups	
Advisory services	Fliegel Beedell & Rehman	1993 1999 & 2000
Intention	Ajzen Tan & Teo Christian et al. Marcil et al.	1991 2000 2002 2001

5.5. Conclusion

This chapter presents the background, method, results and discussion of the qualitative research undertaken to determine the factors and variables associated with the intention to adopt the use of forward contract to sell wool by Western Australian farmers. Four focus groups were conducted in regional Western Australia with a total of 26 wool producers participating. Not all had experience selling wool by forward contract. Curtin University's MGSS was used to capture data which were then transferred into ATLAS.ti for content analysis. A schematic of the results was combined with relevant literature on the TPB and the theory of Diffusion of Innovations to construct a behavioural model that explains farmers' intention to adopt forward contracts to sell wool.

The focus groups revealed five major variables that affect the use of forward contracts: 'pricing', 'complexity', 'business process improvement', 'dominance of the auction system' and 'production risks'. It was also found that some elements of the TPB ('perceived usefulness' and 'subjective norms') and the Diffusion of Innovations theory ('relative advantage', 'compatibility', 'complexity', 'application', 'risk' and 'self-efficacy') fitted with the findings as endogenous variables. Most importantly, however, the TPB's 'attitude' construct was found to remain as an exogenous variable in the form of influences internal and external to the farm business.

The next phase of the research is to further analyse the combined model by employing structural equation modelling approach. This quantitative stage of the research will first involve the development and testing of formal hypotheses of the behavioural model.

Chapter 6 Hypotheses and Questionnaire Development

6.1. Overview

The previous chapter presented the final combined behavioural model developed from a review of the literature on the TRA (Fishbein & Ajzen 1975), the TPB (Ajzen 1991), the Diffusion of Innovation theory (Rogers 1995) and the results of the four focus groups conducted in regional Western Australia with wool producers. This chapter focuses on the development of hypotheses based on the behavioural model presented in Chapter 5. The hypotheses (H1 to H8), illustrated in Figure 6.1, are developed in consideration of relevant literature and are presented in three broad groups: hypotheses related to factors external to the farm business, factors internal to the farm business and factors related to the perceptions of using forward contracts. The high number of hypotheses is acknowledged however the complex nature of research context called for so many relationships to be tested; as per the research of authors such as Quaddus and Hofmeyer (2007), Igbaria et al. (1997), Willock et al. (1999a) and Willock (1999b). Following the development and justification of hypotheses, the remainder of this chapter is dedicated to the development of the survey instrument used to test these hypotheses.

6.2. Hypothesis Development

6.2.1. Hypotheses Related to Factors External to the Farm Business

Research has shown that pressures external to the farm business have an impacting role on the farmers' decision-making (van der Ploeg 1994; McLeay & Zwart 1998; Willock et al. 1999b; Fisher et al. 2000). Such influences include government initiatives and interventions (Ervin & Ervin 1982; Burton 2004), ecological or environmental factors (Lee & Stewart 1983; Rahm & Huffman 1984; Nowak 1987; Harper et al. 1990; Beedell & Rehman 1999 & 2000) or, as is the case with this research, economic factors related to commodity demand and supply (Martin 1998; Willock et al. 1999b; Shafron, Martin & Ashton 2002; Ashton 2003; *Currency volatility no help to market* 2005).

Wool producers are seeking more sophisticated risk management strategies for selling wool (Brakenridge 2004; Kingwell 2000; Mitchell 2003; *New wheat pricing tools launched* 2005; Chambers & Quiggin 2004). This statement is also supported by Woods,

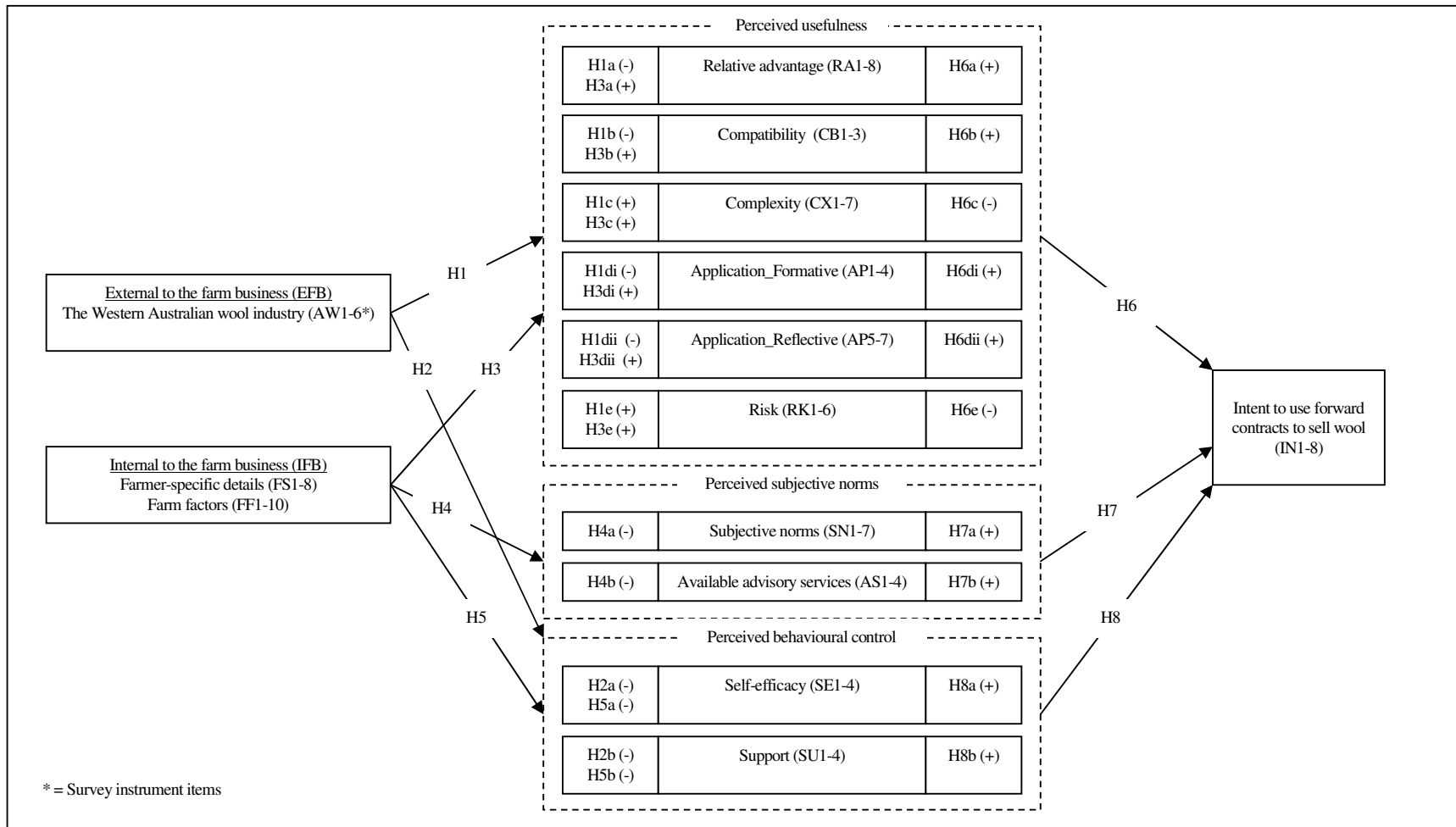


Figure 6.1: Illustration of hypothesised relationships

Hood and Couchman (2005) who concluded that wool growers wish to become more involved in the management of the wool supply chain by producing more valuable processed or semi-processed products. The anticipated increased value of their produce prompted an increased need for methods to better managed price risk. Bolt (2004b) reported on the vigilance of the Australian wool industry to offer growers superior selling methods, such as electronic selling (Waldthausen 2005), to assist them in managing price risk. However, the report suggested these offers seem to have fallen on deaf ears as 85% of the nation's wool clip is sold at auction, an increase from 80% in the 1980s and 1990s (Teasdale 1991). Further to this, despite these industry efforts, the focus groups conducted for this research revealed that the advantages of forward contracts are overshadowed by the disadvantages in the minds of wool producers.

The first hypothesis for this research was derived from results of the four focus groups conducted to gather qualitative data for construction of the behavioural model. Participants of the focus groups discussed their perceptions of the wool industry in terms of industry factors that inhibited them from using forward contracts. Such factors were: how wool producers take a strategic view of the supply chain before selling their wool; how slow and competitive the market is at present; how there is low international demand for wool; how the length of the current wool supply chain influences decision-making; and wool producers' positions as price-takers in the industry. It was said that the length of the supply chain and dominance of the auction system do not allow for adequate quality feedback to the growers, so they are not sufficiently aware of market requirements to take out forward contracts.

Forward contracts are now the main method of selling wool in New Zealand, with their popularity increasing over the past five years (Champion 2004). Before the 1990s, auction was the only method of selling wool in New Zealand but auction now accounts for less than half of the nation's sales. Forward contracts have become dominant in New Zealand due to the buoyancy of the wool industry, their usefulness to wool producers and their benefits to wool buyers and processors (Brakenridge 2004; Goss 1987; The Woolmark Company 2005b). Yet Ben-Kaabia and Gil (2007) report on the effects of asymmetrical information in the Spanish lamb supply chain. These authors argue that retailers benefit from price shocks in the market so they have no interest in offering forward contracts to producers. Given the examples of New Zealand and Spain, it is

reasonable to infer that industry structures can have an impact on producers' perceptions of using forward contracts to sell their goods.

It is therefore hypothesised that:

H1: Perception of factors external to the farm business, specifically the Australian wool industry, will have a generally negative influence over the perceived usefulness of the intent for farmers to use forward contracts to sell wool.

Perceived usefulness is “the degree to which a person believes that using a particular system would enhance his or her own job performance” (Davis 1989, p. 320). This hypothesis needs further expansion, as suggested by Rogers (1995), Tan and Teo (2000) and Fliegel and Kivlin (1962). This expansion will reflect various dimensions of ‘perceived usefulness’, as specified by these authors. Previous research has shown these dimensions to be ‘relative advantage’, ‘compatibility’, ‘complexity’, ‘trialability’ and ‘observability’. All these dimensions will be tested in this study although ‘trialability’ and ‘observability’ will be treated as a single dimension. This is due to the notion that the use of forward contracts can easily be a “one-off” behaviour and are private transactions between farmers and wool buyers. Therefore, trialling and observing the use of forward contracts to sell wool may prove to be unrealistic to this research scenario. As a remedy, ‘trialability’ and ‘observability’ have been merged to create the dimension of ‘application’ which alludes to the application, or suitability, of forward contracts to the farm business. Evidence in support of this merger comes from Pannell et al. (2006) who discuss two innovation characteristics that will inhibit trialability: the ‘longer the lag to adoption’ and ‘complexity’. Pannell et al. state that innovations which are slow to show results, in this case a three-month forward contract compared to the auction system, can lose people’s enthusiasm and costs can be perceived to outweigh benefits. Similarly, complexity of an innovation can limit its trialability. The qualitative phase of this research showed that forward contracts are perceived as being highly complex thus diminishing farmers’ inclination to trial them.

Most of the dimensions of ‘perceived usefulness’ are expected to be negatively influenced by factors external to the farm business, with the exception of ‘complexity’ and an additional dimension: ‘risk’. ‘Risk’ is a salient inclusion to the diffusion model as it is an ever-present factor in agribusiness systems and was a key point of discussion in the focus groups. Numerous authors have included ‘risk’ as an element of research in the

agribusiness domain (see The Merino Company 2006; Abadi Ghadim, Pannell & Burton 2005; Vergara et al. 2004; Murray-Prior & Wright 2001 & 2004; Marra, Pannell & Abadi Ghadim 2003; Pennings & Leuthold 2000 & 2001; Abadi Ghadim & Pannell 1999; Willock et al. 1999b).

Exploratory evidence from the focus groups, in addition to the media articles cited above, provides evidence to support the idea that as pressure from the Australian wool industry increases, so too will wool producers' negative perceptions of the usefulness of forward contracts. Factors such as the dominance of the auction system, the length of the wool supply chain, the current high price volatility, wool increasingly becoming a by-product of meat production and the highly competitive nature of the market are seen to have a negative impact on producers' perceptions of how useful forward contracts are for selling wool (in terms of relative advantage, compatibility with their current business methods and the application of forward contracts to their current business methods). Therefore, hypotheses for these dimensions of 'perceived usefulness' are (see Figure 6.1):

H1a: Perceptions of factors external to the farm business, specifically the Australian wool industry, will negatively influence the relative advantage perceived by farmers to use forward contracts to sell wool.

H1b: Perceptions of factors external to the farm business, specifically the Australian wool industry, will negatively influence the compatibility perceived by farmers to use forward contracts to sell wool.

H1di: Perceptions of factors external to the farm business, specifically the Australian wool industry, will negatively influence the application (using formative indicators) perceived by farmers to use forward contracts to sell wool.

H1dii: Perceptions of factors external to the farm business, specifically the Australian wool industry, will negatively influence the application (using reflective indicators) perceived by farmers to use forward contracts to sell wool.

In terms of 'complexity' and 'risk', evidence exists to suggest that these dimensions will have an inverse relationship to the other dimensions of 'perceived usefulness' (Fliegel & Kivlin 1962; Tan & Teo 2000). 'Relative advantage', 'compatibility' and 'application' are usually considered to have a positive association with a behaviour under consideration. Conversely, 'risk' and 'complexity' are associated with negativity as they add an unknown element to the decision to undertake a behaviour (Vergara et al. 2004).

In alignment with previous research, it is hypothesised that these two dimensions will have an inverse relationship to the aforementioned four hypotheses. It is therefore suggested that:

H1c: Perceptions of factors external to the farm business, specifically the Australian wool industry, will positively influence the complexity perceived by farmers to use forward contracts to sell wool.

H1e: Perceptions of factors external to the farm business, specifically the Australian wool industry, will positively influence the risk perceived by farmers to use forward contracts to sell wool.

The next hypothesis principally centres on the dominance and institutionalisation of the auction system for selling wool in Australia. Most of the justification for this hypothesis comes from results of the focus groups, however, there is evidence in the literature to support the findings of the qualitative research. This literature shows how factors external to the farm business, principally the wool industry, and the advisory services available to farmers, negatively influence ‘perceived behavioural control’ in terms of the adoption of forward contracts to sell wool.

Qualitative research for this project showed that the auction system, in association with wool brokers, was the main method chosen for selling wool. This is supported by Bolt’s (2004b) statement that 85% of wool in Australia is sold at auction. Furthermore, Western Australia has had a wool auctioning service since December 1920 (“Flashback” 2004). The dominance and longevity of the auction system in Australia can be equated to the ‘institutional and competitive bandwagon’ referred to by Abrahamson and Rosenkopf (1993), or an ‘informal institutional arrangement’ described by Smajgl, Vella and Greiner (2003) and Smajgl (2004). These concepts govern the sociological dominance of the auction system within the rural community which, in turn, suppress the use and adoption of forward contracts. For this reason it is hypothesised that farmers’ perceived behavioural control will lie with the auction system, rather than another selling method such as forward contracts.

Further to this is the influence advisory services and the media have over farmers’ perceived behavioural control about selling their wool. Evidence derived from media comments suggests that auction is the only way to sell wool in Australia. Where selling wool is discussed in the mass media, it is mainly in relation to being sold at auction (see

Waldthausen 2005; Connors 2005; Bolt 2004b; Bolt 2006b; Hamilton 1993). It is a well-established fact that media and the transfer of information has a positive influence over Diffusion and adoption of agricultural practices (Longo 1990; Fliegel 1993; Rogers 1995; Saltiel, Bauder & Palakovich 1994; Copp, Sill & Brown 1958; Wilkening 1950). Therefore, while discussion in the media continues to be dominated by auction as being the only method associated with selling wool, perceived behavioural control over the use of forward contracts is expected to be impeded.

Finally, research by Beedell and Rehman (1999 & 2000), Fliegel (1993) and Rogers (1995) has shown that advisory services will influence farmers' adoption of agricultural practices. The qualitative research for this project revealed that the advisory services (defined as wool brokers, buyers and merchants as well as membership of farming groups) available to wool producers will similarly encourage the use of auction, therefore limiting the perceived behavioural control over the use of forward contracts and other selling alternatives. It was also revealed by the focus groups that farmers perceive that no organisations promote the use of forward contracts, nor are their advantages made clear.

From these findings the following hypothesis was developed:

H2: Perceptions of factors external to the farm business (i.e. the Australian wool industry and advisory services available to the farmer) will negatively influence the perceived behavioural control associated with the intention of farmers to use forward contracts to sell wool.

Once again, however, there is a need to break the hypothesis into two parts: 'self-efficacy' and available support. Many authors associate 'perceived behavioural control' with 'self-efficacy' (Burton 2004; Beedell & Rehman 2000; Tan & Teo 2000); even Ajzen (1991) admits that 'self-efficacy' is a compatible term for 'perceived behavioural control'. Bandura (1977 & 1982) stipulates that 'self-efficacy' relates to the confidence that individuals have in their own ability to perform a task. Given findings from the exploratory phase of this research, it would appear logical to interpret that the Australian wool industry, specifically under the dominance of the auction system, is leading wool producers to doubt their ability to use any selling system other than auction. This logic is also thought to hold true to a component used by Tan and Teo (2000) to measure 'perceived behavioural control': 'support'. The focus groups highlighted the importance and dominance of advisory services in the wool-selling process. It is therefore considered

pertinent to include ‘support’ as a component of ‘perceived behavioural control’. The second hypothesis of this research is divided as follows:

H2a: Perceptions of factors external to the farm business (i.e. the Australian wool industry and advisory services available to the farmer) will negatively influence the self-efficacy associated with the intention of farmers to use forward contracts to sell wool.

H2b: Perceptions of factors external to the farm business (i.e. the Australian wool industry and advisory services available to the farmer) will negatively influence the support associated with the intention of farmers to use forward contracts to sell wool.

6.2.2. Hypotheses Related to Factors Internal to the Farm Business

McLeay and Zwart (1998) found that characteristics related to the farm and farmer influence the decision to take out various marketing contracts. In terms of the farmer, such characteristics were found to be: level of market knowledge, management competencies and attitude to risk. Further literature searches found farmer-specific details and farm factors to influence farmer decision-making.

In reference to farmer-specific details, research by Willock et al. (1999b) showed that personality factors, mediated by farming attitudes and objectives in farming, will influence farming behaviours. In this research, it is hypothesised that farmer-specific details will have a positive influence over the ‘perceived usefulness’ of farmers’ intention to use forward contracts to sell wool. The focus groups showed that farmers who have experience with forward contracts, extensive knowledge of their own wool clip and who take a strategic, supply-chain view of the wool industry will perceive forward contracting as useful to their farm business, a finding strongly supported by Vergara et al. (2004). Similarly, factors such as a producer’s financial and tax position will have a positive influence over ‘perceived usefulness’, as will knowledge on the monetary value of their wool clip.

Several authors have shown that farm factors will influence whether farmers are likely to adopt particular behaviours or technologies (Willock et al. 1999b). More specifically, such factors have been found to be: farm location (Fliegel 1993), farm size (Beedell & Rehman 1999 & 2000) and level of dependence on wool to the farm’s income (McLeay & Zwart 1998). Additional factors that were identified during the field studies were

farmers' production objectives, the quality and quantity of wool produced and the farmer's commitment to producing wool.

These findings suggest that:

H3: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the perceived usefulness of the intention of farmers to use forward contracts to sell wool.

As with H1, this hypothesis needs to be broken down into the 'perceived usefulness' dimensions outlined by Rogers (1995) and Tan and Teo (2000): 'relative advantage', 'compatibility', 'complexity', 'application' and 'risk'. Unlike H1, however, it is thought that factors internal to the farm business will have a positive influence over each dimension of 'perceived usefulness', as outlined above. The hypotheses related to H3 will therefore be:

H3a: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the relative advantage perceived by farmers to use forward contracts to sell wool.

H3b: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the compatibility perceived by farmers to use forward contracts to sell wool.

H3c: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the complexity perceived by farmers to use forward contracts to sell wool.

H3di: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the application (using formative indicators) perceived by farmers to use forward contracts to sell wool.

H3dii: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the application (using reflective indicators) perceived by farmers to use forward contracts to sell wool.

H3e: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the risk perceived by farmers to use forward contracts to sell wool.

‘Subjective norms’ are the social pressures to perform or not to perform the behaviour in question (Ajzen 1991). There is considerable evidence from a plethora of research disciplines to show that social pressures impact on an individual’s intention to perform a specific behaviour (Ajzen & Fishbein 1973; Marcil, Bergeron & Audet 2001; Christian & Armitage 2002; Lynne et al. 1995; Shimp & Kavas 1984; Bonfield 1974; Beedell & Rehman 1999 & 2000; Charng, Piliavin & Callero 1988; Ryan 1982; Pennings & Leuthold 2000 & 2001; Burton 2004).

Moreover, much research has been conducted on the strong influence family has on farmers’ decision-making processes since many farmers’ decisions are made within the family environment (Hildenbrand & Hennon 2005; Albrecht & Albrecht 1996; Carlson & Dillman 1983; Gasson 1973; Gasson & Errington 1993; Machum 2005; Herrmann & Uttitz 1990; Pennings & Leuthold 2000; Wilkening & Guerrero 1969; Wilkening & Bharadwaj 1968) with additional evidence showing the influence of peer pressure on farmer decision making (Copp, Sill & Brown 1958; Beedell & Rehman 1999; Frank 1997; Upadhyay et al. 2003). This leads to the suggestion that one of the main influences of a farmer’s choice of wool selling method would be opinion of family and peers.

The impact of ‘subjective norms’ aligned with findings from the field studies. These studies allowed for investigation into the social pressures confronted by producers when selling their wool. It was said that using forward contracts to sell wool creates family disagreements due to the uncertainties associated with price discovery and the familiarity the family has with the auction system. External to the family, it appeared that wool producers used the wool price achieved by their neighbours and significant others as a benchmark for negotiations and knowing if “they had a win” with their wool sales.

An equally important affect to that of family and peers was the influence wool brokers, employed as an advisory service, have over producers when selling wool. Focus group participants said that wool brokers provide important price and market information when selling wool, as well as advice on timing and method of sales. The importance of advisory services and their influence on decision-making is also highlighted by authors such as Cross and Franks (2007), Makus et al. (1990), Beedell and Rehman (1999 & 2000) and Fliegel (1993); as discussed in Section 2.2.1. Results from the focus groups indicate that wool brokers are fervently in favour of the auction system and hence encourage wide use of this system.

In addition to the hypothesised influence of subjective norms, there is evidence to suggest that information sought from advisory services will also influence farmers' attitudes towards forward contracts. Both Fliegel (1993) and Rogers (1995) discuss the importance of advisory services in the adoption process. In support of this, data from the focus groups showed that advisory services play a significant role in the selling choices made by wool producers and how they perceived forward contracts; it was specified that finding a broker was the first step anyone should take in selling wool for the first time. To be more specific, focus group participants were adamant that brokers discouraged the use of forward contracts because of the uncertainty associated with their operation. Therefore, the hypothesis is that:

H4: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence the perceived subjective norms associated with the intention of farmers to use forward contracts to sell wool.

Evidence from the literature and the focus groups suggests that the hypothesis related to perceived subjective norms is divided into hypotheses H4a and H4b to reflect the dichotomy of subjective norms and available advisory services within the over-arching hypothesis:

H4a: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence subjective norms as a way of using forward contracts to sell wool.

H4b: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence available advisory services as a way of using forward contracts to sell wool.

While it is thought that factors internal to the farm business will positively influence 'perceived usefulness' of producers' intent to adopt the use of forward contracts, there is evidence to suggest that these same factors will negatively influence the 'perceived behavioural control' of using forward contracts to sell wool.

Perceived behavioural control "refers to people's perception of the ease or difficulty of performing the behaviour of interest" (Ajzen 1991, p. 183). If this definition is coupled with the knowledge that farmers are generally risk-averse (Bond & Wonder 1980; Pluske & Fraser 1995; Coad 2000; Pannell, Malcolm & Kingwell 2000) and are slow to adopt unproven ideas (Willock et al. 1999b), then there are strong grounds to suggest that

factors internal to the farm business (i.e. farmer-specific details and various farm factors) will inhibit the perceived behavioural control associated with using forward contracts to sell wool. Vergara et al. (2004) present an opposing view that improvements to producers' knowledge of selling systems and increased production quantities will increase the use of forward contracts to sell cotton. However, results from the field studies suggest otherwise.

It was found that there are a great many uncertainties associated with the use of forward contracts (missing out on good prices, buyer insecurity, cash flow requirements, market conditions) and that industry offered insufficient information about their benefits and how they can be used. In addition, the dominance of the auction system (in terms of ease of use, popularity and transparency) suggests that while forward contracts are not necessarily perceived as being difficult to use, the auction system is more attractive. Finally, the premise that wool is a by-product of meat production suggests that producers are more interested in exerting their marketing efforts on meat price discovery rather than wool price discovery or price risk management.

Similar to H2, it is thus hypothesised that:

H5: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence the perceived behavioural control associated with the use of forward contracts to sell wool.

This hypothesis will also be divided into two sub-hypotheses, as explained for H2. The influence factors internal to the farm business (such as farmer-specific details and farm factors) has over components of 'perceived behavioural control' will be measured in terms of 'self-efficacy' and the 'support' available to wool producers. The fifth hypothesis of this research is therefore split into:

H5a: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence the self-efficacy associated with the use of forward contracts to sell wool.

H5b: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence the support associated with the use of forward contracts to sell wool.

6.2.3. Hypotheses Related to the Perceptions of Using Forward Contracts

The TRA and TPB show a direct relationship between attitude and intention in understanding an individual's behaviour. Ajzen and Fishbein (1980, p. 8) demonstrated that the 'attitude' construct will be influenced by "the person's beliefs that the behaviour leads to certain outcomes and his evaluation of these outcomes". In accordance with this statement and the studies of Xu (2003), this research has adapted the traditional 'attitude' construct as 'perceived usefulness'.

Research has found that attitude towards risk is a major factor influencing farmer decision-making (Abadi Ghadim, Pannell & Burton 2005; Marra, Pannell & Abadi Ghadim 2003; Penning & Leuthold 2000; Willock et al. 1999b), and farmers can be characterised as being risk-averse and slow to adopt new technologies despite operating in their environmentally and financially spasmodic industry. Farmers manage this aversion of risk by taking out insurance, diversifying the farm's enterprise mix, hedging, contract selling and taking off-farm employment (Hermann & Uttitz 1990; Willock et al. 1999b; Chambers 2006).

This being the case, five components have been devised for understanding the relationship between 'perceived usefulness' and intention to use forward contracts to sell wool: 'relative advantage', 'compatibility', 'complexity', 'risk' and 'application'. As previously explained, these components are principally derived from a section of Rogers' (1995, p. 207) list for determining rate of adoption. With the exception of 'risk' and 'complexity', each of these factors are hypothesised to have a positive relationship with the intention for forward contracts to be used to sell wool. Research on farmer attitudes by Fliegel and Kivlin (1962), Lynne et al. (1995), Thompson and Panayiotopoulos (1999), Bergevoet et al. (2004) and Tutkun and Lehmann (2006) showed very strong, positive relationships within and between all the constructs of the TRA/TPB. This suggests that in the field of farmer adoption research a strong positive relationship will be found between 'perceived usefulness' of a behaviour and intention to adopt. Other research that has tested 'relative advantage' as a construct in isolation from the TRA/TPB has also shown a positive relationship with adoption (Pannell et al. 2006; D'Emden, Llewellyn & Burton 2006; Marr, Pannell & Ghadim 2003; Black 2000; Abadi Ghadim & Pannell 1999; Kingwell, Pannell & Robinson 1993).

The only expected exceptions to this logic are for the sub-hypotheses related to ‘risk’ and ‘complexity’. In the context of the present research, the concept of ‘complexity’ was drawn from the numerous instances of ‘uncertainty’ re-occurring in the focus group data (see Table 5.1 in Section 5.4.1). In terms of literature on the concept of ‘complexity’, Fliegel and Kivlin (1962) and Batz, Peters and Janssen (1999) conducted studies on farm practice attributes and adoption rates. These authors hypothesised and concluded that ‘complexity’ had a negative influence on adoption: the relationship was found to be highly significant. More recently, Australian researchers confirmed this finding (Pannell et al. 2006; Tiller 2000; Lodge 1991). The conclusion, therefore, is that as ‘complexity’ of an innovation increases, the rate of adoption will slow down. A similar premise of Tan and Teo (2000) found ‘complexity’ had a negative impact in regards to intention, although the relationship was not significant. Tan and Teo’s study also found ‘risk’ to have the same relationship on intention. Another study, more closely related to agribusiness, provides further evidence of this intuitive negative relationship between riskiness and intention to adopt and innovation. Abadi Ghadim, Pannell and Burton (2005) and Batz, Peters and Janssen (1999) all concluded that perceived risk negatively influences farmers’ adoption decisions and levels of adoption.

It is therefore hypothesised that:

H6: The perceived usefulness of using forward contracts to sell wool will generally have a positive influence over the intention of Australian farmers to sell their wool by forward contract.

This is separated into five sub-hypotheses that are in-keeping with Rogers’ dimensions of ‘perceived usefulness’ and those used in H1 and H3:

H6a: The relative advantage of using forward contracts to sell wool will positively influence the intention of Australian farmers to sell their wool by forward contract.

H6b: The compatibility of using forward contracts to sell wool will positively influence the intention of Australian farmers to sell their wool by forward contract.

H6c: The complexity of using forward contracts to sell wool will negatively influence the intention of Australian farmers to sell their wool by forward contract.

H6di: The application of using forward contracts to sell wool will positively influence the intention of Australian farmers to sell their wool by forward contract (using formative indicators).

H6dii: The application of using forward contracts to sell wool will positively influence the intention of Australian farmers to sell their wool by forward contract (using reflective indicators).

H6e: The risk of using forward contracts to sell wool will negatively influence the intention of Australian farmers to sell their wool by forward contract.

The hypothesis related to ‘perceived subjective norms’ will be split in accordance with the explanation of H4. It was previously specified that ‘perceived subjective norms’ for this research include traditional factors of subjective norms (such as family and neighbours) as well as individuals employed to provide advisory services (such as wool brokers) and the influence of the Australian wool industry in terms of the dominance of the auction system.

The literature is dominated by findings that ‘subjective norms’ have a positive influence on the intent for a particular behaviour to be adopted. For example, Pennings and Leuthold (2000 & 2001) found that the opinions of significant others, such as a husband, wife or successor, had a positive influence on farmers’ decisions to use futures for commodities trading. This is supported by authors such as Hildenbrand and Hennon (2005), Albrecht and Albrecht (1996), Carlson and Dillman (1983), Gasson (1973), Gasson and Errington (1993), Machum (2005), Herrmann and Uttitz (1990), Pennings and Leuthold (2000), Wilkening and Guerrero (1969) and Wilkening and Bharadwaj (1968). Beedell and Rehman (1999 & 2000) found that membership to farming groups positively influences the adoption of farmer conservation behaviour. Additional support for this positive relationship can be found in the following research: Shimp and Kavas (1984), Ryan (1982), Lynne et al. (1995), Christian and Armitage (2002), Marcil, Bergeron and Audet (2001), Bergevoet et al. (2004) and Tutkun and Lehmann (2006).

By contrast, Thompson and Panayiotopoulos (1999) used Fishbein and Ajzen’s TRA to research the intention of dairy farmers to buy in feed for their herds. They found that the model proved to be a good predictor of behaviour although this power of prediction was in no way improved by ‘subjective norms’. This is the only research found to be consistent with findings from the focus groups.

The focus groups showed a negative perception of forward contracts for selling wool from producers and their normative groups. It was said that taking out forward contracts could create family disagreements, that no one in the industry promotes the use of

forward contracts and that, among other reasons, auction was the preferred selling system because it offered price transparency between neighbours.

While Thompson and Panayiotopoulos' findings support those of the exploratory phase of this research and provide strong evidence that 'subjective norms' will negatively influence the intention to adopt forward contracts as a method of selling wool, the bulk of research from the agribusiness research domain on this issue suggests that the relationship will indeed be positive.

It is thus hypothesised that:

H7: The perceived subjective norms associated with the use of forward contracts will positively influence the intention of Australian farmers to sell their wool by forward contract.

To be consistent with H4, the present hypothesis is further divided into:

H7a: Subjective norms associated with selling wool will positively influence the intention of Australian farmers to sell their wool by forward contract.

H7b: Advisory services associated with selling wool will positively influence the intention of Australian farmers to sell their wool by forward contract.

Finally, while 'perceived behavioural control' is about "people's perception of the ease or difficulty of performing the behaviour of interest" (Ajzen 1991, p.183), it has two components: 'self-efficacy' (Ajzen 1991; Rogers 1995; Tan & Teo 2000) and the 'facilitating conditions' (Tan & Teo 2000). Rogers (1995, p.170) defines 'self-efficacy' as "the degree to which an individual can control their future", while the second component revolves around "the availability of resources needed to engage in the behaviour". (Tan & Teo 2000, p.12). As a result of these two important components of 'perceived behavioural control', the next hypothesis of this research will be split into sub-hypotheses, in the same vein as H2 and H5.

A significant, positive relationship between 'perceived behavioural control' and the adoption of the behaviour in question was shown in research by Tutkun and Lehmann (2006), Bergevoet et al. (2004), Christian and Armitage (2002), Marcil, Bergeron and Audet (2001), Tan and Teo (2000), Lynne et al. (1995) and Shimp and Kavas (1984). However, only the study by Tutkun and Lehmann (2006) was from the field of

agriculture and other studies reviewed (Beedell & Rehman 1999 & 2000) showed no such relationship.

A study undertaken by Barrett and Martin (2003) revealed that 18% of Australian farmers use the internet to manage their wool-producing enterprises; seeking price information was the most predominant reason for using this technology. Other reasons were gaining market intelligence and meteorological information. This 18% of farmers who used the internet were characterised as being younger than those who have not adopted the technology, and have more profitable farms. This evidence suggests that these wool producers are more comfortable with the use of computer technology to run their farm businesses so should, in turn, start to adopt electronic selling as an alternative to auction (Bolt 2004b).

Yet, despite this promising research, results of the focus groups indicate that producers generally still feel a lack of behavioural control when it comes to taking out forward contracts to sell their wool. They consider there is a lack of advice available about using forward contracts, the market is too volatile for growers to feel secure about “locking in” a good price and selling by forward contract requires detailed knowledge of one’s wool quality and quantity produced in order not to incur payment discounts.

The strength of the empirical evidence overrides that from the focus groups although the caution the qualitative data offers is that there will possibly be low levels of significance with these relationships. Nevertheless, the empirical evidence nominates that:

H8: The perceived behavioural control over the use of forward contracts will positively influence the intention of Australian farmers to sell their wool by forward contract.

Which is further split into:

H8a: The self-efficacy associated with the use of forward contracts will positively influence the intention of Australian farmers to sell their wool by forward contract.

H8b: The support associated with the use of forward contracts will positively influence the intention of Australian farmers to sell their wool by forward contract.

6.3. Questionnaire Development

6.3.1. Adoption and Diffusion Questionnaire

The questionnaire (see Appendix 2) for this study was developed to collect data and included 30 questions which gathered information on demographics, farm business operation and the use of forward contracts to sell wool. The majority of questions were structured in nature; those on demographics and farm business operation made up half of the questionnaire and were principally descriptive, while questions on the use of forward contracts were based on a seven-point Likert scale.

Questions were formatted based on those from various studies related to Rogers' (1995) process of Diffusion, TRA (Ajzen & Fishbein 1980), TPB (Ajzen 1991) and TAM (Tan & Teo 2000). Major constructs being: the 'perceived usefulness', 'perceived behavioural control' and 'subjective norms' associated with taking out forward contracts to sell wool. However, the influences of factors internal and external to the farm environment were included as a result of information gathered from the four regionally-based focus groups that were conducted for this research.

It was originally planned to distribute the questionnaire to participants via mail, however, feedback from farmers suggested that this method would not achieve sufficient valid responses. From this advice, the questionnaire was designed to be conducted by telephone.

The questionnaire (Appendix 2) opens with a brief script introducing to participants the organisations involved in the research, the purpose of the questionnaire, the anticipated time to complete and an assurance of confidentiality. The script then goes on to determine if the participant currently has more than 700 adult sheep, if he/she is a primary producer and if he/she is presently a wool producer. These initial questions were asked in order to determine if the participant was a significant user of the wool selling systems currently operating in Australia. At present, the Department of Agriculture and Food Western Australia (DAFWA) uses 700 adult sheep in its various survey instruments as the determinant of a commercial sheep producer.

It was not necessary for participants to have experience selling wool by forward contract. Because only about 11% of producers use forward contracts, making this a criterion for participant involvement would severely limit the response rate.

Following the introductory section of the questionnaire, definitions were included in the script for telephonists to use should participants be unfamiliar with terms like “forward contract” and “electronic selling”.

Section 1 of the questionnaire concerned factors pertaining to selling wool by forward contract and consisted of questions relating to the external and internal aspects of the farm business.

Factors external to the farm business (EFB) were considered to revolve around producers’ attitudes to the wool industry. It was ascertained from the focus groups that factors external to the farm business are likely to have an impact on people’s intention to use forward contracts. In this sub-section of the questionnaire, questions on dominance of the auction system, beliefs on wool being a by-product of meat production, the length of the wool supply chain, the competitiveness of buyers within the industry, lack of price volatility and economic factors (such as international trading, demand, supply and price-discovery) were asked.

The sub-section on factors internal to the farm business (IFB) considered participants’ reliance on advisory services (as nominated by Fliegel (1993) and Rogers (1995)), methods of setting reserve price for wool, the importance of wool to the farm business (as suggested by Tan & Teo 2000) and elements of consideration when selling wool.

The last sub-section of the questionnaire focused directly on the constructs of TRA, TPB and TAM to test the ‘perceived usefulness’ of forward contracts, ‘perceived behavioural control’ of using forward contracts, the social pressures or ‘subjective norms’ associated with using forward contracts and, finally, the participant’s future intention to use forward contracts. In light of the recommendations of Mitchell (1969) who discussed farmers’ favourable reception of Likert-style survey questions, and many previous studies (Ajzen 1991; Beedell & Rehman 2000; Tan & Teo 2000), all questions used a seven-point Likert scale. This involved a statement being made and the participant choosing a response from a unipolar scale of one to seven, where one represented “Strongly disagree” and seven represented “Strongly agree”. Measures for the TPB/Diffusion-based component of the model (items RA [relative advantage], CB [compatibility], CX [complexity], AP [application], RK [risk], SE [self-efficacy], SU [support], SN [subjective norms] and IN [intention]) were adapted from the literature. Measures for the ‘wool commerce’

component of the model (items EFB, IFB and AS [advisory services]) were developed based on findings for the exploratory phase of the research.

The only diversion from theory was within the ‘perceived usefulness’ construct. In most cases, ‘perceived usefulness’ is measured by testing ‘relative advantage’, ‘compatibility’, ‘complexity’, ‘trialability’, ‘observability’ and ‘risk’. However, for this research, ‘trialability’ and ‘observability’ were combined to be called ‘application’. Section 6.2.1 of Chapter 6 explains why the ‘trialability’ and ‘observability’ constructs were merged to form a single construct which questioned “the usefulness and application of forward contracts to sell wool”. The seven items used here focus on image, improved understanding of finances and wool clip, benefits of forward contracts and the importance of advice from brokers; all of which were issues that arose from the focus groups.

Section 2 of the questionnaire contained demographic and farm business questions. Most questions used fixed, nominal categories to generate descriptive statistics from the data, however, the questions on location of farm, years associated with farming, number of adult sheep and number of wool bales produced were open-ended in order to develop information on frequency.

Demographic questions were based on the work of Fliegel (1993), Rogers (1995) and Beedell and Rehman (1999 & 2000) to gather data on gender, age, stage in family cycle, education and income. Scales for these questions were taken directly from questionnaires currently used by DAFWA. The other two constructs, farmer-specific details and farm factors, were based on work by Willock et al. (1999b), however specific questions were generated from qualitative information gathered from the focus groups. Scales were again taken directly from questionnaires currently used by DAFWA, except in the question on participant experience with using forward contracts; this scale used the categories of farm type employed by the Australian Bureau of Agricultural and Resource Economics (ABARE 2005).

6.3.2. Measurement Instrument Development

This section outlines the development of the measurement instrument based on the behavioural model (Figure 5.2 from Section 5.4.2) in which there are six constructs (‘factors internal to the farm business’, ‘factors external to the farm business’, ‘perceived usefulness’ of using forward contracts, ‘perceived subjective norms’ of using forward contracts, ‘perceived behavioural controls’ surrounding the use of forward contracts and

‘intention’ to use forward contracts). These constructs are further split into the sub-constructs, as illustrated in Figure 5.2. For each of the aforementioned constructs, multiple items were used to measure reliability and validity of the model. These items were principally developed from previous studies but also include knowledge gained from the focus groups discussed in Chapter 5. Details of the items for measuring each variable are provided herein.

