Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.
DECLARATION

The thesis entitled, “Determinants of Coordination Effectiveness of Selected International Agri-food Supply Chains: A Structural Equation Modelling Approach” is submitted to Massey University for the degree of Doctor of Philosophy. I, Pervaiz Akhtar, declare that this thesis is the outcome of my own research work. The material used from other resources is acknowledged. I also certify that the work contained in the thesis, or any part thereof, has not been previously submitted for a degree, diploma or other qualifications.

Signed……………………

Student ID: 08489815

Full Name: Pervaiz Akhtar
ABSTRACT

One of the current discussions in the literature is that intangible (chain coordinators’ competencies/skills) and tangible resources are the key determinants of the effectiveness of supply chain coordination (operational, social and financial performance). Chain coordinators’ abilities (formal and informal education, training and experience), leadership styles (participative and directive), effective communication (communication quality and frequency) and analytical skills (internal and external applications) are found to be the promising intangible resources. The tangible resources consist of human (a number of people for coordination activities) and non-human (budget and technology for coordination activities) assets.

Both tangible and intangible resources determined the effectiveness of supply chain coordination. In other words, the theoretical model proposed that the above mentioned resources were significantly correlated with the effectiveness of supply chain coordination. Also, operational (service and product quality) and social (satisfaction with and trust in supply chain partners) dimensions significantly influenced financial performance (profit, sales and market share). Therefore, these resources, including operational and social dimensions, were considered as the key determinants for coordination success among supply chain partners.

Thus, the development of the proposed model and subsequent testing it based on collected data achieved the study objectives. This first led to investigate the nature of supply chain coordination and to identify chain coordinators from the selected international agri-food supply chains (dairy, meat, apples, onions and wine) of New Zealand, UK and Pakistan. The nature of supply chain coordination showed potential close interactions occur among farmers, chemical suppliers, logistics providers, food processors, wholesalers (importers and exporters) and retailers. These chain partners exchange information and work together to achieve the effectiveness of supply chain coordination. Moreover, these chain partners generally believe in closer coordination rather than arm’s-length relationships. However, the intensity of coordination varies across regions. For instance, it was found that the limited coordination (low-to-medium) occurs in Pakistani selected chains but the chains in New Zealand and the UK use a better integrated approach.
Additionally, importers and exporters play a major role and they also support other chain partners. At organizational level, they (importers and exporters) act as chain coordinators. Within these organizations, chain coordinators (as person) are managing directors or owners in small companies. Chief executive officers (CEOs) and head of departments (marketing managers, supply chain managers, channel or chain managers) play the role of chain coordinators in medium-sized enterprises.

Following the identification of chain coordinators and collecting the data from them, the quantitative analyses were conducted based on a total of 225 and 112 useable responses received from New Zealand and the UK respectively. Overall, the results obtained from the New Zealand sample showed that nearly 85% of the total structural coefficients were significantly correlated with the effectiveness of supply chain coordination whereas the findings based on the UK sample revealed that almost 77% of the total structural coefficients were significant. The findings indicated that education (formal and informal – excluding multiple language skills), training, experience, a participative leadership style, effective communication and analytical skills were the key competencies for chain coordinators. Chain coordinators’ competencies together with non-human resources (budget and technology) determined the effectiveness of supply chain coordination. Additionally, operational and social dimensions had highly significant effects on financial performance.

Therefore, it was concluded that chain coordinators who have the above mentioned competencies or skills are in a better position to understand modern agri-food supply chains. They also perform supply chain activities effectively, in turn, it keeps supply chain partners connected and motivated to achieve the effectiveness of supply chain coordination. Thereby, the study made substantial contributions in the field where there has been a lack of such findings. Also, the directions for future research provide further interesting outcomes and useful guidelines.
ACKNOWLEDGEMENT

First and foremost, I thank Almighty and Merciful God who helped me to complete this thesis. I would also like to express my sincere gratitude to Dr. Norman Marr, Dr. Elena Garnevska and Prof. Dr. Christian Fischer for their constant encouragement, tremendous assistance and guidance. As advisors and supervisors, they have provided the constructive critique to refine the content. The completion of this research work would not be possible without their valuable support and guidelines. Their extensive knowledge, strong analytical skills and commitment to the excellence of research and teaching have truly benefited this thesis. Researching and working with them has proven to be interesting, enjoyable and a great rewarding experience. Hearty thanks to all!

