Examining the Interrelationships among Entrepreneurial Self-Efficacy, Perceived Accessibility of Resources, and Entrepreneurial Intentions in a Chinese Village Context: An Exploratory Study

Ting XU
Bachelor of Agriculture (Honours) Master of Education (Research)

Thesis submitted for the degree of Doctor of Philosophy

Entrepreneurship, Commercialisation and Innovation Centre
The University of Adelaide

18 February 2013

TABLE OF CONTENTS

TABLE OF CONTENTS ..... **i**
LIST OF FIGURES ..... **v**
LIST OF TABLES ..... **vii**
GLOSSARY OF SELECT TERMS ..... **xi**
ABSTRACT ..... **xiii**
DECLARATION ..... **xv**
ACKNOWLEDGEMENTS ..... **xvii**
CHAPTER 1 Introduction **1**
1.1 Introduction 1
1.2 Research Background 3
1.3 Research Problem Statement 5
1.4 Research Aims 7
1.5 Research Questions 7
1.6 Research Significance 8
1.7 Organization of Thesis 8
1.8 Summary 9
CHAPTER 2 Contextual Theories: Review of the Literature **11**
2.1 Introduction 11
2.2 Entrepreneurship 12
2.2.1 The Entrepreneur in Entrepreneurship: An Historical Review 13
2.2.2 An Operational Definition of Entrepreneurship 15
2.2.3 Nascent Entrepreneurs 17
2.2.4 Serial Entrepreneurs 18
2.3 Level of Analysis: The Individual *versus* the Firm or Community 18
2.4 Why the Chinese Village Context Differs from the Western Context 20
2.4.1 Entrepreneurship Research in Western Contexts 21
2.4.2 Entrepreneurship in China 22
2.5 Theoretical Foundations: Theory of Planned Behaviour 24
2.6 Entrepreneurship Intention 26
2.6.1 Entrepreneurial Intention Linked to Other Entrepreneurial Perceptions 26
2.6.2 Entrepreneurial Self-Efficacy 27
2.6.3 Entrepreneurial Attitude 30
2.6.4 Entrepreneurial Subjective Norm 31
2.6.5 Perceived Accessibility of Resources 32
2.6.6 Hypotheses 36
2.7 Conceptual Model 37
2.8 Conclusion 38

CHAPTER 3 Research Methodology 39
3.1 Introduction 39
3.2 Research Approach 39
3.3 Research Design 41
3.4 Constructs 44
3.5 Gaining insight into the Chinese Village Context: Qualitative Phase 44
3.5.1 Selecting an Entrepreneurial Self-efficacy Scale 46
3.5.2 Perceived Accessibility of Resources 51
3.5.3 Entrepreneurial Intention 53
3.6 Participant Groups 54
3.7 Piloting the Instrument 54
3.8 The Chinese Village as a Research Context: Instrument Considerations 55
3.9 Profile of the Chinese Villages that Provided the Context for this Research 58
3.10 Participant Profile 59
3.11 Data Collection 63
3.12 Data Analysis 64
3.12.1 Reliability 64
3.12.2 Validity 64
3.12.3 Structural Equation Modeling (SEM) 64
3.12.4 Normality of the Data 65
3.12.5 Model Fit Criteria 65
3.12.6 Discriminant validity 67
3.12.7 Sample Size 67
3.13 Summary 68
CHAPTER 4 Research Results for the Entrepreneur Group 69
4.1 Introduction 69
4.2 Measurement Model Analyses 69
4.2.1 Assessing Multivariate Normality 70
4.2.2 Factor Analyses of the One Factor Congeneric Measurement Models 71
4.2.3 One Factor Measurement Models 71
4.2.4 Combined Measurement Model Analyses 99
4.3 Full Structural Model 108
4.4 Level of Support for Hypotheses 114
4.5 Chapter Summary 115
CHAPTER 5 Research Results for the Non-Entrepreneur Group 117
5.1 Introduction 117
5.2 Measurement Model Analyses 117
5.2.1 Assessing Multivariate Normality 117
5.2.2 Analysis of the One Factor Congeneric Models 118
5.2.3 One Factor Measurement Models 119