6.3.2.1. Questionnaire section 1

Factors external to the farm business

As mentioned earlier, various literature showed that factors external to the farm business will influence intention to adopt an innovation. The focus groups provided information to suggest that factors specific to the Australian wool industry (AW) are the most logical issues to use in measuring ‘factors external to the farm business’. As a result of this finding, the six items below were generated from the focus group data to measure the impact ‘factors external to the farm business’ have on ‘perceived usefulness’ of using forward contracts and the ‘perceived behavioural control’ surrounding the use of forward contracts.

Table 6.1: Survey instrument items related to the Australian wool industry

Item	Variable	Measure	Source references
AW1	Dominance of the auction system	I feel auction is the only way to sell wool in Australia	Adapted from focus groups
AW2	Wool is a by-product of meat production	Wool is a by-product of meat production	Adapted from focus groups
AW3	The long wool supply chain	I would diversify the way I sell wool if the supply chain was shorter	Adapted from focus groups
AW4	Competition in the market	The lack of buyer competition stops me from diversifying the way I sell wool	Adapted from focus groups
AW5	Lack of price volatility	I desire a method of selling wool for which the price is less volatile than auction	Adapted from focus groups
AW6	Economic factors	A better balance between supply & demand would encourage farmers to use forward contracts more	Adapted from focus groups

Factors internal to the farm business

Again, the literature suggested that factors internal to the farm business would influence the intention to adopt an innovation, although the focus groups provided the subject

matter for this construct. The construct was split into two sub-constructs: farmer-specific (FS) details and farm factors (FF). Eight items were used to measure farmer-specific details. This sub-construct refers to the personal experiences and attitudes individual wool producers expressed in the focus groups. Similarly, 10 items were devised from the focus groups to measure the farm factors that were considered to influence adoption.

Table 6.2: Survey instrument items related to factors internal to the farm business

Item	Variable	Measure	Source references
FS1	Experience with forward contracts	Nominate commodities previously sold by forward contract	Adapted from focus groups
FS2	Experience with forward contracts	Which of the following statement(s) best describes your experience with forward contracts?	Adapted from focus groups
FS3	Methods of selling wool	Nominate frequency of use for each from list	Adapted from focus groups
FS4	Strategic supply-chain view of the industry	I take a strategic view of the wool supply chain when choosing how to sell my wool	Adapted from focus groups
FS5	Knowledge of wool clip	I have an intimate knowledge of the quality of my wool clip from year-to-year	Adapted from focus groups
FS6	Knowledge of wool clip	I have an intimate knowledge of the quantity of my wool clip from year-to-year	Adapted from focus groups
FS7	Tax/financial situation	I consider my taxation and/or financial position when choosing how to sell my wool	Adapted from focus groups
FS8	Wool value	I have no idea how much money my wool clip will bring next financial year	Adapted from focus groups
FF1	Level of dependence of wool to farm income	Wool contributes significantly to my farm's income	McLeay & Zwart 1998, p. 304
FF2	Level of dependence of wool to farm income	My income depends significantly on the income from my wool clip	McLeay & Zwart 1998, p. 304
FF3	Commitment to producing wool	I am committed to my wool-producing enterprise	Adapted from focus groups
FF4	Production objectives	I have production objectives set for the direction of my wool-producing enterprise	Adapted from focus groups
FF5	Farm location	Specify shire	Fliegel, 1993, p. 15 Austin et al 1999, p. S125
FF6	Farm size	Specify size to nearest thousand hectares	Beedell & Rehman 1999, p. 169
FF7	Enterprise mix	Nominate enterprise mix from list	Adapted from focus groups
FF8	Quantity of wool produced	Specify number of adult sheep	Adapted from focus groups
FF9	Quantity of wool produced	Specify number of bales produced	Adapted from focus groups
FF10	Quality of wool produced	Nominate flock average fibre diameter range from list	Adapted from focus groups

Perceived usefulness of using forward contracts

Adhering to Tan and Teo's (2000) adaptation of the TRA, the behavioural model of the present research uses sub-constructs based on Rogers' (1995) Diffusion of Innovations model: 'relative advantage', 'compatibility', 'complexity', 'application' and 'risk'. Similarly, the items used to measure each of these sub-constructs were principally based on the work of Tan and Teo (2000) and Rogers (1995) and adapted to be specific to this research using knowledge gained from the focus groups. Research by Fliegel and Kivlin (1962) was also referred to in order to develop items to measure 'relative advantage' (RA) and 'compatibility' (CB), while the research of Willock et al. (1999b) was referred to for development of items for the construct to measure 'risk'.

In the context of the present research, 'relative advantage' (RA) is measured using eight items which all refer to the advantages forward contracts bring to a wool-producing enterprise. 'Compatibility' (CB) is measured by three items that consider how compatible forward contracts are with the way the farm business is managed. The seven items that measure 'complexity' (CX) were largely drawn from the focus groups and ascertain how difficult wool producers perceive using forward contracts to be. Items regarding the 'application' (AP) of forward contracts to the farm business are a combination of traditional statements on 'trialability' and 'observability'. Finally, the six items to measure 'risk' (RK) refer to the risk and uncertainty that authors like Rogers (1995), Tan and Teo (2000) and Willock et al. (1999b) used to model adoption.

Table 6.3: Survey instrument items related to perceived usefulness

Item	Variable	Measure	Source references
RA1	Profitability	I believe forward contracts are an idea for profit	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
RA2	Income security	I believe forward contracts provide a known and secure income	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
RA3	Budgeting	I believe forward contracts help with annual budgeting	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
RA4	Alternative to auction	I believe forward contracts provide an opportunity not to use auction	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
RA5	Price discovery	I believe forward contracts give the ability to negotiate a decent price for wool	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
RA6	Peace of mind	I believe forward contracts provide peace of mind about earnings from wool	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
RA7	Auction price volatility	I believe forward contracts pricing system is not as volatile as auction	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
RA8	Guarantee to payment	Selling wool at auction is better because there is guarantee of payment	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CB1	Business cash flow requirements	Using forward contacts fits in well with my business cash flow requirements	Rogers 1995, p. 207 Tan & Teo 2000, p. 8

...continued to next page

Table 6.3 (continued)

CB2	Personal cash flow requirements	Using forward contracts fits in well with my personal cash flow requirements	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CB3	Feedback on wool quality	Using forward contracts provides useful feedback on the quality of my wool	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CX1	Experience & confidence	Using forward contracts requires experience and confidence with your wool clip	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CX2	Mental energy	Using forward contracts requires a lot of mental energy	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CX3	Frustration	I think of using forward contracts as being frustrating	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CX4	Ease of selling	Using forward contracts is an easy way of selling wool	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CX5	Fine print	There is too much fine print involved with forward contracts	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CX6	Price discounts	The price discounts for quality and quantity associated with forward contracts make them unattractive to use	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
CX7	Guess work of pricing	When a forward contract is taken out, there is no guess work involved with pricing.	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
AP1	Transparency of benefits	Being able to see the benefits of using forward contracts is important	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
AP2	Research	Research on the most profitable ways to sell wool seems to be lacking	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
AP3	Outcomes	I would like to see studies on the outcomes of selling wool by forward contract	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
AP4	Broker advice	The advice of a broker is important when selling wool by forward contract	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
AP5	Entrepreneurial image	Selling wool by forward contract would give me an entrepreneurial image	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
AP6	Knowledge of finances	Selling wool by forward contract would help me to know more about my finances	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
AP7	Knowledge of wool clip	Selling wool by forward contract would help me to know more about my wool	Rogers 1995, p. 207 Tan & Teo 2000, p. 8
RK1	Profitability	I get concerned about not getting as much ¢/kg as if I sold my wool at auction	Rogers 1995, p. 207 Tan & Teo 2000, p. 8 Willcock et al 1999, p. 8
RK2	Loss of income	I worry that I'll lose money if I sell wool by forward contract	Rogers 1995, p. 207 Tan & Teo 2000, p. 8 Willcock et al 1999, p. 8
RK3	Fulfilment of contract – quality	I worry that there's a chance I won't be able to fulfil my contract in terms of wool quality	Rogers 1995, p. 207 Tan & Teo 2000, p. 8 Willcock et al 1999, p. 8
RK4	Fulfilment of contract – quantity	I worry there's a chance I won't be able to fulfil my contract in terms of wool quantity	Rogers 1995, p. 207 Tan & Teo 2000, p. 8 Willcock et al 1999, p. 8
RK5	Risk management	Using forward contracts is a good risk-management strategy	Rogers 1995, p. 207 Tan & Teo 2000, p. 8 Willcock et al 1999, p. 8
RK6	Risk management versus making money	Forward contracting is a case of risk management versus making money	Rogers 1995, p. 207 Tan & Teo 2000, p. 8 Willcock et al 1999, p. 8

Perceived subjective norms associated with using forward contracts

In previous chapters (Sections 2.4, 2.5.2 and 6.2.3), subjective norms (SN) have been demonstrated to be important inclusions in behavioural models based on the TRA and TPB. In the present research, subjective norms are measured using seven items, all based on the results of the focus groups. In addition to these items, four items are also included to measure the impact of ‘advisory services’ (AS) on wool producers’ decisions to use forward contracts. The importance of advisory services in decision-making was not only emphasised in the focus groups but was also used in the agribusiness-related research of Fliegel (1993), Beedell and Rehman (1999 & 2000) and Makus et al. (1990) from which items for measuring the importance of ‘advisory services’ were drawn.

Table 6.4: Survey instrument items related to perceived subjective norms

Item	Variable	Measure	Source references
SN1	Family friction	Using forward contracts creates family disagreements	Adapted from focus groups
SN2	Price equity	The price other people get for their wool is important to me	Adapted from focus groups
SN3	Dominance of auction system	I use the auction system because it is the normal way to sell wool	Adapted from focus groups
SN4	Diversification of selling method	Other people think that diversifying the methods by which I sell wool is a smart thing to do	Adapted from focus groups
SN5	Broker intervention	I would be more inclined to use forward contracts if advised by a broker	Fliegel, 1993, p. 15 Beedell & Rehman 1999, p. 169
SN6	Influence of commercial wool industry	There is strong pressure from the commercial world to only sell by auction	Adapted from focus groups
SN7	Influence of immediate family	My immediate family think that selling wool by forward contract is a good idea	Adapted from focus groups
AS1	Employment of advisory services	Nominate from list	Fliegel, 1993, p. 15 Beedell & Rehman 1999, p. 169
AS2	Encouragement of selling method diversification	I feel I am actively encouraged to sell my wool clip by various methods	Fliegel, 1993, p. 15 Beedell & Rehman 1999, p. 169
AS3	Advisory services relationship development	An on-going relationship with the organisation that provides me with selling advice is important to me	Fliegel, 1993, p. 15 Beedell & Rehman 1999, p. 169
AS4	Avoidance of advisory services	I tried to avoid using advisory services whenever possible	Fliegel, 1993, p. 15 Beedell & Rehman, 1999 p. 169

Perceived behavioural controls surrounding the use of forward contracts

‘Perceived behavioural control’ is the construct that distinguishes the TPB from the TRA. As discussed in Section 6.2.3, ‘perceived behavioural control’ is often measured with items associated with an individual’s ‘self-efficacy’ (SE), or their beliefs about their own capabilities (Ajzen 1991; Rogers 1995). The four items used to measure ‘self-efficacy’ were underpinned by another four items to measure the ‘support’ (SU) offered to wool producers in taking out forward contracts. The items to measure ‘support’ were drawn from the work of Tan and Teo (2000) but the influence of these support services was further highlighted in the focus groups and the literature.

Table 6.5: Survey instrument items related to perceived behavioural control

Item	Variable	Measure	Source references
SE1	Confidence	Using forward contracts to sell wool requires confidence	Ajzen 1991
SE2	Advice from peers	Advice from my peers helps with using forward contracts	Ajzen 1991
SE3	Advice from broker	Advice from my wool broker or adviser helps with using forward contracts	Ajzen 1991
SE4	Relationship with broker	It is important to me to develop a good working relationship with my broker	Ajzen 1991
SU1	Market reports	Market reports available on the internet assist me with my decision on taking out a forward contract to sell wool	Tan & Teo 2000, p. 8
SU2	Technology	The ability to contact my broker/merchant by phone, fax, mobile or e-mail is important to me when taking out a forward contract	Tan & Teo 2000, p. 8
SU3	Internet trading	Advances in internet trading make the use of forward contracts easier for me	Tan & Teo 2000, p. 8
SU4	Familiarity with forward contracts	It seems that no one is familiar with forward contracts for wool	Tan & Teo 2000, p. 8

Intention to adopt

Eight items were developed to measure the intention (IN) to adopt forward contracts as a method of selling wool. As this construct is an integral component of a TRA or TPB-based model there are many measures available. For this research, items IN1 – IN3 were adapted from the work of Hofmeyer (2005) while items IN4 – IN6 were adapted from the work of Christian and Armitage (2002) and Marcil, Bergeron and Audet (2001).

It must be explained how questions IN7 and IN8 were generated. These questions were designed to test how responsive wool producers are to taking out a forward contract in terms of price. Will producers take a forward contract to secure a price they perceive as high, or will they take a forward contract to secure a price if they perceive that the price will subsequently fall? A 15% rise and fall in the market price was used to test this question. This figure was derived from studying the market indicator⁸ minimum (620 ¢/kg) and maximum (715 ¢/kg) for 21 micron wool over the six months prior to conducting the survey (November 2005 to April 2006). It was found that wool price market indicators had fluctuated 15% during this period: $[100 \times (715 - 620) / 620] = 15.32\%$ change in price over the six months prior to the survey being conducted.

Table 6.6: Survey instrument items related to intention to adopt

Item	Variable	Measure	Sources references
IN1	Benefits to farm business	All things considered, adopting the use of forward contracts to sell wool would be good for my farm business	Hofmeyer 2005
IN2	Compatibility with business processes	I think that adopting the use of forward contracts would fit in well with my current business processes	Hofmeyer 2005
IN3	Dominant method of selling wool	I intend to make the use of forward contracts my main method of selling wool over the next 12 months	Hofmeyer 2005
IN4	Intended adoption	I intend to take out a forward contract to sell wool in the next 12 months	Christian et al 2002, p.223 Marcil et al 2001, p.373
IN5	Likelihood of adoption	I am likely to take out a forward contract to sell wool in the next 12 months	Christian et al 2002, p.223 Marcil et al 2001, p.373
IN6	Chance of adoption	Chances are that I'll take out a forward contract to sell wool in the next 12 months	Christian et al 2002, p.223 Marcil et al 2001, p.373
IN7	Influence of price rise on intended adoption	I intend to take out a forward contract to sell wool if I believe market prices are going to increase by 15% in the next 6 months	Christian et al 2002, p.223 Marcil et al 2001, p.373
IN8	Influence of price fall on intended adoption	I intend to take out a forward contract to sell wool if I believe market prices are going to decrease by 15% in the next 6 months	Christian et al 2002, p.223 Marcil et al 2001, p.373

⁸ Retrieved May 10, 2006, from www.agric.wa.gov.au/wooldesk

6.3.2.2. Questionnaire section 2

Demographic questions

In accordance with previous studies on Australian wool production by DAFWA, a number of items were developed to collect demographic data relating to social structure (SS). These eight items, that will not be included in the structural model, were drawn from DAFWA studies such as Curtis (2007) and Quaddus, Islam and Stanton (2004), excepting three items relating to stage in family cycle (SS4, SS5, SS6) which were based on the work of Gasson and Errington (1993), Rogers (1995), Carlson and Dillman (1983), Wilkening and Guerrero (1969) and Wilkening and Bharadwaj (1968). The principal reason for gathering demographic data was to build a sound picture of sample population to understand any anomalies that may result from data analysis.

Table 6.7: Survey instrument items related to sample demographics

Item	Variable	Measure	Source references
SS1	Gender	Nominate gender	Fliegel, 1993 p. 15 Austin et al 1999, p. S125
SS2	Age	Nominate age bracket	Fliegel, 1993 p. 15 Austin et al 1999, p. S125
SS3	Stage in family cycle	Which age groups best describe the children in your family?	Rogers 1995, p. 207
SS4	Stage in family cycle	Are any of these children living on the farm?	Rogers 1995, p. 207
SS5	Stage in family cycle	If this is your family farm business, at what stage in the family cycle best describes your position?	Rogers 1995, p. 207
SS6	Stage in family cycle	How many years have you been actively involved with this farm business?	Rogers 1995, p. 207
SS7	Education	Nominate level of education from list	Gasson 1998 Fliegel, 1993 p. 15
SS8	Income	Proportion of income earned from wool	Fliegel, 1993 p. 15 Beedell & Rehman 1999 p. 169

6.4. Summary

This chapter has presented eight hypotheses to be used to test the reliability and validity of the behavioural model that was developed in Chapter 5. These hypotheses draw together the independent variables of ‘factors external to the farm business’ (more specifically, the pressures imposed on farmers by the Australian wool industry) and ‘factors internal to the farm’ environment (such as farmer-specific details and farm factors) to show how perceptions, or cognitive responses, held by farmers about selling wool by forward contract (those being ‘perceived usefulness’, ‘perceived behavioural control’ and ‘subjective norms’) are impacted upon. All these constructs will be used to

test wool producers' intentions to use forward contracts for selling wool. Demographic information will also be used to build a picture of the sample population and help explain any anomalies in the data analysis that may be accounted for by social structure. The behavioural model was also the basis for the development of the TRA/TPB/Diffusion questionnaire. In the following chapter details are provided on the pilot survey and complete survey used to collect data for this research. The steps for analysing the survey data are explained and discussion is given on the testing of hypotheses.

Chapter 7 Data Analysis Using Structural Equation Modelling⁹

7.1. Introduction

Chapter 6 described the development and justification of the hypotheses; in this chapter, an analysis of data collected from a telephone survey of 305 respondents is undertaken in order to test the reliability and validity of the behavioural model and then test the hypotheses. First, simple descriptive statistics are presented, generated by SPSS 14, to understand the demographics of the sample population. A richer understanding of the data is then gained by using structural equation modelling (SEM).

While there are several approaches to SEM available, such as LISREL, EQS, AMOS and RAMONA (Gefen, Straub & Boudreau 2000; Schumacker & Lomax 1996), the analytical tool used for this study was the partial least squares (PLS) approach (Barclay, Higgins & Thompson 1995). This framework evaluated the behavioural model in the two-step process detailed by Barclay, Higgins and Thompson (1995), Santosa, Wei and Chan (2005) and Venkatesh et al. (2003). Figure 7.1 illustrates this process.

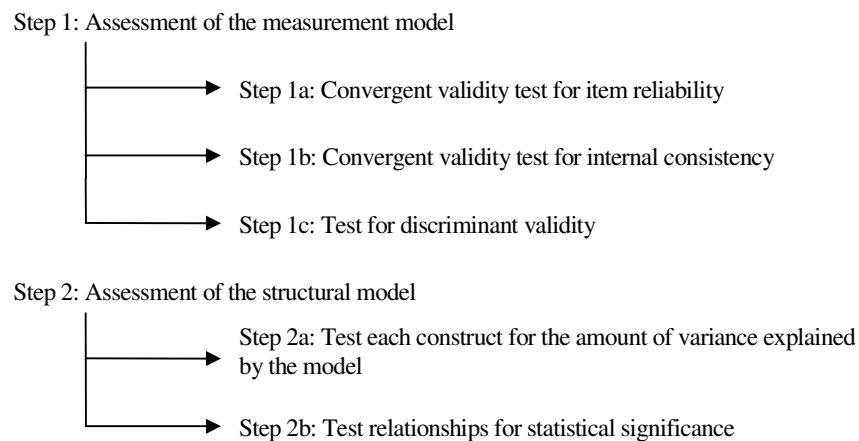


Figure 7.1: The two-step PLS analysis approach

⁹ A summary of this chapter has been published by the researcher in the following peer-reviewed conference proceedings:

‘Behavioural factors affecting the adoption of forward contracts by Australian wool producers’, *Proceedings of the 16th International Farm Management Association Congress*, 15-20 July, 2007, Cork, Ireland.

Chapter 7 is dedicated to describing this process in detail and how it was applied to analyse the data of this study. This chapter principally reports the results of the PLS analysis.

7.2. Survey Pre-testing

Dillman (2000) offers a well-structured, succinct method for pre-testing a survey instrument. This four-step approach was undertaken to ensure that the survey used to test the behavioural model essentially made sense.

The first stage described by Dillman requires the survey to be reviewed by knowledgeable colleagues or analysts in order to ascertain:

- That all necessary questions have been asked
- If any questions are redundant
- If appropriate categories have been used to undertake sensible, logical analysis.

At this stage, the project's three supervisors discussed and made suggestions for improvement of the survey. The main recommendations concerned the structure of the survey, from which point it was decided to employ a one-part survey as opposed to one survey for wool producers who had experience using forward contracts and another survey for wool producers who had no experience with forward contracts.

The second step suggested by Dillman is to carry out interviews to evaluate cognitive and motivational qualities in the survey. This step involved interviewing 10 wool producers on the telephone to ensure that all the words and terms in the survey were understood, that all the questions were interpreted in a similar fashion by respondents and if all questions had an answer that could be marked by the interviewer. These interviews were quite long as participants were encouraged to describe their thoughts on each question and how each was interpreted. The outcome of this stage was that, while some questions were considered irrelevant by the respondents, they were necessary to retain as part of the survey in order to be consistent with previous studies.

Conducting a small pilot study of 100 to 200 respondents is the third step of pre-testing advised by Dillman. This step plays out the actual procedure of the main survey and is considered particularly good for attaining a realistic sense of how long the survey will take to complete. It also allows for the sensitivity of the rating scales to be tested so that participants provide a good cross-section of responses. The pilot study for this research

used 113 responses to trial the survey. Each respondent took about 20 minutes to complete the survey. Another major difference related to the Likert scale for respondents who felt neutral to a question. The researcher originally specified that neutral responses to any Likert-scale question should be marked as '8' but this was changed to '3' (the mid-point of the scale) due to obscure results occurring from simple data analyses conducted in SPSS 14.

Dillman's last recommended step is for the researcher to do a final check of the survey by having it completed by people unrelated to the research project. This step is suggested due to the problem of people associated with the survey, and its revision process, becoming over-familiar with the document and failing to see small, but critical, errors. Dillman warns that people involved in the previous steps often act as proof readers rather than respondents. In the case of this study, three of the researcher's friends were asked to complete the survey; they found no errors that needed correcting.

Upon reflection, while few changes were required to the survey as a result of carrying out Dillman's four steps for pre-testing a survey, it was a valuable process to undertake because it eliminated the element of surprise when the main survey was finished.

7.3. Sample Population Demographics

Before any sophisticated analysis is conducted, it is prudent to use demographic data from the survey to develop a profile of the sample population so a picture can be gained of the types of respondents. Table 7.1 to Table 7.14 show information on the sample population's gender, age, principal farm location, position in family cycle, education, years of involvement with the farm business, size of farm in hectares, description of farm production, earnings from wool production and the use of forward contracts.

Gender

It can be seen from Table 7.1 that the vast majority (88.5%) of respondents were male.

Table 7.1: Survey respondents by gender

Gender	Frequency	Percentage (%)
Male	270	88.5
Female	35	11.5

Age

Most respondents (36.7%) were in the 46-55 years age bracket while about 70% were over 46 years of age. This shows that the farming community reflected in this sample is generally an aging population.

Table 7.2: Survey respondents by age

Age	Frequency	Percentage (%)
18-25	4	1.3
26-35	18	5.9
36-45	74	24.3
46-55	112	36.7
56-65	75	24.6
66 and over	22	7.2

Principal farm location

Participants were asked the shire in which their farm business is mainly located. To be consistent with research conducted by DAFWA (see Curtis 2007; Curtis & Croker 2005) and national wool auction catalogues, the shires were further grouped into DAFWA's wool statistical areas or wool selling areas (WSA). Geographic details of the WSAs are provided in Appendix 3.

The quantity of wool producers sampled from each WSA is in proportion to the number of producers determined by the June 2001 Australian Bureau of Statistics agricultural census. Table 7.3 shows that W09, W11 and W12 had the highest number of survey participants. This makes intuitive sense since these WSAs are the areas of highest wool production in Western Australia. Within these three WSAs are shires such as Kojonup (W09), Northam (W11) and Wagin (W12).

Table 7.3: Survey respondents by principal farm location

Wool selling area (WSA)	Frequency	Percentage (%)
W06	45	14.7
W07	32	10.5
W08	27	8.9
W09	47	15.4
W10	14	4.6

...continued next page

Table 7.3 (continued)

W11	52	17.0
W12	50	16.4
W13	3	1.0
W14	17	5.6
W20	18	5.9

Position in family cycle

Table 7.4 shows that there is a fairly equal distribution of respondents who are primary (49.8%) and joint (46.6%) decision makers in the farm business.

Table 7.4: Survey respondents by stage in family cycle

	Frequency	Percentage (%)
Primary decision maker	152	49.8
Secondary decision maker	11	3.6
Joint decision maker	142	46.6

Education

Most respondents received a high school education (73.1%).

Table 7.5: Survey respondents by education level

Education	Frequency	Percentage (%)
Attended high school	223	73.1
Completed degree or diploma	62	20.3
Post-graduate qualification	20	6.6

Years of involvement with the farm business

Table 7.6 shows that respondents had been involved with the farm business for a minimum of two years, a maximum of 65 years and a mean of 31.0. years. These results indicate that a satisfactory range of age groups and experience levels contributed to this study.

Table 7.6: Survey respondents by years of involvement with the farm business

Minimum (years)	Maximum (years)	Mean (years)
2	65	31.01

Size of farm

The average size of the farm respondents reported was nearly 3,000 hectares; as shown in Table 7.7. The minimum was 202 hectares and the maximum was 18,000 hectares.

Table 7.7: Survey respondents by farm size

Minimum (hectares)	Maximum (hectares)	Mean (hectares)
202	18000	2992.97

Description of farm production

It is shown in Table 7.8 that most of the survey respondents (78.4%) produce a mix of livestock and crops and that there were relatively few respondents who only produce wool (5.9%). The implication of this is that many of the survey respondents may have experience selling grain by forward contract, but not necessarily have the same experience with wool.

Table 7.8: Survey respondents by farm production type

Type of production system	Frequency	Percentage (%)
Livestock/crop mixed	239	78.4
Crops mainly	29	9.5
Sheep (wool mainly)	18	5.9
Sheep (meat mainly)	11	3.6
Sheep/beef mixed	8	2.6

Table 7.9 gives an indication of how many sheep are carried by respondents of the survey. Exactly 37% of respondents carry 2,000 to 4,000 sheep. This result is consistent with the findings of Curtis (2007) who found that the median number of sheep shorn per property in Western Australia during 2005/06 was 3,575. This is reassuring since the sample population attained in this survey is evidently consistent with recent similar surveys.

Table 7.9: Survey respondents by numbers of sheep per property

Sheep per property	Frequency	Percentage (%)
500-1000	27	8.9
1000-2000	66	21.6
2000-4000	113	37.0
4000-8000	76	24.9
8000-16000	22	7.2
> 16000	1	0.4

In the 2004/05 financial year there was an interesting distribution of bales of wool produced per farm; as shown in Table 7.10. The highest frequencies are relatively equal and fall between 50 and 200 bales per farm. Once again, this aligns with Curtis' (2007) survey that showed the median number of bales produced per farm was 84 (in the 2005/06 financial year) and provides evidence to suggest that the present survey is a reasonable representation of the entire population of Western Australian wool producers.

Table 7.10: Survey respondents by number of wool bales per property

Bales per farm	Frequency	Percentage (%)
< 20	6	2.0
20-50	44	14.5
50-80	73	23.9
80-120	76	24.9
120-200	73	23.9
200-300	22	7.2
> 300	11	3.6

Finally, in terms of production demographics, Table 7.11 shows that most wool produced by the survey respondents is of medium quality (19.5 – 23.5 μm). It is this range of wool types that have historically sought the highest prices without incurring the high production costs associated with super-fine wool production (ABARE 2005).

Table 7.11: Survey respondents by wool average fibre diameter production

Micron (µm)	Frequency	Percentage (%)
< 19.5	31	10.1
19.6-23.5	272	89.1
> 23.6	2	0.8

Earnings from wool production

Table 7.12 demonstrates that most respondents (45.2%) receive about 20% of their income from wool production. Further to this, 26.2% of respondents earn about 40% of their income from wool production, while 17.7% earn less than 10% from wool production.

Table 7.12: Survey respondents by earnings from wool production

Earnings from wool production	Frequency	Percentage (%)
< 10%	54	17.7
About 20%	138	45.2
About 40%	80	26.2
About 60%	23	7.5
> 70%	10	3.4

Use of forward contracts

Table 7.13 shows the experience of using forward contract adoption by the sample population. Some 55% of the sample population have used forward contracts to sell grain whereas only about 24% have used them to sell wool. At least 34% of respondents have no experience with using forward contracts. Some additional information about the use of forward contracts within the sample population is displayed in Table 7.14. It can be seen that just over 75% of survey respondents always use the auction system to sell their wool while 80% never use forward contracts. So, while forward contracts are used by Western Australian farmers, there is evidence from this research to suggest that forward contracts for selling wool are not common.

Table 7.13: Survey respondents' experience with using forward contracts

Experience with forward contracts	Frequency	Percentage (%)
Wool	73	23.9
Grain	168	55.1
Livestock	74	24.3
No experience	105	34.4

Table 7.14: Survey respondents' frequency of using and auction and forward contracts

Selling method	Always use (% of sample)	Never use (% of sample)
Auction	75.1	6.6
Forward contact	1.3	80.0

7.4. Selection of Estimation Method

7.4.1. Estimation Methods

The hypotheses discussed in Section 6.2 were developed based on the model for this research (Figure 5.2, Section 5.4.2). Data were analysed using SEM, specifically, PLSgraph software. SEM, the chosen statistical tool for this research, is a second-generation multivariate data analysis technique that allows the simultaneous assessment of reliability and validity whilst also estimating the relationships among constructs (Barclay, Higgins & Thompson 1995). Barclay, Higgins and Thompson (1995, p. 288) outline the three main advantages of SEM:

1. It permits the assessment of measurement properties of constructs within different theoretical contexts in which they are embedded.
2. It deals explicitly with measurement error.
3. It provides the benefit of simultaneous relationship analysis that is not available with first-generation techniques, such as multiple regressions, principle components analysis and cluster analysis.

This method of analysis is chosen for its ability to estimate multiple and interrelated dependence relationships and its function of representing unobserved concepts of such relationships (Hair et al. 1992). Further to these advantages SEM has been successfully

applied to agricultural-based studies in the past (see Tutkun & Lehmann 2006; McEachern & Warnaby 2005; Pennings & Leuthold 2001).

While there are several applications of SEM available, the partial least square (PLS) is used for this research for its orientation towards the predictive nature of the study. Chin, Marcolin and Newsted (1996) comment that this approach to SEM is gaining in popularity due to its success in dealing with models of which the data set does not have a normal distribution or the sample size might be uncharacteristically small. Examples of research that have successfully used PLS to develop models from small to medium sample sizes include Quaddus (2004) which used 129 valid survey responses, Chin, Marcolin and Newsted (1996) which used 250 valid survey responses and Barclay, Higgins and Thompson (1995) which used 270 valid responses.

In another publication Chin (1998b, p. ix) describes PLS as a way around the problem of all measures having to be 'reflective', and thus consistent, with the statistical algorithm "that assumes that the correlations among indicators for a particular latent variable are caused by that latent variable". Such a problem, Chin says, is experienced by many psychological and sociological researchers.

Finally, PLS is the chosen data analysis tool for this research because of the developmental, and thus predictive, nature of the study. In this research, the first aim is to develop a behavioural model of wool producers' intentions to adopt the use of forward contract. While the model has a strong theoretical basis, this study is considering the predictive power of the behavioural model and explores the causal relationships associated with using forward contracts to sell wool. It is for this reason that the PLS approach to SEM is being used (Barclay, Higgins & Thompson 1995). On the other hand, if the study aimed to confirm the application of the TRA/TPB/Diffusion theory in the agribusiness domain, the LISREL or AMOS approach to SEM would have been more appropriate.

7.4.2. Sample Size

Two sources clearly specify the sample size requirement for a PLS study. Gefen, Straub and Boudreau (2000) state that the sample size requirement should be at least 10 times the number of items within the most complex, formative construct of the model. According to this rule, the minimum sample size for this research would need to be 180 data points ($n = 180$ items related to factors internal to the farm business $\times 10$). Barclay, Higgins and

Thompson (1995) and Chin (1998a) provide the preferred rule of thumb for determining sample size. These authors state that sample size must be either 10 times the indicators within the most complex formative construct of the model or 10 times “the largest number of antecedent constructs leading to an endogenous construct as predictor in an [ordinary least squares] regression.” (Barclay, Higgins & Thompson 1995, p. 292).

A professional marketing company was employed to administer a telephone survey of randomly-selected Western Australian wool producers in May 2006. The pilot survey, detailed in Section 7.2, was conducted in order to ensure the validity of the survey. The final survey yielded 310 valid responses. The only requirements of respondents were that, at the time of the survey, they were primary producers, had a flock of at least 700 adult sheep and were commercial wool producers.

Given the aforementioned sample size specifications of Gefen, Straub and Boudreau (2000) and Barclay Higgins and Thompson (1995), there is sufficient evidence to suggest that the desired the sample size of 310 is more than enough to satisfy the requirements of a robust PLS model.

7.4.3. Data Examination

Prior to data analysis, it is good practice to clean the data in order to eliminate any outlying samples that may produce erroneous results (Alreck & Settle 1995). The entire data set was scanned on a line-by-line basis to seek out errors in the form of missing data, superfluous data or disordered records. Upon reviewing the data for such outlying records, five records were identified as outliers and thus deleted due to irrational responses given to particular questions. As a result of data examination, 305 valid responses were used for analysis of the model.

In the early stages of data analysis it is common for descriptive statistics to be drawn from data sets to test for normality. However, since there is no requirement for a normally distributed data set for PLS analysis (Chin, Marcolin & Newsted 1996), tests for normality such as skewness, kurtosis and the Kolmogorov-Smirnov test are not necessary.

A total of 82 items were initially used in this behavioural model. Two exogenous variables were used (‘factors external to the farm business’ [‘EFB’] which consists of the influence of the Australian wool industry [AW1-6 {refer to Section 6.3.2.1 for details on these abbreviations}] and ‘factors internal to the farm business’ [IFB] which consists of

the influence of farm-factors [FF1-5] and farmer-specific details [FS3-8]) and 11 endogenous variable in the behavioural model. Of these 13 variables, there are nine 'reflective' (a total of 47 items) and four formative constructs (a total of 35 items) used; each of which has an associated number of indicators attached. 'Reflective' indicators (RA1-8, CB1-3, CX1-7, AP_Ref11-3, RK1-6, SE1-4, SU1-4, SN1-4 and IN1-8) are described by Chin (1998a, p. 305) as commonly used latent variables that measure "the same underlying phenomenon" whereas 'formative' indicators (EFB, IFB, AP_Form1-4 and AS1-4) do not measure the same underlying phenomenon and cannot be assumed to correlate. Following the advice of Kline (1998) and Rahim, Antonioni & Psenicka (2001), it should be noted that a minimum of two indicators per variable was used in the questionnaire.

7.5. Model Assessment

7.5.1. Two-step Model Assessment Structure

Many authors discuss the two-step analytical method of SEM (Figure 7.1). A measurement model is first developed to describe the relationship between latent constructs and their manifest indicators, this is followed by a structural model being developed to describe the relationship between latent constructs (Barclay, Higgins & Thompson 1995; Santosa, Wei & Chan 2005; Quaddus & Achjari 2005; Gefen, Straub & Boudreau 2000; Hair et al. 1998; Igbaria et al. 1997; Schumacker & Lomax 1996; Hair et al. 1992).

Within each of these two steps, several sub-steps are carried out to ensure that a statistically robust, valid and reliable model is developed. Barclay Higgins and Thompson (1995) describe these sub-steps in great detail. They specify a series of minimum criteria which must be met at each stage of analysis; these criteria are illustrated in Figure 7.1 but will be detailed in subsequent sections of this chapter. The method used by Barclay, Higgins and Thompson has been adopted by numerous researchers (Lee 2006; Hofmeyer 2005; Santosa, Wei & Chan 2005; Gefen, Straub & Boudreau 2000; Chin & Newsted 1999; Chin 1998a) for its depth of research and clarity of method. It is therefore the preferred method for the data analysis of this study.

7.5.1.1. Assessment of the measurement model

The aim of assessing the measurement properties is to test for item reliability, internal consistency and discriminant validity (Santosa, Wei & Chan 2005); it therefore shows how well the measurement items describe their respective constructs (Hanlon 2001). Before proceeding with the data analysis, attention must be drawn to the exclusion of all ‘formative’ variables from the analysis of the model (EFB, IFB, AP_Form, AS¹⁰). The literature suggests that the “stand-alone” nature of ‘formative’ indicators dictates that while it is perfectly satisfactory to include them as influencing behavioural factors, their significance in a PLS model is not contributed to by their correlation values or levels of internal consistency (Bollen & Lennox 1991; Bagozzi 1994; Nunnally & Bernstein 1994; Barclay, Higgins & Thompson 1995; Chin 1998a&b; Gefen, Straub & Boudreau 2000; Diamantopoulos & Winklhofer 2001; Santosa, Wei & Chan 2005). Therefore, the analysis procedure of Barclay, Higgins and Thompson (1995) described below is only relevant to ‘reflective’ indicators and variables (RA, CB, CX, AP_Refl, RK, SE, SU, SN, IN¹¹ [see Section 6.3.2.1 for details]).

Item reliability

There are two steps involved with analysing the measurement model: convergent validity followed by discriminant validity. The first task in the analysis of a PLS model is to consider the model’s convergent validity using two measures: individual item reliability and internal consistency (Santosa, Wei & Chan 2005).

Individual item reliability is concerned with the output loadings, sometimes referred to as simple correlations. While Barclay, Higgins and Thompson (1995) specify that items with loadings less than 0.707 should be discarded, other authors cite literature in which a minimum of 0.4 is acceptable (Igbaria et al. 1997; Hair et al. 1998). The data showed that using 0.707 as the minimum criterion for items loadings would be difficult to maintain the more important rule of having two items per construct (Kline 1998; Rahim, Antonioni & Psenicka 2001), so a compromise was made and the minimum criterion for items

¹⁰ Where EFB = Factors external to the farm business, IFB = Factors internal to the farm business, AP_Form = Application (formative items), AS = Advisory services.

¹¹ Where RA = Relative advantage, CB = Compatibility, CX = Complexity, AP_Refl = Application (reflective items), RK = Risk, SE = Self-efficacy, SU = Support, SN = Subjective norms, IN = Intention.

loading used by Hanlon (2001) and Igbaria et al. (1997) of 0.5 was adopted. As a consequence, there were 14 items that failed to meet this criterion: RA1, CX 2, CX3, CX5, CX6, RK5, RK6, RK7, SE1, SU4, SN1, SN2, SN3 and SN4 (see Section 6.3.2.1 for the wording of each of these items).

Due to the predictive nature of this study, and many of the items being developed from scratch, each construct was tested using a large quantity of items with the expectation that many may not meet the aforementioned rule. Although 'relative advantage', 'complexity', 'risk' and 'subjective norms' are key constructs in many adoption models and show strong relationships with people's intentions to adopt an innovation (Rogers 1995; Ajzen & Fishbein 1980; Abadi Ghadim, Pannell & Burton 2005; Marra, Pannell & Abadi Ghadim 2003; Penning & Leuthold 2000; Fliegel & Kivlin 1962; Batz, Peters & Janssen 1999) some of the items within these constructs had to be omitted from the model. The aforementioned authors make persuasive arguments for items measuring 'relative advantage', 'complexity', 'risk' and 'subjective norms' to remain in such a behavioural model. However, since each construct contained the minimum quantity measurement items it was felt that the model would be served better if low loadings items were removed.

Similar logic applies to items that measure 'self-efficacy' and 'support', however, there is less literature to suggest that these constructs will significantly impact on intentions to adopt an innovation. The items of these constructs were principally drawn from the focus groups with their inclusion in the survey instrument justified by a limited amount of literature. It was therefore likely that some items used to measure 'self-efficacy' and 'support' would not meet the 0.5 minimum loading limit. Before deleting any items, checks were made against the questionnaire that their omission left no contradictions or illogical holes in the survey instrument.