Additionally, I would like to acknowledge Massey University for providing excellent research facilities and financial support. Thanks also to the Venture Trust Inc. which provided financial support to conduct the pilot survey.

I also sincerely thank Dr. David Harness (Hull University) who helped in collecting the data from UK importers. Particularly, I acknowledge my gratitude to the research participants who donated priceless time from their busy schedules.

Last, but not least, many thanks are due to all my family members, friends and colleagues for their unconditional love and support.
# TABLE OF CONTENTS

DECLARATION .......................................................................................................................... ii  
ABSTRACT ................................................................................................................................. iii  
ACKNOWLEDGEMENT ........................................................................................................... v  
LIST OF TABLES ..................................................................................................................... viii  
LIST OF FIGURES .................................................................................................................. xi  

CHAPTER 1 INTRODUCTION ............................................................................................ 1  
1.1 Introduction ................................................................................................................... 1  
1.2 Research Background ................................................................................................. 1  
1.3 Research Problem Statement ..................................................................................... 4  
1.4 Research Aims, Objectives and Questions ................................................................ 5  
1.5 Structure of the Thesis ............................................................................................... 7  

CHAPTER 2 SELECTED CHAINS’ BACKGROUND .......................................................... 10  
2.1 Introduction .................................................................................................................. 10  
2.2 Dairy Industry .............................................................................................................. 10  
2.3 Meat Industry ............................................................................................................... 22  
2.4 Apple Industry ............................................................................................................. 33  
2.5 Onion Industry ............................................................................................................. 40  
2.6 Wine Industry ............................................................................................................. 43  

CHAPTER 3 LITERATURE REVIEW AND THEORETICAL FRAMEWORK ............... 52  
3.1 Introduction .................................................................................................................. 52  
3.2 Supply Chain Management ....................................................................................... 52  
3.3 Supply Chain Coordination ...................................................................................... 56  
3.4 Chain Coordinators ................................................................................................. 65  
3.5 Supply Chain Performance Measurement Issues ...................................................... 76  
3.6 Theoretical Framework and Hypotheses .................................................................. 80
3.7 Links between Extant Literature and This Study (Contribution Summary) .......... 94

3.8 Summary ................................................................................................................... 94

CHAPTER 4 METHODOLOGY .......................................................................................... 98

4.1 Introduction .............................................................................................................. 98

4.2 Research Objectives and Aim ..................................................................................... 98

4.3 Research Philosophies, Approaches and Data Collection Methods ......................... 99

4.4 Sampling and Sampling Techniques ......................................................................... 104

4.5 Reliability and Validity ............................................................................................. 107

4.6 Data Analysis Techniques, Advantages and Limitations .......................................... 108

4.7 Thesis Methodology and Techniques ....................................................................... 115

4.8 Conclusion and Methodology Summary ................................................................... 133

CHAPTER 5 EXPLORATORY AND DESCRIPTIVE ANALYSIS ................................ 136

5.1 Introduction .............................................................................................................. 136

5.2 Pilot Survey .............................................................................................................. 136

5.3 Quantitative Data Analysis ....................................................................................... 141

5.4 Summary and Conclusion ......................................................................................... 154

CHAPTER 6 STRUCTURAL EQUATION MODELLING (MAIN FINDINGS) ............ 156

6.1 Introduction .............................................................................................................. 156

6.2 Structural Equation Modelling – New Zealand ......................................................... 156

6.3 Structural Equation Modelling – UK ........................................................................ 171

6.4 Summary and Conclusion ......................................................................................... 182

CHAPTER 7 DISCUSSION AND CONCLUSIONS .............................................................. 184

7.1 Introduction .............................................................................................................. 184