5.2.4 Combined Measurement Model 149
5.3 Full Structural Model 159
5.4 Level of Support for Hypotheses 164
5.5 Chapter Summary 165
CHAPTER 6 Discussion 167
6.1 Introduction 167
6.2 Sample Summary 167
6.3 Research Questions and Hypothesis Testing 169
6.4 Summary 187
CHAPTER 7 Summary 189
7.1 Introduction 189
7.2 Research Summary 189
7.3 Response to Research Questions and Research Objectives 191
7.4 Theoretical Contributions 192
7.4.1 Perceived Accessibility of Resources as a New Construct 192
7.4.2 Perceived Family Resources and Entrepreneurial Intention 192
7.4.3 Perceived Public Resources and Entrepreneurial Intention 193
7.4.4 Entrepreneurial Self-Efficacy (Perceived Planned Behaviour) 193
7.4.5 Entrepreneurial Cognition 194
7.4.6 Entrepreneurship in the Chinese Village Context 194
7.5 Practical Implications for Policy-Makers, Entrepreneurship Course Designers, and Practitioners 195
7.5.1 Policy-Makers 195
7.5.2 Entrepreneurship Course Design 196
7.5.3 Practitioners 196
7.6 Research Limitations 197
7.7 Implications for Future Research 198
7.8 Conclusion 199
REFERENCES 201
APPENDIX A Interview Questions (English): 213
APPENDIX B Interview Questions (Chinese): 215
APPENDIX C Survey (English) 219
APPENDIX D Survey (Chinese) 223
APPENDIX E List of Publications from Doctoral Research 227

LIST OF FIGURES

Figure 2.1 Entrepreneurial Intention Model 25
Figure 2.2 Family Influence on Resource Management, Strategy, and Performance 35
Figure 2.3 Conceptual Model ..... **Error! Bookmark not defined.**
Figure 3.1 Geographic Details of Cixi in the Yangtze River Delta 58
Figure 3.2 Geographic Details of Cixi in China 59
Figure 3.3 Gender Profile of Non-Entrepreneurs 60
Figure 3.4 Businesses Sectors Represented in Entrepreneur Group 62
Figure 4.1 One Factor Measurement Model for ESE: Planning 73
Figure 4.2 One Factor Measurement Model for ESE: Implementing People 76
Figure 4.3 Revised One Factor Measurement Model for ESE: Implementing People 77
Figure 4.4 One Factor Measurement Model for ESE: Searching 80
Figure 4.5 Paired Measurement Models for ESE: Searching and ESE: Planning 81
Figure 4.6 Revised Paired Measurement Models for ESE: Searching and ESE: Planning 82
Figure 4.7 One Factor Measurement Model for ESE: Marshalling 85
Figure 4.8 Paired Measurement Models for ESE: Marshalling and ESE: Planning 86
Figure 4.9 One Factor Measurement Model for ESE: Implementing Financials 88
Figure 4.10 Paired Measurement Models for ESE: Implementing Financials and ESE: Implementing People 88
Figure 4.11 One Factor Measurement Model for Perceived Accessibility of Family Resources 90
Figure 4.12 Revised One Factor Measurement Model for Perceived Accessibility of Family Resources 92
Figure 4.13 One Factor Measurement Model for Perceived Accessibility of Public Resources 95
Figure 4.14 Revised One Factor Measurement Model for Perceived Accessibility of Public Resources 96
Figure 4.15 ESE Combined Measurement Model 99
Figure 4.16 Revised ESE Combined Measurement Model 101
Figure 4.17 Perceived Accessibility of Resources Combined Measurement Model 104
Figure 4.18 Revised Perceived Accessibility of Resources Combined Measurement Model 105
Figure 4.19 Full Structural Model 109
Figure 4.20 Revised Structural Model 110
Figure 5.1 One Factor Measurement Model for ESE: Planning 120
Figure 5.2 One Factor Measurement Model for Entrepreneurial Self-Efficacy: Implementing People 124
Figure 5.3 Revised One Factor Measurement Model for ESE: Implementing People 125
Figure 5.4 One Factor Measurement Model for ESE: Searching 128
Figure 5.5 Two Factor Measurement Model for ESE: Searching and ESE: Planning 128
Figure 5.6 Revised Paired Measurement Models for ESE: Searching and ESE: Planning 129
Figure 5.7 One Factor Measurement Model for ESE: Marshalling 132
Figure 5.8 Two Factor Measurement Model for Entrepreneurial Self-Efficacy: Marshalling and Entrepreneurial Self-Efficacy: Implementing People 133
Figure 5.9 Revised Paired Measurement Models for ESE: Marshalling and ESE: Implementing People 134