Overall, the decision to remove items was based on intuitive sense and criteria specified by Hanlon (2001) and Igbaria et al. (1997). Of the 47 reflective items that were tested, 14 were discounted at this first stage of analysis, as shown earlier. Given the rules of Barclay, Higgins and Thompson (1995), this fraction of deletions is quite conservative. The researcher's decision to remove these items from the model was carried out with the knowledge that deleted items were unlikely to diminish the predictive power of the model, or weaken or change the associated constructs (Nunnally 1978). Furthermore, it

was certain that the model's reliability and validity would actually be improved in their absence.

When the revised model was re-run, the remaining 33 items all showed loadings of greater than 0.5 (Table 7.15). It should be noted at this point that since 'formative' constructs do not have any bearing on items loadings, only their weights are presented (Santosa, Wei & Chan 2005). The only questionable loading was SN6 (loading = 0.4923) which was considered to be close enough to 0.5 to remain as an item in the model. If SN6 had been deleted, only two items would have remained as a measure of 'subjective norms'. The minimum is said to be two items per construct, however reliability will be improved with additional items (Kline 1998; Rahim, Antonioni & Psenicka 2001).

Table 7.15: Assessment of item reliability

Construct	Item	Weight	Loading
External to the farm business# (EFB)	AW1	-0.0663	N/A
	AW2	0.1169	N/A
	AW3	0.1880	N/A
	AW4	0.2555	N/A
	AW5	0.4140	N/A
	AW6	0.9641	N/A
Internal to the farm business# (IFB)	FS3_1	0.1057	N/A
	FS3_2	0.6038	N/A
	FS3_3	0.1150	N/A
	FS3_4	-0.0062	N/A
	FS3_5	0.0104	N/A
	FS3_6	-0.1139	N/A
	FS3_7	-0.1622	N/A
	FF1	-0.2559	N/A
	FF2	0.1188	N/A
	FF3	0.2011	N/A
	FF4	0.0991	N/A
	FS4	0.1808	N/A
	FS5	0.1499	N/A
	FS6	0.2224	N/A
	FS7	0.4214	N/A
	FS8	0.0283	N/A
	FF7	0.0177	N/A
Relative advantage (RA)	RA2	N/A	0.7743
	RA3	N/A	0.8039
	RA4	N/A	0.6728
	RA5	N/A	0.7273
	RA6	N/A	0.8632
	RA7	N/A	0.7356
	CB1	N/A	0.9296
Compatibility (CB)	CB2	N/A	0.9218
	CB3	N/A	0.8224
	CX1	N/A	0.5073
Complexity (CX)	CX4	N/A	0.8553

... continued next page

Table 7.15 (continued)

	CX7	N/A	0.7926
AP_Formative# (AP_Form)	AP1	0.4712	N/A
	AP2	0.2712	N/A
	AP3	0.3334	N/A
	AP4	0.2592	N/A
AP_Reflective (AP_Refl)	AP5	N/A	0.6372
	AP6	N/A	0.8772
	AP7	N/A	0.8015
Risk (RK)	RK1	N/A	0.6148
	RK2	N/A	0.7328
	RK3	N/A	0.8355
	RK4	N/A	0.7954
Self-efficacy (SE)	SE2	N/A	0.6472
	SE3	N/A	0.8780
	SE4	N/A	0.6109
Support (SU)	SU1	N/A	0.8586
	SU2	N/A	0.7402
	SU3	N/A	0.8000
Subjective norms (SN)	SN5	N/A	0.7411
	SN6	N/A	0.4923
	SN7	N/A	0.8519
Advisory services# (AS)	AS1_1	0.2230	N/A
	AS1_2	0.3001	N/A
	AS1_3	0.4727	N/A
	AS1_4	-0.0176	N/A
	AS1_5	0.1785	N/A
	AS2	0.6021	N/A
	AS3	0.2750	N/A
	AS4	-0.1046	N/A
Intention (IN)	IN1	N/A	0.8146
	IN2	N/A	0.8478
	IN3	N/A	0.7739
	IN4	N/A	0.8724
	IN5	N/A	0.8675
	IN6	N/A	0.8738
	IN7	N/A	0.6437
	IN8	N/A	0.6684

formative constructs therefore values not interpreted, N/A = Not applicable

This analysis concluded that all items loaded adequately on their respective construct. This was particularly impressive since many of the items were newly developed for this study and had thus not been tested in previous research. The other conclusion to be drawn from this finding is that items from the theoretical frameworks utilised were highly reliable: loadings of ‘relative advantage’ ranged from 0.67 to 0.86, loadings of ‘compatibility’ ranged from 0.82 to 0.93 and loadings of ‘intention’ ranged from 0.64 to 0.87.

Internal consistency

Internal consistency, the second reliability measure of the first sub-step of PLS analysis, was developed by Fornell and Larcker (1981). This measure is considered to be superior to the traditional measure of consistency (Cronbach's alpha) because it is not influenced by the number of indicators (Hanlon 2001). Equation 1 is the formula for how internal consistency is calculated:

$$\text{Internal consistency} = \frac{(\sum \lambda_{yi})^2}{(\sum \lambda_{yi})^2 + \sum \text{Var}(\varepsilon_i)} \quad \text{Equation 1}$$

Where λ = component loading to an indicator, y = construct, i = item, $\text{Var}(\varepsilon_i) = 1 - \lambda_{yi}^2$

Using Equation 1, all constructs were tested for internal consistency with the minimum value of 0.7 (as suggested by Igbaria et al. 1997; Barclay, Higgins & Thompson 1995). Table 7.16 shows that all constructs met this criterion. Of the 'reflective' constructs, 'subjective norms' had the lowest internal consistency of 0.746 while 'intention' had the highest of 0.934. Most constructs had an internal consistency of about 0.8.

Although Average Variance Extracted (AVE) is not a measure of convergent validity, it is prudent to note the work of Fornell and Larcker (1981) at this point because they specify that AVE should be at least 0.5 for convergent validity to be satisfied. Table 7.16 shows this test of convergent validity is met by all 'reflective' constructs.

Table 7.16: Assessment of internal consistency and AVE

Construct	Internal consistency	AVE
External to the farm business# (EFB)	N/A	N/A
Internal to the farm business# (IFB)	N/A	N/A
Relative advantage (RA)	0.894	0.586
Compatibility (CB)	0.921	0.797
Complexity (CX)	0.771	0.539
AP_Formative# (AP_Form)	N/A	N/A
AP_Reflective (AP_Refl)	0.819	0.606
Risk (RK)	0.835	0.561
Self-efficacy (SE)	0.760	0.521
Support (SU)	0.843	0.642
Subjective norms (SN)	0.746	0.506
Advisory services# (AS)	N/A	N/A
Intention (IN)	0.934	0.640

= formative indicators therefore values not interpreted, N/A = Not applicable

Discriminant validity

The final measure is to test for discriminant validity at the indicator and construct level using Average Variance Extracted (AVE), as suggested by Fornell and Larcker (1981). Barclay, Higgins and Thompson (1995) describe discriminant validity as the degree to which any given construct is different from any other. Discriminant validity is assessed by AVE and comparing it with the inter-construct correlation. The AVE is calculated using Equation 2.

$$\text{Average variance extracted (AVE)} = \frac{\sum \lambda_{yi}^2}{\sum \lambda_{yi}^2 + \sum \text{Var}(\varepsilon_i)} \quad \text{Equation 2}$$

Where λ = component loading to an indicator, y = construct, i = item, $\text{Var}(\varepsilon_i) = 1 - \lambda_{yi}^2$

The literature recommended that these tests are best tabulated, as in Table 7.17, because the off-diagonal elements (correlation of latent variables) must be less-than or equal to the bolded, diagonal elements (square root of the average variance explained) in the corresponding rows and columns (Igbaria et al. 1997; Barclay, Higgins & Thompson 1995; Gefen, Straub & Boudreau 2000). In this study, the assessment of discriminant validity does not reveal any major problems because the bolded, diagonal values are greater than the off-diagonal correlation values in their corresponding rows and columns. For this reason no further items needed to be rejected from the model.

Table 7.17: Correlation of latent variables and the square root of AVE

	RA	CB	CX	AP_Refl	RK	SE	SU	SN	IN
RA	0.945 †								
CB	0.533	0.959							
CX	0.598	0.448	0.878						
AP_Refl	0.390	0.451	0.373	0.905					
RK	-0.108	-0.040	-0.076	0.139	0.914				
SE	0.471	0.371	0.459	0.301	0.158	0.872			
SU	0.498	0.363	0.389	0.240	-0.001	0.485	0.918		
SN	0.555	0.526	0.449	0.476	0.044	0.505	0.441	0.864	
IN	0.600	0.531	0.414	0.314	-0.224	0.358	0.418	0.585	0.966

† Bolded diagonal elements are the square root of AVE

Testing discriminant validity requires a further analytical procedure: loadings and cross loadings of measures to test at the item level. Barclay, Higgins and Thompson (1995) and Gefen, Straub and Boudreau (2000) specify that, within the cross-loading matrix (Table 7.18), the loading of items within a construct (shown in columns) should be

greater than the loading of any other item within the same column. At this stage of analysis it was found that SN6 with a loading of 0.492 did not meet this criterion as there were several items that had loadings higher than this within the SN column of the matrix (e.g. IN1, IN2).

Because there were only three items measuring 'subjective norms', the researcher was wary of deleting SN6. While 'subjective norms' are an important construct within a TPB model (Beedell & Rehman 1999 & 2000; Ajzen 1991; Ajzen & Fishbein 1973; Pennings & Leuthold 2000 & 2001; Burton 2004), this was the second instance of the 'subjective norm' indicators being questioned (see page 135). The researcher thus felt it was important to reconsider the value of this item for measuring 'subjective norms' in the present model by reviewing the items used to measure 'subjective norms'. From this exercise it made intuitive sense to replace both SN6 and SN7 with SN2 and SN4. This decision was made because SN2 and SN4 seemed to have more positive connotations in terms of the subjective norms associated with using forward contracts to sell wool (see Appendix 2). Once these items were replaced with SN2 and SN4, all items loaded higher on themselves than on any other construct therefore satisfying all the criteria outlined thus far. As a result, items to measure 'subjective norms' from this point will be: SN2 (loading = 0.537) , SN4 (loading = 0.779) and SN5 (loading = 0.801), as shown in Table 7.21.

With these changes, the model now demonstrates both convergent and discriminant validity. The changes made showed great differences in the results of the reliability and validity tests discussed thus far; minor differences were noted for other items and constructs. Table 7.19 shows the revised loadings and internal consistency, Table 7.20 shows the revised correlation matrix and Table 7.21 shows the revised cross-loading matrix.

Table 7.18: Loading and cross loading matrix

	EFB#	IFB#	RA	CB	CX	AP_Form#	AP_Ref	RK	SE	SU	SN	AS#	IN
AW1	-0.102	-0.079	-0.111	-0.044	-0.092	-0.099	0.078	0.206	0.081	-0.068	-0.061	-0.103	-0.215
AW2	0.211	-0.120	0.025	0.057	0.143	0.050	0.118	0.109	0.091	0.041	0.082	-0.055	-0.042
AW3	0.444	0.202	0.109	0.135	0.027	0.255	0.151	0.158	0.138	0.209	0.272	0.102	0.178
AW4	0.255	0.107	0.038	0.085	0.032	0.165	0.117	0.130	0.073	0.076	0.093	0.002	0.048
AW5	0.414	0.160	0.181	0.131	0.128	0.217	0.057	0.058	0.105	0.150	0.197	0.085	0.201
AW6	0.964	0.223	0.423	0.323	0.296	0.378	0.288	0.058	0.280	0.341	0.459	0.179	0.346
FS3_1	0.004	-0.013	-0.020	-0.084	-0.012	0.083	-0.033	0.127	0.127	0.002	-0.033	-0.018	-0.119
FS3_2	0.070	0.621	0.285	0.264	0.178	0.064	0.018	-0.252	0.091	0.146	0.173	0.202	0.505
FS3_3	0.100	0.398	0.138	0.080	0.119	0.013	0.039	-0.033	0.137	0.148	0.099	0.191	0.250
FS3_4	0.045	0.084	0.022	0.063	-0.025	-0.074	-0.129	-0.028	0.011	0.065	0.028	0.092	0.056
FS3_5	-0.011	0.191	0.075	0.175	0.038	-0.112	-0.020	-0.131	0.056	0.008	0.071	0.074	0.121
FS3_6	-0.046	0.127	0.078	0.140	0.040	-0.030	0.006	-0.173	-0.090	0.023	0.065	0.011	0.254
FS3_7	0.045	-0.079	0.000	0.047	-0.001	-0.012	0.023	0.016	-0.144	-0.074	0.002	-0.013	0.072
FF1	0.051	0.231	0.090	0.139	-0.008	0.057	0.037	0.075	0.040	0.024	0.076	0.137	0.041
FF2	0.104	0.292	0.132	0.166	0.007	0.057	0.035	0.031	0.012	0.030	0.145	0.140	0.121
FF3	0.086	0.425	0.122	0.068	0.029	0.207	0.068	0.083	0.162	0.127	0.148	0.198	0.109
FF4	0.045	0.362	0.109	0.108	0.014	0.158	0.079	0.070	0.137	0.098	0.089	0.173	0.102
FS4	0.123	0.447	0.156	0.133	0.162	0.101	0.060	-0.002	0.094	0.111	0.073	0.238	0.163
FS5	0.083	0.444	0.151	0.132	0.066	0.155	-0.065	-0.035	0.131	0.167	0.098	0.187	0.028
FS6	0.234	0.448	0.136	0.154	0.036	0.218	0.061	-0.009	0.137	0.117	0.112	0.183	0.081
FS7	0.182	0.562	0.246	0.164	0.123	0.072	0.078	0.063	0.167	0.218	0.188	0.172	0.176
FS8	0.076	-0.037	-0.052	0.033	0.068	-0.009	0.010	0.157	0.020	0.018	-0.003	-0.073	-0.044
FF7	0.013	0.018	-0.034	0.029	0.046	-0.064	0.003	-0.061	0.062	-0.084	0.051	0.022	-0.011
RA2	0.254	0.301	0.774	0.395	0.468	0.313	0.287	-0.144	0.322	0.381	0.394	0.267	0.444
RA3	0.293	0.276	0.804	0.390	0.444	0.327	0.275	-0.070	0.362	0.413	0.391	0.242	0.445
RA4	0.255	0.278	0.673	0.275	0.464	0.457	0.192	0.088	0.390	0.333	0.341	0.116	0.355
RA5	0.337	0.322	0.727	0.459	0.428	0.343	0.318	-0.049	0.387	0.356	0.467	0.299	0.482
RA6	0.394	0.310	0.863	0.507	0.507	0.377	0.369	-0.106	0.392	0.428	0.457	0.249	0.497
RA7	0.340	0.285	0.736	0.386	0.440	0.399	0.320	-0.180	0.315	0.368	0.472	0.219	0.507
CB1	0.356	0.280	0.561	0.930	0.443	0.388	0.430	-0.073	0.372	0.392	0.540	0.245	0.534
CB2	0.292	0.280	0.474	0.922	0.390	0.292	0.367	-0.072	0.316	0.316	0.448	0.222	0.469
CB3	0.221	0.229	0.371	0.822	0.359	0.292	0.413	0.059	0.301	0.246	0.408	0.224	0.405
CX1	0.169	0.049	0.340	0.236	0.507	0.373	0.296	0.145	0.308	0.202	0.274	0.083	0.203
CX4	0.247	0.202	0.541	0.414	0.855	0.378	0.300	-0.141	0.376	0.358	0.413	0.174	0.422
CX7	0.230	0.222	0.408	0.305	0.793	0.392	0.247	-0.082	0.334	0.271	0.283	0.130	0.240
AP1	0.246	0.185	0.456	0.312	0.453	0.796	0.305	0.082	0.367	0.331	0.379	0.167	0.378
AP2	0.341	0.118	0.237	0.226	0.322	0.656	0.208	0.122	0.208	0.133	0.247	0.049	0.179
AP3	0.350	0.155	0.334	0.292	0.303	0.807	0.300	0.222	0.361	0.287	0.381	0.120	0.290
AP4	0.346	0.183	0.344	0.234	0.394	0.686	0.211	0.257	0.554	0.331	0.344	0.264	0.178
AP5	0.168	0.029	0.175	0.196	0.121	0.210	0.637	0.131	0.163	0.165	0.245	0.032	0.108
AP6	0.313	0.101	0.411	0.407	0.424	0.352	0.877	0.077	0.296	0.224	0.443	0.119	0.305
AP7	0.191	0.018	0.263	0.400	0.237	0.239	0.801	0.145	0.216	0.166	0.381	0.159	0.266
RK1	0.191	-0.025	0.002	0.032	0.016	0.237	0.135	0.615	0.201	0.104	0.135	0.029	-0.061
RK2	0.102	-0.034	-0.085	-0.037	-0.075	0.219	0.130	0.733	0.123	-0.012	0.055	-0.034	-0.163
RK3	0.031	-0.136	-0.087	-0.023	-0.091	0.138	0.107	0.836	0.132	-0.006	0.017	-0.056	-0.194
RK4	0.002	-0.079	-0.130	-0.073	-0.057	0.083	0.061	0.795	0.050	-0.054	-0.036	-0.076	-0.225
SE2	0.231	0.109	0.312	0.324	0.287	0.299	0.413	0.201	0.647	0.268	0.416	0.102	0.247
SE3	0.207	0.261	0.434	0.319	0.435	0.444	0.203	0.034	0.878	0.499	0.431	0.264	0.383
SE4	0.201	0.281	0.245	0.142	0.236	0.307	0.036	0.162	0.611	0.223	0.226	0.219	0.083
SU1	0.335	0.279	0.450	0.298	0.295	0.232	0.185	-0.060	0.349	0.859	0.332	0.205	0.370
SU2	0.261	0.239	0.391	0.293	0.342	0.460	0.149	0.080	0.540	0.740	0.373	0.233	0.343
SU3	0.261	0.205	0.344	0.279	0.302	0.207	0.250	-0.016	0.270	0.800	0.363	0.138	0.282
SN5	0.376	0.203	0.408	0.354	0.341	0.478	0.357	0.125	0.552	0.359	0.741	0.203	0.396
SN6	0.343	0.069	0.206	0.205	0.142	0.276	0.285	0.276	0.230	0.134	0.492	0.060	0.182
SN7	0.367	0.259	0.496	0.491	0.402	0.280	0.386	-0.110	0.307	0.379	0.852	0.264	0.558
AS1_1	0.024	0.126	0.085	0.023	0.024	0.093	0.003	-0.023	0.123	0.081	0.047	0.351	0.113
AS1_2	0.024	0.060	0.136	0.082	0.072	0.108	-0.037	0.037	0.135	0.093	0.111	0.278	0.135
AS1_3	0.065	0.184	0.148	0.109	0.068	0.117	0.148	-0.081	0.125	0.144	0.122	0.607	0.236
AS1_4	-0.033	0.004	0.077	-0.089	0.066	0.051	0.048	-0.061	0.030	0.040	-0.063	0.037	0.022
AS1_5	-0.042	-0.069	-0.139	-0.041	-0.071	-0.162	0.026	-0.016	-0.186	-0.082	-0.093	-0.257	-0.110
AS2	0.173	0.310	0.193	0.227	0.141	0.075	0.079	-0.017	0.137	0.133	0.234	0.727	0.178
AS3	0.163	0.213	0.258	0.162	0.148	0.203	0.100	0.007	0.322	0.203	0.191	0.513	0.132
AS4	0.040	0.001	-0.167	-0.005	-0.125	-0.199	-0.050	0.105	-0.109	-0.081	0.006	-0.185	-0.138
IN1	0.415	0.403	0.617	0.476	0.390	0.439	0.352	-0.116	0.424	0.442	0.604	0.277	0.815
IN2	0.437	0.371	0.625	0.485	0.406	0.412	0.329	-0.181	0.443	0.450	0.600	0.293	0.848
IN3	0.252	0.314	0.365	0.416	0.291	0.209	0.191	-0.231	0.173	0.236	0.423	0.184	0.774
IN4	0.201	0.393	0.435	0.445	0.293	0.185	0.204	-0.242	0.190	0.268	0.449	0.242	0.872
IN5	0.181	0.390	0.439	0.398	0.277	0.210	0.179	-0.238	0.226	0.261	0.424	0.268	0.867
IN6	0.193	0.418	0.446	0.413	0.312	0.234	0.196	-0.245	0.213	0.254	0.424	0.307	0.874
IN7	0.279	0.281	0.335	0.357	0.251	0.230	0.291	-0.061	0.239	0.292	0.335	0.215	0.644
IN8	0.272	0.221	0.478	0.370	0.389	0.368	0.234	-0.114	0.295	0.412	0.387	0.208	0.668

= formative constructs, therefore loadings are not interpreted

Table 7.19: Revised assessment of item reliability and internal consistency

Construct	Item	Loading	Internal consistency	AVE
Relative advantage (RA)	RA2	0.7743	0.894	0.586
	RA3	0.8046		
	RA4	0.6736		
	RA5	0.7262		
	RA6	0.8631		
	RA7	0.7355		
	CB1	0.9299		
Compatibility (CB)	CB2	0.9217	0.921	0.797
	CB3	0.8220		
	CX1	0.5113		
Complexity (CX)	CX4	0.8534	0.776	0.539
	CX7	0.7922		
	AP5	0.6376		
AP_Reflective (AP_Refl)	AP6	0.8773	0.819	0.606
	AP7	0.8011		
	RK1	0.6098		
Risk (RK)	RK2	0.7307	0.835	0.561
	RK3	0.8365		
	RK4	0.7995		
	SE2	0.6449		
Self-efficacy (SE)	SE3	0.8776	0.761	0.521
	SE4	0.6142		
	SU1	0.8576		
Support (SU)	SU2	0.7415	0.843	0.642
	SU3	0.7997		
	SN2	0.5375		
Subjective norms (SN)	SN4	0.7791	0.843	0.642
	SN5	0.8009		
	IN1	0.8184		
Intention (IN)	IN2	0.8501	0.933	0.639
	IN3	0.7699		
	IN4	0.8681		
	IN5	0.8635		
	IN6	0.8703		
	IN7	0.6486		
	IN8	0.6727		

Table 7.20: Revised correlation of latent variables and the square root of AVE

	RA	CB	CX	AP_Refl	RK	SE	SU	SN	IN
RA	0.765†								
CB	0.533	0.892							
CX	0.599	0.448	0.734						
AP_Refl	0.390	0.451	0.373	0.778					
RK	-0.109	-0.040	-0.076	0.138	0.749				
SE	0.471	0.371	0.459	0.300	0.157	0.722			
SU	0.498	0.363	0.390	0.240	-0.002	0.485	0.801		
SN	0.398	0.379	0.363	0.438	0.144	0.517	0.372	0.715	
IN	0.602	0.531	0.416	0.316	-0.223	0.360	0.421	0.431	0.799

† Bolded diagonal elements are the square root of AVE

Table 7.21: Revised loading and cross-loading matrix

	EFB#	IFB#	RA	CB	CX	AP_Form#	AP_RefI	RK	SE	SU	SN	AS#	IN
AW1	-0.103	-0.071	-0.111	-0.044	-0.091	-0.099	0.078	0.205	0.081	-0.068	-0.053	-0.104	-0.215
AW2	0.210	-0.114	0.025	0.057	0.143	0.050	0.118	0.109	0.091	0.041	0.083	-0.059	-0.041
AW3	0.444	0.212	0.108	0.135	0.027	0.255	0.151	0.157	0.138	0.209	0.230	0.096	0.179
AW4	0.255	0.114	0.038	0.085	0.032	0.164	0.117	0.130	0.073	0.076	0.128	0.000	0.050
AW5	0.414	0.161	0.181	0.131	0.128	0.217	0.057	0.058	0.105	0.150	0.206	0.080	0.203
AW6	0.964	0.221	0.423	0.323	0.296	0.378	0.288	0.057	0.280	0.341	0.367	0.178	0.348
FS3_1	0.004	0.029	-0.020	-0.084	-0.011	0.083	-0.033	0.127	0.127	0.002	0.041	-0.011	-0.117
FS3_2	0.070	0.577	0.284	0.264	0.177	0.063	0.018	-0.252	0.092	0.146	0.115	0.199	0.503
FS3_3	0.100	0.387	0.138	0.080	0.119	0.013	0.039	-0.033	0.137	0.148	0.090	0.189	0.249
FS3_4	0.045	0.085	0.022	0.063	-0.026	-0.073	-0.129	-0.029	0.010	0.065	0.042	0.090	0.056
FS3_5	-0.011	0.166	0.075	0.175	0.037	-0.112	-0.020	-0.131	0.056	0.008	0.042	0.067	0.120
FS3_6	-0.046	0.106	0.078	0.140	0.040	-0.031	0.006	-0.173	-0.090	0.023	0.041	0.010	0.252
FS3_7	0.045	-0.099	0.000	0.047	-0.001	-0.012	0.023	0.016	-0.144	-0.074	-0.039	-0.016	0.072
FF1	0.051	0.199	0.089	0.139	-0.008	0.057	0.037	0.076	0.040	0.024	0.008	0.134	0.041
FF2	0.104	0.247	0.131	0.166	0.007	0.057	0.035	0.031	0.012	0.030	0.045	0.136	0.121
FF3	0.086	0.440	0.122	0.068	0.029	0.208	0.068	0.083	0.163	0.127	0.173	0.199	0.110
FF4	0.045	0.394	0.109	0.108	0.014	0.158	0.079	0.070	0.137	0.099	0.161	0.177	0.103
FS4	0.123	0.462	0.156	0.133	0.162	0.101	0.060	-0.001	0.094	0.111	0.133	0.236	0.163
FS5	0.083	0.434	0.151	0.132	0.066	0.155	-0.065	-0.034	0.132	0.167	0.089	0.186	0.029
FS6	0.234	0.463	0.136	0.154	0.036	0.218	0.061	-0.009	0.138	0.117	0.158	0.179	0.082
FS7	0.182	0.566	0.246	0.164	0.123	0.072	0.078	0.063	0.167	0.218	0.209	0.172	0.176
FS8	0.075	-0.040	-0.052	0.033	0.068	-0.009	0.010	0.157	0.020	0.018	-0.016	-0.077	-0.044
FF7	0.013	-0.020	-0.035	0.029	0.046	-0.064	0.003	-0.061	0.062	-0.084	-0.032	0.016	-0.010
RA2	0.254	0.294	0.774	0.396	0.468	0.314	0.287	-0.145	0.321	0.381	0.248	0.271	0.445
RA3	0.293	0.278	0.805	0.390	0.445	0.327	0.275	-0.071	0.362	0.413	0.310	0.245	0.447
RA4	0.255	0.281	0.674	0.275	0.464	0.458	0.191	0.087	0.391	0.333	0.308	0.118	0.357
RA5	0.337	0.304	0.726	0.459	0.427	0.343	0.318	-0.049	0.387	0.356	0.331	0.298	0.483
RA6	0.394	0.302	0.863	0.507	0.507	0.377	0.369	-0.106	0.392	0.428	0.306	0.253	0.499
RA7	0.340	0.277	0.736	0.386	0.440	0.400	0.320	-0.181	0.315	0.368	0.320	0.221	0.508
CB1	0.357	0.267	0.560	0.930	0.443	0.388	0.430	-0.073	0.371	0.392	0.362	0.243	0.535
CB2	0.292	0.264	0.474	0.922	0.390	0.292	0.367	-0.072	0.316	0.316	0.320	0.217	0.469
CB3	0.221	0.213	0.371	0.822	0.359	0.292	0.413	0.058	0.300	0.246	0.335	0.217	0.406
CX1	0.169	0.056	0.341	0.236	0.511	0.373	0.296	0.145	0.308	0.202	0.252	0.088	0.204
CX4	0.247	0.191	0.541	0.414	0.853	0.378	0.300	-0.142	0.376	0.358	0.321	0.174	0.423
CX7	0.230	0.221	0.408	0.305	0.792	0.391	0.247	-0.082	0.334	0.271	0.226	0.131	0.241
AP1	0.246	0.197	0.456	0.312	0.454	0.797	0.305	0.081	0.367	0.331	0.333	0.173	0.379
AP2	0.341	0.123	0.237	0.226	0.322	0.651	0.208	0.121	0.208	0.133	0.248	0.053	0.181
AP3	0.350	0.175	0.334	0.292	0.304	0.810	0.300	0.221	0.361	0.287	0.424	0.121	0.292
AP4	0.346	0.193	0.344	0.234	0.395	0.686	0.211	0.256	0.555	0.331	0.411	0.265	0.180
AP5	0.167	0.042	0.175	0.196	0.121	0.210	0.638	0.131	0.163	0.165	0.250	0.032	0.110
AP6	0.313	0.104	0.411	0.407	0.424	0.352	0.877	0.077	0.295	0.224	0.405	0.120	0.308
AP7	0.191	0.019	0.262	0.400	0.238	0.239	0.801	0.144	0.215	0.166	0.340	0.159	0.267
RK1	0.191	-0.009	0.002	0.032	0.017	0.238	0.135	0.610	0.201	0.104	0.269	0.028	-0.060
RK2	0.102	-0.017	-0.085	-0.037	-0.074	0.220	0.130	0.731	0.123	-0.012	0.157	-0.037	-0.162
RK3	0.031	-0.123	-0.087	-0.023	-0.090	0.139	0.107	0.837	0.132	-0.006	0.093	-0.059	-0.192
RK4	0.002	-0.071	-0.130	-0.073	-0.056	0.083	0.062	0.799	0.051	-0.054	0.049	-0.077	-0.223
SE2	0.231	0.117	0.312	0.324	0.288	0.300	0.413	0.200	0.645	0.268	0.379	0.102	0.249
SE3	0.207	0.270	0.434	0.319	0.435	0.444	0.203	0.033	0.878	0.499	0.457	0.268	0.385
SE4	0.201	0.289	0.245	0.142	0.236	0.307	0.036	0.161	0.614	0.224	0.261	0.217	0.084
SU1	0.335	0.280	0.450	0.298	0.295	0.232	0.185	-0.061	0.348	0.858	0.255	0.206	0.372
SU2	0.261	0.249	0.391	0.293	0.342	0.461	0.149	0.079	0.540	0.742	0.368	0.233	0.345
SU3	0.261	0.209	0.345	0.279	0.302	0.208	0.250	-0.016	0.270	0.800	0.275	0.141	0.284
SN2	0.191	0.216	0.165	0.210	0.140	0.150	0.295	0.179	0.181	0.115	0.537	0.035	0.137
SN4	0.262	0.259	0.243	0.239	0.261	0.320	0.301	0.094	0.312	0.272	0.779	0.159	0.334
SN5	0.376	0.212	0.408	0.354	0.341	0.479	0.357	0.123	0.552	0.359	0.801	0.203	0.398
AS1_1	0.024	0.139	0.085	0.023	0.025	0.093	0.003	-0.023	0.123	0.081	0.061	0.373	0.114
AS1_2	0.024	0.061	0.136	0.082	0.073	0.108	-0.037	0.037	0.135	0.093	0.126	0.280	0.136
AS1_3	0.065	0.188	0.148	0.109	0.068	0.117	0.148	-0.081	0.125	0.144	0.059	0.614	0.236
AS1_4	-0.033	0.025	0.077	-0.089	0.066	0.051	0.048	-0.061	0.030	0.040	-0.014	0.069	0.023
AS1_5	-0.042	-0.075	-0.139	-0.041	-0.071	-0.162	0.026	-0.016	-0.186	-0.083	-0.131	-0.268	-0.111
AS2	0.173	0.303	0.193	0.227	0.141	0.075	0.079	-0.017	0.137	0.133	0.183	0.714	0.178
AS3	0.163	0.209	0.258	0.162	0.148	0.205	0.100	0.006	0.322	0.204	0.118	0.508	0.133
AS4	0.040	-0.010	-0.167	-0.005	-0.125	-0.200	-0.050	0.106	-0.109	-0.081	-0.055	-0.205	-0.139
IN1	0.415	0.396	0.616	0.477	0.390	0.440	0.352	-0.116	0.423	0.442	0.524	0.280	0.818
IN2	0.438	0.365	0.624	0.485	0.405	0.413	0.329	-0.182	0.443	0.450	0.468	0.295	0.850
IN3	0.252	0.295	0.365	0.416	0.291	0.209	0.191	-0.231	0.173	0.236	0.271	0.184	0.770
IN4	0.201	0.372	0.434	0.445	0.292	0.186	0.203	-0.242	0.190	0.268	0.273	0.243	0.868
IN5	0.181	0.370	0.439	0.398	0.277	0.211	0.179	-0.238	0.225	0.261	0.256	0.268	0.863
IN6	0.193	0.401	0.446	0.413	0.311	0.235	0.196	-0.246	0.212	0.255	0.260	0.307	0.870
IN7	0.279	0.271	0.335	0.357	0.251	0.231	0.291	-0.061	0.238	0.292	0.312	0.218	0.649
IN8	0.272	0.221	0.478	0.370	0.389	0.368	0.234	-0.115	0.295	0.412	0.298	0.211	0.673

= formative constructs, therefore loadings are not interpreted

7.5.1.2. Assessment of the structural model

Now that all the criteria have been met for assessing the measurement model, an assessment can be carried out on the structural model. Hanlon (2001) describes this as a comparison between the constructs within the model, whereas Barclay, Higgins and Thompson (1995) say that this step assesses the statistical significance of the path loadings and path co-efficients between each construct. Again, PLSgraph was used as the tool for analysis.

Chin and Newsted (1999) and Hanlon (2001) specify that it is inappropriate to use traditional tests to ascertain the statistical significance between factors due to the fact that PLS does not assume a normal distribution of data. Scholars of PLS have developed two nonparametric approaches to test the relationship between variables: either jackknife or bootstrap techniques can be used (Santosa, Wei & Chan 2005; Gefen, Straub & Boudreau 2000); both have advantages and disadvantages (Chin 1998a). Bootstrap is used for data analysis in this study because it is considered to be a more sophisticated approach than jackknife (Chin 1998a). It produces two measures of the structural model: a t-value (similar to the t-test) and R^2 (interpreted similarly to traditional multiple regression analysis).

The bootstrap output provides R^2 values to assess the predictive power of the model for the endogenous constructs and the level of variance explained (AVE) by each construct. Table 7.22 shows the R^2 values within the model while Figure 7.2 illustrates the loadings and R^2 values within the model.

Table 7.22: R^2 values

Construct	R^2
Relative advantage (RA)	0.253
Compatibility (CB)	0.152
Complexity (CX)	0.113
AP_Reflective (AP_Refl)	0.091
Risk (RK)	0.020
Self-efficacy (SE)	0.144
Support (SU)	0.183
Subjective norms (SN)	0.098
Intention (IN)	0.510

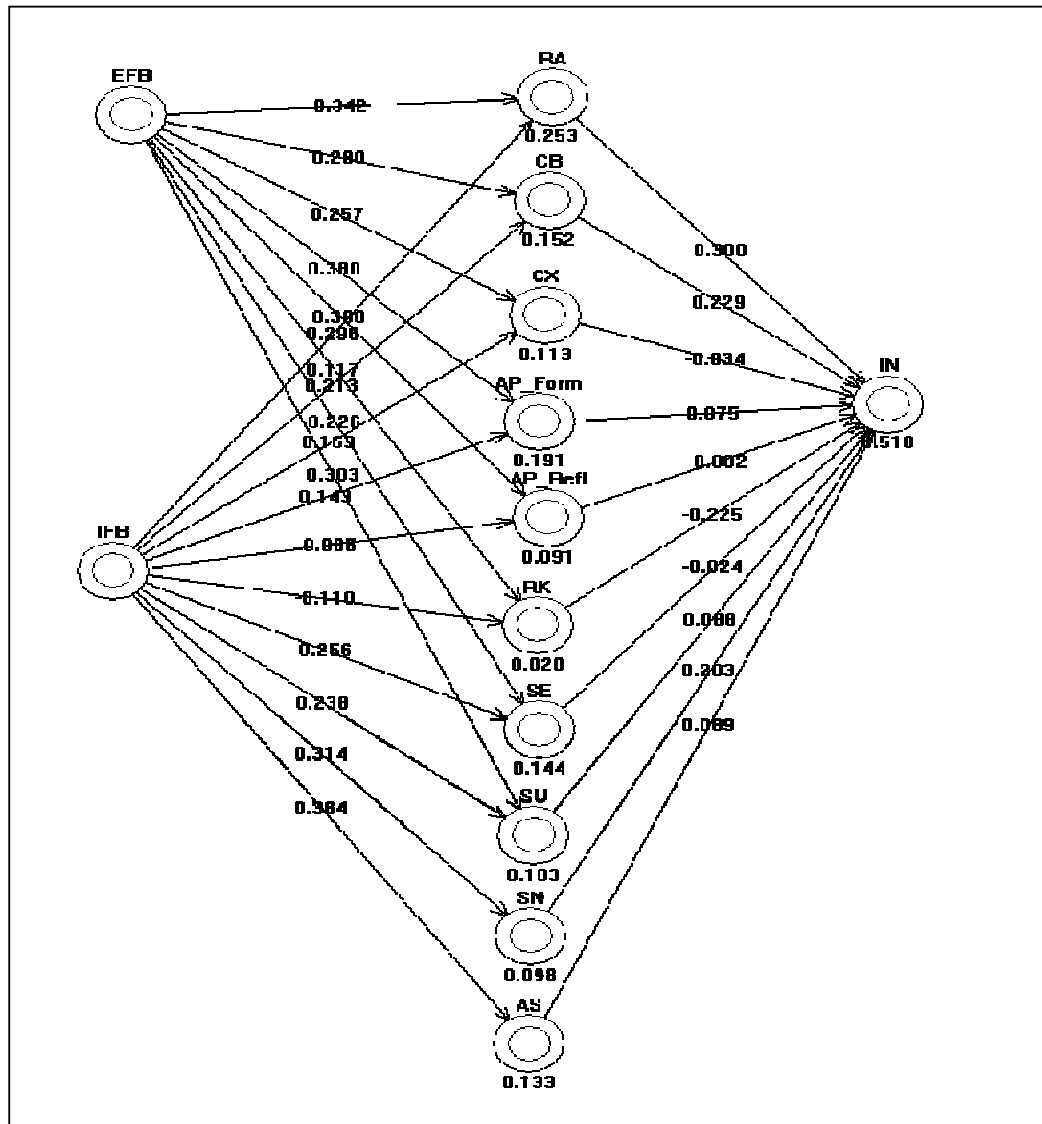


Figure 7.2: Structural model estimation

Figure 7.2¹² shows the direction of each relationship, the loadings on each relationship (the value on the arrow) and R^2 values for each dependent construct (the value beneath the circles). The strongest R^2 value is that of 'intention' (0.51) thereby indicating that

¹² Where EFB = Factors external to the farm business, IFB = Factors internal to the farm business, RA = Relative advantage, CB = Compatibility, CX = Complexity, AP_Form = Application (formative items), AP_Refl = Application (reflective items), RK = Risk, SE = Self-efficacy, SU = Support, SN = Subjective norms, AS = Advisory services, IN = Intention.

51% of producers' intention to adopt the use of forward contract can be explained by the constructs used with this model.

The other variances explained by the model are not quite as strong. Table 7.22 demonstrates that the model explains 25.3% of the variance in 'relative advantage', 15.2% of the variance in 'compatibility', 11.3% of the variance in 'complexity', 19.1% of the variance in 'application' (formative items), 14.4% of the variance in 'self-efficacy', 18.3% of the variance in 'support' and 13.3% of the variance in 'advisory services'. These endogenous constructs' R^2 values meet the 0.10 minimum limit suggested by Santosa, Wei and Chan (2005) and Hanlon (2001). Three constructs fail to satisfy the '0.10' rule: AP_Refl ($R^2 = 0.091$), RK ($R^2 = 0.020$) and SN ($R^2 = 0.098$).

These areas of concern can be accounted for by examining the very low loadings of these constructs illustrated in Figure 7.2. AP_Refl has loadings of 0.300 (EFB→AP_Refl), 0.005 (IFB→AP_Refl) and -0.002 (AP_Refl→IN). RK has loadings of 0.117 (EFB→RK), -0.110 (IFB→RK), and -0.225 (RK→IN). Finally, SN has loadings of 0.314 (IFB→SN) and 0.203 (SN→IN). Because the case values of the items are determined by the weights of each loading (Chin 1998a), the consequence of low loadings accounts for the low R^2 values. However, as Hanlon (2001) found, the low R^2 values can be considered adequate due to the exploratory nature of this study and the fact that these constructs have never before been tested under such circumstances; particularly in the cases of AP_Refl and SN that have R^2 very close to 0.10.