7.2 Research Objectives, Hypotheses and Managerial Implications .............................. 184

7.3 Links between the Key Relevant Studies, Hypotheses and Objectives .................... 193

7.4 Major Research Limitations ...................................................................................... 196
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5 Contributions and Future Research</td>
<td>197</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>200</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>225</td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>227</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>228</td>
</tr>
<tr>
<td>APPENDIX D</td>
<td>230</td>
</tr>
<tr>
<td>APPENDIX E</td>
<td>234</td>
</tr>
<tr>
<td>APPENDIX F</td>
<td>237</td>
</tr>
<tr>
<td>APPENDIX G</td>
<td>245</td>
</tr>
<tr>
<td>APPENDIX H</td>
<td>246</td>
</tr>
<tr>
<td>APPENDIX I</td>
<td>247</td>
</tr>
<tr>
<td>APPENDIX J</td>
<td>249</td>
</tr>
<tr>
<td>APPENDIX K</td>
<td>251</td>
</tr>
<tr>
<td>APPENDIX L</td>
<td>253</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

Table 2.1: Top Ten Milk Producing Countries, 2010 .......................... 12
Table 2.2: Major Exporters of Dairy Products, 2011 ......................... 14
Table 2.3: UK Trade Balance of Butter and Cheese, 2010 ................... 20
Table 2.4: Meat Production, Trade and Consumption (Thousand Tonnes), 2011 .............................................. 22
Table 2.5: Main Export Markets for New Zealand Meat, July to April 2012 .......................................................... 30
Table 2.6: UK Sheepmeat Imports, 000 Tonnes ............................... 33
Table 2.7: Top Ten Apple Producers and Consumers, 2011 ................ 35
Table 2.8: Top Ten Apple Importers and Exporters, 2011 .................... 35
Table 2.9: Apple Districts and Varieties in New Zealand ....................... 37
Table 2.10: Onion Producing Regions, 2010/11 Season ..................... 41
Table 2.11: Onion Producing Countries, 2010/11 Season ..................... 41
Table 2.12: Major Export Markets for New Zealand Grown Onions, 2007–2011 ............................................ 43
Table 2.13: Top Wine Producing Countries, 2009/10 and 2010/11 ............ 45
Table 3.1: Variants used for Chain Coordinators .................................. 66
Table 3.2: Job Titles used for Chain Coordinators ................................. 66
Table 3.3: Job Characteristics of Chain Coordinators ......................... 70
Table 3.4: Hypotheses and Addressing to the Research Objectives .......... 96
Table 4.1: Research Philosophies ................................................... 99
Table 4.2: Research Approaches .................................................... 100
Table 4.3: Data Collection Methods ................................................. 102
Table 4.4: A Summary of Research Options ....................................... 103
Table 4.5: Fit Indices and Recommended Values ................................. 113
Table 4.6: Characteristics of the Respondents .................................... 118
Table 4.7: Findings for the Questionnaire Development ...................... 121
Table 4.8: Selected Country Samples and Data Collection Methods ........ 127
Table 5.1: Job Titles for Chain Coordinators, NZ ................................................................. 143
Table 5.2: Special Field of Education, NZ ............................................................................. 144
Table 5.3: Years of Education, NZ ......................................................................................... 144
Table 5.4: Age Group, NZ ........................................................................................................ 145
Table 5.5: Years of Experience, NZ ....................................................................................... 146
Table 5.6: Major Field of Experience, NZ ............................................................................... 146
Table 5.7: Main Products, NZ ................................................................................................... 147
Table 5.8: Number of Employees, NZ ..................................................................................... 147
Table 5.9: Job Titles for Chain Coordinators, UK ................................................................. 149
Table 5.10: Years of Education, UK ...................................................................................... 150
Table 5.11: Field of Education, UK .......................................................................................... 150
Table 5.12: Years of Experience, UK .................................................................................... 151
Table 5.13: Age Group, UK ...................................................................................................... 151
Table 5.14: Major Field of Experience, UK ............................................................................ 152
Table 5.15: Main Products, UK ................................................................................................ 152
Table 5.16: Number of Employees, UK .................................................................................. 153
Table 6.1: Final Results of Measurement Models, NZ ............................................................ 160
Table 6.2: Evaluation of Measurement Models, NZ ................................................................. 166
Table 6.3: Discriminant Validity of the Constructs (2nd method), NZ .................................... 167
Table 6.4: Recommended and Resultant Values of Fit Indices, NZ ......................................... 170
Table 6.5: Final Results of Measurement Models, UK .............................................................. 172
Table 6.6: Evaluation of Measurement Models, UK ................................................................. 177
Table 6.7: Discriminant Validity of the Constructs (2nd method), UK ..................................... 178
Table 6.8: Recommended and Resultant Values of Fit Indices, UK ....................................... 180
Table 7.1: Links between the Key Relevant Studies, Hypotheses and Objectives............... 194
LIST OF FIGURES