Figure 5.10 One Factor Measurement Model for ESE: Implementing Financial 137

Figure 5.11 Two Factor Measurement Model for ESE: Implementing People and Implementing Financial..... 138

Figure 5.12 Revised Paired Measurement Models for ESE: Implementing Financials and ESE: Implementing People 139

Figure 5.13 One Factor Measurement Model for Perceived Accessibility of Family Resource 142

Figure 5.14 Revised One Factor Measurement Model for Perceived Accessibility of Family Resources 144

Figure 5.15 One Factor Measurement Model for Perceived Accessibility of Public Resource 146

Figure 5.16 Revised One Factor Measurement Model for Perceived Accessibility of Public Resources 147

Figure 5.17 Combined Measurement Model for ESE..... 150

Figure 5.18 Revised ESE Combined Measurement Model..... 152

Figure 5.19 Perceived Accessibility of Resources Combined Measurement Model..... 155

Figure 5.20 Revised Perceived Accessibility of Resources Combined Measurement Model..... 156

Figure 5.21 Full Structural Model..... 159

Figure 5.22 Revised Structural Model 160

LIST OF TABLES

Table 3.1 Research Development Process 43
Table 3.2 Profile of the 10 Villagers Interviewed 45
Table 3.3 Six-Factor Entrepreneurial Self-Efficacy Scale 48
Table 3.4 Details of Peterman and Kennedy‘s (2003) Instrument 49
Table 3.5 Five Dimensions of Entrepreneurial Self-efficacy 50
Table 3.6 Demographic of the Three Villages: Shengshantou, Dawan, and Zhenqian 59
Table 3.7 Entrepreneur Education Levels 61
Table 3.8 Non-Entrepreneur Education Levels 61
Table 3.9 Age of Entrepreneurial Businesses 62
Table 3.10 No. Employees in Businesses in the Entrepreneur Group 63
Table 4.1 Results of Tests for Non-Normality for the Entrepreneur Group with all Items Included 70
Table 4.2 Analysis Statistics of the One Factor Measurement Model for ESE: Planning 73
Table 4.3 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model ESE: Planning 74
Table 4.4 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for ESE: Planning 75
Table 4.5 Analysis Statistics of the One Factor Measurement Model for ESE: Implementing People 77
Table 4.6 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model ESE: Implementing People 78
Table 4.7 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for Entrepreneurial Self-efficacy: Implementing People 79
Table 4.8 Analysis Statistics of the Paired One Factor Measurement Models ESE: Searching and ESE Planning 81
Table 4.9 Sample Covariances, Sample Correlations, and Eigenvalues for the Revised One-Factor Measurement Model ESE: Planning-Searching 83
Table 4.10 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for ESE: Planning-Searching 84
Table 4.11 Analysis Statistics of the Paired One Factor Measurement Models ESE: Marshalling and ESE: Planning 86
Table 4.12 Analysis Statistics of the Paired One Factor Measurement Models ESE: Implementing Financials and ESE: Implementing People 89
Table 4.13 Analysis Statistics of the One Factor Measurement Model for Perceived Accessibility of Family Resources 91
Table 4.14 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model Perceived Accessibility of Family Resources 92
Table 4.15 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for Perceived Accessibility of Family Resources 93
Table 4.16 Analysis Statistics of the One Factor Measurement Model for Perceived Accessibility of Public Resources 95
Table 4.17 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model Perceived Accessibility of Public Resources 96
Table 4.18 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for Perceived Accessibility of Public Resource 98