Table 7.23 shows the standardised path co-efficient (γ) and t-value (similar to t-test) outputs from the 100-sample bootstrap analysis. The table illustrates that nine relationships are not statistically significant, however most other relationships have an impressively high level of significance. This suggests that while relationships exist between these constructs (either positive or negative) the relationship is not strong enough to be considered significant. Table 7.23 also shows that factors internal to the farm business do not have a significant influence on farmers' perceived application of forward contracts to their farm business. Curiously, 'factors external to the farm business' have a highly significant impact on this construct. Finally, there were a number of paths that had no significance on producers' intention to adopt the use of forward contracts to sell wool. 'Complexity', 'application', 'advisory services', 'self-efficacy' and 'support' all had no statistical significance on producers' intentions to adopt forward contracts. Like the other constructs that do not possess statistically significant relationships, this indicates that there

are five factors that cannot be said to explain intention to adopt the use of forward contracts to sell wool so should therefore be excluded from the final model (Barclay, Higgins & Thompson 1995). Although Barclay, Higgins and Thompson (1995) suggest that such paths should be deleted and the model be re-analysed in confirmatory-type models, most authors retain the paths of constructs that are not statistically significant and do not re-analyse the data (Hanlon 2001, Igbaria et al. 1997; Goldschmidt & Tan 1999; Hofmeyer 2005; Gefen, Straub & Boudreau 2000). In accordance with the bulk of the literature, Figure 7.3¹³ illustrates the results of the structural model analysis with significant paths shown as bold lines and paths without significance shown as broken lines; standardised path co-efficients are shown for each relationship with the respective t-value in parentheses. More discussion on testing of hypotheses will be undertaken in the next section.

¹³ Where EFB = Factors external to the farm business, IFB = Factors internal to the farm business, RA = Relative advantage, CB = Compatibility, CX = Complexity, AP_Form = Application (formative items), AP_Refl = Application (reflective items), RK = Risk, SE = Self-efficacy, SU = Support, SN = Subjective norms, AS = Advisory services, IN = Intention.

Table 7.23: Bootstrap path co-efficients and their t-values

Hypothesis	Path	γ	t-value	Significance
H1a	EFB \rightarrow RA	0.342	5.371	$p < 0.005$
H1b	EFB \rightarrow CB	0.280	4.962	$p < 0.005$
H1c	EFB \rightarrow CX	0.257	3.763	$p < 0.005$
H1di	EFB \rightarrow AP_Form	0.380	6.560	$p < 0.005$
H1dii	EFB \rightarrow AP_Refl	0.300	5.956	$p < 0.005$
H1e	EFB \rightarrow RK	0.117	1.070	Not significant
H2a	EFB \rightarrow SE	0.226	3.452	$p < 0.005$
H2b	EFB \rightarrow SU	0.303	4.372	$p < 0.005$
H3a	IFB \rightarrow RA	0.296	4.900	$p < 0.005$
H3b	IFB \rightarrow CB	0.213	2.741	$p < 0.005$
H3c	IFB \rightarrow CX	0.163	2.259	$p < 0.05$
H3di	IFB \rightarrow AP_Form	0.143	2.114	$p < 0.05$
H3dii	IFB \rightarrow AP_Refl	0.005	0.067	Not significant
H3e	IFB \rightarrow RK	-0.110	1.029	Not significant
H4a	IFB \rightarrow SN	0.314	4.611	$p < 0.005$
H4b	IFB \rightarrow AS	0.364	5.771	$p < 0.005$
H5a	IFB \rightarrow SE	0.256	3.462	$p < 0.005$
H5b	IFB \rightarrow SU	0.238	3.363	$p < 0.005$
H6a	RA \rightarrow IN	0.300	5.098	$p < 0.005$
H6b	CB \rightarrow IN	0.229	4.070	$p < 0.005$
H6c	CX \rightarrow IN	-0.034	0.699	Not significant
H6di	AP_Form \rightarrow IN	0.075	1.233	Not significant
H6dii	AP_Refl \rightarrow IN	-0.002	0.039	Not significant
H6e	RK \rightarrow IN	-0.225	3.698	$p < 0.005$
H7a	SN \rightarrow IN	0.203	3.589	$p < 0.005$
H7b	AS \rightarrow IN	0.089	1.522	Not significant
H8a	SE \rightarrow IN	-0.024	0.447	Not significant
H8b	SU \rightarrow IN	0.088	1.620	Not significant

γ = Standardised path co-efficient

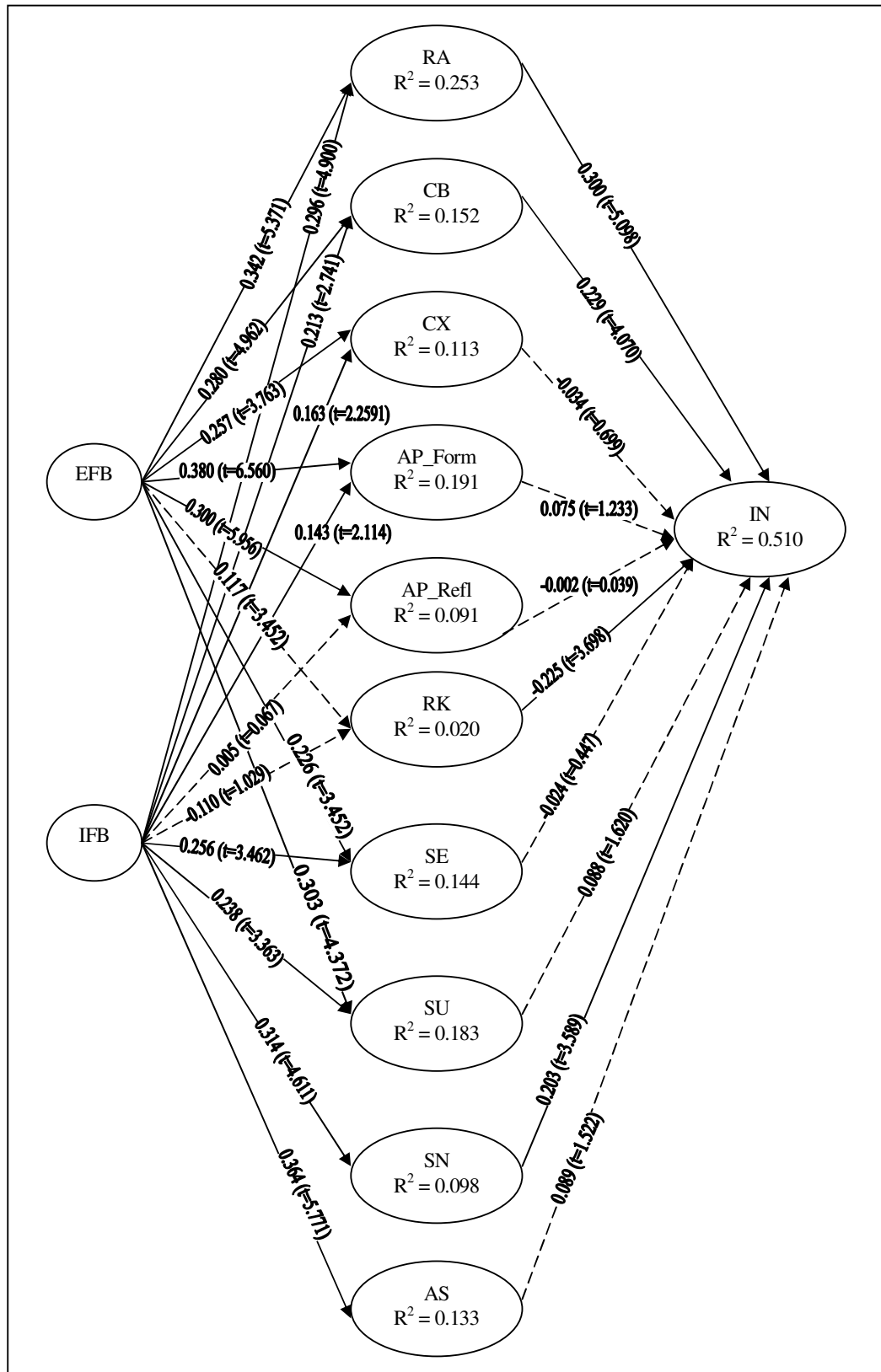


Figure 7.3: Analysis of the structural model

7.6. Hypothesis Testing

It has been shown that ‘intention to adopt forward contracts’ has a relatively good fit to the data ($R^2 = 0.510$), although not all the relationships within the model were found to be statistically significant. Further to this, not all the relationships hypothesised detailed in Section 6.2 were found to be supported. This section is an examination of each hypothesis using the estimates of the t-value for each relationship. Results of this analysis are tabulated in Table 7.24, Table 7.25, Table 7.26, Table 7.27 and Table 7.28.

Table 7.24: Summary of hypothesis testing (Factors external to the farm business)

Hypothesis	γ	t-value	Outcome
H1a: Factors external to the farm business, specifically the Australian wool industry, will negatively influence the relative advantage perceived by farmers to use forward contracts to sell wool	0.342	5.371**	Not supported
H1b: Factors external to the farm business, specifically the Australian wool industry, will negatively influence the compatibility perceived by farmers to use forward contracts to sell wool	0.280	4.962**	Not supported
H1c: Factors external to the farm business, specifically the Australian wool industry, will positively influence the complexity perceived by farmers to use forward contracts to sell wool	0.257	3.763**	Supported
H1di: Factors external to the farm business, specifically the Australian wool industry, will negatively influence the application (formative) perceived by farmers to use forward contracts to sell wool	0.380	6.560**	Not supported
H1dii: Factors external to the farm business, specifically the Australian wool industry, will negatively influence the application (reflective) perceived by farmers to use forward contracts to sell wool	0.300	5.956**	Not supported
H1e: Factors external to the farm business, specifically the Australian wool industry, will positively influence the risk perceived by farmers to use forward contracts to sell wool	0.117	1.070	Not supported
H2a: Factors external to the farm business (i.e. the Australian wool industry and advisory services available to the farmer) will negatively influence the self-efficacy associated with the intention of farmers to use forward contracts to sell wool	0.226	3.452**	Not supported
H2b: Factors external to the farm business (i.e. the Australian wool industry and advisory services available to the farmer) will negatively influence the support associated with the intention of farmers to use forward contracts to sell wool	0.303	4.372**	Not supported

γ = Standardised path co-efficient

* indicates significance at $t_{0.05} > 1.645$

** indicates significance at $t_{0.005} > 2.576$

Table 7.25: Summary of hypothesis testing (Factors internal to the farm business)

Hypothesis	γ	t-value	Outcome
H3a: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the relative advantage perceived by farmers to use forward contracts to sell wool	0.296	4.900**	Supported
H3b: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the compatibility perceived by farmers to use forward contracts to sell wool	0.213	2.741**	Supported
H3c: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the complexity perceived by farmers to use forward contracts to sell wool	0.163	2.259*	Supported
H3di: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the application (formative) perceived by farmers to use forward contracts to sell wool	0.143	2.114*	Supported
H3dii: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the application (reflective) perceived by farmers to use forward contracts to sell wool	0.005	0.067	Not supported
H3e: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will positively influence the risk perceived by farmers to use forward contracts to sell wool	-0.110	1.029	Not supported
H4a: Factors internal to the farm business (i.e. social structure, farmer-specific details and farm factors) will negatively influence subjective norms as a way of using forward contracts to sell wool	0.314	4.611**	Not supported
H4b: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence available advisory services as a way of using forward contracts to sell wool	0.364	5.771**	Not supported
H5a: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence the self-efficacy associated with the use of forward contracts to sell wool	0.256	3.462**	Not supported
H5b: Factors internal to the farm business (i.e. farmer-specific details and farm factors) will negatively influence the support associated with the use of forward contracts to sell wool	0.238	3.363**	Not supported

γ = Standardised path co-efficient

* indicates significance at $t_{0.05} > 1.645$

** indicates significance at $t_{0.005} > 2.576$

Table 7.26: Summary of hypothesis testing (Perceived behavioural control)

Hypothesis	γ	t-value	Outcome
H6a: The relative advantage of using forward contracts to sell wool will positively influence the intention of Australian farmers to sell their wool by forward contract	0.300	5.098**	Supported
H6b: The compatibility of using forward contracts to sell wool will positively influence the intention of Australian farmers to sell their wool by forward contract	0.229	4.070**	Supported
H6c: The complexity of using forward contracts to sell wool will negatively influence the intention of Australian farmers to sell their wool by forward contract	-0.034	0.699	Not supported
H6di: The application (formative) of using forward contracts to sell wool will positively influence the intention of Australian farmers to sell their wool by forward contract	0.075	1.233	Not supported
H6dii: The application (reflective) of using forward contracts to sell wool will positively influence the intention of Australian farmers to sell their wool by forward contract	-0.002	0.039	Not supported
H6e: The risk of using forward contracts to sell wool will negatively influence the intention of Australian farmers to sell their wool by forward contract	-0.225	3.698**	Supported

γ = Standardised path co-efficient

* indicates significance at $t_{0.05} > 1.645$

** indicates significance at $t_{0.005} > 2.576$

Table 7.27: Summary of hypothesis testing (Perceived subjective norms)

Hypothesis	γ	t-value	Outcome
H7a: Subjective norms associated with selling wool will positively influence the intention of Australian farmers to sell their wool by forward contract	0.203	3.589**	Supported
H7b: Advisory services associated with selling wool will positively influence the intention of Australian farmers to sell their wool by forward contract	0.089	1.522	Not supported

γ = Standardised path co-efficient

* indicates significance at $t_{0.05} > 1.645$

** indicates significance at $t_{0.005} > 2.576$

Table 7.28: Summary of hypothesis testing (Perceived behavioural control)

Hypothesis	γ	t-value	Outcome
H8a: The self-efficacy associated with the use of forward contracts will positively influence the intention of Australian farmers to sell their wool by forward contract	-0.024	0.447	Not supported
H8b: The support associated with the use of forward contracts will positively influence the intention of Australian farmers to sell their wool by forward contract	0.088	1.620*	Not supported

γ = Standardised path co-efficient

* indicates significance at $t_{0.05} > 1.645$

** indicates significance at $t_{0.005} > 2.576$

7.6.1. Factors External to the Farm Business

Hypothesis 1 (Section 6.2.1) tested how factors of the Australian wool industry impact on several elements of the degree to which producers perceive the usefulness of forward

contracts to sell wool. This hypothesis was split into five sub-hypotheses in order to capture the relationship that exists between the various elements of Rogers' (1995) 'perceived behavioural control' construct ('relative advantage', 'compatibility', 'complexity', 'application' and 'risk').

It was hypothesised that the Australian wool industry would have a negative impact on the perceived 'relative advantage' of using forward contracts to sell wool (H1a). Table 7.24 shows that this statement was not supported by the model. The standardised path co-efficient from 'factors external to the farm business' to 'relative advantage' was 0.342 with a t-value of 5.371 ($p < 0.005$). It can therefore be said that the Australian wool industry does not negatively influence producers' perceptions associated with the relative advantages of forward contracts. This provides evidence to suggest that there is a positive and significant relationship between these two variables. The implication of this finding is that, despite the findings of the focus groups, the broader sample population considers that the Australian wool industry is highly supportive of farmers using forward contracts to sell wool. From this finding, it is evident that the Australian wool industry is promoting the relative advantage of using forward contracts to sell wool and that wool producers understand that there are other ways of selling wool than just at auction.

Hypothesis 1b proposed that the Australian wool industry would have a negative influence on the perceived compatibility of forward contracts to the farm business; principally this hypothesis was generated as a result of the focus groups. The empirical research showed this relationship to be highly significant with a t-value of 4.962 ($p < 0.005$), although the hypothesis was not supported since the standardised path co-efficient between the two variables was positive. It can therefore be said that the Australian wool industry has a significant, positive impact on the perceived compatibility of forward contracts to the farm business. Once again, this is contrary to the views expressed about the structure of the Australian wool industry in the focus groups (see Section 5.4.1). The findings of the larger study therefore suggest that the Australian wool industry is actually building a positive picture of the compatibility with the farm business of forward contracts to sell wool, and, most importantly, this picture is being recognised as important to wool producers.

Strong support was found for H1c which stated that the Australian wool industry would have a positive impact on the perceived complexity of forward contracts for selling wool. Results summarised in Table 7.24 showed a standardised path co-efficient of 0.257 and a

t-value of 3.763 ($p < 0.005$) between 'factors external to the farm business' and 'complexity'. Hypothesis 1c was therefore supported and suggests that there is overwhelming statistical evidence to show that the Australian wool industry adds to the level of perceived complexity wool producers have about using forward contracts.

Hypothesis 1d was split between 'formative' and 'reflective' measurement items. This hypothesis tested if a negative relationship exists between the Australian wool industry and the perceived application of forward contracts to the farm business. The path between 'factors external to the farm business' and 'Application_Formative' (H1di) produced a standardised path co-efficient of 0.380 and t-value of 6.560 ($p < 0.005$) while the path between 'factors external to the farm business' and 'Application_Reflective' (H1dii) produced a standardised path co-efficient of 0.300 and t-value of 5.956 ($p < 0.005$). Both these relationships were found to be highly significant, but the nature of the relationship proved to be opposite than that hypothesised. It can therefore be said that the application of forward contracts have to the farm business is positively influenced by the Australian wool industry. This is in direct contrast to the notions proposed in the focus groups that the Australian wool industry actively promotes the auction system, thereby limiting the perceived application of forward contracts to the farm business. It can therefore be said that the Australian wool industry is positively influencing the perceived 'relative advantage', 'compatibility' and 'complexity', as well as the application of forward contracts to the farm business.

Hypothesis 1 related to how the Australian wool industry influences the perceived usefulness of forward contracts. The last sub-hypothesis within H1 is H1e which said that 'factors external to the farm business' will have a positive influence on the risk wool producers associate with forward contracts (detailed in Section 6.2.1). While this hypothesis was found to be supported, it is not statistically significant and consequently was rejected. The standardised path co-efficient was 0.117 but the t-value was 1.070 (not significant). As mentioned in the previous section, this hypothesis had been excluded from the final model as per the advice of Barclay, Thompson and Higgins (1995).

The second group of hypotheses (see Section 6.2.1) tested the relationship between 'factors external to the farm business' and the 'perceived behavioural control' associated with using forward contracts to sell wool. Similar to the first group of hypotheses (H1), H2 was split into two sub-hypotheses to test how 'self-efficacy' (H2a) and support mechanisms available to producers (H2b) are influenced by the Australian wool industry.

Both relationships were hypothesised to have negative relationships because of the results of comments made in the focus groups; however, this relationship was contradicted by the study. The relationship between the Australian wool industry and factors influencing 'perceived behavioural control' was found to be positive and highly significant. Hypothesis 2a had a standardised path co-efficient of 0.226 and t-value of 3.452 ($p < 0.005$) and H2b had a standardised path co-efficient of 0.303 and t-value of 4.372 ($p < 0.005$), therefore suggesting, contrary to the findings of the focus groups, that the Australian wool industry has a highly significant, positive relationship with the 'perceived behavioural control' (measured by 'self-efficacy' and 'support') that producers associate with using forward contracts.

7.6.2. Factors Internal to the Farm Business

Hypothesis 3 (Section 6.2.2) examined how various factors internal to the farm business influence producers' perceived usefulness of using forward contracts to sell wool. As with H1, H3 was split into six sub-hypotheses. These sub-hypotheses were based on the research of Fliegel (1993), Rogers (1995) and Tan and Teo (2000).

Hypothesis 3a tested if factors internal to the farm business positively influence producers' perceived 'relative advantage' of using forward contracts to sell wool. With a standardised path co-efficient of 0.296 and a t-value of 4.900 ($p < 0.005$), this hypothesis was supported with a very high level of statistical significance. This suggests that issues directly related to the farm business, such as production objectives, importance of wool to the farm business and past selling experiences have a positive impact on the perceived 'relative advantage' of using forward contracts to sell wool.

As with H3a, H3b was supported at a high level of significance. The standardised path co-efficient for the relationship between factors internal to the farm business and the compatibility of forward contracts to the farm business was 0.213 and the t-value was 2.741 ($p < 0.005$). These results support the hypothesised relationship and show that the perceived level of compatibility forward contracts have to the farm business is strongly influenced by factors unique to the individual farm.

Hypothesis 3c and 3di were also supported and are statistically significance ($p < 0.05$). Hypothesis 3c tested if there was a positive relationship between factors internal to the farm business and the perceived complexity of using forward contracts to sell wool. The standardised path co-efficient supported this hypothesis (0.163) although the t-value was

2.259 ($p < 0.05$). Similarly, H3di, which tested if a positive relationship exists between factors internal to the farm business and the application of forward contracts to the farm business ('formative' items), was found to be supported but at the same lower level of significance as H3c (t-value was 2.114 [$p < 0.05$]).

The final two hypotheses that examined the relationship between factors internal to the farm business and the 'perceived usefulness' of using forward contracts to sell wool were both rejected. Hypothesis H3dii posited that factors internal to the farm business would have a positive impact on the perceived application ('reflective') of using forward contracts to sell wool. While the positive nature of this hypothesis was supported (standardised path co-efficient was 0.005), the t-value of 0.067 showed the relationship not to be significant thus requiring the hypothesis to be rejected. The results of the focus groups led the researcher to believe that factors internal to the farm business would have a positive impact on the perceived risk of using forward contracts (H3e), basically because producers felt so much uncertainty about using forward contracts. The study revealed that this hypothesis was not supported because the standardised path co-efficient was - 0.110. Similarly, it was proved that the hypothesised relationship was not significant (t-value of 1.029), therefore H3e was also rejected.

Hypothesis 4 (see Section 6.2.2) considered how the 'perceived subjective norms' associated with using forward contracts were influenced. Results of the focus groups showed that factors internal to the farm business were likely to negatively impact on 'subjective norms' associated with using forward contracts to sell wool (H4a) and the attitude towards the advisory services utilised by producers (H4b). Both hypotheses were not supported thereby suggesting that factors internal to the farm business actually have a positive influence over 'subjective norms' (standardised path co-efficient of 0.314) and attitudes towards the advisory services (standardised path co-efficient of 0.364). Interestingly, both relationships were found to be highly statistically significant with respective t-values of 4.611 and 5.771 ($p < 0.005$). The relationship between 'factors internal to the farm business' with 'advisory services' (H4b) in fact yielded highest t-value in the study (5.771). The inference can therefore be drawn that, while the results of the focus groups were not supported, producers' 'subjective norms' and their attitudes towards advisory services were influenced by factors internal to the farm business in a very positive way.

Like the second group of hypotheses, H5 (detailed in Section 6.2.2) related to understanding the factors influencing ‘perceived behavioural control’. Hypothesis 5 stated that factors internal to the farm business would have a negative impact on ‘self-efficacy’ (H5a) and ‘support’ (H5b). Despite the results of the focus groups, quantitative testing of these relationships found these hypotheses were not supported as the standardised path co-efficients were 0.256 and 0.238, respectively. On the other hand, each relationship was found to be highly significant: H5a had a t-value of 3.462 ($p < 0.005$) and H5b had a t-value of 3.363 ($p < 0.005$). Results of the focus groups (Section 5.4.1) suggested that wool producers do not feel confident enough to use forward contracts to sell wool and that there is insufficient support available to facilitate adoption of this selling method. It is clear from the empirical study that ‘perceived behavioural controls’ (in the form of ‘self-efficacy’ and ‘support’) are positively influenced by factors internal to the farm business. This is possibly because individuals within the sample population, beyond the focus groups, consider that they have adequate personal capabilities to deal with using forward contracts to sell their wool and that there is enough support from within their internal environment to positively assist with the decision to use forward contracts.

The following results test the behavioural model’s focus on the relationships of the traditional TPB/Diffusion model; that is, testing which variables impact on an individual’s intentions to use forward contracts to sell wool. While results of the focus groups were considered when developing the hypotheses, the plethora of the literature discussing these relationships accounted for much of the justification of hypotheses.

7.6.3. Perceived Usefulness of Using Forward Contracts

Hypothesis 6 (see Section 6.2.3) tested how ‘perceived usefulness’ of using forward contracts impacts on intention to adopt. Like H1 and H3, ‘perceived usefulness’ is measured using six constructs: ‘relative advantage’, ‘compatibility’, ‘complexity’, ‘application’ (‘formative’ and ‘reflective’) and ‘risk’.

Within H6, three sub-hypotheses were supported at a high level of significance. The literature showed that ‘relative advantage’ will have a positive impact on ‘intention’ (H6a), this was supported with a standardised path co-efficient of 0.300 and a t-value of 5.098 ($p < 0.005$). Similarly, it was hypothesised that compatibility will have a positive impact on ‘intention’ (H6b), this notion was also supported with a standardised path co-

efficient of 0.229 and a t-value of 4.070 ($p < 0.005$). Finally, the literature suggested that the perceived risk associated with adopting an innovation will have a negative impact on 'intention' (H6e). This hypothesis was supported with a standardised path co-efficient of -0.225 and a t-value of 3.698 ($p < 0.005$).

Hypothesis 6c reflected the findings of the literature and stated that 'complexity' would have a negative impact on 'intention' to adopt forward contracts. While the findings of Tiller (2000), Batz, Peters and Janssen (1999), Lodge 1991 and Fliegel and Kivlin (1962) all found 'complexity' to have a significant, negative relationship on 'intention' to adopt an agricultural innovation, in this study the direction of the relationship between 'complexity' and 'intention' to adopt was similarly found to be negative (standardised path co-efficient of -0.034). As it is not significant, H6c is ultimately rejected based on the t-value of 0.699.

The final hypotheses to be considered in order to understand the impact of 'perceived usefulness' on 'intention' is the application of forward contracts to the farm business. Both application ('formative') and application ('reflective') were thought to have a positive impact on 'intention', as described in Section 6.2.3, however it was found that this hypothesis only held true for the formative items that tested 'application'. The relationship between application ('formative': H6di) and 'intention' had a standardised path co-efficient of 0.075 and a t-value of 1.233. As expected, the direction of the relationship was positive but the lack of statistical significance resulted in the hypothesis being rejected. The relationship between application ('reflective': H6dii) and 'intention' had a standardised path co-efficient of -0.002 and a t-value of 0.039. These results therefore show that this relationship is contrary to what was expected, nor is it significant. Like the hypothesis between application ('formative') and 'intention', the hypothesis between application ('reflective') and 'intention' was rejected.

7.6.4. Perceived Subjective Norms Associated with Using Forward Contracts

Hypothesis 7 (Section 6.2.3) explored the impact 'perceived subjective norms' has on people's intention to adopt forward contracts to sell wool; both H7a ('subjective norms' to 'intention') and H7b ('support' to 'intention') were hypothesised to be positive. Hypothesis 7a was found to be supported at a high level of significance with a standardised path co-efficient of 0.203 and a t-value of 3.586 ($p < 0.005$). This suggests

that intention to adopt forward contracts for selling wool is strongly influenced by the peer pressures and the general community. Similarly, H7b proposed that ‘advisory services’ would have a positive impact on producers’ intention to adopt the use of forward contracts to sell wool. While the direction of the hypothesis was as expected (with a standardised path co-efficient of 0.089), the t-value of 1.522 was not significant and, therefore, the hypothesis was rejected. Hence, the study supports the influence of ‘subjective norms’ on the intention to adopt, but not the influence of ‘advisory services’.

7.6.5. Perceived Behavioural Control Associated with Using Forward Contracts

The final hypothesis to be tested in this study is H8 (described in Section 6.2.3): does ‘perceived behavioural control’ have a positive influence on intention to adopt? ‘Perceived behavioural control’ was measured using constructs that tested ‘self-efficacy’ and ‘support’. Hypothesis 8a stated that ‘self-efficacy’ would have a positive impact on intention to adopt; in line with literature on the issue (Tutkun & Lehmann 2006; Bergevoet et al. 2004; Christian & Armitage 2002; Marcil, Bergeron & Audet 2001; Tan & Teo 2000; Lynne et al. 1995; Shimp & Kavas 1984). Surprisingly, it was found that a positive relationship did not exist (standardised path co-efficient of -0.024), nor was it found to be significant. Since the t-value was 0.447 (not significant), this hypothesis was rejected.

Hypothesis 8b was also expected to show a positive relationship between ‘support’ and intention to adopt. The direction of the relationship was supported by the standardised path co-efficient of 0.088 although the hypothesis was rejected from the model as it was not significant (t-value was 1.620). The inference can thus be drawn from these results that perceived behavioural control is not an influencing factor on intention; whether considered from the ‘self-efficacy’ or ‘support’ point of view.

7.7. Summary

This chapter has detailed the demographics of the sample population and the SEM results of a PLS analysis. The chapter aimed to develop a profile of the survey respondents and also determine the validity and reliability of a behavioural model that focuses on wool producers’ adoption of forward contracts. A telephone survey yielded 305 valid responses to the instrument used to measure the variables of the model.

The highlights of the simple, descriptive statistics of the sample population were that 88.5% of respondents were male, about half the total respondents were the primary decision makers of the farm while the other half were joint decision makers. Respondents had an average of 31 years' involvement with the farm business. In terms of production systems, 78.4% produced both livestock and crops and 72.7% produced between 50 and 200 bales of wool per year. The greatest range of average fibre diameters produced by respondents fell in the range of 19.6 to 23.5 micron. Finally, 55.1% of respondents had experience selling grain by forward contract, 23.9% had experience selling wool by forward contract while 34.4% had no experience using forward contracts.

Subsequent to understanding the sample population, the conventional two-step approach to PLS analysis was used; the first step testing the measurement models and the second step testing the structural models.

In testing the measurement models, the first task is to assess item reliability. Once run, the PLS analysis showed that there were several items that loaded poorly on their respective constructs. Using a cut-off point of 0.5 as the minimum loading, the decision was made to omit items relating to 'relative advantage', 'complexity', 'risk', 'self-efficacy', 'support' and 'subjective norms' from the model. The second task tests for internal consistency. This is achieved by using a minimum of 0.7 for internal consistency values of each construct, as well as using a minimum value of 0.5 for the average variance extracted for each construct. After revising the model to ensure adequate reliability of all items were met, these measures of internal consistency were met as well. The final task for analysing the measurement models is to test for discriminant validity. Average variance extracted is used in these tests, however, the objective is to ensure that no items or constructs load heavier on any others than themselves. During this phase of analysis it was discovered that items within the 'subjective norms' construct did not meet this criterion. When SN6 and SN7 were substituted with SN2 and SN4, all requirements of the discriminant validity test were satisfied.

In analysing the structural model, the standardised path loadings were obtained and significance of these paths was ascertained from the bootstrap analysis feature of PLSgraph. It was found that three constructs did not meet the minimum R^2 value of 0.1, however justification was provided by Hanlon (2001) who said that research (which is exploratory in nature) can be more flexible with such rules. Overall, the individual hypotheses proposed within the model proved to have a reasonably good fit to the data

since more than half proved to be statistically significant. Following this, 19 of the 28 paths within the model were significant. Significant hypotheses of the model were: H1a, H1b, H1c, H1di, H1dii, H2a, H2b, H3a, H3b, H3c, H3di, H4a, H4b, H5a, H5b, H6a, H6b, H6e and H8a. Discussion of these remaining hypotheses is carried out in the next chapter.

Chapter 8 Results, Interpretation and Discussion

8.1. Overview

In Chapter 7, data collected from a telephone survey of 305 Western Australian wool producers were analysed. Simple descriptive statistics were used to develop a profile of the sample population, and the partial least squares (PLS) approach to structural equation modelling (SEM) was subsequently used to test the hypotheses of the behavioural model developed in Chapter 6. Chapter 8 follows on from Chapter 7 to provide the results, interpretation and discussion of the data analysis. Herein the results of the data analysis are interpreted by discussing the hypotheses that were proposed in Chapter 6. Following this, the behavioural model will be examined by discussing the impact factors internal and external to the farm business have on the ‘perceived usefulness’ of using forward contracts to sell wool, the ‘perceived subjective norms’ associated with using forward contracts and the ‘perceived behavioural control’ surrounding the use of forward contracts. Discussion will clarify which of these factors impact wool producers’ intentions to use forward contracts.

8.2. Discussion of data analysis results

As shown in Chapter 7, more than half the hypotheses proposed in Chapter 6 were not supported. Details of the data analysis in Chapter 7 showed that hypotheses were tested using the estimates of t-values and standardised path co-efficients; the results of which are shown in Table 7.24, Table 7.25, Table 7.26, Table 7.27 and Table 7.28. Of the 28 hypotheses listed, nine were found to support the hypothesised relationships whereas the remaining 19 were not supported. This indicates that there are a number of factors that do not influence wool producers’ intentions to adopt the use of forward contracts.

8.2.1. Factors External to the Farm Business

An assessment of how factors external to the farm business affect decision making surrounding the use of forward contracts was made using two hypotheses. Hypothesis 1 (Section 6.2.1) assessed the impact of how ‘factors external to the farm business’ influence the perceived usefulness of forward contract. Hypothesis 2 (Section 6.2.1) assessed the impact of how ‘factors external to the farm business’ influence the perceived behavioural control of using forward contracts. Logic for H1 and H2 was principally drawn from the focus group data.

Hypothesis 1

To test the relationship between ‘factors external to the farm business’ and the ‘perceived usefulness’ of forward contracts, this hypothesis was broken down into six sub-hypotheses, of which only one sub-hypothesis was supported (H1c).

Hypotheses 1a, H1b, H1di and H1dii were not supported (H1e discussed later). These relationships were hypothesised to be negative as focus group participants were adamant that factors external to the farm business, such as the dominance of the auction system, the long wool supply chain, lack of price volatility and various economic factors, overshadow the benefits of forward contracts. In the case of this research, such benefits were the ‘relative advantage’, ‘compatibility’ and ‘application’ of forward contracts to the farm business. Results showed these relationships to be highly significant although these factors were found to have a positive, rather than negative, relationship. While an assessment of the structural model showed these relationships were not supported, Quaddus and Achjari (2005) use bivariate correlations to test if isolated pairs of constructs also exhibit the outcomes of the proposed hypothesised relationship. In this research, the four aforementioned hypotheses were further analysed in SPSS 14 (using Kendall’s tau-b non-parametric measure of association) to determine if any of these hypotheses show negative relationships when correlated alone, rather than in the presence of all other constructs. This simple analysis revealed that the four relationships are, in fact, positive with a high level of significance ($p < 0.01$). The conclusion can thus be drawn that, whether H1a, H1b, H1di and H1dii are tested alone or within a structural context, there is a strong, positive relationship between ‘factors external to the farm business’ and ‘relative advantage’, ‘compatibility’ and ‘application’ of forward contracts to the farm business.

Evidence that supports these findings, but is contrary to those concluded from the focus groups and the research of Ben-Kaabia and Gil (2007), is presented by The Merino Company (2006), Woods, Hood and Couchman (2005) and McLeay and Zwart (1998). McLeay and Zwart (1998) found that structural characteristics of an agribusiness industry influence individual farmer’s sales transaction choice. However, the literature of The Merino Company (2006) and Woods, Hood and Couchman (2005), more specifically and more recently, describe how Australian wool producers are satisfied with the current nature of the nation’s wool industry and are not seeking any changes. Therefore, while evidence was found to support comments and feelings from the focus groups, empirical evidence from the present study, and findings of The Merino Company (2006), suggest

that the current structure of the Australian wool industry is actually aiding, rather than inhibiting, wool producers from perceiving that forward contracts are useful for selling wool. Further to these arguments, Deane and Malcolm (2006, p. 31) concluded that “It can be misleading to look at the business risk that volatile wool prices may create in isolation” and that an insignificant number of wool producers are large enough to possess the economic motivation to use hedging tools. This diverse range of views from the literature, coupled with the empirical findings of this study suggest that no matter how unattractive the auction system may be and how attractive forward contracts become, the nature of the Australian wool industry is not a limiting factor in the adoption of forward contracts.

Empirical evidence of this study found that factors external to the farm business have a positive impact on the perceived complexity associated with the use of forward contracts. This supported the findings of the focus groups in which participants described forward contracts as difficult to use because of their complexity, the amount of ‘fine print’ used and the amount of paper-work they involve. Thus, the implication of this study is that wool buyers who want to encourage the use of forward contracts by producers must work to reduce the complexity associated with their employment. The introduction of on-line forward contracts and better relationship marketing involving on-farm visits may improve this situation.

While the Australian wool industry was found to significantly add complexity to the perceptions of forward contracts, it was conversely found that the perception of risk associated with the use of forward contracts is not exacerbated by the structure of the wool industry. Therefore H1e was not significant and was rejected. Upon conducting a bivariate correlation analysis of this relationship ($EFB \rightarrow RK$, refer to Sections 7.6.1 and 6.2.1) it was found that a highly significant, positive relationship ($p < 0.01$) exists when the two variables are correlated independently of others within the structural model, thus supporting the findings of the focus groups and the hypothesis. This means that the structure of the Australian wool industry is a significant contributor to the perceptions of risk that wool producers have about forward contracts. However, when various other factors are taken into account, this perception is diminished to the point of not existing. The implication is therefore that there must be an explanation beyond this model for the risk that producers perceive about taking out forward contracts. This is an important investigation for further research.

While there were mixed relationships and mixed findings from H1, as reported in Section 7.6.1, the main conclusion to be drawn is that the factors external to the farm business determining the current nature of the Australian wool industry all have a positive impact on the ‘perceived usefulness’ of forward contracts for selling wool. This was generally contrary to the findings of the focus groups, but concurred with the findings of The Merino Company (2006) and Woods, Hood and Couchman (2005). In so saying however, it seems reasonable to infer from the data that the current nature of the Australian wool industry is perpetuating the complexity perceived about using forward contracts. It can therefore be surmised that practitioners within the Australian wool industry are in a good position to improve the perception of complexity felt about using forward contracts, a complexity wool producers consider is espoused by the industry.

Hypothesis 2

In relation to the notion that factors external to the farm business will have a negative influence on the perceived behavioural control associated with using forward contracts, the ideas and literature that were used to build this hypothesis were not supported by this research. The concept of the dominance of the auction system resulting in what Abrahamson and Rosenkopf (1993) refer to as an institutional and competitive bandwagon or what Smajgl, Vella and Greiner (2003, p. 2) and Smajgl (2004) refer to as an “informal institutional arrangement” did not hold true. Further to this, Fliegel (1993) and Rogers (1995) all showed that advisory services, such as those offered by these dominant organisations, will influence farmers’ adoption of agricultural practices. The relationship in this research was found to be positive; thus not supporting H2.

Data from the focus groups were principally used to suggest that factors associated with perceived behavioural control, such as producers’ self-efficacy and the ‘support’ required to take out forward contracts, would be negatively effected by factors external to the farm business. The empirical findings were further supported by the findings of bivariate correlation analysis. This yielded the same findings as the analysis of the structural model: there is a highly significant ($p < 0.01$), positive relationship between both $EFB \rightarrow SE$ and $EFB \rightarrow SU$ (described in Section 7.6.1).

Because H2a and H2b were developed from the findings of the field study, the fact that these hypotheses were not supported in the empirical study highlights a discrepancy between the qualitative and quantitative methods used in this research. The lack of

support from these findings also infers that there is not the presence of an institutional bandwagon within the Australian wool industry, as initially hypothesised. The empirical study results showed that the inference can be made that the Australian wool industry adequately supports wool producers' feelings about their capabilities of taking out forward contracts and it also provides ample support, by way of advisory services, for taking out forward contracts. These findings therefore imply that there is currently no evidence to suggest that changes should be implemented to alter the structure of the Australian wool industry in order to improve the adoption of forward contracts.

8.2.2. Factors Internal to the Farm Business

As with assessing the nexus between 'factors external to the farm business' and the perceptions of forward contract for selling wool, it was hypothesised that factors internal to the farm business would also impact on such perceptions. Hypotheses 3, 4 and 5 assess how factors internal to the farm business impact on the 'perceived usefulness' of forward contracts, the 'perceived subjective norms' surrounding the use of forward contracts and 'perceived behavioural control', respectively.

Hypothesis 3

Similar to H1, H3 (Section 6.2.1) was split into six sub-hypotheses. All sub-hypotheses were supported, with the exception of H3dii and H3e.

This research found support for the findings of the focus groups as the sub-hypotheses related to 'relative advantage', 'compatibility', 'complexity' and 'application' to the farm business were all supported. This leads to the inference that factors internal to the farm business, such as past experiences with using forward contracts and level of dependence on wool to the farm income, largely contribute to the 'perceived usefulness' of forward contracts for selling wool. This means that practitioners wanting to encourage the use of forward contracts would be best advised to target wool producers who are seriously committed to their wool-producing enterprise. Deane and Malcolm (2006) provide support for this finding as they advocate that the rational price risk manager will concentrate on managing the risk of the farm enterprise that either earns most revenue or incurs the highest production costs.

Interestingly, 'complexity' is usually associated with negative relationships in behavioural studies (Rogers 1995; Tan & Teo 2000; Fliegel & Kivlin 1962), however, in this study, the relationship was theorised to be positive (IFB → CX, as described in Section 6.2.2).