Figure 2.1: Leading Milk Producing Countries and Future Expectations................................. 11
Figure 2.2: Average Per Capita Consumption of Dairy in Leading Countries ......................... 13
Figure 2.3: Major Importers of Dairy Products (2008–10) and Future Expectations .................. 15
Figure 2.4: Regional Distribution of Dairy Cows in New Zealand, 2010/11 .............................. 17
Figure 2.5: Distribution of Milk Processed in the UK, 2010.................................................... 19
Figure 2.6: UK Butter Imports, 2011 and 2012 (January and May) ........................................ 21
Figure 2.7: UK Cheddar Imports, 2011 and 2012 (January and May) ...................................... 21
Figure 2.8: Developing Countries Increase in Meat Production, 2011 ....................................... 23
Figure 2.9: Increase in Meat Consumption in Major Regions, 1960s–2000s ............................... 24
Figure 2.10: Sheepmeat Production in the Last 30 Years, 1980–2009 ........................................ 27
Figure 2.11 New Zealand’s Meat Export Chain ....................................................................... 28
Figure 2.12 UK Meat Production and Imports in 25 Years, 1987–2011 .................................... 31
Figure 2.13: Global Apple Production and Consumption, 2007–2012 ....................................... 33
Figure 2.14: Global Apple Trade, 2007–2012 ......................................................................... 34
Figure 2.15: Apple Production in New Zealand, 2000–2011 ................................................... 36
Figure 2.16: Apple Exports from New Zealand, 2000–2011 .................................................... 38
Figure 2.17: Apple Export Markets for New Zealand, 2011 .................................................... 39
Figure 2.18: UK Apple Imports from New Zealand, 2005–2010 .............................................. 40
Figure 2.19: Onion Production in New Zealand, 2005–2011 ................................................... 42
Figure 2.20: Major Wine Consuming nations, 2007/08–2010/11 ............................................. 46
Figure 2.21: Wine Producing Regions in New Zealand ............................................................. 48
Figure 2.22: Wine Export Markets for New Zealand, 2010 ..................................................... 49
Figure 3.1: A Graphical View of Agri-Food Supply Chains ....................................................... 53
| Figure 3.2: Key Transitional Practices in Supply Chains | 58 |
| Figure 3.3: A Framework of Supply Chain Collaboration | 59 |
| Figure 3.4: Strategic Options for Coordination | 60 |
| Figure 3.5: Types of Value Chain Governance | 61 |
| Figure 3.6: Coordination Examples | 63 |
| Figure 3.7: Guidelines for Coordination | 64 |
| Figure 3.8: A Two-Dimensional Role of an Effective Chain Coordinator | 68 |
| Figure 3.9: Links between Chain Coordinators, Functions and Activities | 71 |
| Figure 3.10: Supply Chain Performance Model | 92 |
| Figure 3.11: Supply Chain Coordination Effectiveness Model | 92 |
| Figure 3.12: Supply Chain Coordination Effectiveness and Dimensions | 93 |
| Figure 4.1: Types of Sampling | 105 |
| Figure 4.2: Types of Purposive Sampling | 106 |
| Figure 4.3: Supply Chain Coordination Effectiveness Model | 123 |
| Figure 4.4: Supply Chain Coordination Effectiveness and Dimensions | 124 |
| Figure 4.5: Data Analysis Techniques and Tests | 131 |
| Figure 4.6: A Summary of the Research Procedure | 134 |
| Figure 6.1: Proposed Theoretical Model | 157 |
| Figure 6.2: Measurement Model of Leadership Styles, NZ | 161 |
| Figure 6.3: Measurement Model of Effective Communication, NZ | 162 |
| Figure 6.4: Measurement Model of Non-human Resources, NZ | 163 |
| Figure 6.5: Measurement Model of Analytical Skills, NZ | 163 |
| Figure 6.6: Measurement Model of Financial Performance, NZ | 164 |
| Figure 6.7: Measurement Model of Operational Performance, NZ | 164 |
| Figure 6.8: Measurement Model of Social Performance, NZ | 165 |
| Figure 6.9: Results from Structural Equation Modelling (proposed model, NZ) | 168 |