Table 4.19 Analysis Statistics of the Combined ESE Measurement Models 100

Table 4.20 Sample Covariances, Sample Correlations, and Eigenvalues for the Revised Combined ESE Measurement Model 101

Table 4.21 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for the Revised Combined ESE Measurement Model 102

Table 4.22 Analysis Statistics of the Combined Perceived Accessibility of Resource Measurement Models 104

Table 4.23 Sample Covariances, Sample Correlations, and Eigenvalues for the Revised Perceived Accessibility of Resources Combined Measurement Model 106

Table 4.24 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for the Revised Perceived Accessibility of Resources Combined Measurement Model 107

Table 4.25 Analysis Statistics of the Combined Measurement Model 109

Table 4.26 Sample Covariances, Sample Correlations, and Eigenvalues for the Revised Structural Model 110

Table 4.27 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for the Revised Structural Model 112

Table 5.1 Results of Tests for Non-Normality for the Non-Entrepreneur Group with all Items Included 118

Table 5.2 Analysis Statistics of the One Factor Measurement Model for ESE: Planning 121

Table 5.3 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model ESE: Planning 121

Table 5.4 the Entrepreneur Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for the Perceived Entrepreneurial Self-efficacy: Planning 122

Table 5.5 Analysis Statistics of the One Factor Measurement Model for ESE: Implementing People .. 124

Table 5.6 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model for Entrepreneurial Self-efficacy: Implementing People 125

Table 5.7 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for Entrepreneurial Self-efficacy: Implementing People 126

Table 5.8 Analysis Statistics of the Paired One Factor Measurement Models..... 129

Table 5.9 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model for Entrepreneurial Self-Efficacy: Searching and Planning..... 130

Table 5.10 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for ESE: Searching and Planning 131

Table 5.11 Analysis Statistics of the Paired One Factor Measurement Models ESE: Marshalling and ESE: Implementing People 134

Table 5.12 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model for Entrepreneurial Self-Efficacy: Marshalling and Entrepreneurial Self-Efficacy: Implementing People 135

Table 5.13 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for ESE: Marshalling and Implementing People 136

Table 5.14 Analysis Statistics of the Paired One Factor Measurement Models ESE: Implementing Financials and ESE: Implementing People 138

Table 5.15 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model for ESE: Implementing People and ESE: Implementing Financials 140

Table 5.16 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for ESE: Implementing Financial and ESE: Implementing People 141

Table 5.17 Analysis Statistics of the One Factor Measurement Model for Perceived Accessibility of Family Resources 143

Table 5.18 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model for Perceived Accessibility of Family Resource 144

Table 5.19 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for Perceived Accessibility of Family Resource 145

Table 5.20 Analysis Statistics of the One Factor Measurement Model for Perceived Accessibility of Public Resources 146

Table 5.21 Sample Covariances, Sample Correlations, and Eigenvalues for the One-Factor Measurement Model for Perceived Accessibility of Public Resource 147

Table 5.22 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for Perceived Accessibility of Public Resource 148

Table 5.23 Analysis Statistics of the Combined ESE Measurement Models 150

Table 5.24 Sample Covariances, Sample Correlations, and Eigenvalues for the Combined Measurement Model for ESE 152

Table 5.25 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for Combined Measurement Model for ESE. 153

Table 5.26 Analysis Statistics of the Combined Perceived Accessibility of Resource Measurement Models 155

Table 5.27 Sample Covariances, Sample Correlations, and Eigenvalues for the Revised Perceived Availability of Resources Combined Measurement Model 156