This positive relationship was supported. While factors internal to the farm business aid in the 'perceived usefulness' of forward contracts, so too do they add to the perceived complexity of forward contracts. This could be accounted for by the notion that as wool producers put more emphasis on their wool-producing enterprise and become more liberal with their adoption of risk management strategies, like forward contracts, they become more aware of the complexities they face in terms of monitoring markets. The implication of this finding is that wool-buying organisations wanting to use more forward contracts should be focusing on producers whose characteristics include being highly dependent on wool for the farm income, having concrete production objectives, being committed to wool production, having a sound knowledge of their wool clip and taking a strategic view of the wool supply chain. Once again this finding agrees with the conclusions of Deane and Malcolm (2006).

The structural model rejected sub-hypotheses H3dii and H3e (Section 7.6.2). This held true when these sub-hypotheses were also tested using bivariate correlation in isolation of the model. In terms of H3dii, this makes intuitive sense because wool producers, unlike many groups studied for TRA/TPB research, will not concern themselves with internal issues that are related to issues such as gaining an entrepreneurial image from using forward contracts (as found in the pilot survey, Section 7.2). However, rejection of H3dii also shows that no matter how knowledgeable wool producers are with their finances and wool production, they consider that the use of forward contracts will not assist them in adding to that knowledge. This is a surprising result as findings from the focus groups found strong support for forward contracts providing improved knowledge; particularly with budgeting. A possible explanation for this finding is that wool producers do not consider their internal wool production enterprise in isolation when thinking about selling methods, but rather are more strongly influenced by the Australian wool industry, as found in H3dii.

In terms of the other sub-hypothesis that was rejected ($IFB \rightarrow RK$, refer to Section 7.6.2), it is evident that factors internal to the farm business were thought to influence perceived risk. This is mainly due to wool producers commenting in the focus groups that wool currently contributes so little to whole farm income and the lack of commitment to managing price risk for wool in comparison to grain. Evidence from this research indicates that this is not the case, nor is it the case that factors external to the farm business contribute to the perception of risk and uncertainty surrounding the use of

forward contracts. The finding here is that knowledge gained from the focus groups was not consistent with the larger population; a flaw of mixed-method research experienced by Quaddus, Islam and Stanton (2006).

Hypothesis 4

Once again, focus group data were disproved. Evidence from the focus groups provided information, contrary to academic literature, to infer that factors such as wool producers' experiences of selling wool, the knowledge of their wool clip and the level of dependence of wool to the farm business would negatively influence how producers perceived 'subjective norms' and 'advisory services'. This research did not support the H4a or H4b when tested in the structural model or in isolation. In contrast, the research empirically showed that the relationship between 'factors internal to the farm business' in terms of 'subjective norms' and 'advisory services' were both highly significant and positive. This finding provides strong evidence to support the findings of numerous authors that 'family' (Hildenbrand & Hennon 2005; Albrecht & Albrecht 1996; Carlson & Dillman 1983; Gasson 1973; Gasson & Errington 1993; Machum 2005; Herrmann & Uttitz 1990; Pennings & Leuthold 2000; Wilkening & Guerrero 1969; Wilkening & Bharadwaj 1968), 'peers' (Copp, Sill & Brown 1958; Beedell & Rehman 1999; Frank 1997; Upadhyay et al. 2003; Chiffolleau 2005) and 'advisory services' (Cross & Franks 2007; Makus et al. 1990; Beedell & Rehman 1999 & 2000; Fliegel 1993) are all highly important to farmer decision making. It also shows that as the aforementioned factors internal to the farm business become more important, so too does the importance of key characters in the decision-making environment. As with the conclusion relating to H3e, these findings show that the knowledge gained from the focus groups was not consistent with the attitudes of the larger population. The finding also suggests that, once again, factors internal to the farm business are key influencing factors that practitioners must understand when targeting a change of perception about the use of forward contracts for wool.

Hypothesis 5

As with H4, H5 (Section 7.6.2) was not supported, principally due to knowledge drawn from the focus groups. Participants argued that forward contracts are too difficult to use, that brokers rarely provide information about using any system other than auction and that there is generally not enough information available to assist with making the decision to use forward contracts to sell wool. The absence of support for this hypothesis indicates

that factors internal to the farm business are significant contributors to the self-efficacy and support surrounding the use of forward contracts; tested within the structural model and in isolation ($p < 0.01$). It is clear that factors such as producers' wool selling experiences, their knowledge of their own wool clip, their commitment to producing wool and level of dependence of wool to the farm business income add to the perceived behavioural control of using forward contracts in two ways. These factors contribute to producers' beliefs about their capabilities to take out forward contracts and the amount of support available. McLeay and Zwart (1998) discussed similar findings that the choices made by individual farmers are influenced by their marketing competencies, among other factors such as farm and farm manager characteristics and the structural characteristics of the industry under consideration.

8.2.3. Perceived Usefulness of Using Forward Contracts

The final three hypotheses are derived from the traditional TPB and Diffusion of Innovations frameworks. Justification for these hypotheses was mainly drawn from the literature on these theoretical frameworks, however, consideration was also given to the results of the focus groups discussed in Chapter 4.

Hypothesis 6

Based on the findings of Fliegel and Kivlin (1962), Lynne et al. (1995), Thompson and Panayiotopoulos (1999), Bergevoet et al. (2004) and Tutkun and Lehmann (2006), the impact that 'perceived usefulness' of using forward contracts to sell wool on the intention of producers to actually adopt the use forward contracts was tested by H6 (Section 6.2.3). The findings of Quaddus and Xu (2005) suggested that 'perceived usefulness' could be broken down into six sub-hypotheses that reflect constructs from the Diffusion of Innovations: 'relative advantage', 'compatibility', 'complexity', 'trialability', 'observability' and 'risk'. As explained in Section 6.2.1, 'trialability' and 'observability' were combined (as per research by Tan & Teo 2000) into a construct called 'application'.

Strong support was found in this study for the notions proposed by authors such as Pannell et al. (2006), D'Emden, Llewellyn and Burton (2006), Marra, Pannell and Abadi Ghadim (2003), Black (2000), Abadi Ghadim and Pannell (1999), Kingwell, Pannell and Robinson (1993). These authors concluded that 'relative advantage' has a positive relationship to adoption of an agricultural innovation (H6a in Section 6.2.3). The same finding was reached for H6b (Section 6.2.3), that the compatibility of forward contracts to

the farm business would have a positive effect on intention to adopt; in agreement with Rogers (1995) and Fliegel and Kivlin (1962). The conclusion can therefore be reached that the advantages forward contracts bring to the farm business and their compatibility with farm finances are key motivational factors for wool producers using this method of selling wool.

The application of forward contracts to the farm business was hypothesised to have a positive influence on intention to adopt (AP_Form \rightarrow IN and AP_Refl \rightarrow IN, refer to Section 7.6.3). The structural model showed both these relationships to be not significant which was thought to be a curious finding since ‘trialability’ and ‘observability’ are commonly known to be important factors that contribute to adoption. A test of bivariate correlations showed support of the hypothesis (H6d, as described in Section 7.6.3) that application of forward contracts to the farm business will have a positive effect on the intention to adopt forward contracts. Therefore, when ‘application’ is tested in the presence of all other behavioural factors, it is not significant. However, when it is tested in isolation it is found to be a highly significant factor contributing to intention to adopt. The implication of this finding is that while application of forward contracts to the farm business is evidently an important contributor to adoption, in the presence of other “real world” factors it does not impact on adoption. A possible explanation for this could be that farmers are more interested in managing price risk for a dominant revenue-earning enterprise which, in the case of this research, is grain; as proposed by Deane and Malcolm (2006).

‘Relative advantage’, as well as ‘compatibility’, ‘trialability’ and ‘observability’, ‘risk’ and ‘complexity’ are factors that contribute to the perceived usefulness of an innovation (Rogers 1995; Quaddus & Xu 2005). ‘Risk’ and ‘complexity’, however, are most often found to have negative effects on intentions to adopt an innovation (Fliegel & Kivlin 1962; Batz, Peters & Janssen 1999; Pannell et al. 2006; Tiller 2000; Lodge 1991; Abadi Ghadim, Pannell & Burton 2005). Results of this research were in agreement with Abadi Ghadim, Pannell and Burton (2005) and Batz, Peters and Janssen (1999) as ‘risk’ was found to have a negative impact on producers’ intentions to adopt forward contracts (H6e, refer to Section 7.6.3). Therefore, the inference can be drawn that, in the presence of high risk, forward contracts are not likely to be taken out by wool producers whereas in the presence of low risk, forward contracts will be more attractive.

In general terms, this knowledge supports the literature that farmers can be characterised as being risk averse (Bond & Wonder 1980; Pluske & Fraser 1995; Coad 2000; Pannell, Malcolm & Kingwell 2000). However, this is an important finding for wool industry practitioners who want to encourage the use of forward contracts in order to better structure the wool supply chain. This finding indicates that adoption of forward contracts can be increased if their beneficial characteristic of risk-management can be emphasised to wool producers, particularly in terms of suppressing the volatility of the auction system.

The impact of risk within the selling environment on the adoption of forward contracts can be further explained by studying the means of two survey questions (AW5 and RA7 in Appendix 2) that tested wool producers' attitudes to the volatility of the auction system:

AW5: I desire a method of selling wool for which the price is less volatile than auction.

RA7: I believe that forward contracts provide a pricing system that is not as volatile as auction.

The means of these two questions were each subjected to one-sample t-tests using a target value at the mid-point of the seven-point Likert scale from the survey. Despite nonparametric tests being used throughout this study it was considered that one-sample t-tests would be ideal for this situation, irrespective of the sample's population distribution, because the sample size was greater than 30. Each test resulted in a positive t-value and were found to be significantly higher ($p < 0.05$) than their respective means. This confirms that wool producers want a selling system in which price discovery is less volatile/risky/uncertain than auction.

Intriguingly, however, while 'risk' was found to have a highly significant, negative impact on farmers' intentions to adopt the use of forward contracts, the source of perceived risk has not been revealed by this study. This is because neither H1e (EFB \rightarrow RK, refer to Section 7.6.1) nor H3e (IFB \rightarrow RK, refer to Section 7.6.2) were found to have significant relationships. The aforementioned investigation of the data revealed that wool producers are sensitive to risky or uncertain situations, as determined by Abadi Ghadim, Pannell and Burton (2005), so are keen to manage the situation. However the source of this risk is not fully explained here. Deane and Malcolm (2006, p. 31) offer the solution that price risk should be examined in the context of the whole farm system

because “For a farmer, the inherent business risks they face (prices, yields) in their farming business generally only have meaning when related to the business liabilities (financial risk).” These authors also rationalised that farmers will devote their energy to managing price risk for the farm enterprise that contributes the greatest costs and revenues to the business. Deane and Malcolm continue their argument by pointing out that, since grain is generally eclipsing wool in terms of production levels in Australia, it is rational for producers to pay most attention to managing the price risks associated with grain production.

The work of these authors highlights the premise that the present research is limited to the wool-producing enterprise as part of a whole farm business or system. This limitation is based on the notion that the incomplete adoption of forward contracts for other commodities (such as grain or livestock) does not present a problem for the respective industries. The scope of the present research dictated that the wool-producing enterprise of the farm business be considered in isolation so did not assess how the adoption of risk management strategies for all enterprises impacts on the decision-making associated with wool sales. It can therefore be said that a limitation of this research is that the farm business was not considered as an entire unit, nor was the interaction of decision making between enterprise types. This understanding of the interaction between aspects of the whole farm business is known as an agricultural system.

Systems thinking has been discussed by prominent authors such as von Bertalanffy (1975) and Checkland (1999) but has also been used to understand farmers’ behaviour and decision-making processes (Dent & Anderson 1971; Bosch, Ross & Beeton 2003). Von Bertalanffy’s definition of a theoretical model was used in Chapter 2 (Section 2.4) as grounding for developing the behavioural model for this research.

Authors of agricultural systems research argue that the farm business is a complex system so studying isolated components will not give a complete representation of the greater system or the interactions within the system (Dent & Anderson 1971; Bosch, Ross & Beeton 2003). In recent times, this philosophy has extended to understanding how outputs of whole farm systems are related to people’s responses to their economic and social environments, including decisions made within the farm household (Pannell et al. 2006; Dent, Edwards-Jones & McGregor 1995; McGregor Rola-Rubzen & Murray-Prior 2001). The present research has accounted for social influences, like the influence of peers and family in decision making, although environmental conditions have been

omitted. In this context of the present research, environmental conditions are considered to be the existing physical environment in which the farm operates, for example, the farm's enterprise mix, operational practices or available resources. There is much evidence from Australian research to suggest that such constructs should be included in models that are attempting to understand farmers' adoption behaviours (Deane & Malcolm 2006; Abadi Ghadim, Kingwell & Pannell 1991; Pannell et al. 2006).

While 'risk' was found to have a highly significant relationship to 'intention', 'complexity' was found to have no significant relationship to 'intention' (H6c, see Section 7.6.3); a curious conclusion given results of the literature review and the focus groups. So, while factors external to the farm business have a strong, negative impact on 'complexity', this same notion is disregarded when producers are thinking about using forward contracts to sell wool. This shows that the issue of complexity is in the minds of wool producers when they think about forward contracts, but complexity does not encourage or discourage producers from actually adopting; contrary to the findings of authors such as Rogers (1995), Fliegel and Kivlin (1962), Batz, Peters & Janssen (1999) and Tiller (2000). It may be the case that another negative factor, such as risk, overshadows the disadvantage of complexity. This provides a research question for further investigation.

8.2.4. Perceived Subjective Norms Associated with Using Forward Contracts

Hypothesis 7, stated in Section 6.2.3, was split into two sub-hypotheses in order to assess the impact 'subjective norms' and 'advisory services' have on producers' intentions to take out forward contracts to sell wool.

Hypothesis 7

There is much evidence in the literature to suggest that social, or subjective norms will influence an individual's intention to perform a particular behaviour (Ajzen & Fishbein 1973; Marcil, Bergeron & Audet 2001; Christian & Armitage 2002; Lynne et al. 1995; Shimp & Kavas 1984; Bonfield 1974; Beedell & Rehman 1999 & 2000; Charng, Piliavin & Callero 1988; Ryan 1982; Pennings & Leuthold 2000 & 2001; Burton 2004). Evidence also exists to suggest that advisory services (Cross & Franks 2007; Makus et al. 1990; Beedell & Rehman 1999 & 2000; Fliegel 1993) and family within farming communities are important aspects of the social networks that make up the decision-

making environment of a farmer (Chiffolleau 2005; Hildenbrand & Hennon 2005; Albrecht & Albrecht 1996; Carlson & Dillman 1983; Gasson 1973; Gasson & Errington 1993; Machum 2005; Herrmann & Uttitz 1990; Pennings & Leuthold 2000; Wilkening & Guerrero 1969; Wilkening & Bharadwaj 1968). Since H7a (see Section 7.6.4) was strongly supported, it can be said that the findings of this study concur with those of the literature in that the subjective norms, shown to be derived from factors internal to the farm business, definitely influence wool producers' intentions to adopt the use of forward contracts. Therefore, practitioners need to be aware that factors beyond their immediate control will influence their clients' decision to take out a forward contract.

It was also hypothesised that 'advisory services', such as membership of farming groups rather than advice from brokers or merchants, would have a positive impact on 'intention' due to the conclusions of Beedell and Rehman (1999 & 2000), Shimp and Kavas (1984), Ryan (1982), Lynne et al. (1995), Christian and Armitage (2002), Marcil, Bergeron and Audet (2001), Bergevoet et al. (2004) and Tutkun and Lehmann (2006). The structural model showed the relationship of H7b (Section 7.6.4) not to be significant. However, when this relationship was tested in isolation of all other constructs within the model it was found to be significant ($p < 0.05$), therefore showing support for the literature. It can therefore be said that wool producers will respond well to advice from farming groups when considering whether or not to adopt forward contracts. However, their ultimate decision to take out a forward contract will be based on a broader range of factors, although this range of factors will not include the impact of advisory services sought from farming groups.

8.2.5. Perceived Behavioural Control Associated with Using Forward Contracts

The final hypothesis to be tested involved measuring the impact 'perceived behavioural control' has on producers' intentions to take out forward contracts to sell wool. Like H7, this final hypothesis was split into two sub-hypotheses (see Section 6.2.3).

Hypothesis 8

It has been shown that the Australian wool industry plays a substantial role in the decision-making processes of wool producers. The Australian wool industry is a contributing factor to how confident producers feel about taking out forward contracts (in terms of self-efficacy [SE]) and how much support (SU) they perceived to be available.

The literature by Tutkun and Lehmann (2006), Bergevoet et al. (2004), Christian and Armitage (2002), Marcil, Bergeron and Audet (2001), Tan and Teo (2000), Lynne et al. (1995) and Shimp and Kavas (1984) showed significant, positive relationships between ‘perceived behavioural control’ (SE and SU) and the adoption of the behaviour in question in each piece of research. The structural model of the present research did not support these findings as no significant relationship was found to exist between $SE \rightarrow IN$ or $SU \rightarrow IN$ (see Section 7.6.5). This had an important consequence as these are the critical constructs of the TPB; the fact that they are not significant shows that the TRA is possibly a more appropriate theoretical framework for this study situation, as also found by Thompson and Panayiotopoulos (1999).

As the results of H8a ($SE \rightarrow IN$ in Section 7.6.5) and H8b ($SU \rightarrow IN$ in Section 7.6.5) were surprising, when these relationships were tested in isolation of all other constructs (using bivariate correlations), both hypotheses were strongly supported ($p < 0.01$). This shows that ‘self-efficacy’ and ‘subjective norms’ both contribute to wool producers’ intentions to adopt the use of forward contracts. However, in the “real-world” setting where there are multiple issues that influence decision-making, ‘self-efficacy’ and ‘subjective norms’ were found not to impact on the adoption of forward contracts to sell wool.

The conclusion can therefore be drawn that intention to adopt forward contracts for selling wool will be assisted when there is adequate support available to producers and also when they are confident to undertake the process. The final, important conclusion from this hypothesis is that further research is needed to test if an extended version of the TRA is a more appropriate theoretical framework than the TPB to apply to this research topic; as found by Thompson and Panayiotopoulos (1999) in their study of British dairy farmers.

8.3. Summary

Chapter 7 revealed that many of the hypotheses tested in the behavioural model of this research were not supported. This was principally because so many of the hypotheses were drawn from the focus groups conducted for this research. Quaddus, Islam and Stanton (2006) experienced a similar problem with their mixed method research on determining the motivational factors for producing wool. The discrepancies between the results of the focus groups and empirical findings does not mean that either method is

redundant, it is simply a demonstration of the gap between interpretivist and positivist research methodologies. In this instance, the interpretivist approach was taken to build a model that adequately reflected the farm-level decision making environment. While many of the hypotheses were not supported, the constructs and their relationships developed from the focus groups and combined with the TRA/TPB/Diffusion literature proved to be significant contributors to this model.

This discussion and further data analysis has yielded some substantial findings about two of the theoretical frameworks used in the research (TRA and TPB). The main finding was that the TRA is likely to be a more appropriate theoretical framework for this model. This is principally because the characterising construct that separates the TRA from the TPB ('perceived behavioural control') was found to have no significant impact on intention. Further research needs to be conducted to test if the TRA is a more appropriate framework.

Aside from this major finding, factors external to the farm business were found to play a highly significant role in how wool producers perceive the usefulness of forward contracts to the farm business. These factors also strongly contribute to wool producers' beliefs on how successfully they can use forward contracts to sell wool.

Factors internal to the farm business are also important determinants of how wool producers feel about using forward contracts. The 'perceived usefulness' of forward contracts, the 'subjective norms' associated with their use and their 'relative advantage' were all explained by various factors internal to the farm business; the only exception was in terms of risk. Surprisingly, neither factors external nor internal to the farm business had any significant relationship to 'risk'. The consequence of this finding is that the risk and uncertainty wool producers feel towards using forward contracts is not explained by this study. Again, this is a finding that needs further research to more fully explain this outcome.

Factors internal and external to the farm business can be said to generally explain wool producers' attitudes towards using forward contracts, however, this discussion of results also shows that 'perceived usefulness' and 'subjective norms' are the factors that contribute to producers' intentions to actually adopt the use of forward contracts. The only exceptions to these conclusions are that 'application' to the farm business and 'complexity' were not contributing factors to intentions to use forward contracts. This is

a new finding as the literature nominates 'complexity' to be a significant inhibitor of adoption.

The major finding of this chapter was associated with the success of the behavioural model and how well the exogenous variables (factors external and internal to the farm business) agreed with the traditional TPB/Diffusion model. Factors internal and external to the farm business significantly contribute to what wool producers think of using forward contracts and their adoption intentions. The final important finding was that risk is the major limiting factor accounting for why wool producers have been slow to adopt forward contracts as a method of selling their wool, although the source of this risk has not been determined. It was suggested that a systems approach, such as that used by Dent and Anderson (1971) or Pannell et al. (2006), would have shed more light on this issue. Nevertheless, Chapter 9 aims to further develop the behavioural model and use case studies as a strategy to complete the research by determining the sources of risk that wool producers perceive about using forward contracts.

Chapter 9 Case Studies¹⁴

9.1. Introduction

Chapter 8 presented a discussion of data analysis results. While many of the results reported in Chapter 7 were found to support the hypotheses proposed in Chapter 6, a number of issues require deeper investigation. For example, the model did not fully explain the source of risk felt by wool producers when taking out forward contracts, nor did it account for the lack of significance of complexity associated with using forward contracts. Some prominent authors recommend the case study methodology as a means of exploring situations in which processes being studied have no definitive outcomes (Yin 2003) or for further developing research born from deductive-analytic methodologies (Hamel 1991; Bailey et al. 2006). This chapter presents the research questions, research method, results, discussion and conclusions reached from multiple case studies. The aim is to further explore, and therefore explain, the motivational behaviours associated with the adoption of forward contracts by wool producers, as evidenced in the empirical part of this research (see Chapter 7 and Chapter 8).

9.2. Research questions

While Sections 7.6 and 8.2 provided sound explanations for most of the relationships within the model, there were a number of behavioural factors described in the focus groups and found in the literature that were not supported by the structural model. It is well documented that farmers' perceptions related to risk and uncertainty (Abadi Ghadim, Pannell & Burton 2005) and their perceptions and attitudes (Pannell et al. 2006) are key influencing factors on adoption decisions. In this research, many of the perceived risks were found to be associated with taking out forward contracts and the impact price volatility of the auction system has on producers' decision making. Further explanation is therefore required regarding the root causes of these risks and subsequent adoption, or non-adoption, of forward contracts. Another point of clarification is needed on the source

¹⁴ A version of this chapter has been published by the researcher in the following peer-reviewed conference proceedings:

'Case studies of forward contract adoption by wool producers: Ideas on behavioural determinants from Western Australia', *Curtin Business School Doctoral Colloquium*, 30-31 August, 2007, Perth.

of complexity associated with using forward contracts. Therefore, to complete this research, and further develop the behavioural model proposed herein (Hamel 1991), an interview guide was constructed around the following questions:

1. Why do perceptions of risk exist in association with using forward contracts?
2. How do farmers deal with the risks associated with selling wool?
3. Why is complexity not a significant factor in the adoption of forward contracts to sell wool?

9.3. Method

9.3.1. Concurrent Triangulation Strategy

“Case studies are rich, empirical descriptions of particular instances of a phenomenon that are typically based on a variety of data sources” (Eisenhardt & Graebner 2007, p. 25). They are useful for comparing the behaviours of multiple types of people and they provide a rich insight into complex patterns of causality that are sometimes lost in quantitative approaches to research like those described in Section 7.4 (Hamel 1991). Berg (2001) and Stake (2000) describe a number of approaches to case study research. Of these approaches, the instrumental, explanatory approach was chosen for this research. This is principally because the intention of this study is to use a qualitative methodology to further explore and explain the findings of the survey and attempt to answer some questions that were unexplained by the previous quantitative study (Bailey et al. 2006; Howden & Vanclay 2000). This integration of quantitative and qualitative findings is termed the concurrent triangulation strategy by Creswell (2003); the purpose of which is said “to strengthen the knowledge claims of the [whole] study or explain any lack of convergence that may result” (p. 217). By employing concurrent triangulation strategy, richer information about producers’ wool selling behaviours will be gained, as well as providing insight into the sources of risk felt when using forward contracts. The virtues of mixed-method research were described in Section 4.2, with particular reference to qualitative-quantitative research. However, with the need to further explore dimensions within the behavioural model, the research process of Bailey et al. (2006) is followed herein. These authors also conducted qualitative-quantitative research and then used case studies to complete their evaluation of how a particular government-funded project encouraged change at the farm level.

9.3.2. Sample

Given that the purpose of this case study research is to further explore hypotheses, rather than test theory (as explained in Section 7.4.1), purposive sampling was chosen as the strategy to select cases. The basis of purposive sampling is given by Berg (2001) who recommends that this sampling strategy be adopted after an initial study to ensure that specific individuals are targeted. These individuals targeted for purposive sampling are selected because they display particular attributes that require further explanation.

The literature says that, in case study research, cases can be selected because they compare extremes within the research context (Glaser & Strauss 1967; Hamel 1991; Eisenhardt & Graebner 2007; Miles & Huberman 1994). This is more specifically known as the ‘polar types’ approach to theoretical sampling (Eisenhardt & Graebner 2007). In the situation of this research, four wool producers were systematically selected, each of whom had varying levels of commitment and experience with using forward contracts to sell wool: the first candidate had never used forward contracts to sell wool, the second candidate was committed to using forward contracts but not any other price risk management tool, the third candidate was an ex-wool producer who exited the industry in 2005, while the fourth candidate had disadopted the use of forward contracts in favour of using futures contracts to sell wool. This selection of cases, specifically chosen to further develop the relationships between the constructs in the research model (Figure 5.2), show extreme perspectives of the research problems and attempt to explain some of the ambiguities and gaps exposed in the quantitative phase of the study (Siggelkow 2007; Creswell 1998; Yin 2003).

9.3.3. Interviews

Given that the purpose of these case studies was to further develop the behavioural model and better explain its relationships, semi-structured interviews were conducted using an interview guide (Appendix 4). Having a semi-structured interview guide, as recommended by Yin (2003) and Gladwin (1989), allowed the researcher to explore the predetermined topics with the option of deviating from initial questions as new ideas emerged from conversations. Miles and Huberman (1994) suggest that open-ended questions are the most appropriate devices for a descriptive study where the parameters are largely unknown. These authors, along with Hartley (2004), support the idea of a

standardised instrument for multiple-case studies so that the findings can be systematically laid alongside one another for comparison.

While the larger part of this study principally focuses on the social phenomena that exist when producers sell wool, this chapter is designed to further explain the questions raised from discussion of the behavioural model. The very nature of the ‘how’ and ‘why’ research questions proposed in this chapter (see Section 9.2) have determined that case studies are the most appropriate strategy to use for this final stage of the research (Yin 2003; Eisenhardt & Graebner 2007).

A final comment on the research process needs to be made about the fluid and changing nature of the interview guide. Eisenhardt (1989) goes to great lengths to build an argument for researchers to take advantage of experiential learning and allow adjustments to be made to the interview guide as more data are gathered and new themes emerge. As a result of this advice, *ad hoc* questions were added to the interviews as time progressed.

9.3.4. Data Collection

Yin (2003) discusses the advantages of running a pilot case study prior to data collection as a method of helping the researcher to develop a line of questions. In the instance of this research, the questions for the interview guide had clearly emerged from the study’s quantitative results so a pre-test in the form of a ‘dress rehearsal’, rather than a true pilot test, was all that was necessary. This pre-test of the interview guide was carried out two weeks before the four interviews were conducted. It provided the opportunity to have a final test run of the interview situation, that is, test the questions for structure and flow, test the time taken for the interview and test the audio recording equipment. The pre-test interview, which lasted about one hour, was conducted at Curtin University’s Muresk Institute of Agriculture with an agribusiness and extension lecturer who is also responsible for selling the Muresk farm’s wool. The interview was recorded on a digital Dictaphone and then transferred onto the researcher’s computer for subsequent transcribing. The interview guide seemed to suit the purposes of the research although the interview candidate cited the research of prominent ethnographer Christina Gladwin (1979 & 1989) as a suggestion for improvement. This author discusses the importance of distinguishing between people’s actual behaviours (norms) and the generalisations (beliefs) they make about their behaviours (Gladwin 1979). To overcome this problem, it is advised to combine participation observation and ethnographic interviews (Gladwin

1989). Because observing producers' wool-selling behaviours was not practical, the alternative strategy was to slightly alter the interview guide in order to take heed of Gladwin's advice. As a consequence, the question in the interview guide that asked the interview candidate to describe how they sold wool was changed to: "Can you describe for me how you sold your wool last year?", this was then followed by: "Is this the usual way you do things or was last year's strategy different than usual?".

Prior to the interviews taking place, the data collection instrument was passed by the University Ethics Committee. The conditions of this Committee required that each interview candidate was provided with a short statement of information about the project and that they signed a consent form to show they understood the research, that they were at liberty to withdraw at any time without prejudice and that their personal details would remain confidential in the event of publication of the research. These criteria were strictly adhered to during the interview process.

Once the pre-test was complete and the data collection instrument was updated, the four interviews were conducted in various locations in Perth; some interviews were conducted in public locations while one was conducted in the researcher's home. At the beginning of each interview, candidates were thanked for agreeing to participate and reminded that their contributions were entirely confidential and that they were at liberty to withdraw from the interview at anytime without prejudice. The interviews lasted between 42 and 98 minutes. Each interview was recorded on a digital Dictaphone and was transcribed *verbatim* into an MS Word document within one month of the data collection.

9.3.5. Data Analysis

When multiple cases are used in theory building, cross-case analysis is a common method of data analysis. Cross-case analysis is a thematic analysis of themes across all cases and is generally carried out after each case has been analysed on its own (Creswell 1998; Graebner 2004). It is usual to precede cross-case analysis by 'within-case analysis' in order for the researcher to develop an intimate familiarity with the data and to build constructs from the case studies (Creswell 1998; Graebner 2004; Eisenhardt 1989). For this research, the step of within-case analysis was used to identify themes for coding across cases, a tactic for developing cross-case patterns described by Eisenhardt (1989), as the researcher was not attempting to confirm but to explain patterns of behaviour

(Creswell 1998; Yin 2003). Data transcripts in MS Word were loaded into QSR NVivo 7 for analysis.

9.4. Results and Interpretations

In all cases examined, wool provided the main source of income. However, some form of grain or fodder crops were also produced. Further to this, other information about the sample is useful for developing a picture of the individual cases (Table 9.1). The interview candidates in each case were all male, third or fourth generation farmers who had been involved with the farm business for a range of 26 – 45 years. Farm sizes ranged from 900 – 2,950 hectares. In terms of farm production, the three interview candidates who are currently farming each have flocks of approximately 14,000 sheep, whereas the interview candidate who has exited the industry had a flock of approximately 5,500 sheep at his last shearing. The largest wool producer was not the candidate with the largest farm; overall, wool production ranged from 140 – 400 bales per annum. Simple arithmetic after the interviews showed that the cases which use forward contracts produce the most bales of wool per hectare. The implication of this is that using forward contracts may allow producers to more finely determine their on-farm enterprise mix therefore enabling them to better optimise their land resource.

Table 9.1: Descriptive information of interview candidates

	Cases			
	#1	#2	#3	#4
Length of family involvement with the farm (years)	100	99	75	84
Length of individual's involvement with the farm (years)	45	31	29	26
Size of farm (hectares)	2,630	2,950	900	2,200
Sheep at last shearing (nearest '00 head)	14,000	14,000	5,500	14,000
Wool production at last shearing (bales)	286	330	140	400
Wool production (bales) per hectare*	0.109	0.112	0.155	0.182

#1 = Never used forward contracts to sell wool, #2 = Consistently used forward contracts to sell wool, #3 = Had exited the wool industry, #4 = Used futures for selling wool; not forward contracts.

* = Wool production at last shearing/size of farm.

The following description and discussion of results is broken down into four sub-sections in order to answer the research questions posed at the beginning of this chapter. This section starts with identifying the perceptions of risks associated with using forward contracts to sell wool. This is followed by an analysis of the sources of perceived risks

and then a description of how risk is managed in each case study. The final sub-section discusses the issue of complexity perceived about forward contracts to sell wool. A summary of the results from these case studies is provided in Table 9.2.

9.4.1. Perceptions of Risk

Abadi Ghadim, Pannell and Burton (2005) showed that the risk perceived about an innovation will strongly influence its adoption. The present study concurred with this finding although further clarification was needed on the actual factors that contributed to the risk perceived about the use of forward contracts to sell wool. The case studies conducted for this chapter shed some light on this problem.

Surprisingly, many of the perceptions about the risk of using forward contracts that were raised in the case studies were contrary to the findings of the survey and closely mirrored those issues discussed in the focus groups, as described in Section 5.4. Quaddus, Islam and Stanton (2006) had a similar experience with their mixed-method research on understanding farmers' motivation to produce wool. They found that factors that were determined as key constructs from analysis of focus group data of why farmers continue to produce wool proved not to be significant when tested in a structural model.

The case studies revealed that there were three key perceptions of risk about using forward contracts to sell wool. There was the concern that the price differential between the spot market and the forward market was too great to warrant using forward contracts, the fear of not being paid for the wool after the forward contract had closed and the concern of not meeting the obligations of the forward contract. Each of these perceptions is explained in more detail below.

9.4.1.1. Price Differential

The perception of the price differential between the spot and forward markets is two-fold. Results of the focus groups showed that wool producers were not keen to take out forward contracts to sell wool because they were concerned that the spot market (auction system) would offer a higher price on the day a forward contract closes, this was often termed "locking in" a price (as described in Section 5.4.1). While this finding concurred with the conclusions of Ben-Kaabia and Gil (2007), "locking in" an unfavourable price was of a lesser concern in the case of the farm businesses studied for this later research. The case studies showed an alternative point of view: the aspect of the price differential

Table 9.2: Summary of case study results

Research question	Issue	Factors	Finding
Why do perceptions of risk exist in association with using forward contracts?	Perceptions of risk	Price differential between the spot market and forward contracts	Forward contracts are only attractive to use in an ‘upward’ market (see Section 9.4.1.1) and price will always override desire for a secure income (see Section 9.5.4)
		Fear of wool buyer not meeting contractual obligations	The wool supply chain is too long and mature for buyers to renege on contracts (see Section 9.4.1.2)
		Fear of wool producer not being able to meet contractual obligations	The fear of not being able to fill a forward contract was found to be valid in the instance of grain production, but not a valid concern for wool production (see Section 9.4.1.2)
	Sources of risk	Farm profits	Producers will focus their risk management on the most profitable farm enterprise, or the enterprise that incurs the highest costs (see Section 9.5.1)
		The whole farm system	Decision-making must be considered in the context of the whole farm system, not just one enterprise in isolation (see Section 9.5.2)
		Media publications	The influence of the media is a major component of subjective norms (see Section 9.5.3)
		Social pressures	Producers who use forward contracts are characterised by their ability to withstand social pressures (see Section 9.5.4)
How do farmers deal with the risks associated with selling wool?	Managing the risks	Operational strategies	Reduce stocking rate, adjust flock’s average fibre diameter, split shearing, test wool quality before shearing (see Section 9.6.1)
		Marketing strategies	Sell $\frac{2}{3}$ of wool clip on the spot market, information gathering (see Section 9.6.2)
Why is ‘complexity’ not a significant factor in the adoption of forward contracts?	Complexity		It is likely that ‘complexity’ is a significant factor affecting the adoption of forward contracts but the sample population did not reflect this view (see Section 9.7)

between the spot and forward market. Ironically, this concept was conspicuous in its absence from Section 5.4.1.

The wool producers interviewed described the forward market (that is, forward contracts or futures) as being unattractive at the time of gathering information to make a selling decision because it offered a lower price than the spot market. Therefore, the perceived risk in this situation is not the fear of “locking in” an unfavourable price for selling wool but forward prices not being comparable to current auction prices. Evidence of this sentiment is demonstrated by comments from the wool producer who exclusively used the auction system, the wool producer who usually used forward contracts and the wool producer who usually used futures, respectively: “The forward market is roughly a dollar under the physical.” and

.../ In the last year we didn't sell forward, we sold at auction. When the market was drifting along and trending down, the discounts for selling forward were not an incentive to do so, so we shored the wool and sold it in auction probably over a small number of sales, say two or three sales .../We haven't forward marketed too far out and that's only in recent history simply because wool prices have been bloody ordinary and you haven't got to be a rocket scientist to know that there's no premiums in the forward market based on the current physical market prices .../

These results are not surprising for two reasons. The first reason, born from a statement by Pannell et al. (2006), suggests that one of the factors that contributes to the perceived relative advantage of an innovation is the “cost or profitability that the innovation will replace” (p. 1414). These authors use the adoption of herbicides in the United States as an example. It is said that farmers could no longer afford not to use herbicides because the price of fuel and labour (used for traditional cultivation methods) were increasingly disproportionate to farm income. The reverse appears to be the case with wool price discovery. The above statements show that the price differential between the spot and forward markets means that forward contracts are not attractive enough to be adopted. This is particularly evident in the quote by the wool producer who traditionally uses forward contracts but did not do so last year because the price differential was too great. Both Tiller (2000) and The Merino Company (2006) produced similar findings to the above, however a review of the literature on the background of forward selling (Section 2.3.2) yielded an alternative view. The literature stipulates that users of forward contracts

must accept lower prices than those offered by the spot market. This is principally because buyers carry a degree of risk by taking out a forward contract. In the case of wool, Cumming (2004) said that this could be as high as 200 ¢/kg.

The second reason why this finding is not surprising is explained by the downward nature of wool prices in the past few years. There is no rational reason why wool producers would forward contract based on a downward market, it is only in an upward market, in which prices are forecast to rise, that a rational decision-maker would take out a forward contract. While recent reports favour an up turn in wool prices, they are quick to specify that favourable prices are likely to be short-lived (Bolt 2007). In respect to the present finding, more attention should be paid to generalist reports that suggest that wool prices are likely to continue falling in relation to other agricultural commodities (Wood & Ashton 2007; ABARE 2006), a perception obviously shared by the wool producers of these case studies.

9.4.1.2. Other Concerns

In addition to price differential being recognised as a factor limiting the adoption of forward contracts among wool producers, Section 5.4.1 showed there to be two other limiting factors that need to be addressed herein: the fear of being unable to meet contractual obligations and farmers not being paid for delivering wool to a forward contract. All four cases in this paper showed these latter two factors to be myth rather than fact.

The fear of not being able to meet contractual obligations was discussed by Blackburn and Ashby (2007) and explored in this research; strategies to overcome this risk are described later in this chapter under the 'Operational strategies' section. Similarly, the issue of not being paid for delivering wool to a forward contract was also explored and rejected in all cases. Focus group participants at Kojonup and Merredin gave the impression that wool producers feared that wool buyers would not honour forward contracts by taking wool but not paying. The interview candidates discussed how the wool supply chain was too long and complex for any single party not to honour an agreement to take and subsequently pay for a delivery of wool (.../ because it is going through second hands .../ I have never actually heard of that happening with the wool industry. I think that the wool industry is that ingrained .../).

9.5. Sources of risk

The second objective of conducting the case studies was to determine the sources of risk about using forward contracts to sell wool. Analysis of the behavioural model showed that risk (alternatively known as uncertainty) was the only negative, significant factor impacting on the intention to adopt forward contracts as a way of selling wool (Section 7.6.3). The model also showed that neither factors internal nor external to the farm business were the source of this perception. The cases used to further explore this issue exposed some highly specific factors that may demonstrate the source of the perceived risk of using forward contracts. As explained in the following sections, the main factors that emerged were the importance of farm profits when making selling decisions, the whole farm system, media publications and social pressure.