Table 5.28 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for the Revised Perceived Accessibility of Resources Combined Measurement Model 157

Table 5.29 Analysis Statistics of the Structural Model 159

Table 5.30 Sample Covariances, Sample Correlations, and Eigenvalues for the Revised Structural Model 161

Table 5.31 Group Scalars (Regression Weights, Standardised Regression Weights, and Squared Multiple Correlations) for the Revised Structural Model 162

Table 6.1 The McGee et al. (2009) entrepreneurial self-efficacy instrument 177

Table 6.2 The McGee et al. (2009) entrepreneurial self-efficacy instrument 184

GLOSSARY OF SELECT TERMS

Term	Description
AGFI	Adjusted Goodness-of-Fit Index
CFI	Comparative Fit Index
EI	Entrepreneurial intention
Entrepreneurs	Individuals who currently own one or more businesses
ESE	Entrepreneurial self-efficacy
ESE_IF	Entrepreneurial self-efficacy: Implementing financial
ESE_IP	Entrepreneurial self-efficacy: Implementing people
ESE_M	Entrepreneurial self-efficacy: Marshalling
ESE_ P	Entrepreneurial self-efficacy: Planning
ESE_ S	Entrepreneurial self-efficacy: Searching
Non-entrepreneur	Individuals who currently do not own a business
PAFR	Perceived accessibility of family resources
PAPR	Perceived accessibility of public resources
RBV	Resource-based view
RMSEA	Root Mean-Square Error of Approximation
SEM	Structural Equation Modeling
SMEs	Small-and medium-sized enterprises
SRMR	Standardized Root Mean-square Residual
TLI	Tucker-Lewis Index

ABSTRACT

This study explores the inter-relationships among the entrepreneurial self-efficacy, entrepreneurial intentions and a newly developed concept: perceived accessibility of resources in a Chinese village context for both entrepreneurs and non-entrepreneurs. This is an important area of research because most research that focuses on these types of constructs occurs in a Western context. Yet, the importance of China in world economic affairs is growing exponentially and China would not be the economic power that it is without the entrepreneurial spirit engendered in village communities. Although entrepreneurship in Chinese cities contributes significantly to economic development, Chinese village entrepreneurship is the backbone of Chinese economic development.

From an entrepreneurship perspective, understanding the entrepreneurial mind of two groups is important for economic development. First, there are those who are not current entrepreneurs who want to start new businesses (referred to as ―nascent entrepreneurs"), and second, those who are already entrepreneurs who could potentially start other new businesses and become serial entrepreneurs. Within the Chinese village context, it is the individual entrepreneur who drives the entrepreneurial process. Thus, developing a better understanding of these two groups, the nascent and the potential serial entrepreneurs, is important for Chinese regional economic development.

This research involves a comprehensive literature review, interviews, and a survey with a group of Chinese village entrepreneurs in order to better understand their entrepreneurial cognitions. In the first stage of the research, a theoretical model is developed based on the literature review and interviews. This model informed the development of a questionnaire. The questionnaires were distributed to 950 villagers with 768 questionnaires being returned. Of the returned questionnaires, usable questionnaires were received from 296 non-entrepreneurs and 285 entrepreneurs.

The findings identify the important role played by the perceived accessibility of resources when examining entrepreneurial intentions in a Chinese village context. More specifically, what was highlighted was the importance of the perceived accessibility of *family resources* for non-entrepreneurs and the perceived accessibility of *public resources* for entrepreneurs in a Chinese village context. With both groups, the results confirmed the significant positive relationship of perceived accessibility of resources to entrepreneurial

intentions. In terms of the types of resources perceived to be important by Chinese village entrepreneurs: social capital, business advice, and technical support appear to be key. In contrast, non-entrepreneurs identified social capital, business advice, and business property as key resources for influencing entrepreneurial intentions.

This study also found that entrepreneurial self-efficacy has a positive relationship with perceived accessibility of resources and entrepreneurial intentions. However, there was a need to modify the Western-developed entrepreneurial self-efficacy measure when it was applied in a Chinese village context.

The research contributes to an improved theoretical understanding of (1) the importance of the perceived accessibility of resources in a Chinese village entrepreneurial intentions model from both family and public source perspectives, and (2) entrepreneurial self-efficacy when examined in a Chinese village context.

This study is significant since it builds upon underlying Western theory and then expands this theory to develop entrepreneurial cognition concepts that help to explain Chinese village entrepreneurship. The research makes a particular contribution to the field of entrepreneurship research through development of an instrument to measure perceived accessibility of resources – an element which is vital to the understanding of the entrepreneurial mind in a Chinese village context and which may have ramifications for entrepreneurship research conducted in village contexts in other developing countries.

DECLARATION

I, Ting XU, certify that this work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

I also give permission for the digital version of my thesis to be made available on the web, via the University‘s digital research repository, the Library catalogue and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

Signature:

_____

Ting XU

Date: 18/2/2013

ACKNOWLEDGEMENTS

Without a group of people providing academic advice, and my family‘s emotional support, it would not be possible for me to complete this thesis.

First, thanks to my supervisor Professor Noel Lindsay who has had a significant and continued impact on my research. The PhD is a lonely journey despite the support of family and friends, but Professor Lindsay has been an important fellow-traveller who did not instruct me, but rather empowered and mentored me to develop as an academic and enabled me to develop my own academic capabilities. His effective motivation and critical attitude helped me on my PhD journey and will help me in my later academic life.

My great appreciation and thanks also go to my co-supervisor, Dr Allan O‘Connor. His critical and valuable responsiveness to my research requests inspired with the intention to become an academic like him. His critical comments and constructive recommendations expanded my perspective of entrepreneurial cognition research and also enabled me to develop a comparatively reader friendly thesis.

I also wish to thank my participants, particularly the 10 entrepreneurs I interviewed. I also valued the input of the 20 people who participated in the pilot study and the 296 non-entrepreneurs and 285 entrepreneurs for their generosity in spending time completing the questionnaires in this research. I particularly thank Mr Xie sen and Xu Jianpin who distributed and collected the questionnaires for this research.

Thanks also go to Dr Michelle Picard and her Researcher Education and Development team for academic English training and their continuing support during my PhD journey. Thanks also go to the library staff at The University of Adelaide who provided me with guidance about how to effectively search for literature. Thanks also to Merrilyn Larusson for language editing.

The staff members in our office also deserve thanks. They are the people who make our small community a very friendly working environment. Specifically, thanks to Karen Snook and Julia Miller for their friendliness, support, and positive attitude.

Thanks also to my Colleagues: Dr Barry Elsey, Dr Graciela Corral de Zubielqui, Gary G. Hancock, and Dr Jiwat Ram who shared their research experiences with me and

discussed my research. I also would like to thank Dr Yuewu, Jiming Xiong, Dr Ruyi Li from different schools at the University of Adelaide for their generous sharing of their personal experiences.

My sincere thanks go to my wife Jingjing for her complete understanding and support. It must have been extremely hard to live with two babies and one husband who was doing his PhD. Jingjing never complained, and took care of the babies. When I returned home of an evening with a tired body and confused mind, her encouragement and the big smile of my children motivated me go further and deeper into my research. Because I want to generate knowledge for the next generation, I thank my two children, Zixuan and Ziayuan, and say –sorry" here to them. Thanks for your big encouraging smiles, sorry that I spent more time on my thesis than with the two of you - but, please understand, that I will make it up to you in the future!

Thanks also to my parents. Only when I, myself, became a parent, did I understand how much you contributed to my life. Thanks also to Jingjing's parents for their understanding that Jingjing could not start her studies due to the birth of the babies.

Last but not least, my big thanks to Sandy McConachy and Iris Liu for their continued support during my study.

The PhD journey has contributed to my life and enabled me to develop courage to discover the world and respect science and humanity, and continue to be a thinker.