9.5.1. Farm Profits

Abadi Ghadim, Pannell and Burton (2005) showed that perceived potential profit from an agricultural innovation was a significant factor when making an adoption decision. In this research, it appeared that the farm's profit, or revenue earning potential, was pivotal in the decision-making process examined in each case. Evidence of this inference is provided by the following seven statements:

.../I suppose within myself it is that we have operated profitably, that we have [earned] more than our cost of production. I think if we can make a profit each year we will be around next year to have another go. So as long as I can operate at a profit I am happy .../For our enterprise we just aim to make a profit, that's what we do is try to make a profit and we do benchmarking and all these things, but I don't necessarily see that we have to be at the top of the benchmark .../Effectively I knew what I needed per kilo to break even or get in front and I got into a position where I was selling about a third of my clip on forward selling which I tried to set up to cover my costs, so the other two-thirds of the clip would be the marginal profit .../That covered my costs. I would ring them up and say what are you offering? They would give me a price and then I would basically go back and say, what's it going to cost to shear, da da da da. OK. That's my costs in the bag .../We would still be getting the same money as we got at shearing time back in October. So the market hasn't

improved off what we have already sold wool for. That's just the backstop at the moment. If it starts to get better than what we got for it last year, yeah, it is getting closer .../Unfortunately the market is not a place of charity. If it is worth \$6.50, that's all it is worth. Don't delude yourself. Right, go and try and grow \$11 type wool, you know 16 ½ -17 micron. You can do it, but I tell you what, nine times out of 10 your environment will kill you anyway, and then you will end up in discounts as you come down in those microns and the quality has got to be better because the discounts are just horrific .../ We just work on a price that we know that we can earn a comfortable living from and we will stitch up a futures contract relative to that .../

In this evidence, profit and price discovery were discussed in terms of the decisions made on which selling methods to choose. The above statements show that, in each case, the ability of the farm business to earn a profit dictates the wool producer's attitude towards pricing, which in turn, dictates the method ultimately chosen to sell wool. Once again, this concurs with the findings of Deane and Malcolm (2006) that the rational risk manager will concentrate risk management efforts on the enterprise that contributes the most to cash flow and expenditure. Another insight can be provided by re-examining the survey data. This study focused only on wool production. Given that 78.4% of survey respondents mainly operate mixed livestock-cropping farms, the majority of responses come from a combined livestock-cropping perspective. Although this is a potential weakness of the survey, it may account for the lack of evidence about the source of risk because survey respondents were not asked about their point of reference when concentrating on risk management initiatives.

9.5.2. The Whole Farm System

Closely linked to the concept of profit-making was the importance of considering the whole farm system when making selling decisions about wool. Systems thinking was raised in Chapter 8 (Section 8.2.3) as a possible explanation for the model not adequately explaining the sources of perceived risk. This notion came from arguments made by Deane and Malcolm (2006) who warned that research on farmers' decisions about forward marketing should be considered from the perspective of the whole farm and it is naïve to look at individual enterprises in isolation.

In the case of the wool producer who had never used forward contracts to sell wool it was said:

.../You can still make money at both those prices but you use completely different management skills. Those management skills in a lot of cases have got dollars attached to them. By using one method you can scrape through on the smell of an oily rag. It is like you do not give the extra drench when you should, you can actually put it off because the price is not going to have a big bearing, but at a higher priced wool you can even double that price to \$10 a kilo. You would make certain that your sheep are fed properly, that their health status is number one. In other words you can afford to increase your management skills by a dollar a head and still have a margin to work on. If, all of a sudden, you are using everything properly at \$10, and all of a sudden the price of wool drops to bloody \$5 dollars, all of a sudden you might find that you are not breaking even and the cost of production has gone up. Other things are: yes, I can afford to run more sheep, if I run more sheep it means I have to conserve more fodder so that if anything goes wrong I can get through. Or you can take the simplistic approach as saying if I drop my stocking rate by 1 DSE there is still a very healthy margin in it, it means I do not have to conserve as much fodder .../

The importance of this statement lies in the description of the wool producer not only managing his on-farm resources in order to make a profit from wool, but also the knowledge that an entirely different approach to sheep production may be required if profits are going to be made.

Further evidence of the importance of considering the whole farm system came from the wool producer who consistently used forward contracts to sell wool and grain. This case study showed that the use of forward contracts is a philosophical strategy in that, no matter if the farmer is forward contracting wool, meat, or grain, his main intention is to “try and sell forward a certain portion to lock in our income”. Even when discussing production risks, forward contracts were discussed in the context of the whole farm system:

...I think probably production risks would be the biggest thing. With wool for us it is not so great. With selling grain forward the production risk is probably our number one risk. For our wool production enterprise, regardless of the season, we are going to grow roughly the same amount of wool because we are geared up for summer drought .../

The attention that must be paid to the whole farm system is emphasised by Wood and Ashton (2007) who advocate that a systems approach to decision making is most important in the context of mixed livestock-crop farms. Given that 78.4% of survey respondents operate mixed livestock-crop farms, it is reasonable to conclude that studying the entire farm business system, instead of one only one aspect, is an important point of reference for determining an appropriate research paradigm.

9.5.3. Media Publications

These case studies showed that the media is an important influencing factor on farmers' adoption decisions on forward contracts to sell wool. Rehman et al. (2007) showed that farming press, among other factors, would support a decision to change farming systems and practice. Similar conclusions were reached by Saltiel, Bauder and Palakovich (1994), Longo (1990) and Wilkening (1950); as discussed in the literature review (Section 2.4.3). The impact of communications and the influence of advisory services were included in the behavioural model of this research after reading Fliegel (1993) and Rogers (1995). However, in the context of this research the influence of the media alone was only exposed in the later part of this study. Both Fliegel (1993) and Rogers (1995) advocate that the mass media is an important element of the Diffusion of Innovations theory; a phenomenon supported by this research.

Weekly publication, in the *Farm Weekly* and the *Countryman*, of business names that earned the highest wool prices at auction was regarded as a major impediment to the adoption of selling systems alternative to auction. This finding was not unexpected since the views of the general community, otherwise known as 'subjective norms', were found to be highly statistically significant in relation to factors internal to the farm business (Section 7.6.2 [H4a]) and wool producers' intention to adopt the use of forward contracts (Section 7.6.4 [H7a]). This positive relationship means that as community perceptions increase, so too do people's intentions to adopt the use of forward contracts. Therefore, it can also be said that wool producers are sensitive to ideas generated by the general

community. The frustrations communicated in these case studies supports this empirical finding because wool producers are said to be strongly influenced by issues covered in the media.

To verify this finding, the wool producer who consistently sold his wool using futures said:

.../I have never been able to understand why rows and rows and rows of people's names are listed for what they got for bales of wool. You have no idea what it is like, why is it published. It has got no relevance to me. I will look through clients and see if they have done alright because I know some clients who love the auction system and love getting their name in the Farm Weekly, so I will sift through it. But it has got me buggered why it is published in the Farm Weekly and the Countryman every week .../

The wool producer who has exited the industry gave further support to this statement by saying:

.../We are not competitors, but it is almost a competitive thing. Everyone runs around crapping on about figures. When wool was doing well I would read the Farm Weekly and I would see this article and the guy would go: "Oh yeah, we averaged 6 kilos a head over 10,000 sheep". – 6 kilos of fleece wool is a big fleece... It is a lot of bull. The next week you read an article and this bloke would be raving on about his wethers cutting 8 kilos and you would be thinking "5000 wethers cut 8 kilos". But they couldn't get their sums right because I worked it out, yeah, 200 kilos a bale wool is 40 bales or whatever and they go yeah, we got 25 bales of wool, well you wouldn't have got 25 bales off so many wethers if you'd cut 8 kilos, you'd get double. It is just bloody weird .../

The lesson learned from these two cases is that the print media evidently plays a large role in bolstering the significance of selling systems in wool producers' minds. The behavioural model showed that 'subjective norms' are significant contributors to wool producers' adoption behaviours, but what has been identified here is that media publications are evidently a form of subjective norms amongst producers. It was also shown that the mass media is a source of competitiveness amongst producers because names and prices are so regularly and openly advertised. It can therefore be inferred that

this is perpetuating the notion that a high wool price is the only price that is acceptable, rather than a pre-determined, secure wool price that earns a profit for the farm business.

9.5.4. Social Pressures

These case studies identified the media as a possible source of concern for wool producers about using forward contracts. Another issue raised, closely related to that of subjective norms, was the influence of peers and brokers in the decision to use forward contracts to sell wool. All the cases provided evidence that people of significant importance to the decision-maker doubted or criticised decisions to use a method other than auction to sell wool.

There was evidence from the cases that there was doubt from wool brokers about using forward contracts: “The brokers were adamant that this was it. ... They were really concerned that I was going to come back to them in two years’ time and go, ‘You bastards, why didn’t you talk me out of it.’” Similarly, “I said, yes, I will take that contract for this many bales. They asked me if I was sure. They rang me back three times to confirm it.” Following this, the wool producer who consistently sold wool by forward contract inadvertently offered an explanation for brokers’ reticence:

.../Well, a while ago when we first started [using forward contracts], they were all averse to it, but I think that’s from the services they have got to offer though. There is a conflict of interest there in that if a service provider is offering something, they are going to want people to use that service they are being offered and not want to use another service, which means they have got to stop doing something and develop something else, which requires money and effort. So it is easier to keep the status quo .../

There was also doubt from peers:

.../One year I managed to sell a line of wool for three years’ running at about 1100c clean and, that must have been 2002 when the Chinese came and blew the market apart, and it went through the roof. Everyone said to me you are mad signing up for another three years of 1100c .../Probably two or three years ago I reckon 90% of my peers would have criticised me for selling anything forward .../

While there is evidence to suggest that significant others made derogatory comments about the use of forward contracts, it appears that the individuals interviewed for this research have particular strategies that separate them from the norm.

.../There is that relating [price] back to the spot market, so we don't do that .../I don't receive gratification in saying I am at the top of the list or think I am a failure because we are average. We have our goals written down and, to me, I have succeeded or failed whether we have or haven't achieved those goals. It is not relative to what other people are doing. If I see someone else is making a squillion out of doing something I would probably listen to what they are doing. (Laughter.) But I don't see that what other people are doing as a benchmark for what we do .../Whether it is more or less than what our neighbours got or the group we benchmark with doesn't really interest me a lot because I don't compete. To me it is a meaningless exercise, but unfortunately it is used as a benchmark for some reason .../That is one thing you never try and do is pick the top and the bottom of the market, you just go at a price you are happy with that you know you can educate the kids, you can have a holiday and plan for retirement .../

This evidence suggests that people who have adopted the use of forward contracts, and are satisfied with this as a method of selling wool, possess clear knowledge about their production costs and can thus make an informed decision about wool pricing. The decision making of these people is not influenced by the general community (which includes comments from significant others, the mass media or the price of wool at auction). A similar result was generated from the focus group conducted at Kojonup (a specialist wool-producing area) during which discussion was held on the concept of “Being satisfied with the price you get [for a forward contract]”.

Therefore, while the behavioural model showed that ‘subjective norms’ have a positive relationship to the intention to adopt forward contracts, it must be remembered that 75.1% of survey respondents always used auction to sell wool. The findings of Thompson and Panayiotopoulos (1999), described in Section 2.5.1, may shed some light on the importance of this conclusion. Thompson and Panayiotopoulos (1999) found that ‘subjective norms’ do not contribute to understanding why UK dairy farmers would buy feed for their herds. The reasoning for this was linked to the repeat behaviour of buying

cattle feed. Thompson and Panayiotopoulos (1999) argued that social pressures had an initial impact on a farmers' decision to purchase cattle feed but once the behaviour had been adopted this pressure was thought to diminish in importance. Such knowledge gives credence to the idea that once a wool producer takes the step to use a forward contract, despite their exposure to social pressures, the benefits of this selling method will encourage an increase in confidence to not comply with the expectations of salient referents. However, given the discussion in Section 9.4.1.1 between the spot and forward markets, this confidence and determination to use forward contracts will only exist until the point when the wool producer perceives that the price differential between the auction and forward markets is not attractive enough to sell forward.

The combined implication of these findings is that auction users are influenced by pressures of the wider community whereas adopters of forward contracts have the ability to reject social pressures and adopt rational behaviours for managing wool price risk.

9.6. Managing the Risks

The sources of risk associated with using forward contracts to sell wool were identified using cross-case analysis of the data. This analysis showed that there are four basic sources of risk: the need to generate farm profits, the needs of the whole farm system, the influence of the mass media on decision making and the influence of social pressures on those who use forward contracts to sell wool. The investigation also revealed that there are several strategies that have been adopted in order to manage the general price risks associated with wool production, as well as the perceived risks associated with using forward contracts. It appears that there are two basic methods of managing risk within the cases: operational strategies and marketing strategies.

9.6.1. Operational Strategies

In response to the perceived down turn in Australian wool prices over time, three of the four farm businesses studied for this research have slowly been reducing farm stocking rates in order to alter the farm's enterprise mix. This finding was not unexpected in light of comments made by Bolt (2007) and Wood and Ashton (2007) about Australia's diminishing wool production. The strategy of reducing stocking rate was aimed at diversifying the farm's income and also concentrating production efforts on the core competencies of the farm (in terms of available skills and environmental resources). Another operational strategy that was adopted was the adjustment of the average fibre

diameter of the farm's flock in response to market signals indicating that finer wool types were in demand. In the case of the wool producers who used forward selling (that is, forward contracts or futures), splitting their time of shearing was another operational strategy adopted to manage income. As discussed in Section 2.2.2.4, time of shearing was reported by Murray-Prior and Wright (2004) as a response farmers take to the risks of wool marketing. These authors found that wool producers believe that it is impossible to predict wool prices so prefer to shear their sheep and sell the wool immediately, rather than shear when convenient and sell prices cover the cost of production.

In terms of managing the risks associated with forward contracts, the most innovative ideas came from of the wool producer who had exited the industry. In each of the four cases, production risks associated with meeting forward contracts for wool were said not to be an issue. The wool producer who had exited the industry went to great lengths to describe that, although production risks were not of concern to him, he adopted the use of objectively testing wool on his sheep prior to shearing to minimise the risk of not being able to meet contractual obligations. This involved testing wool samples from all sheep in order to gain information about the flock's wool quality and communicating it to the wool buyer. By having complete information about the flock, forward contracts could be taken out with confidence – on behalf of the wool buyer and the wool producer.

The other operational strategy discussed, that is more related to the whole farm system, was from the case of the wool producer who consistently used futures to sell wool. In this case, emphasis was placed on maximising returns per hectare.

.../In the enterprise that we are running, while we are trying to maximise prices that we get for our wool, our main criteria [sic] for success is our production levels. We don't hinge everything on price, we try and maximise our prices by hanging onto wool and marketing and working with cycles and graphing and all the rest of it. But we try and maximise our returns per hectare in wool production .../

It is evident from the above comment that wool prices, marketing strategies and information gathering are secondary to this wool producer's ultimate goal. This wool producer aims to maximise profit so has adopted the operational strategy of optimising the use of the farm's resources in order to optimise earning power.

While the concept of managing price volatility by using forward contracts was accounted for in the behavioural model of this research, neither the issue of testing wool prior to shearing nor maximising production levels, rather than price, were considered. The case studies have, once again, shown that wool producers' wool selling decisions are based on a systems approach by which operational strategies are also used to manage various risks involved with wool production and selling.

9.6.2. Marketing Strategies

In addition to the operational strategies that have been adopted to manage the risk of producing and selling wool, a number of marketing strategies were also discussed.

The predominant marketing strategy used in all the cases was to use the spot market as the main method of selling wool, not surprising as this strategy was discussed in the focus groups at Merredin and Esperance. In this instance, the spot market is defined as the auction system or one of the two available web-based selling systems (e-wool™ or Wooltrade Australia Pty Ltd). The decision criteria for this strategy were based on two decision points. In all cases a trigger price (based on production costs and profit margins) was used as a strategy to take a forward contract; a forward contract would be taken out upon meeting the predetermined trigger price. This was even the case of the wool producer who consistently used auction. The other decision point was that 30% of wool was to be sold on forward contract. This was a decision rule discussed in the focus groups, but it was not until the rule was cited in one of the case studies that the source of this rule was identified (www.profarmer.com.au). This decision rule was discussed in two of the cases, as well as in the focus groups (see Section 5.4.1) so is evidently known and accepted in the general community as a rule for taking out forward contracts.

The conclusion that can be drawn from this finding is that there are obviously two community norms influencing the adoption of forward contracts: the requirement of a trigger price, and that it is ill-advised to sell more than 30% of production using forward contracts. With the latter so deeply embedded as a social norm, it is little wonder that forward contracts are experiencing such low levels of adoption.

The final significant marketing strategy identified in the case studies was the importance of information gathering for decision making. As identified in the Section 2.4.3, communication for accessing new ideas is a key factor in Rogers' (1995) Diffusion of Innovations theory. Interestingly, research reviewed by Tutkun and Lehmann (2006)

showed that communication was the most significant determinant of intention to adopt an agricultural innovation in their TPB model. Marsh, Burton and Pannell (2006) found that adoption of monitoring water tables for salinity management is better when farmers are able to use the information collected for assessing management strategies on their farm. If this knowledge is put in the context of selling wool, it is clear that specialist wool producers will use all the information they gather for selling wool to benefit their whole farm business. On the other hand, mixed-enterprise farmers may find wool price information redundant in the broader scheme of their whole farm, particularly if their farm business is mainly split between grain and prime lamb production.

The information gathered in the studied cases involved:

- Talking to wool brokers and industry contacts;
- Studying current supply and demand in the international and national wool industries;
- Using the internet as a source of information on prices and general market activity.

In all cases, wool selling decisions were made based on information gathered, again giving credence to the importance of social norms and mass media discussed by so many prominent authors of this subject (Rogers 1995; Fliegel 1993; Rehman et al. 2007).

9.7. An Explanation of Complexity

Despite the common finding that complexity will have a negative influence on the decision to adopt an innovation (Rogers 1995; Fliegel & Kivlin 1962; Tiller 2000; Batz, Peters & Janssen 1999), the empirical conclusions of the research showed there to be no significance in this relationship. It was anticipated that an explanation for this lack of significance between ‘complexity’ and the intention to adopt would be explained in the case studies, although this did not eventuate.

In all cases, including the wool producer who consistently used auction, complexity associated with using forward contracts was found not to be an issue. The perception of forward contracts is that they are simple to use and that the wool supply chain is too long and well-established for any contracts not to be honoured by buyers or processors; as perceived by so many participants in the focus groups.

Given the inconclusive nature of this finding, it is pertinent to revisit the survey data. There were three items used to measure 'complexity' in the behavioural model:

CX1: Using forward contracts requires experience with your wool clip.

CX4: Using forward contracts is an easy way of selling wool.

CX7: When using forward contracts, there is no guess work involved with pricing.

These items had respective means of 5.2, 3.89 and 4.62 from the 7-point Likert scale. In order to understand the significance of these results, these means were subjected to one-sample t-tests using a target value at the mid-point of the Likert scale used in the survey. Items CX1 and CX7 both proved to be highly significant ($t = 13.027$ and 8.188 , respectively [$p < 0.05$]) which indicates that experience with one's wool clip is required for selling wool by forward contract but also that, once a forward contract is taken out, any complexity associated with guessing future prices is annulled. In contrast to CX1 and CX7 being highly significant, CX4 was not significant ($t = -1.192$) thereby indicating that the ease of use is not a deciding factor associated with forward contracts.

This finding is similar to that of Tan and Teo (2000). In their investigation of the adoption of internet banking services in Singapore, these authors found a lack of support for 'complexity' as a construct in their behavioural model. The conclusion from this finding was that, because internet banking in Singapore was quite new at the time of the study, an insufficient amount of people within the sample population had had the opportunity to trial the innovation. Given that 80% of survey respondents have never used forward contracts to sell wool, the lack of support for the hypothesis related to complexity appears to be due to the lack of familiarity survey respondents had to actually using this selling method.

9.8. Summary

The purpose of the research reported in this chapter was to explore the unexplained elements of the behavioural model. Case studies were chosen as the research strategy because they are an effective way of gathering a range of view points on a particular subject. Four wool producers with varying levels of commitment to using forward contracts were interviewed as case studies for the research. Cross-case analysis helped answer the research questions proposed in Section 3.2. These questions asked about the perceptions of risks, how these risks are managed and, despite findings from the focus

groups and a plethora of literature, why 'complexity' is not a significant factor in the intention to adopt forward contracts as a method of selling wool.

It was found that the price differential between the spot market and the forward market was the main source of perceived risk related to using forward contracts. In all cases, the spot market was said to offer better prices for wool than the forward market. Evidence was provided to demonstrate that the sources of risks were identified as being the need to maximise farm profits, the influence of the whole farm system in decision making about selling methods and the influence of the mass media and social norms on perceptions of using forward contracts. The most important of these findings, from an industry perspective, was that wool producers are highly responsive to the influence of the mass media and social norms. In addition, those who have already adopted the use of forward contracts are part of a small group who are not responsive to the pressures of the general community. In terms of managing risks associated with wool production in general, both operational and marketing strategies were identified in each of the cases. Finally, the issue of complexity was addressed. Cross-case analysis was unable to explain why 'complexity' was not a significant factor in wool producers' decision making. Survey data were re-examined and compared with the literature to provide the possible explanation that survey respondents had insufficient exposure to forward contracts to show a positive or negative relationship between forward contracts and intention to adopt.

The findings of this chapter have sufficiently explained the unanswered aspects of the behavioural model discussed in Chapter 8. The next chapter will conclude this research and offer ideas for future research.

Chapter 10 Conclusions and Future Directions

10.1. Introduction

The final chapter of this thesis summarises all the research conducted to complete this study. Having undertaken a thorough literature review on various theoretical and industrial aspects of the research problem and outlined the research questions and objectives, a behavioural model was developed that combined knowledge from the literature and four focus groups with Western Australian wool producers. Hypotheses within the model were written and then tested via a telephone survey that gathered 305 valid responses from Western Australian wool producers. The data from the telephone survey were analysed using SPSS 14 and the partial least squares (PLS) approach to structural equation modelling (SEM). Most relationships within the model could be explained after rigorous quantitative analysis, however, further explanation was required to understand two final aspects of adoption behaviour: firstly, the sources of risk wool producers perceive about using forward contracts and, secondly, why 'complexity', which is usually a strong limiting factor to adoption, was not significant in the context of using forward contracts to sell wool. Case studies of four Western Australian wool producers were conducted to fill these final gaps. This led to the concluding chapter in which the study is summarised, contributions to the literature and the Western Australian agribusiness industry are presented, limitations of the study are highlighted and several ideas for future research are detailed.

10.2. Summary of Research

This study has taken a mixed-method, three-phase approach to understanding the behavioural determinants of the adoption of forward contracts by Western Australian wool producers (see Figure 4.1). The first phase involved conducting qualitative research that was designed to add genuine, first-hand experiences of wool producers to knowledge gained from the literature on adoption behaviours. Data gathered from four focus groups in regional Western Australia were combined with a review of literature on prominent behavioural theories used in agriculture to understand adoption (Theory of Reasoned Action [TRA], Theory of Planned Behaviour [TPB] and Diffusion of Innovations). The result was a combined behavioural model that used 28 hypotheses to test the intention of Western Australian wool producers to adopt the use of forward contracts.

The second phase of the research saw the development of a questionnaire to test the hypotheses within the behavioural model. The questionnaire was piloted on 113 wool producers before a final sample population of 305 valid responses was gained. Descriptive data from the telephone survey were analysed using SPSS 14 while the hypotheses were tested using SEM (PLS approach).

Data analysis of the behavioural model revealed that additional research was required to further explain the research questions. This requirement led to the third phase of the present research. Four case studies were conducted to provide more in-depth knowledge about wool producers' perceptions of risk and complexity associated with using forward contracts. This final phase of the research was useful as it provided knowledge to complete and close the study.

10.3. Contributions

The results of this study are believed to have made contributions to the academic literature on farmers' adoption behaviours as well as the agribusiness industry of Western Australia.

10.3.1. To the Literature

The most important contribution to the literature from this study is the finding that the TRA is likely to be a better predictor of wool producers' intentions to adopt the use of forward contracts than the TPB. This conclusion is principally based on the finding that 'perceived behavioural control', the defining construct between the TRA and TPB, is not a significant determinant of wool producers' intentions to use forward contracts. Since the creation of the TPB, few studies have used the TRA (as discussed in Section 2.5.1) because the 'perceived behavioural control' construct has proved to be so important in the adoption of a behaviour (Bergevoet et al. 2004; Lynne et al. 1995; East 1993; Gorddard 1991 & 1993). The present research has shown that, in terms of the adoption of forward contracts among Western Australian wool producers, 'perceived behavioural control' is not a significant determinant of intention to adopt. It is therefore reasonable to conclude that the TRA is better theoretical framework for the research questions herein.

The finding that 'complexity' is not a significant determinant of adoption is another major contribution to the literature. Most studies that use the TRA, TPB or Diffusion of Innovations as a theoretical framework show that 'complexity' is a highly significant

deterrent for adopting an innovation (Rogers 1995; Fliegel & Kivlin 1962; Tiller 2000; Batz, Peters & Janssen 1999). The present research has contrasted this knowledge and demonstrated that, in the context of adopting forward contracts to sell wool in Western Australian, 'complexity' does not impact on intention to adopt. The practical reason for the lack of complexity associated with using forward contracts is that wool producers are familiar with this method of selling and know that the industry is sufficiently well-established to have overcome any imperfections with the process of forward contracting. The theoretical reason for the lack of complexity identified in the present research is simply that the population sample may not have had sufficient experience with using forward contracts to sell wool to offer a complete explanation of complexity.

Other contributions to the literature are that this study has confirmed there to be a number of important constructs that account for the adoption decisions of wool producers when it comes to forward contracts. Such constructs are: 'subjective norms', 'relative advantage', 'compatibility' and 'risk'.

Finally, this research has confirmed that non-traditional constructs can be added to improve the TRA and TPB and add topic-specific dimensions to these prominent behavioural theories. In the case of this research, the influences of factors external and internal to the farm business were successfully added to the behavioural model.

10.3.2. To Agribusiness

This study has also contributed to the Western Australian agribusiness industry. The research showed that Western Australian wool producers desire a method of selling wool for which price discovery is less volatile than that offered by the auction system (see Section 8.2.3). This suggests that wool brokers and other industry bodies that desire a structured approach to communicating wool qualities and quantities to customers can rest with the knowledge that wool producers are keen to use a selling method alternative to auction. However, it was found that wool producers perceive that there is risk and uncertainty involved with using forward contracts. In the context of this research, risk can be defined as wool producers' potential loss of a proportion of revenue due to sale as future contract rather than a direct sale in the spot market. This risk is principally born from the influences of the mass media and social pressures that achieving the highest possible price is more desirable than having a secured income. Therefore, any education or extension initiatives about using forward contracts to sell wool should focus on the

aspects of price security that forward contracts bring to farm income. The most important factor that the agribusiness industry needs to recognise is that forward contracts will fail to be adopted in a downward market when the spot market (auction price or prices offered by web-based wool trading services) offers higher prices than the forward market.

10.4. Research Limitations

The major limitation of this study is that the methodology did not address the research problem from a whole farm system point of view. Deane and Malcolm (2006) stated that it is naïve to consider individual farm enterprises in isolation. This is a particularly important point since 78.4% of people contributing to the empirical aspect of this research operate mixed-enterprise farms. While most of the relationships within the behavioural model, based on the TRA/TPB/Diffusion of Innovations framework, were statistically significant, a model that was more sympathetic to incorporating other dimensions of the farm business may have yielded an even better result.

It would also have been prudent to consider the influence debt-financing institutions, such as banks and credit societies, have on wool producers' intentions to use forward contracts. A combination of the national drought and funding new farm investments have increased farm debt in recent years (Martin et al. 2007; ABARE 2006). Accordingly, financial institutions would be expected to advocate that farmers guard against commodity price fluctuations and guarantee that financial obligations are met by adopting risk management strategies such as using forward contracts. The influence of financial institutions may have added strength to the behavioural model, however, it is difficult to know this for certain since it was never raised in any of the qualitative research conducted for this study.

Another limitation of this research is the small geographic coverage of the study. Qualitative and quantitative data were only gathered from Western Australia. However, much of the industry information used was from an Australian perspective. Curtis (2007) nominated that Western Australia is the third largest wool-producing state in Australia. It therefore would have been beneficial to take into account the opinions of wool producers in New South Wales and Victoria, many of whom are specialist wool producers. Chapter 9 showed that specialist wool producers have different attitudes to using forward contracts than their mixed-enterprise counterparts. From this finding, it is thought that better knowledge on adoption behaviours, rather than non-adoption behaviours, would

have been gathered if data were drawn from areas that have a greater population of specialist wool producers. Additional support for this logic is provided by Deane and Malcolm (2006) who suggest that the rational decision maker will focus risk management initiatives on the enterprise(s) that contribute most to earning power or the enterprise that incurs the greatest operating costs.

East (1993) and Beedell and Rehman (2000) commented that a questionnaire developed for a TPB study can be prohibitively long and that the questions need to be highly detailed, so detailed that they can often seem convoluted to the survey participant. A similar impression was experienced with this study. Although the questionnaire only took 20 to 25 minutes to complete, there were in excess of 75 questions to be scrutinised by the survey participants. The length of the questionnaire was compounded by the requirement of a structural equation model to have a minimum of two items (questions) per construct. In order to have some flexibility with the analysis, some constructs were measured with up to eight items. Having now written and conducted a questionnaire for a structural equation model based on a TPB framework, support is given to the criticisms made about such a questionnaire; particularly for statements such as IN3, IN4, IN5 and IN6: 'I intend to make the use of forward contracts my main method of selling wool over the next 12 months', 'I intend to take out a forward contract to sell wool in the next 12 months', 'I am likely to take out a forward contract to sell wool in the next 12 months' and 'Chances are that I'll take out a forward contract to sell wool in the next 12 months'.

The differences identified between results of the qualitative focus groups and quantitative survey could also be considered a limitation of this research. It was explained in Chapter 8 (Section 8.3) that Quaddus, Islam and Stanton (2006) had a similar experience with their mixed-method research involving wool producers. An explanation of this limitation may be provided by Martin (2001) who touches on a shortcoming of action research. This author says that within organisations, the interviewer needs to clearly outline the responsibilities and actions of the study. Following this, it is said that research is often needed to generate new knowledge about an organisation, but participants must understand the research cannot be counted upon to bring about changes to the entire system. Upon reflection, it appears that the present research should have incorporated Martin's advice. It seems that focus group participants viewed the occasion as an opportunity to 'fix' the problems they perceive with the wool industry, rather than providing their views and experiences with using forward contracts. It seems that much

of the data used from the focus groups were either redundant, such as the uncertainty some producers have about the quality and quantity of their wool clip, or were disproved by the greater population, such as the complexity associated with using forward contracts. The virtues of focus groups, discussed in Section 5.2.1, appear to have had a negative impact on the results of the present study. Focus groups were selected as the qualitative data collection strategy because they facilitate interaction of ideas between participants; in doing so, a lot of 'noise' was created that distracted the researcher from the topic at hand. The present research would perhaps have been more coherent if the researcher had been more vigilant in separating superfluous details offered during the focus groups and also during subsequent data analysis. Another improvement would have been to combine face-to-face interviews with individual wool producers with focus groups.

10.5. Future Research

Throughout this study comments alluded to the need for further research on several issues beyond the scope of the immediate study. To summarise the topics identified for future research, there are four areas that would make for intriguing further enquiry:

1. Theoretical investigation into the possible superiority of the TRA and TPB in the context of the present research topic,
2. The impact of re-engineering the supply chain on the adoption of forward contracts for wool,
3. An investigations into additional behavioural factors linked to adoption such as trust, habit and social cohesion,
4. Empirical research on the source of risk and complexity associated with using forward contracts for wool.

The first proposal for future research is in reference to the major contribution of this study to the literature. The present research adds to the small literature of instances in which the TRA is a better predictor of behaviour than the TPB (Thompson & Panayiotopoulos 1999; Park & Levine 1999). Like the research of Thompson and Panayiotopoulos (1999) and Park & Levine (1999), findings from this research suggest that the TRA is likely to be a better theoretical framework than the TPB framework for understanding the adoption of forward contracts by Western Australian wool producers. However, no absolute conclusions were drawn herein. It is therefore suggested that the data be re-analysed

without the constructs associated with 'perceived behavioural control' ('self-efficacy' and 'support'). Definite conclusions could then be drawn on whether the TRA is truly a superior theoretical framework for answering the research question proposed here in. Further to this, deeper conclusions can be drawn about the issues surrounding volitional control and perceived behavioural control associated with using forward contracts to sell wool in Australia; important issues raised by Armitage and Conner (2001) and Leone, Perugini and Ercolani (1999) in their research on the application of the TRA and TPB models.

The small geographic coverage of this research was remarked upon in Section 10.4. Following on from this, a national study of wool producers' attitudes to adopting the use of forward contracts would add more scope and depth to the research questions. It also would be interesting to further investigate the reports of Courtney (2007) and Page (2007) on the increase in wool production and adoption of forward contracts in Tasmania compared to Western Australia. Could the success in Tasmania be linked with the re-engineering supply chain efforts of Roberts Limited? If so, has the similar initiative of Primaries of WA Pty Ltd met with such success?

Strauss and Corbin (1990) describe a strategy for conducting qualitative research that they term 'theoretical sensitivity'. They define theoretical sensitivity as "...the ability to recognise what is important in data and to give it meaning." (p. 46) and say that continual interaction with data will result in the emergence of new and more in-depth knowledge. Continual interaction with the data over the course of this study has led the researcher to believe that there may be additional constructs that need to be included in the present behavioural model. More specifically, it is thought that constructs associated with the trust wool producers have in their advisory services, the social cohesion brought about by the common language of the auction system and the habit that wool producers may have fallen into from using the auction system for generations may benefit a structural model based on the wool-selling behaviours of farmers. It is therefore suggested that future research, conducted with the research questions of this study in mind, should include

constructs and hypotheses to measure the influence of trust, habit and social cohesion on the intention to adopt forward contracts for selling wool¹⁵.

The case studies conducted for further analysis into the sources of risk and completely associated with the use of forward contracts (Chapter 9) provided some explanation to the conclusion reached from the empirical part of this study (Chapter 8). It is acknowledged that the sample of these case studies is small so further research should be conducted in the form of a nation-wide, empirical study to draw more accurate conclusions about the risk and complexity producers associate with using forward contracts to sell wool.

10.6. Summary

The final chapter of this thesis has summarised the study and specified its contributions to the literature and the Australian agribusiness industry. The mixed-method approach combined the virtues of qualitative and quantitative methodologies to shed light on the research questions and objectives proposed in Chapter 3. The major contribution to the literature was the finding that the TRA is more likely to be a better theoretical framework than the TPB for understanding wool producers' intentions to adopt the use of forward contracts. In terms of the contribution made to the Australian agribusiness industry, this study has highlighted some critical issues that need to be understood about farmers' adoption of forward contracts, such as the perceptions of risk wool producers feel toward using forward contracts. While this study has made some solid contributions, its limitations have also been summarised. These limitations have been used as the basis for developing ideas for future research, among other ideas that were raised during the course of data analysis and discussion of results. This chapter, and indeed the thesis, closes with a brief discussion on the researcher's aspirations for conducting future research on the behavioural determinants of the adoption of forward contracts by Western Australian wool producers.

¹⁵ See: 'A multi-disciplinary approach for determining adoption of agricultural price risk management strategies', *Proceedings of the 81st Agricultural Economics Society Conference*, 2-4 April, 2007, Reading, UK, from: http://www.aes.ac.uk/conf_07_docs/index.php?path=papers/ for a complete description.

Reference List

- Abadi Ghadim, A., Kingwell, R. & Pannell, D. 1991, 'An economic evaluation of deep tillage to reduce soil compaction on crop-livestock farms in Western Australia', *Agricultural Systems*, vol. 37, no. 3, pp. 291-307.
- Abadi Ghadim, A. K. & Pannell, D. J. 1999, 'A conceptual framework of adoption of an agricultural innovation', *Agricultural Economics*, vol. 21, no. 2, pp. 145-154.
- Abadi Ghadim, A. K., Pannell, D. J. & Burton, M. P. 2005, 'Risk, uncertainty, and learning in adoption of a crop innovation', *Agricultural Economics*, vol. 33, no. 1, pp. 1-9.
- ABARE, 2005, *Australian Commodity Statistics*, Australian Bureau of Agricultural and Resource Economics, Canberra.
- ABARE 2006, *Financial performance of wool producing farms to 2004-05*, Australian Bureau of Agricultural and Resource Economics, Australian Wool 06.1.
- Abdulai, A. & Huffman, W.E. 2005, 'The diffusion of new agricultural technologies: The case of crossbred-cow technology in Tanzania', *American Journal of Agricultural Economics*, vol. 87, no. 3, pp. 645-660.
- Abrahamson, E. & Rosenkopf, L. 1993, 'Institutional & competitive bandwagons: using mathematical modeling to explore innovation diffusion', *The Academy of Management Review*, vol. 18, no. 3, pp. 487-517.
- Ajzen, I. 1985, 'From intentions to actions: A theory of planned behavior', in J. Kuhl and J. Beckmann (eds), *Action-control: From cognition to behavior*, Springer, Heidelberg, pp. 11-39.
- Ajzen, I. 1991, 'The Theory of Planned Behaviour', *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2, pp. 179-211.
- Ajzen, I. & Driver, B.L. 1991, 'Prediction of leisure participation from behavioural, normative and control beliefs: An application of the Theory of Planned Behaviour', *Leisure Sciences*, vol. 13, no 3, pp. 185-204.

- Ajzen, I. & Fishbein, M. 1973, 'Attitudinal and normative variables as predictors of specific behaviors', *Journal of Personality and Social Psychology*, vol. 27, no. 1, pp. 41-57.
- Ajzen, I. & Fishbein, M. 1980, *Understanding Attitudes and Predicting Social Behavior*, Prentice-Hall, New Jersey.
- Albrecht, D. E. & Albrecht, S. L. 1996, 'Family structure among urban, rural and farm populations: Classic sociological theory revisited', *Rural Sociology*, vol. 61, no. 3, pp. 446-463.
- Alreck, P.L. & Settle R.B. 1995, *The Survey Research Handbook: Guidelines and strategies for conducting a survey*, 2nd edn, Irwin Professional Publishing, Chicago.
- Armitage, C.J. & Conner, M. 2001, 'Efficacy of the Theory of Planned Behaviour: A meta-analytic review', *British Journal of Social Psychology*, vol. 40, no. 4, pp. 471-499.
- Ashton, D. 2003, 'Economic outlook for sheep and wool', *Sheep Updates 2003*, Department of Agriculture Western Australia, Perth.
- Austin, E. J., Deary, I. J., Gibson, G. J., McGregor, M. J. & Dent, B. J. 1996, 'Attitudes and values of Scottish Farmers: "Yeoman" and "entrepreneur" as factors, not distinct types', *Rural Sociology*, vol. 61, no. 3, pp. 464-474.
- Austin, E. J., Deary, I. J. & Willock, J. 2001, 'Personality and intelligence as predictors of economic behaviour in Scottish farmers', *European Journal of Personality*, vol. 15, no. S1, pp. S123-S137.
- Austin, E. J., Willock, J., Deary, I. J., Gibson, G. J., Dent, J. B., Edward-Jones, G., Morgan, O., Grieve, R. & Sutherland, A. 1998a, 'Empirical models of farmer behaviour using psychological, social and economic variables. Part I: Linear modelling', *Agricultural Systems*, vol. 58, no. 2, pp. 203-224.
- Austin, E. J., Willock, J., Deary, I. J., Gibson, G. J., Dent, J. B., Edward-Jones, G., Morgan, O., Grieve, R. & Sutherland, A. 1998b, 'Empirical models of farmer behaviour using psychological, social and economic variables. Part II: Nonlinear and expert modelling', *Agricultural Systems*, vol. 58, no. 2, pp. 225-241.
- Australian Wool Innovation n.d., *Wool Marketing – Selling and buying*. Retrieved August 24, 2007, from

http://www.woolinnovation.com.au/Education/Student_information/Wool_marketing/page_2161.aspx#sb.

Australian Wool Innovation Production Forecasting Committee 2007, *Australian Wool Production Forecast Report*, Retrieved December 11, 2007, from http://wool.com.au/mediaLibrary/attachments/Trade_Markets/WPFC_report_Mar%2007.pdf.

Bagozzi, R. P. 1986, 'Attitude formation under the theory of reasoned action and a purposeful behaviour reformulation', *British Journal of Social Psychology*, vol. 25, no. 2, pp. 95-107.

Bagozzi, R. P. 1992, 'The self-regulation of attitudes, intentions and behavior', *Social Psychology Quarterly*, vol. 55, no. 2 (Special issue: Theoretical advances in social psychology), pp. 178-204.

Bagozzi, R. P. 1994, 'Structural equation models in marketing research: Basic principles', in R. P. Bagozzi, (ed.) *Principles of Marketing Research*, Blackwell Business, Massachusetts, pp. 317-385.

Bagozzi, R.P., Baumgartner, H. & Yi, Y. 1992, 'State versus action orientation and the theory of reasoned action: an application to coupon usage', *Journal of Consumer Research*, vol. 18, no. 4, pp. 505-518.

Bagozzi, R. P. & Kimmel, S. K. 1995, 'A comparison of leading theories for the prediction of goal-directed behaviours', *British Journal of Social Psychology*, vol. 34, no. 4, pp. 437-461.

Bailey, A. P., Garforth, C. J., Angell, B., Scott, T., Beedell, J., Beechener, S. & Rana, R. B. 2006, 'Helping farmers adjust to policy reforms through demonstration farms: Lessons from a project in England', *Journal of Farm Management*, vol. 12, no. 10, pp. 613-625.

Bandura, A. 1977, 'Self-efficacy: Toward a unifying theory of behavioural change', *Psychological Review*, vol. 84, pp. 191-215.

Bandura, A. 1982, 'Self-efficacy mechanism in human agency', *American Psychologist*, vol. 37, no. 2, pp. 122-147.

- Barclay, D., Higgins, C. & Thompson, R. 1995, 'The partial least squares (PLS) approach to causal modelling: Personal computer adoption and use as an illustration', *Technology Studies*, vol. 2, no. 2, pp. 285-324.
- Bardsley, P. 1994, 'The collapse of the Australian wool reserve price scheme', *The Economic Journal*, vol. 104, no. 426, pp. 1087-1105.
- Barnard, C. S. & Nix, J. S. 1979, 'Uncertainty and farm organisation and planning', in *Farm Planning and Control*, 2nd edn, Cambridge University Press, pp. 382-411.
- Barrett, D. & Martin, P. 2003, *Internet use by wool producers*, ABARE, Australian Farm Surveys Report 2003.
- Batz, F. J., Peters, K. J. & Janssen, W. 1999, 'The influence of technology characteristics on the rate and speed of adoption', *Agricultural Economics*, vol. 21, no. 2, pp. 121-130.
- Beedell, J. & Rehman, T. 1999, 'Explaining farmers' conservation behaviour: Why do farmers behave the way they do?' *Journal of Environmental Management*, vol. 57, no. 3, pp. 165-176.
- Beedell, J. & Rehman, T. 2000, 'Using social-psychology models to understand farmers' conservation behaviour', *Journal of Rural Studies*, vol. 16, no. 1, pp. 117-127.
- Ben-Kaabia, M. & Gil, J. M. 2007, 'Asymmetric price transmission in the Spanish lamb sector', *European Review of Agricultural Economics*, vol. 34, no. 1, pp. 53-80.
- Berg, B.L. 2001, *Qualitative Research Methods for the Social Sciences*, 4th edn, Allyn and Bacon, Needham Heights.
- Bergevoet, R. H. M., Ondersteijn, C. J. M., Saatkamp, H. W., van Woerkum, C. M. J. & Huirne, R. B. M. 2004, 'Entrepreneurial behaviour of Dutch dairy farmers under a milk quote system: Goals, objectives and attitudes', *Agricultural Systems*, vol. 80, no. 1, pp. 1-21.
- Black, A. W. 2000, 'Extension theory and practice: A review', *Australian Journal of Experimental Agriculture*, vol. 40, no. 4, pp. 493-502.
- Blackburn, A. & Ashby, R. 2007, *Financing Your Farm: A practical guide to financial growth*, 4th edn, Australian Bankers' Association, New South Wales.

- Blank, S. C., Carter, C. A. & McDonald, J. 1997, 'Is the market failing agricultural producers who wish to manage risks?' *Contemporary Economic Policy*, vol. 15, no. 3, pp. 103-112.
- Bollen, K. & Lennox, R. 1991, 'Conventional wisdom on measurement: A structural equation perspective', *Psychological Bulletin*, vol. 110, no. 2, pp. 305-314.
- Bolt, C. 2004a, 'AWH to set up wool auction', *The Age*, April 7, 2004, Retrieved June 21, 2004, from <http://www.theage.com.au/cgi-bin/common/popupPrintArticle.pl?path=articles/2004>.
- Bolt, C. 2004b, 'Plan for rival wool sales', *The West Australian*, 6 April, p. 45.
- Bolt, C. 2006a, 'Wool price up, but growers seek more', *The West Australian*, 28 October, p. 80.
- Bolt, C. 2006b, 'Grim outlook for WA farmers', *The West Australian*, 11 January 2006, p. 7.
- Bolt, C. 2007, 'Wool prices, stocks on the rise as demand begins to soften', *The West Australian*, 19 May, p. 86.
- Bond, G. & Wonder, B. 1980, 'Risk attitude amongst Australian farmers', *Australian Journal of Agricultural Economics*, vol. 24, no. 1, pp. 16-34.
- Bonfield, E. H. 1974, 'Attitude, social influence, personal norm, and intention interactions as related to brand purchase behavior', *Journal of Marketing Research*, vol. 11, pp. 379-389.
- Bosch, O.J.H., Ross, R.A. & Beeton, R.J.S. 2003, 'Integrating science and management through collaborative learning and better information management', *Systems Research and Behavioural Science*, vol. 20, no. 2, pp. 107-118.
- Brakenridge, J. 2004, *Contracts gain traction*, Retrieved October 13, 2004, from <http://www.nzmerino.co.nz/news/merinonews.asp?id=230>.
- Brodt, S., Klonsky, K., Tourte, L., Duncan, R., Hendricks, L., Ohmart, C. & Verdegaal, P. 2004, 'Influence of farm management style on adoption of biologically integrated farming practices in California', *Renewable Agriculture and Food Systems*, vol. 19, no. 4, pp. 237-247.

- Burton, M., Rigby, D. & Young, T. 2003, 'Modelling the adoption of organic horticultural technology in the UK using duration analysis', *The Australian Journal of Agricultural and Resource Economics*, vol. 47, no. 1, pp. 29-54.
- Burton, R. J. F. 2004, 'Reconceptualising the 'behavioural approach' in agricultural studies: a socio-psychological perspective', *Journal of Rural Studies*, vol. 20, no. 3, pp. 359-371.
- Carlson, J. E. & Dillman, D. A. 1983, 'Influence of kinship arrangements on farmer innovativeness', *Rural Sociology*, vol. 48, no. 2, pp. 183-200.
- Chambers, R.G. 2006, 'Some empirical implications of state-contingent production models', *Australian Agricultural and Resource Economics Society*, Manly.
- Chambers, R. G. & Quiggin, J. 2004, 'Technological and financial approaches to risk management in agriculture: An integrated approach', *The Australian Journal of Agricultural and Resource Economics*, vol. 48, no. 2, pp. 199-223.
- Champion, S. C. & Fearne, A. P. 2001a, 'Alternative marketing systems for the apparel wool textile supply chain: Filling the communication vacuum', *International Food and Agribusiness Management Review*, vol. 4, no. 3, pp. 237-256.
- Champion, S. C. & Fearne, A. P. 2001b, 'Supply chain management: A 'first principles' consideration of its application to wool marketing', *Wool Technology and Sheep Breeding*, vol. 49, no. 3, pp. 222-236.
- Champion, S. C. 2004, 'Customising to the needs of the customer - insights from the New Zealand Merino experience', *Proceedings of Agribusiness Sheep Updates*, Perth, Australia pp. 18-19.
- Charng, H., Piliavin, J. A. & Callero, P. L. 1988, 'Role identity and reasoned action in the prediction of repeated behaviour', *Social Psychology Quarterly*, vol. 51, no. 4, pp. 303-317.
- Checkland, P. 1999, *Soft Systems Methodology: A 30-year retrospective*, John Wiley & Sons Ltd, England.
- Chiffolleau, Y. 2005, 'Learning about innovation through networks: The development of environmentally-friendly viticulture', *Technovation*, vol. 25, no. 10, pp. 1193-1204.

- Chin, W. W. 1998a, 'The partial least squares approach to structural equation modeling', in G. A. Marcoulides, (ed.) *Modern Methods for Business Research*, Lawrence Erlbaum Associates Inc., New Jersey, pp. 295-336.
- Chin, W. W. 1998b, 'Commentary: Issues and opinions on structural equation modeling', *MIS Quarterly*, vol. 22, no. 1, pp. vii-xvi.
- Chin, W. W., Marcolin, B. L. & Newsted, P. R. 1996, 'A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and voice mail emotion/adoption study', *Proceedings of the Seventeenth International Conference on Information Systems*, Cleveland, Ohio, 16-18 December pp. 21-41.
- Chin, W.W. & Newsted, P.R. 1999, 'Structural equation modeling analysis with small samples using partial least squares', in R.H. Hoyle (ed.), *Statistical Strategies for Small Sample Research*, Sage Publications, California, pp. 307-41.
- Christian, J. & Armitage, C. J. 2002, 'Attitudes and intentions of homeless people towards service provision in South Wales', *The British Journal of Social Psychology*, vol. 41, no. 2, pp. 219-231.
- Coad, A. 2000, 'Hedging strategies for price risk management by wool producers in Western Australia', PhD Thesis, University of Western Australia.
- Connors, R. 2005, 'We positively need the facts', *The Countryman*, December 1, 2005, p. 40.
- Connors, R. 2006, 'Auction still the main game', *Countryman*, 13 April, p. 39.
- Copp, J. H., Sill, M. L. & Brown, E. J. 1958, 'The function of information sources in the farm practice adoption process', *Rural Sociology*, vol. 23, no. 2, pp. 146-157.
- Corral, C. M. 2002, 'Structure: A behavioural model for environmental and technology policy analysis', in *Environmental Policy and Technological Innovation: Why do firms adopt or reject new technologies?*, Edward Elgar, Cheltenham, UK, pp. 36-59.
- Cottle, D.J. (ed) 1991, *Australian Sheep and Wool Handbook*, Inkata Press, Melbourne.
- Courtney, P. 2007, *Boutique Wool*, Retrieved March 5, 2007, from <http://www.abc.net.au/landline/content/2006/s1860209.htm>.

- Creswell, J.W. 1998, *Qualitative Inquiry and Research Design: Choosing among five traditions*, Sage Publications, Thousand Oaks, California.
- Creswell, J. W. 2003, *Research Design: Qualitative, quantitative, and mixed methods approaches*, 2nd edn, Sage Publications, Thousand Oaks, California.
- Cribb, J. 2006, 'Growth industry - 2026 A vision for the nation's future: Part 11 Agriculture', *The Australian Magazine*, 2 November, p. 1.
- Cross, M. & Franks, J.R. 2007, 'Farmer's and advisor's attitudes towards to Environmental Stewardship Scheme', *Journal of Farm Management*, vol. 13, no. 1, pp. 47-68.
- Cuming, M. 2004, 'Bank sees no future in futures', *The Land*, 12 August.
- Cuming, M. 2006, 'Links in wool sector prove effective', *Farm Weekly*, 27 April, p. 31.
- 'Currency volatility no help to market' 2005, *The Countryman*, 8 December, p. 44.
- Curtis, K. & Croker, K. 2005, *Wool Desk Report - September 2005*, Retrieved June 20, 2007, from http://www.agric.wa.gov.au/pls/portal30/docs/FOLDER/IKMP/AAP/SL/WOOL/200509_WDR06.PDF.
- Curtis, K. 2007, *Wool Desk Report - May 2007*, Retrieved May 25, 2007, from http://www.agric.wa.gov.au/pls/portal30/docs/FOLDER/IKMP/AAP/SL/WOOL/200705_WDR08.PDF.
- Davis, F.D. 1989, 'Perceived usefulness, perceived ease of use, and user acceptance of information technology', *MIS Quarterly*, vol. 13, no. 3, pp. 319-339.
- Davison, S. 2006, *Australia - Wide drought results in further decline in production*, Retrieved December 8, 2006, from http://woolinnovation.com.au/Media_Releases/Media_Releases/page_7198.aspx.
- Deane, P. & Malcolm, B. 2006, 'Do Australian woolgrowers manage price risk rationally?' *Australian Farm Business Management Journal*, vol. 3, no. 2, pp. 26-32.
- D'Emden, F. H., Llewellyn, R. S. & Burton, M. P. 2006, 'Adoption of conservation tillage in Australian cropping regions: An application of duration analysis', *Technological Forecasting and Social Change*, vol. 73, no. 2, pp. 630-647.

- Dent, J. B. & Anderson, J. R. 1971, 'Systems, management and agriculture', in J. B. Dent & J. R. Anderson, (eds.), *Systems Analysis in Agricultural Management*, John Wiley & Sons Australasia, Australia, pp. 3-16.
- Dent, J. B., Edward-Jones, G. & McGregor, M. J. 1995, 'Simulation of ecological, social and economic factors in agricultural systems', *Agricultural Systems*, vol. 49, no. 4, pp. 337-351.
- de Sousa, I. S. F. & Busch, L. 1998, 'Networks & Agricultural Development: The case of soybean production and consumption in Brazil', *Rural Sociology*, vol. 63, no. 3, pp. 349-371.
- Diamantopoulos, A. & Winklhofer, H. M. 2001, 'Index construction with formative indicators: An alternative to scale development', *Journal of Marketing Research*, vol. 38, no. 2, pp. 269-277.
- Dierks, L. & Hanf, C. H. 2006, 'Trust as a determinant of consumer behaviour in food safety crises', *26th International Association of Agricultural Economists Conference*, Gold Coast, Queensland, 12-18 August.
- Dillman, D. A. 2000, *Mail and Internet Surveys: The Tailored Design Method*, 2nd edn, John Wiley & Sons Inc., New Jersey.
- Drynan, R. 1981, 'Risk attitude amongst Australian farmers: A comment', *Australian Journal of Agricultural Economics*, vol. 25, no. 1, pp. 73-76.
- Duke, C., Hanrahan, P. & O'Neill, T. 2002, 'Technology adoption and total factor productivity: Victorian wool producers 1999/2000', *Wool Technology and Sheep Breeding*, vol. 50, no. 3, pp. 215-221.
- Dumas, T. L. 1987, 'An analysis of management practices - Louisiana Sheep Producers' Association, 1986' Educa.D. Thesis, Louisiana State University and Agricultural & Mechanical College.
- East, R. 1993, 'Investment decisions and the theory of planned behaviour', *Journal of Economic Psychology*, vol. 14, no. 2, pp. 337-375.
- Eisenhardt, K. M. 1989, 'Building theories from case study research', *Academy of Management Review*, vol. 14, no. 4, pp. 532-550.

- Eisenhardt, K. M. & Graebner, M. E. 2007, 'Theory building from cases: Opportunities and challenges', *Academy of Management Journal*, vol. 50, no. 1, pp. 25-32.
- Ervin, C. A. & Ervin, D. E. 1982, 'Factors affecting the use of soil conservation practices: hypotheses, evidence, and policy implications', *Land Economics*, vol. 58, no. 3, pp. 277-292.
- Fairweather, J. R. & Keating, N. C. 1994, 'Goals and management styles of New Zealand farmers', *Agricultural Systems*, vol. 44, no. 2, pp. 181-200.
- Feder, G. & O'Mara, G. T. 1982, 'On information and innovation diffusion: A Bayesian approach', *American Journal of Agricultural Economics*, vol. 64, no. 1, pp. 145-147.
- Feder, G. & Slade, R. 1984, 'The acquisition of information and the adoption of new technology', *American Journal of Agricultural Economics*, vol. 66, no. 3, pp. 312-320.
- Feder, G. & Umali, D. L. 1993, 'The adoption of agricultural innovation: A review', *Technological Forecasting and Social Change*, vol. 43, pp. 215-239.
- Fischer, A. J., Arnold, A. J. & Gibbs, M. 1996, 'Information and speed of innovation adoption', *American Journal of Agricultural Economics*, vol. 78, no. 4, pp. 1073-1081.
- Fishbein, M. & Ajzen, I. 1975, *Belief, Attitude, Intention and Behavior: An introduction to theory and research*, Addison-Wesley Publishing Company, USA.
- Fisher, B.S. & Wall, C.A. 1990, 'Supply response in the Australian sheep industry', *Australian Journal of Agricultural Economics*, vol. 34, no. 2, pp. 147-166.
- Fisher, C. 2004, *Researching and Writing a Dissertation for Business Students*, Prentice Hall, England.
- Fisher, D. K., Norvell, J., Sonka, S. & Nelson, M. J. 2000, 'Understanding technology adoption through system dynamics modelling: implication for agribusiness management', *International Food and Agribusiness Management Review*, vol. 3, no. 3, pp. 281-296.
- "Flashback" 2004, *Countryman*, June 17, pg. 53.

- Flett, R., Alpass, F., Humphries, S., Massey, C., Morriss, S. & Long, N. 2004, 'The technology acceptance model and use of technology in New Zealand dairy farming', *Agricultural Systems*, vol. 80, no. 2, pp. 199-211.
- Fliegel, F. C. 1993, *Diffusion Research in Rural Sociology*, Greenwood, Westport, USA.
- Fliegel, F. C. & Kivlin, J. E. 1962, 'Farm practice attributes and adoption rates', *Social Forces*, vol. 40, no. 4, pp. 364-370.
- Fornell, C. & Larcker, D. F. 1981, 'Evaluating structural equation models with unobservable variables and measurement error', *Journal of Marketing Research*, vol. 18, no. 1, pp. 39-50.
- Forte-Gardner, O., Young, F.L., Dillman, D.A. & Carroll, M.S. 2004, 'Increasing the effectiveness of technology transfer for conservation cropping systems through research and field design', *Renewable Agriculture and Food Systems*, vol 19, no. 4, pp. 93-114.
- 'Forward contracts: Similar route for Harvey Beef' 2006, *Countryman*, 13 April, p. 15.
- Frank, B. R. 1997, 'Adoption of innovations in the north Queensland beef industry. III: Implications for extension management', *Agricultural Systems*, vol. 55, no. 3, pp. 347-358.
- Fraser, R. 1997, 'Seasonal variability, land values and willingness-to-pay for a forward wheat contract with protein premiums and discounts', *The Australian Journal of Agricultural and Resource Economics*, vol. 41, no. 2, pp. 139-155.
- Frost, F. M. 2000, 'Value orientations: Impact and implications in the extension of complex farming systems', *Australian Journal of Experimental Agriculture*, vol. 40, no. 4, pp. 511-517.
- Gasson, R. 1969, 'The choice of farming as an occupation', *Sociologia Ruralis*, vol. 9, no. 2, pp. 146-166.
- Gasson, R. 1973, 'Goals and values of farmers', *Journal of Agricultural Economics*, vol. 24, no. 3, pp. 521-542.
- Gasson, R. 1974, 'Socioeconomic status and orientation to work: The case of farmers', *Sociologia Ruralis*, vol. 14, no. 3, pp. 127-140.

- Gasson, R. 1998, 'Educational qualifications of UK farmers: A review', *Journal of Rural Studies*, vol. 14, no. 4, pp. 487-498.
- Gasson, R. & Errington, A. 1993, 'Objectives, goals and values in the family farm', in *The Farm Family Business*, Cab International, United Kingdom, pp. 88-113.
- Gefen, D., Straub, D. W. & Boudreau, M. 2000, 'Structural equation modeling and regression: Guidelines for research practice', *Communications of the Association of Information Systems*, vol. 4, no. 7, pp. 1-77.
- Gillmor, D. A. 1986, 'Behavioural studies in agriculture: Goals, values and enterprise choice', *Irish Journal of Agricultural and Rural Sociology*, vol. 11, pp. 19-33.
- Gladwin, C.H. 1979, 'Cognitive strategies and adoption decisions: A case study of nonadoption of an agronomic innovation', *Economic Development and Cultural Change*, vol. 28, no. 1, pp. 155-174.
- Gladwin, C.H. 1989, *Ethnographic Decision Tree Modeling*, Sage Publications, Newbury Park, California.
- Glaser, B.G. & Strauss, A.L. 1967, *The discovery of grounded theory; strategies for qualitative research*, Aldine Publishing Company, Chicago.
- Goldschmidt, P. & Tan, C. 1999, 'A model for the adoption of agent technology', *Western Australian Workshop on Information Systems Research*, Perth, Western Australia.
- Gorddard, B. J. 1991, *The adoption of minimum tillage in the Western Australian wheatbelt*, University of Western Australia, Agricultural economics discussion paper no. 3/91.
- Gorddard, B. J. 1992, 'Barriers to the adoption of conservation tillage in Western Australia', *Proceedings of the 7th ISCO conference*, Sydney pp. 391-403.
- Gorddard, B. J. 1993, *Beliefs, attitudes and conservation behaviour*, Retrieved March 16, 2006, from http://auth.lis.curtin.edu.au/cgi-bin/auth-ng/eres_display.cgi?url=DC60003447.pdf©right=1.
- Goss, B. A. 1987, 'Wool prices and publicly available information', *Australian Economic Papers*, vol. 26, no. 49, pp. 225-236.

- Goss, B. A. & Avsar, S. G. 1992, 'A rational expectations model of the Australian wool spot and futures market', in B. A. Goss, (ed.) *Rational Expectations and Efficiency in Futures Markets*, Routledge, New York, pp. 190-209.
- Goss, K. F. 1979, 'Consequences of diffusion of innovations', *Rural Sociology*, vol. 44, no. 4, pp. 754-772.
- Graebner, M. E. 2004, 'Momentum and serendipity: how acquired leaders create value in the integration of technology firms', *Strategic Management Journal*, vol. 25, no. 8/9, pp. 751-777.
- Grolleau, G., Mzoughi, N. & Thomas, A. 2006, 'Determinants of ISO 14001 certification in the agro-food industry', paper presented to the *80th Agricultural Economics Society*, Paris, 30-31 March.
- Hair, J. F., Anderson, R. E., Tatham, R. L. & Black, W. C. 1992, 'What is structural equation modeling?' in *Multivariate data analysis - with readings*, Macmillan Publishing Company, Canada, pp. 432-452.
- Hair, J. F., Anderson, R. E., Tatham, R. L. & Black, W. C. 1998, *Multivariate Data Analysis*, 5th edn, Prentice Hall, New Jersey.
- Hall, C. 2006, 'Identifying farmer attitudes towards genetically modified (GM) crops in Scotland', paper presented to the *80th Agricultural Economics Society*, Paris, 30-31 March.
- Hamel, G. 1991, 'Competition for competence and inter partner learning within international strategic alliances', *Strategic Management Journal*, vol. 12, no. Special issue, pp. 83-103.
- Hamilton, F. 1993, *The Workboot Series: Wool*, The Kondinin Group, Western Australia.
- Hanlon, D. 2001, *Vision and support in new venture start-ups*, Retrieved December 11, 2006, from www.babson.edu/entrep/fer/Babson2001/XI/XIB/XIB/xib.htm#Top.
- Hardaker, J. B., Huirne, R. B. M., Anderson, J. R. & Lien, G. 2004, *Coping with Risk in Agriculture*, 2nd edn, CABI Publishing, Oxfordshire.

- Harper, J. K., Rister, M. E., Mjelde, J. W., Drees, B. M. & Way, M. O. 1990, 'Factors influencing the adoption of insect management technology', *American Journal of Agricultural Economics*, vol. 72, no. 4, pp. 997-1005.
- Harris, M. 2006, *Roberts launches new wool marketing initiative*, media release, Roberts Pty Ltd, 2 May.
- Hartley, J. 2004, 'Case study research', in C. Cassel & G. Symon (eds), *Essential Guide to Qualitative Methods in Organizational Research*, Sage Publications, London, pp. 323-33.
- Hategekimana, B. & Trant, M., 2002, 'Adoption and diffusion of new technology in agriculture: genetically modified corn and soybeans', *Canadian Journal of Agricultural Economics*, vol. 50, no. 4, p. 357-371.
- Hausman, A. 2005, 'Innovativeness among small businesses: Theory and propositions for future research', *Industrial Marketing Management*, vol.34, no. 8, p. 773-782.
- Herrmann, V. & Uttitz, P. 1990, "'If only I didn't enjoy being a farmer!' - Attitudes and opinions of monoactive and pluriactive farmers', *Sociologia Ruralis*, vol. 30, no. 1, pp. 63-75.
- Hildenbrand, B. & Hennon, C. B. 2005, 'Above all, farming means family farming: Context for introducing the articles in this special issue', *Journal of Comparative Family Studies*, vol. 36, no. 3, pp. 357-367.
- Hofmeyer, G. D. 2005, 'An Investigation of the Factors that Influence the Intention to Adopt Business to Business (B2B) Trading Exchanges in Small Business in Western Australia', DBA Thesis, Curtin University of Technology.
- Howden, P. & Vanclay, F. 2000, 'Mythologization of farming styles in Australian broadacre cropping', *Rural Sociology*, vol. 65, no. 2, pp. 295-310.
- Howden, P., Vanclay, F., Lemerle, D. & Kent, J. 1998, 'Working with the grain: Farming styles amongst Australian broadacre croppers', *Rural Society*, vol. 8, no. 2, pp. 109-125.
- Igbaria, M., Zinatelli, N., Cragg, P. & Cavaye, A. L. M. 1997, 'Personal computing acceptance factors in small firms: A structural equation model', *MIS Quarterly*, vol. 21, no. 3, pp. 279-305.

- Islam, N. 2003, 'Driving and motivational factors for producing wool: Views from selected WA wool producers', *Proceedings of the Agribusiness Sheep Updates 2003*, Department of Agriculture Western Australia, Perth, Western Australia, Retrieved June 23, 2004, from <http://www.agric.wa.gov.au/pls/portal30/docs/FOLDER/IKMP/AAP/SL/su2003economics.pdf#nais>.
- Islam, N. 2004a, 'Regional agricultural production systems: Estimates for Western Austral', *Review of Rural and Urban Development Studies*, vol. 16, no. 3, pp. 189-209.
- Islam, N. 2004b, 'An analysis of productivity growth in Western Australian agriculture', *Academia Economic Papers*, vol. 32, no. 3, pp. 467-499.
- Islam, N., Stanton, J. & Kopke, E. 2005, *Increased demand for wool apparel in Western European markets: Effects on Australian wool auctions*, Department of Agriculture Western Australia, Miscellaneous Publication 31/2005.
- Jensen, R. A. 1982, 'Adoption and diffusion of an innovation of uncertain probability', *Journal of Economic Theory*, vol. 27, no. 1, pp. 182-193.
- Jensen, R.A. 2001, 'Strategic intrafirm innovation adoption and diffusion', *Southern Economic Journal*, vol. 68, no. 1, pp. 120-133.
- Jones, C., Menezes, F. & Vella, F. 2004, 'Auction price anomalies: Evidence from wool auctions in Australia', *Economic Record*, vol. 80, no. 250, pp. 271-288.
- Kaine-Jones, G. 1988, *Exporting Australian Wool: The changing economic role of the wool exporter*, The Rural Development Centre, University of New England, Armidale.
- Kerridge, K. W. 1978, 'Value orientations and farmer behaviour - An exploratory study', *Quarterly Review of Agricultural Economics*, vol. 31, no. 1, pp. 61-72.
- Kingwell, R. 2000, 'Price risk management for Australian broadacre farmers: some observations', *Australian Agribusiness Review*, vol. 8, no. paper 2.
- Kingwell, R., Bathgate, A. & O'Connell, M. 1999, 'Wool in Western Australia - Research, development and extension', *Australian Agribusiness Review*, vol. 7, no. 12.

- Kingwell, R. S., Pannell, D. J. & Robinson, S. D. 1993, 'Tactical responses to seasonal conditions in whole-farm planning in Western Australia', *Agricultural Economics*, vol. 8, no. 3, pp. 211-226.
- Kislev, Y. & Shchori-Bachrach, N. 1973, 'The process of an innovation cycle', *American Journal of Agricultural Economics*, vol. 55, no. 1, pp. 28-37.
- Kline, R. B. 1998, *Principles and Practices of Structural Equation Modeling*, Guilford Press, New York.
- Knudson, W., Wysocki, A., Champagne, J. & Peterson, H. C. 2004, 'Entrepreneurship and innovation in the agri-food system', *American Journal of Agricultural Economics*, vol. 86, no. 5, pp. 1330-1336.
- Koch, R. 2006, 'So you are thinking of hedging?' *Countryman*, 6 February, p. 54.
- Krueger, R. A. 1994, *Focus groups: A practical guide for applied research*, 2nd edn, Sage Publications, Thousand Oaks, California.
- Ladyman, L. 2006, 'Hands up for AWB', *Countryman*, 4 May, p. 1.
- Lee, H.C. 2006, 'The Influence of Buyer-Supplier Relationships on the Intention to Adopt Electronic Purchasing by the Printing Industry (SMES) in Singapore', DBA Thesis, Curtin University of Technology.
- Lee, L. K. & Stewart, W. H. 1983, 'Landownership and the adoption of minimum tillage', *American Journal of Agricultural Economics*, vol. 65, no. 2, pp. 256-264.
- Leone, L., Perugini, M. & Ercolani, A.P. 1999, 'A comparison of three models of attitude-behaviour relationships in the studying behaviour domain', *European Journal of Social Psychology*, vol. 29, no. 2/3, pp. 161-189.
- Liddle, J. 2004, 'Is there a future for wool futures?' *Wool Record*, vol. 163, no. 3720, p. 1.
- Lindner, R. K. 1986, 'Adoption and diffusion of technology: An overview', *Proceedings of the Australian Centre for International Agricultural Research Conference*, Bangkok, Thailand pp. 144-151.
- Lodge, G. M. 1991, 'Management practices and other factors contributing to the decline in persistence of grazed lucerne in temperate Australia: A review', *Australian Journal of Experimental Agriculture*, vol. 31, no. 5, pp. 713-724.

- Longo, R. M. J. 1990, 'Information transfer and the adoption of agricultural innovations', *Journal of the American Society for Information Science*, vol. 41, no. 1, pp. 1-9.
- Lowe, S. 2005, 'The outlook for sheep products', in *Farm Budget Guide 2005*, Farm Weekly, Western Australia, pp. 96-102.
- Lubulwa, M., Beare, S., Bui-Lan, A. & Foster, M. 1997, *Wool futures - price risk management for Australian wool growers*, ABARE Research Report 97.1.
- Lynne, G. D., Casey, C. F., Hodges, A. & Rahmani, M. 1995, 'Conservation technology adoption decisions and the theory of planned behavior', *Journal of Economic Psychology*, vol. 16, no. 4, pp. 581-598.
- Machum, S. 2005, 'The persistence of family farming in the wake of agribusiness: A New Brunswick, Canada case study', *Journal of Comparative Family Studies*, vol. 36, no. 3, pp. 377-390.
- Madden, T. J., Scholder Ellen, P. & 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.
- Makus, L. D., Lin, B., Carlson, J. & Krebill-Prather, R. 1990, 'Factors influencing farm level use of futures and options in commodity marketing', *Agribusiness*, vol. 6, no. 6, pp. 621-631.
- Mann, T. L. J. 1991, 'Integration of crops and livestock', in V. Squire & P. Tow, (eds.), *Dryland Farming: A systems approach*, Sydney University Press, Sydney, pp. 102-118.
- Marcil, I., Bergeron, J. & Audet, T. 2001, 'Motivational factors underlying the intention to drink and drive in young male drivers', *Journal of Safety Research*, vol. 32, no. 4, pp. 363-376.
- Marra, M., Pannell, D. J. & Abadi Ghadim, A. 2003, 'The economics of risk, uncertainty and learning in the adoption of new agricultural technologies: Where are we on the learning curve?' *Agricultural Systems*, vol. 75, no. 2-3, pp. 215-234.
- Marsh, S.P., Burton, M.P. & Pannell, D.J. 2006, 'Understanding farmers' monitoring of water tables for salinity management', *Australian Journal of Experimental Agriculture*, vol. 46, no. 9, pp. 1113-22.

- Martin, A.W. 2001, 'Large-group processes as action research', in P. Reason & H. Bradbury (eds.), *Handbook of Action Research: Participative inquiry & practice*, Sage Publications, London, pp. 200-208.
- Martin, P. 1998, *Profile of Australian Wool Producers*, ABARE Research Report 98.5.
- Martin, P., Mues, C., Phillips, P., Shafron, W., van Mellor, T., Kokic, P., Nelson, R. & Treadwell, R. 2007, 'Farm financial performance', *Australian Commodities*, vol. 14, no. 1, pp. 179-200.
- Masters, W.A. 2005, 'Research prizes: A new kind of incentive for innovation of African agriculture', *International Journal of Biotechnology*, vol. 7, no. 1-3, p. 195.
- Mazzocchi, M., Lobb, A. E. & Traill, W. B. 2006, 'Food scares and consumer behaviour: A European perspective', *26th International Association of Agricultural Economists Conference*, Gold Coast, Queensland, 12-18 August.
- McEachern, M. G. & Warnaby, G. 2005, 'Improving customer orientation within the fresh meat supply chain: A focus on assurance schemes', *Journal of Marketing Management*, vol. 21, no. 1/2, pp. 89-115.
- McGregor, M. J., Rola-Rubzen, M. F. & Murray-Prior, R. 2001, 'Micro and macro-level approaches to modelling decision making', *Agricultural Systems*, vol. 69, no. 1-2, pp. 63-83.
- McKay, L., Lawrence, D. & Vlastuin, C. 1983, 'Profit, output supply, and input demand functions for multiproduct firms: The case of Australian agriculture', *International Economic Review*, vol. 24, no. 2, pp. 323-340.
- McLeay, F. & Zwart, T. 1998, 'Factors affecting choice of cash sales versus forward marketing contracts', *Agribusiness*, vol. 14, no. 4, pp. 299-309.
- Miles, M. B. & Huberman, A. M. 1994, *An Expanded Sourcebook: Qualitative Data Analysis*, Sage Publications, Thousand Oaks, California.
- Miller, S. E. 1986, 'Forward contracting versus hedging under price and yield uncertainty', *Southern Journal of Agricultural Economics*, vol. 18, no. 2, pp. 139-146.

- Mishra, S.N. & Hossain, M.M. 2000, 'Role of Krishi Vigyan Kendra in diffusion of farm and allied technology among farmers of Kalahandi district, Orissa', *Indian Journal of Agricultural Economics*, vol. 55, no. 3, pp. 554-556.
- Mitchell, B. 2003, 'Price risk management in the wool industry', *Wool Technology and Sheep Breeding*, vol. 51, no. 3, pp. 242-259.
- Mitchell, G.F.C. 1969, *Application of a Likert-scale to the measurement of the degree of farmers' subscriptions to certain goals or values*, University of Bristol, Department of Economics (Agricultural Economics).
- Morse, J. M. & Richards, L. 2002, *Readme First for a User's Guide to Qualitative Methods*, Sage Publications, California.
- Munshi, K. 2004, 'Social learning in a heterogeneous population: Technology diffusion in the Indian Green Revolution', *Journal of Development Economics*, vol. 73, no. 1, p. 185-213.
- Murray-Prior, R. B. 1994, 'Modelling decisions of wool producers: hierarchical decision models and personal construct theory', PhD Thesis, University of New England.
- Murray-Prior, R. 1996, 'Modelling decision processes: A new technique for applying personal construct psychology', in B. M. Walker, J. Costigan, L. L. Viney & B. Warren, (eds.), *Personal Construct Theory: A psychology for the future*, The Australian Psychology Society, Carlton, Victoria, pp. 201-215.
- Murray-Prior, R. & Wright, V. 2004, 'Use of strategies and decision rules by Australian wool producers to manage uncertainty', *Australian Farm Business Management Journal*, vol. 1, no. 1, pp. 56-71. Retrieved March 14, 2004, from www.afbmnetwork.orange.usyd.edu.au/afbmjournal/database.
- Murray-Prior, R. B. & Wright, V. E. 2001, 'Influence of strategies and heuristics on farmers' response to changes under uncertainty', *Australian Journal of Agricultural and Resource Economics*, vol. 45, no. 4, pp. 573-598.
- Musser, W. N., Patrick, G. F. & Eckman, D. T. 1996, 'Risk and grain marketing behavior of large-scale farmers', *Review of Agricultural Economics*, vol. 18, no. 1, pp. 65-77.
- Neill, S.P. & Lee, D. R. 2001, 'Explaining the adoption and disadoption of sustainable agriculture: The case of cover crops in northern Honduras', *Economic Development and Cultural Change*, vol. 49, no. 4, pp. 793-821.

- 'New wheat pricing tools launched' 2005, *Countryman*, 24 February, p. 5.
- Nosek, J. & Mandviwalla, M. 1996, 'Mobile group support technologies for any-time, any-place team support', *Information Technology & People*, vol. 9, no. 4, pp. 58-70.
- Nowak, P. J. 1987, 'The adoption of agricultural conservation technologies: economic and diffusion explanations', *Rural Sociology*, vol. 52, no. 2, pp. 208-220.
- Nunnally, J.C. 1978, *Psychometric Theory*, McGraw-Hill, New York.
- Nunnally, J. C. & Bernstein, I. H. 1994, 'Factor analysis I: The general model and variance condensation', in *Psychometric Theory*, 3rd edn, McGraw-Hill, New York, pp. 447-490.
- O'Donnell, V., Bailey, D., Delforce, R. & Dickson, A. 2005, 'Agriculture', *Australian Commodities*, vol. 12, no. 4, pp. 639-640.
- Oliver, R. L. & Bearden, W. O. 1985, 'Crossover effects in the theory of reasoned action: A moderating influence attempt', *Journal of Consumer Research*, vol. 12, pp. 324-340.
- Page, L. 2007, 'Marketing Tasmanian wool to the world', *Australian Farm Journal*, vol. 17, no. 6, pp. 16-21.
- Pampel, F. & van Es, J. C. 1977, 'Environmental quality and issues of adoption research', *Rural Sociology*, vol. 42, no. 1, pp. 57-71.
- Pannell, D. J., Malcolm, B. & Kingwell, R. S. 2000, 'Are we risking too much? Perspectives on risk in farm modelling', *Agricultural Economics*, vol. 23, no. 1, pp. 69-78.
- Pannell, D. J., Marshall, G. R., Barr, N., Curtis, A., Vanclay, F. & Wilkinson, R. 2006, 'Understanding and promoting adoption of conservation practices by rural land holders', *Australian Journal of Experimental Agriculture*, vol. 46, no. 11, pp. 1407-1424.
- Park, H.-S. & Levine, T.R. 1999, 'The Theory of Reasoned Action and self-construal: Evidence from three cultures', *Communications Monographs*, vol. 66, no. 3, pp. 199-218.

- Patrick, G. F., Musser, W. N. & Eckman, D. T. 1998, 'Forward marketing practices and attitudes of large-scale midwestern grain producers', *Review of Agricultural Economics*, vol. 20, no. 1, pp. 38-53.
- Pelaez, V. & Schmidt, W. 2002, 'The dissemination of genetically modified organisms in Brazil', *International Journal of Biotechnology*, vol. 4, no. 2, p. 211.
- Pennings, J. M. E. & Leuthold, R. M. 2000, 'The role of farmers' behavioral attitudes and the heterogeneity in futures contracts usage', *American Journal of Agricultural Economics*, vol. 82, no. 4, pp. 908-919.
- Pennings, J. M. E. & Leuthold, R. M. 2001, 'A behavioural approach towards futures contract usage', *Australian Economic Papers*, vol. 40, no. 4, pp. 461-478.
- Perry, R. 2005, 'Sheep industry outlook to 2009-10', *Australian Commodities*, vol. 12, no. 1, pp. 58-62.
- Piggot, R. 1993, 'Agricultural marketing', in D. B. Williams, (ed.) *Agriculture in the Australian Economy*, Sydney University Press, Australia.
- Pluske, J. & Fraser, R. 1995, 'Can producers place valid and reliable valuations on wool price-risk information?' *Review of Marketing and Agricultural Economics*, vol. 63, no. 2, pp. 284-291.
- Qaim, M. & de Janvry, A. 2005, 'Bt cotton and pesticide use in Argentina: Economic and environmental effects', *Environment and Development Economics*, vol. 10, vol. 2, p. 179.
- Quaddus, M. 2004, 'A partial least square approach to modelling electronic commerce success in Australia', paper presented to the *International Conference on Computing and Information Technology*, Dhaka, 25-27 December.
- Quaddus, M. & Achjari, D. 2005, 'A model for electronic commerce success', *Telecommunications Policy*, vol. 29, no. 2-3, pp. 127-152.
- Quaddus, M. & Hofmeyer, G. 2007, 'An investigation into the factors influencing the adoption of B2B trading exchanges in small business', *European Journal of Information Systems*, vol. 16, no. 3, pp. 202-15.

- Quaddus, M., Islam, N. & Stanton, J. 2004, 'Driving and Motivational Factors for Producing Wool: Views from Selected WA Wool Producers', *Sheep Updates 2004*, Curtin University of Technology, Perth, pp. 1-15.
- Quaddus, M., Islam, N. & Stanton, J. 2006, 'An investigation of significant factors influencing Western Australian wool producers to produce wool: A structural equation modelling approach', *26th International Association of Agricultural Economics*, Gold Coast, Queensland, 12-18 August.
- Quaddus, M. & Xu, J. 2005, 'Adoption and diffusion of knowledge management systems: Field studies of factors and variables', *Knowledge-Based Systems*, vol. 18, no. 2-3, pp. 107-115.
- Rahim, M. A., Antonioni, D. & Psenicka, C. 2001, 'A structural equation model of leader power, subordinate' styles of handling conflict, and job performance', *International Journal of Conflict Management*, vol. 12, no. 3, pp. 191-211.
- Rahm, M. R. & Huffman, W. E. 1984, 'The adoption of reduced tillage: the role of human capital and other variables', *American Journal of Agricultural Economics*, vol. 66, no. 4, pp. 405-413.
- Rahman, S. 2003, 'Environmental impacts of modern agricultural technology diffusion in Bangladesh: An analysis of farmers' perceptions and their determinants', *Journal of Environmental Management*, vol. 68, no. 2, p. 183.
- Rajesh, R. & Varadarajan, S. 2000, 'Constraints in diffusion of new farm technology in dry farming region: A critical analysis', *Indian Journal of Agricultural Economics*, vol. 55, no. 3, pp. 563-565.
- Ramsden, S. & Wilson, P. 2006, 'Are English farmers diversified enough? Risk management for combinable crops under the Mid Term Review', paper presented to the *80th Agricultural Economics Society*, Paris, 30-31 March.
- Rehman, T., Garforth, C., McKemey, K., Yates, C. & Rana, R. 2007, 'Incorporating elements of farmers' behaviour in agricultural policy models', paper presented to the *81st Annual Conference of the Agricultural Economics Society*, Reading, UK, 2-4 April.

- Richardson, B. 2001, 'The politics and economics of marketing wool, 1950-2000', *Australian Journal of Agricultural and Resource Economics*, vol. 45, no. 1, pp. 95-115.
- Riffe, D., Lacy, S. & Fico, F.G. 1998, *Analysing Media Messages: Using Quantitative Content Analysis in Research*, Lawrence Erlbaum Associates, New Jersey.
- Robson, C. 2002, *Real World Research*, 6th edn, Blackwell Publishing, UK.
- Rogers, E. M. 1958, 'Categorizing the adopters of agricultural practices', *Rural Sociology*, vol. 23, no. 4, pp. 345-354.
- Rogers, E. M. 1995, *Diffusion of Innovations*, 4th edn, The Free Press, New York.
- Ruttan, V. W. 1996, 'What happened to technology adoption-diffusion research?' *Sociologia Ruralis*, vol. 36, no. 1, pp. 51-73.
- Ryan, B. & Gross, N. C. 1943, 'The diffusion of hybrid seed corn in two Iowa communities', *Rural Sociology*, vol. 8, no. 1, pp. 15-24.
- Ryan, M. J. 1982, 'Behavioral intention formation: The interdependency of attitudinal and social influence variables', *The Journal of Consumer Research*, vol. 9, no. 3, pp. 263-278.
- Saltiel, J., Bauder, J. W. & Palakovich, S. 1994, 'Adoption of sustainable agricultural practices: Diffusion, farm structure and profitability', *Rural Sociology*, vol. 59, no. 2, pp. 333-349.
- Santosa, P. I., Wei, K. K. & Chan, H. C. 2005, 'User involvement and user satisfaction with information-seeking activity', *European Journal of Information Systems*, vol. 14, no. 4, pp. 361-370.
- Sarver, V. T. 1983, 'Ajzen and Fishbein's "Theory of Reasoned Action": A critical assessment', *Journal for the Society of Social Behaviour*, vol. 13, no. 2, pp. 155-163.
- Saunders, M., Lewis, P. & Thornhill, A. 2003, 'Deciding on the research approach and choosing a research strategy', in *Research Methods for Business Students*, 3rd edn, Prentice Hall, England, pp. 82-112.
- Schumacker, R. E. & Lomax, R. G. 1996, *A Beginner's Guide to Structural Equation Modeling*, Lawrence Erlbaum Associates, Inc., New Jersey.

- Seale, J. 1996, 'Wool selling options - Strengths and weaknesses', *Wool Technology and Sheep Breeding*, vol. 44, no. 4, pp. 303-310.
- Sekaran, U. 2003, *Research Methods for Business: A skills building approach*, 4th edn, John Wiley & Sons, USA.
- Shafron, W., Martin, P. & Ashton, D. 2002, *Profile of Australian Wool Producers 1997-98 to 2001-02*, ABARE Research Report 02.7.
- Sharman, L. 2006a, 'NZ chain model doubts', *Countryman*, 13 April, p. 9.
- Sharman, L. 2006b, 'More demand for WA wool', *Countryman*, 13 April, p. 3.
- Sharman, L. 2006c, 'Wooltrade to sign 'big two'', *Countryman*, 8 June, p. 10.
- Sheppard, B. H., Hartwick, J. & Warshaw, P. R. 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. 325-343.
- Shimp, T. A. & Kavas, A. 1984, 'The theory of reasoned action applied to coupon usage', *Journal of Consumer Research*, vol. 11, no. 3, pp. 795-809.
- Siggelkow, N. 2007, 'Persuasion with case studies', *Academy of Management Journal*, vol. 50, no. 1, pp. 20-4.
- Simpson, W.S. 2002, 'Wool production and fibre marketing', in W.S. Simpson & G.H. Crawshaw (eds), *Wool: Science and technology*, Woodhead Publishing Limited, Cambridge, pp. 1-20.
- Smajgl, A. 2004, 'Modelling evolving rules for the use of common-pool resources in an agent-based model', in *10th Biennial conference of the international association for the study of common property*, Mexico.
- Smajgl, A., Vella, K. & Greiner, R. 2003, 'Frameworks and models for analysis and design of institutional arrangements in outback regions', in *IASCP Pacific Regional Meeting - Traditional Lands in the Pacific Region: Indigenous Common Property Resources on Convulsion or Cohesion*, Brisbane.
- Smith, K. 2001, Effects of price on the seasonality and level of prime lamb supply from the central wheatbelt of WA, Honours, Curtin University of Technology.

- Stake, R.E. 2000, 'Case studies', in N.K. Denzin & Y.S. Lincoln (eds), *Handbook of Qualitative Research*, 2nd edn, Sage Publications, Thousand Oaks, California, pp. 435-54.
- Stanton, J. 2004, 'Wool', in *Western Australian Agri-food and fibre industry outlook*, Department of Agriculture Western Australian, Bulletin # 4639, pp. 32-35, Retrieved May 14, 2007, from www.agric.wa.gov.au/pls/portal30/docs/FOLDER/IKMP/AMT/AGB/BULLETIN4639.PDF.
- Stanton, J. 2005, *Western Australia's agri-food, fibre and fisheries industries 2006: Market information for investors, traders and businesses*, Department of Agriculture Western Australian, Bulletin # 4670, Retrieved January 16, 2006, from www.agric.wa.gov.au/servlet/page?_pageid=449&_dad=portal30&_schema=PORTAL30&p_reference_path=798_IKMP_NAVIGATION_PORTLET_260&p_start_url=&p_home_url=&p_show_menu=&p_login_url=&p_topic_id=20120&p_topic_name=0AAP0SL0WOOL0&p_no_summpage=N&p_appname_img.
- Stanton, J. 2007, 'Wool', in *Western Australia's agricultural, food and fisheries industries 2002-2003*, Bulletin # 4702, pp. 64-68, Retrieved October 18, 2007, from <http://www.agric.wa.gov.au/content/AMT/AGB/bulletin4702.pdf>.
- Stanton, J. H., Curtis, K. M. S. & Dolling, M. 2003, *Pass-in rates at auction have no effect on export levels for wool from Australia*, International Wool Textile Organisation - Technology & Standards Committee - Commercial Technology Forum, Buenos Aires, CTF nn (May).
- Stephens, L. & Campbell, A. 2005, *Land, water & wool: Shaping the Future*, Australian Wool Innovation, AWI code PR051010.
- Stewart, P.A., Harding, D. & Day, E. 2002, 'Regulating the new agricultural biotechnology by managing innovation diffusion', *American Review of Public Administration*, vol. 32, no. 1, pp. 78-100.
- Strauss, A. & Corbin, J. 1990, *Basics of Qualitative Research – Grounded theory procedures and techniques*, Sage Publications, California.
- Tan, M. & Teo, T. S. H. 2000, 'Factors influencing the adoption of internet banking', *Journal of the Association for Information Systems*, vol. 1, no. 5, pp. 1-42.

- Teasdale, D. 1991, 'Wool preparation and processing', in D. J. Cottle, (ed.) *Australian Sheep and Wool Handbook*, Inkata Press, Melbourne.
- 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 and Behavioral Research*, Sage Publications, Thousand Oaks, California, pp. 3-50.
- The Merino Company 2006, *New Zealand Merino supply chain business model for Australia*, Australian Wool Innovation Limited, EC709, Retrieved March 27, 2007, from http://www.wool.com.au/Publications/Trade_development/attachments/Publications/Trade_development/Final_Report_NZ_Merino.pdf
- The Woolmark Company 2005a, *AWS Concise Annual Report 2005 - Market Overview*, Retrieved November 9, 2005, from www.woolmark.com/upload/AWSConRep05WEB.pdf.
- The Woolmark Company 2005b, *New Zealand Wool Exports (media release)*, Retrieved October 14, 2005, from www.wool.com.au/LivePage.aspxId=2239.
- Thomson, D. 2002, 'Understanding diversity in farming behaviour using "farming styles"', *Wool Technology and Sheep Breeding*, vol. 50, no. 3, pp. 280-286.
- Thompson, K. E., Haziris, N. & Alekos, P. J. 1994, 'Attitudes and food choice behaviour', *British Food Journal*, vol. 96, no. 11, pp. 9-13.
- Thompson, K. E. & Panayiotopoulos, P. 1999, 'Predicting behavioural intention in a small business context', *Journal of Marketing Practice*, vol. 5, no. 3, pp. 89-96.
- Thompson, K. E. & Vourvachis, A. 1995, 'Social and attitudinal influences on the intention to drink wine', *International Journal of Wine Marketing*, vol. 7, no. 2, pp. 35-44.
- Thompson, N. J. & Thompson, K. E. 1996, 'Reasoned action theory: An application to alcohol-free beer', *Journal of Marketing Practice*, vol. 2, no. 2, pp. 35-48.
- Tiller, B. M. 2000, *Price risk management tools and the Western Australian grain producer*, Honours, Curtin University of Technology.

- Trafimow, D. & Fishbein, M. 1995, 'Do people really distinguish between behavioural and normative beliefs?', *British Journal of Social Psychology*, vol. 32, no. 3, pp. 257-266.
- Turvey, C. G. & Baker, T. G. 1990, 'A farm-level financial analysis of farmers' use of futures and options under alternative farm programs', *American Journal of Agricultural Economics*, vol. 72, no. 4, pp. 946-957.
- Tutkun, A. & Lehmann, B. 2006, 'Explaining the conversion to particularly animal-friendly stabling system of farmers of the Obwalden Canton, Switzerland - Extension of the Theory of Planned Behavior within a structural equation modeling Approach', paper presented to the *80th Agricultural Economics Society conference*, Paris, 30-31 March.
- Tutkun, A., Lehmann, B. & Schmidt, P. 2006, 'Explaining the conversion to organic farming of farmers of the Obwalden Canton, Switzerland - Extension of the Theory of Planned Behaviour within a structural equation modeling approach', *26th International Association of Agricultural Economists Conference*, Gold Coast, Queensland, 12-18 August.
- Upadhyay, B. M., Young, D. L., Wang, H. H. & Wandschneider, P. 2003, 'How do farmers who adopt multiple conservation practices differ from their neighbors?' *American Journal of Alternative Agriculture*, vol. 18, no. 1, pp. 27-36.
- van der Ploeg, J. D. 1994, 'Styles of farming: An introductory note on concepts and methodology', in J. D. van der Ploeg & A. Long, (eds.), *Born from Within: Practice and perspectives of endogenous rural development*, Van Gorcum, Assen, The Netherlands, pp. 7-30.
- van Everdinger, Y. & Wierenga, B. 2002, 'Intra-firm adoption decisions: Role of inter-firm and intra-firm variables', *European Management Journal*, vol. 20, no. 6, p. 649.
- Vanclay, F., Mesiti, L. & Howden, P. 1998, 'Styles of farming and farming subcultures: Appropriate concepts for Australian rural sociology', *Rural Society*, vol. 8, no. 2, pp. 85-107.
- Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. 2003, 'User acceptance of information technology: Toward a unified view', *MIS Quarterly*, vol. 27, no. 3, pp. 425-478.

- Vergara, O., Coble, K. H., Knight, T. O., Patrick, G. F. & Baquet, A. E. 2004, 'Cotton producers' choice of marketing techniques', *Agribusiness*, vol. 20, no. 4, pp. 465-479.
- Vincent, D.P, Dixon, P.B. & Powell, A.A. 1980, 'The estimation of supply response in Australian agriculture: The cresh/creth production system', *International Economic Review*, vol. 21, no. 1, pp. 221-243.
- von Bertalanffy, L. 1975, *Perspectives on General System Theory: Scientific-philosophical studies*, George Braziller, New York.
- Walburger, A. M., Klein, K. K. & Folkins, T. 1999, 'Diffusion of wheat varieties in three agro-climatic zones of western Canada', *Canadian Journal of Agricultural Economics*, vol. 47, no. 3, pp. 293-304.
- Waldthausen, G. 2005, 'Woolcheque' clip pricing website launched, Retrieved July 20, 2005, from www.wool.com.au/LivePage.aspx?PageID=2063.
- Ward, L. 1998, *The Wool CRC: A global perspective of the Australian wool industry in 1998*, The Cooperative Research Centre for Premium Quality Wool, Fitzroy, Australia.
- Weir, S. & Knight, J. 2004, 'Externality effects of education: Dynamics of the adoption and diffusion of an innovation in rural Ethiopia', *Economic Development and Cultural Change*, vol. 53, no. 1, pp. 93-204.
- Whatmore, S., Munton, R., Little, J. & Marsden, T. 1987, 'Towards a typology of farm businesses in contemporary British agriculture', *Sociologia Ruralis*, vol. 27, no. 1, pp. 21-37.
- Wilcox, C. 2004, 'Review and outlook for wool - 2003/04 and beyond', in *2004 Farm Budget Guide*, Western Australian Primary Industry Press, Western Australia, pp. 106-112.
- Wilkening, E. A. 1950, 'Sources of information for improved farm practices', *Rural Sociology*, vol. 15, no. 1, pp. 19-30.
- Wilkening, E. A. & Bharadwaj, L. K. 1968, 'Aspirations and task involvement as related to decision-making among farm husbands', *Rural Sociology*, vol. 33, no. 1, pp. 30-45.

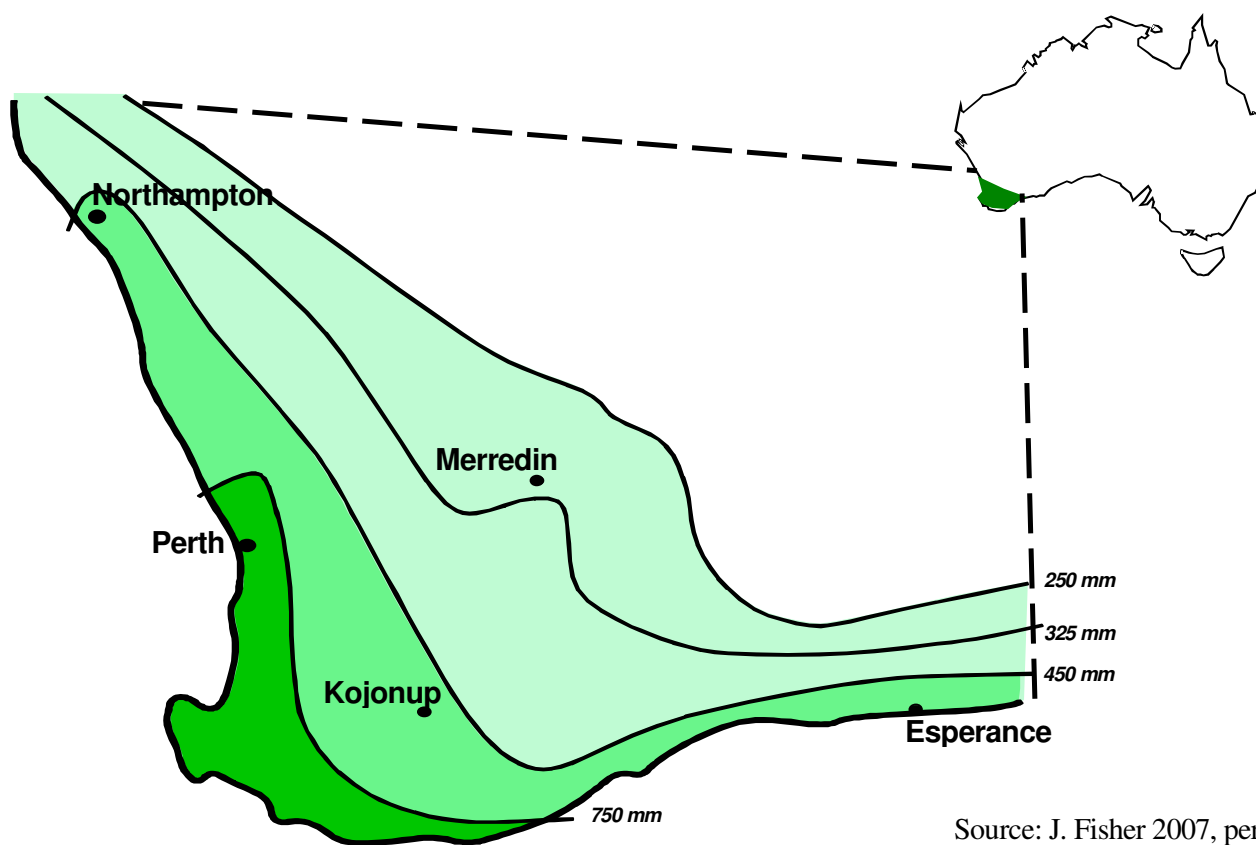
- Wilkenning, E. A. & Guerrero, S. 1969, 'Consensus in aspirations for farm improvement and adoption of farm practices', *Rural Sociology*, vol. 34, no. 2, pp. 182-196.
- Wilkinson, S. 2004, 'Focus group research', in D. Silverman, (ed.) *Qualitative Research Theory, Method and Practice*, 2nd edn, Sage Publications, London, pp. 177-199.
- Willock, J., Deary, I. J., Edward-Jones, G., Gibson, G. J., McGregor, M. J., Sutherland, A., Dent, J. B., Morgan, O. & Grieve, R. 1999a, 'The role of attitudes and objectives in farmer decision making: Business and environmentally-orientated behaviour in Scotland', *Journal of Agricultural Economics*, vol. 50, no. 2, pp. 286-303.
- Willock, J., Deary, I. J., McGregor, M. J., Sutherland, A., Edward-Jones, G., Morgan, O., Dent, B., Grieve, R., Gibson, G. & Austin, E. 1999b, 'Farmers' attitudes, objectives, behaviors, and personality traits: The Edinburgh study of decision making on farms', *Journal of Vocational Behavior*, vol. 54, no. 1, pp. 5-36.
- Wilson, D. T., Mathews, H. L. & Harvey, J. W. 1975, 'An empirical test of the Fishbein behavioral intention model', *The Journal of Consumer Research*, vol. 1, no. 4, pp. 39-48.
- Wood, A. 2006, 'Sheep industry', *Australian Commodities*, vol. 13, no. 3, pp. 491-493.
- Wood, A. & Ashton, D. 2007, 'Wool', *Australian Commodities*, vol. 14, no. 1, pp. 52-56.
- Woods, A., Hood, S. & Couchman, R. C. 2005, *Wool Marketing and Risk Management Scoping Study (EC740)*, Australian Wool Innovation Limited.
- Wool Industry Review Committee 1993, *Wool - Structuring for global realities*, Commonwealth of Australia, Canberra.
- Wool pool to help Tas growers* 2006. Retrieved May 10, 2006, from www.abc.net.au/rural/news/content/2006/s1629636.htm.
- Xu, J. 2003, 'A study of the factors influencing knowledge management systems diffusion in Australia', PhD Thesis, Curtin University of Technology.
- Xu, J. & Quaddus, M. 2005, 'Adoption and diffusion of knowledge management systems: An Australian survey', *The Journal of Management Development*, vol. 24, no. 4, pp. 335-361.

Yin, R. K. 2003, *Case Study Research: Design and methods*, 3rd edn, Sage Publications, Thousand Oaks, California.

Zikmund, W. G. 2003, *Business Research Methods*, 7th edn, Thomson South-Western, USA.

Every reasonable effort has been made to acknowledge the owners of copyright material. I would be pleased to hear from any copyright owner who has been omitted or incorrectly acknowledged.

Appendix 1 Geographic Locations of Focus Groups



Source: J. Fisher 2007, pers. comm., 30 July.

Appendix 2 Forward Contract Adoption Questionnaire

Producer's name: _____

Survey code number: _____

Telephone number: _____

Locality and wool selling area code: _____

Hello Mr/Mrs, I am calling on behalf of the Department of Agriculture & Food, Western Australia. We are conducting a survey to understand more about WA farmers' use of forward contracts to sell their wool. Would you mind in assisting us with this survey by answering some short questions? It will take about 25 minutes and all answers will remain strictly confidential.

Do you currently have a flock of 700 or more adult sheep on your property?

YES ↓	NO "I am sorry to have interrupted you" – "Thank you and good night."
--------------	--

Are you currently a primary producer?

YES ↓	NO "I am sorry to have interrupted you" – "Thank you and good night."
--------------	--

Are you currently a wool producer?

YES ↓ Go to section 1	NO "I am sorry to have interrupted you" – "Thank you and good night."
-------------------------------------	--

Some helpful definitions

Forward contract:

A binding contract specifying the price (or price formula), quality and quantity of raw wool to be delivered at some specified date.

Electronic selling:

Selling wool by any means over the internet eg Wool Trade, e-wool

Section 1: Factors about selling wool by forward contract.

A. Some information relating to issues external to your wool-producing enterprise

1. Do you utilise the services of any of the following types of advisers to sell your wool? (select as many responses as appropriate) [AS1]

Farm advisor/consultant . . . 1
 Wool broker . . . 2
 Portfolio Manager . . . 3
 Sheep adviser . . . 4
 None of the above . . . 5

2. The following are some questions about your attitudes to the advisory services you receive and how you feel about the wool industry in general. Specify the most appropriate response, where 1 indicates strongly disagree and 7 indicates strongly agree.

Strongly disagree ← → Strongly agree

AS2	I feel I am actively encouraged to sell my wool clip by various methods	1	2	3	4	5	6	7
AS3	An on-going relationship with the organisation that provides selling advice is important to me	1	2	3	4	5	6	7
AS4	I try to avoid using advisory services whenever possible	1	2	3	4	5	6	7
AW1	I feel auction is the only way to sell wool in Australia	1	2	3	4	5	6	7
AW2	Wool is a by-product of meat production	1	2	3	4	5	6	7
AW3	I would diversify the way I sell wool if the supply chain was shorter	1	2	3	4	5	6	7
AW4	The lack of buyer competition stops me from diversifying the way I sell wool	1	2	3	4	5	6	7
AW5	I desire a method of selling wool for which the price is less volatile than auction	1	2	3	4	5	6	7
AW6	A better balance between supply & demand would encourage farmers to use forward contracts more	1	2	3	4	5	6	7

B. Some information relating to issues internal to your wool-producing enterprise

3. Do you have experience selling any of the following by forward contract? (if no experience skip the next question)[FS1]

Wool . . . 1
 Grain . . . 2
 Livestock . . . 3
 No experience . . . 4

4. Which of the following statement(s) best describes your experience with using forward contracts of any sort? (select as many responses as appropriate) [FS2]

Easy to use . . . 1
 A good idea . . . 2
 Too much paper work . . . 3
 Too much risk associated with it . . . 4
 Too hard to organise . . . 5
 Not enough information available . . . 6

5. How do you go about setting the reserve price whenever you sell wool?

- Take advice from someone who is involved with my farm business . . . 1
- Take advice from an advisor or wool broker . . . 2
- Use the current auction price . . . 3
- Use the current auction price + a margin . . . 4
- Work out what I need to cover my costs of producing that wool . . . 5
- Work out what I need to cover my costs of producing that wool + a margin . . . 6
- Take what I can get . . . 7
- None of the above . . . 8

6. The following are methods of selling wool, nominate how often you use each (1 is never and 7 is very often): [FS3] (*Speaker's prompt: in the last 5 years*)

Never \longleftrightarrow Very often

Auction	1	2	3	4	5	6	7
Forward contract	1	2	3	4	5	6	7
Futures and options trading	1	2	3	4	5	6	7
Selling on the internet (e.g. WoolTrade or e-wool)	1	2	3	4	5	6	7
Fibre Direct	1	2	3	4	5	6	7
Direct to mill	1	2	3	4	5	6	7
Processed, ready to sell	1	2	3	4	5	6	7

7. Indicate the importance of wool production in relation to your farm business by specifying the most appropriate response, where 1 indicates very low and 7 indicates very high importance.

Very low \longleftrightarrow Very high

FF1	Wool contributes significantly to my farm's income	1	2	3	4	5	6	7
FF2	My income depends significantly on the income from my wool clip	1	2	3	4	5	6	7
FF3	I am committed to my wool-producing enterprise	1	2	3	4	5	6	7
FF4	I have objectives set for the direction of my wool-producing enterprise	1	2	3	4	5	6	7

8. Indicate your attitudes to selling your wool by specifying the most appropriate response, where 1 indicates strongly disagree and 7 indicates strongly agree.

Strongly disagree \longleftrightarrow Strongly agree

FS4	I take a strategic view of the wool supply chain when choosing how to sell my wool (<i>Speaker's prompt: "strategic view" = considering international & national wool selling issues</i>)	1	2	3	4	5	6	7
FS5	I have an intimate knowledge of the <u>quality</u> of my wool clip from year-to-year	1	2	3	4	5	6	7
FS6	I have an intimate knowledge of the <u>quantity</u> of my wool clip from year-to-year	1	2	3	4	5	6	7
FS7	I consider my taxation and/or financial position when choosing how to sell my wool	1	2	3	4	5	6	7
FS8	I have no idea how much money my wool clip will bring next financial year	1	2	3	4	5	6	7

C. Some information regarding the use of forward contracts to sell your wool clip

9. Indicate the extent to which you strongly disagree (1) or strongly agree (7) with the following statement.

		Strongly disagree \longleftrightarrow Strongly agree						
<i>I believe that forward contracts. . . .</i>		1	2	3	4	5	6	7
RA1	are an idea for profit	1	2	3	4	5	6	7
RA2	provide a known and secure income	1	2	3	4	5	6	7
RA3	help with annual budgeting	1	2	3	4	5	6	7
RA4	provide an opportunity not to use auction	1	2	3	4	5	6	7
RA5	give the ability to negotiate a decent price for wool	1	2	3	4	5	6	7
RA6	provide peace of mind about earnings from wool	1	2	3	4	5	6	7
RA7	provide a pricing system that is not as volatile as auction	1	2	3	4	5	6	7
RA8	Selling wool at auction is better because there is guarantee of payment	1	2	3	4	5	6	7

10. The following are some statements regarding how compatible forward contracts are with your way of life and the way you work (1 indicates strongly disagree and 7 indicates strongly agree).

		Strongly disagree \longleftrightarrow Strongly agree						
<i>Using forward contracts. . . .</i>		1	2	3	4	5	6	7
CB1	fits in well with my business cash flow requirements	1	2	3	4	5	6	7
CB2	fits in well with my personal cash flow requirements	1	2	3	4	5	6	7
CB3	provides useful feedback on the quality of my wool	1	2	3	4	5	6	7

11. The following are some statements regarding the level of complexity you associate with using forward contracts to sell all/some of your wool clip (1 indicates strongly disagree and 7 indicates strongly agree).

		Strongly disagree \longleftrightarrow Strongly agree						
CX1	Using forward contracts requires experience and confidence with your wool clip	1	2	3	4	5	6	7
CX2	Using forward contracts requires a lot of mental energy	1	2	3	4	5	6	7
CX3	I think of using forward contracts as being frustrating	1	2	3	4	5	6	7
CX4	Using forward contracts is an easy way of selling wool	1	2	3	4	5	6	7
CX5	There is too much fine print involved with forward contracts	1	2	3	4	5	6	7
CX6	The price discounts for quality and quantity associated with forward contracts make them unattractive to use	1	2	3	4	5	6	7
CX7	When a forward contract is taken out, there is no guess work involved with pricing	1	2	3	4	5	6	7

12. The following are some statements regarding the usefulness and application of using forward contracts to sell all/some of your wool clip (1 indicates strongly disagree and 7 indicates strongly agree).

		Strongly disagree ← → Strongly agree						
AP1	Being able to see the benefits of using forward contracts is important	1	2	3	4	5	6	7
AP2	Research on the most profitable ways to sell wool seems to be lacking	1	2	3	4	5	6	7
AP3	I would like to see studies on the outcomes of selling wool by forward contract	1	2	3	4	5	6	7
AP4	The advice of a broker is important when selling wool by forward contract	1	2	3	4	5	6	7
AP5	Selling wool by forward contract would give me an entrepreneurial image	1	2	3	4	5	6	7
AP6	Selling wool by forward contract would help me to know more about my finances	1	2	3	4	5	6	7
AP7	Selling wool by forward contract would help me to know more about my wool	1	2	3	4	5	6	7

13. The following are some statements regarding risk associated with using forward contracts to sell all/some of your wool clip (1 indicates strongly disagree and 7 indicates strongly agree).

		<div> <div>Strongly disagree</div> <div>↔</div> <div>Strongly agree</div> </div>						
RK1	I get concerned about not getting as much ¢/kg as if I sold my wool at auction	1	2	3	4	5	6	7
RK2	I worry that I'll lose money if I sell wool by forward contract	1	2	3	4	5	6	7
RK3	I worry that there's a chance I won't be able to fulfil my contract in terms of wool <u>quality</u>	1	2	3	4	5	6	7
RK4	I worry there's a chance I won't be able to fulfil my contract in terms of wool <u>quantity</u>	1	2	3	4	5	6	7
RK5	Using forward contracts is a good risk-management strategy	1	2	3	4	5	6	7
RK6	Forward contracting is a case of risk management versus making money	1	2	3	4	5	6	7

14. The following are some statements regarding the level of control you feel when using forward contracts to sell all/some of your wool clip (1 indicates strongly disagree and 7 indicates strongly agree).

Strongly disagree

↔

Strongly agree

SE1	Using forward contracts to sell wool requires confidence	1	2	3	4	5	6	7
SE2	Advice from my peers helps with using forward contracts	1	2	3	4	5	6	7
SE3	Advice from my wool broker or adviser helps with using forward contracts	1	2	3	4	5	6	7
SE4	It is important to me to develop a good working relationship with my broker	1	2	3	4	5	6	7
SU1	Market reports available on the internet assist me with my decision on taking out a forward contract to sell wool	1	2	3	4	5	6	7
SU2	The ability to contact my broker/merchant by phone, fax, mobile or e-mail is important to me when taking out a forward contract	1	2	3	4	5	6	7
SU3	Advances in internet trading make the use of forward contracts easier for me	1	2	3	4	5	6	7
SU4	It seems that no one is familiar with forward contracts for wool	1	2	3	4	5	6	7

15. The following are some statements regarding the level of influence significant others have over you in your decision to take out forward contracts to sell all/some of your wool clip (1 indicates strongly disagree and 7 indicates strongly agree).

Strongly disagree ← → Strongly agree

SN1	Using forward contracts creates family disagreements	1	2	3	4	5	6	7
SN2	The price other people get for their wool is important to me	1	2	3	4	5	6	7
SN3	I use the auction system because it is the normal way to sell wool	1	2	3	4	5	6	7
SN4	Other people think that diversifying the methods by which I sell wool is a smart thing to do	1	2	3	4	5	6	7
SN5	I would be more inclined to use forward contracts if advised by a broker	1	2	3	4	5	6	7
SN6	There is strong pressure from the commercial world to only sell by auction	1	2	3	4	5	6	7
SN7	My immediate family think that selling wool by forward contract is a good idea	1	2	3	4	5	6	7

16. Indicate the extent to which you strongly disagree (1) or strongly agree (7) with the following statement about your intention to use forward contracts.

Strongly disagree ← → Strongly agree

IN1	All things considered, adopting the use of forward contracts to sell wool would be good for my farm business	1	2	3	4	5	6	7
IN2	I think that adopting the use of forward contracts would fit in well with my current business processes	1	2	3	4	5	6	7
IN3	I intend to make the use of forward contracts <u>my main</u> method of selling wool over the next 12 months	1	2	3	4	5	6	7
IN4	I intend to take out a forward contract to sell wool in the next 12 months	1	2	3	4	5	6	7
IN5	I am likely to take out a forward contract to sell wool in the next 12 months	1	2	3	4	5	6	7
IN6	Chances are that I'll take out a forward contract to sell wool in the next 12 months	1	2	3	4	5	6	7
IN7	I intend to take out a forward contract to sell wool if I believe market prices are going to <u>increase</u> by 15% in the next 6 months	1	2	3	4	5	6	7
IN8	I intend to take out a forward contract to sell wool if I believe market prices are going to <u>decrease</u> by 15% in the next 6 months	1	2	3	4	5	6	7

Section 2: Some questions about you and your farm business

Please answer the questions below by nominating the most appropriate response.

17. Gender (no need to ask): [SS1]

Male 1
Female 2

18. Age Group: [SS2]

18 – 25 1
26 – 35 2
36 – 45 3
46 – 55 4
56 – 65 5
over 66 6
refused 7

19. In which shire is your farm business principally located? [FF5] _____

20. Which age groups best describe the children in your family? (select as many as necessary) [SS3]

No children 1
Sons less than 17 2
Sons between 17 and 30 3
Sons over 30 4
Daughters less than 17 5
Daughters between 17 and 30 6
Daughter over 30 7

21. Are any of these children living on the farm (only if there are children from previous question) [SS4]
(select as many as necessary)

None living on the farm 1
Male less than 17 2
Male between 17 and 30 3
Male over 30 4
Female less than 17 5
Female between 17 and 30 6
Female over 30 7

22. If this is your family farm business, at what stage in the family cycle best describes your position? [SS5]

Primary decision maker 1
Secondary decision maker 2
Joint decision maker 3
Hired/contracted/employed farm manager 4

23. How many years have you been actively involved with this farm business? [SS6] _____

24. What is your highest level of education? [SS7]

Attended high school 1
Completed degree or diploma 2
Post-graduate qualification 3

25. What is the total size of your farm to the nearest thousand hectares? [FF6] _____

26. How is your farm business best described? [FF7]

Livestock - crop mixed 1
Crops mainly 2
Sheep (wool mainly) 3
Sheep (meat mainly) 4
Sheep - beef mixed 5

27. Approximately how many adult sheep do you currently have? [FF8] _____

28. Approximately how many bales of wool did you produce in the 2004/05 financial year? [FF9]

29. What average fibre diameter does your wool clip generally give? [FF10]

- ≤ 19.5 micron 1
- 19.6 – 23.5 micron 2
- 23.6 – 27.5 micron 3
- ≥ 27.5 micron 4

30. What proportion of your annual income came from wool sale in the 2004/05 financial year? [SS8]

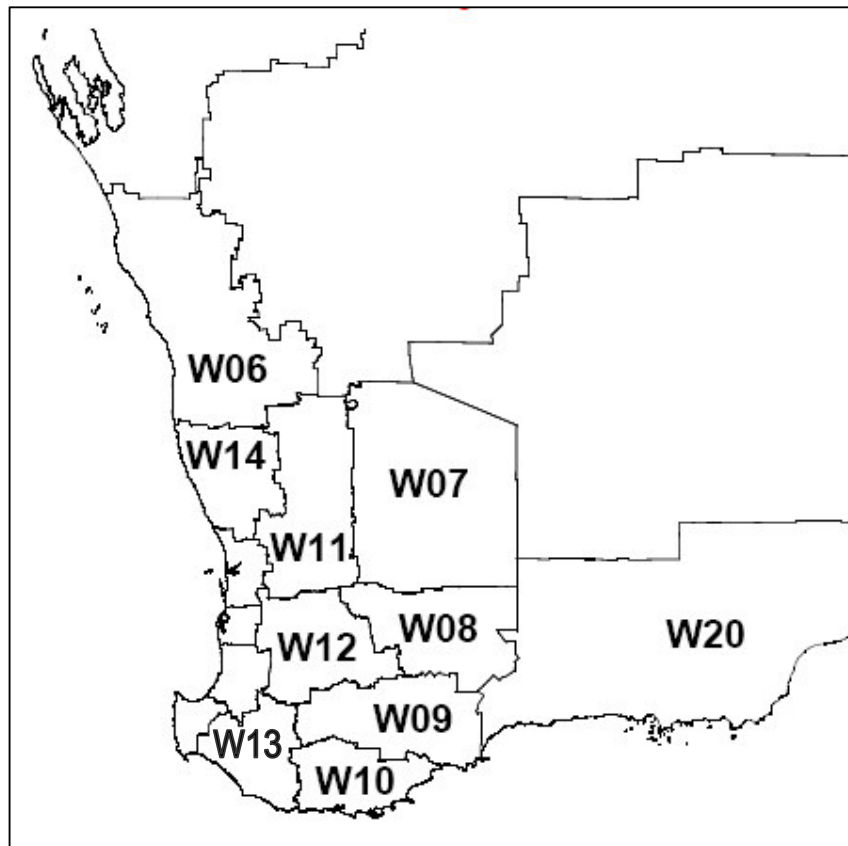
- Less than 10% 1
- About 20% 2
- About 40% 3
- About 60 % 4
- More than 70% 5

We are looking for some wool producers to interview for the development of a case study on the forward contracting of wool. Would you be interested in being visited by one of our researchers for an interview? (Take name and best contact number)

Finally, if you would like a copy of the results from this study, can you please provide your name and a postal or e-mail address:

That's all! Many thanks for your co-operation. Good night.

Appendix 3 WSA Geographic Locations



Source:

<http://www.agric.wa.gov.au/pls/portal30/docs/FOLDER/IKMP/AAP/SL/WOOL/WOOLREPORT05.PDF>

Appendix 4 Case Study Interview Guide

- Start off by **thanking** the participant for taking part in the research.
- Explain that everything discussed in this interview is **confidential** and any evidence published from the interview will not make any connection to the participant's name or business.
- The interview can be **paused or terminated** at any time without prejudice.
- Any statements that the participant does not want to be **recorded** can be omitted from the tape.

1. How long has **your family been involved** with this farm business?
2. **What about you**, how long have you been involved with this farm business?
3. What's the **size** of your farm?
4. **How many sheep** were shorn at your last shearing?
5. About **how many bales of wool** do you produce each year?
 - Is that getting smaller or larger? Why?
6. Does your farm produce **crops, prime lambs or beef**, as well as wool?
7. Is wool your **main source of income**?
 - Has it ever been?
 - What caused the change?
8. Can you describe for me **how you sold** your wool **last year**?
 - Method
 - Time of shearing
 - Frequency of sales (entire clip at once vs multiple sales of small lots)
 - Is it all the same every year or do things alter from year-to-year?
9. Is this the **usual** way you do things or was **last year's strategy different** than usual?
10. **Why** is this/these your chosen methods?
11. With this/these methods, what are the **risks involved**?
12. How do you **deal with these risks**?
13. When you sell wool, how do you know that you got **a good price**?

Questions for auction-users

1. **Why don't** you use forward contracts to sell your wool?
2. Does **pressure** from family have anything to do with it? What about pressure from friends? Pressure from the person who give you advice about selling your wool?
3. Why is the auction system so **attractive to you**?
4. Can you **describe to me** what you know about forward contracts?
5. Do you have experience using forward contracts to **sell anything other than wool**?
 - Why do you choose to sell...by forward contract, but not wool?
6. What would it **take for you to use a forward contract** to sell some of your wool?
 - A high price? How high? How much higher than the current market price?
 - Flexibility in the contract? What sort of flexibility? Quantity? Quality?
 - Encouragement/assistance from a broker or merchant? What sort of encouragement/assistance?
7. **Has anyone ever suggested** to you that a forward contract (for wool) would be a good thing to try?
 - Who made the suggestion?
 - Why did you not take up the suggestion?

Close

Thank you again for assisting with this research project. Would it be possible for me to give you a call if I need some clarification on what has been discussed today?

- Let me check that I've got your correct phone number.

Questions for forward contract-users

1. **How long** have you used forward contracts to sell wool? Is it a regular way for you to sell wool?
2. **How come** you decided to use forward contracts to sell your wool?
3. Has anyone **ever criticised you** for using forward contracts to sell wool?
 - What was the criticism based on?
 - Who did it come from?
 - What did they say?
4. Are you likely to **continue using forward contracts** to sell wool in the future?
5. Do you think there are **risks involved** with using forward contracts to sell wool?
6. How do you know what **quantity of your wool** should be sold via forward contract?
7. How do you think using forward contracts to sell your wool could be **made easier**?

Close

Thank you again for assisting with this research project. Would it be possible for me to give you a call if I need some clarification on what has been discussed today?

- Let me check that I've got your correct phone number.