Regenerating Chinese Cities: A Framework for Sustainable Decision Making based on Chinese Traditional Philosophy

Wenli Dong
B. Engineering (Urban Planning)

A thesis Submitted in Partial Fulfillments of the requirements of the Degree of Doctor of Philosophy (Architecture)

November 2012

School of Architecture and Built Environment
Faculty of Engineering and Built Environment
The University of Newcastle
New South Wales 2308, Australia
Dedicated to

My parents:

Shuliang Dong and Yuqiao Shi
CONTENTS

CONTENTS .................................................................................................................. i
LIST OF TABLES .......................................................................................................... ix
LIST OF FIGURES ....................................................................................................... xii
LIST OF ACRONYMS AND ABBREVIATIONS .............................................................. xx
ACKNOWLEDGEMENTS ........................................................................................... xxiv
DECLARATION ............................................................................................................ xxv
APPROVAL OF THE HUMAN ETHICS COMMITTEE .................................................... xxvi
ABSTRACT .................................................................................................................. xxvii

1. CHAPTER ONE: INTRODUCTION .......................................................................... 1
   1.1. BACKGROUND ...................................................................................................... 1
     1.1.1. The Definition of Sustainability ................................................................. 1
     1.1.2. Dilemma and Difficulties ............................................................................. 2
     1.1.3. Shifting from the Definition to Evaluation ............................................... 4
     1.1.4. The Need for an Indigenous Philosophy-Based Sustainability Framework .... 4
   1.2. CURRENT PROBLEMS ..................................................................................... 7
   1.3. RESEARCH QUESTION, AIM AND OBJECTIVES ............................................. 9
     1.3.1. Research Question ..................................................................................... 9
     1.3.2. Aim and Objectives ................................................................................... 9
   1.4. BRIEF METHODOLOGY ................................................................................... 11
   1.5. SCOPE OF WORK ............................................................................................ 13
   1.6. OUTLINE OF THE THESIS ............................................................................. 15

2. CHAPTER TWO: WESTERN URBAN PLANNING AND SUSTAINABILITY EVALUATION FRAMEWORK ................................................................. 22
   2.1. INTRODUCTION ................................................................................................. 22
   2.2. AN OVERVIEW OF SUSTAINABLE DEVELOPMENT IN WESTERN PLANNING ......22
     2.2.1. Sustainable Urban Forms and Urban Regeneration .................................... 23
     2.2.2. The Evolution of Sustainable Development and Urban Regeneration .......... 28
2.2.3. The Emerging Model of Urban Regeneration.........................................................28
2.2.4. The Problem in Decision Making of Intensified, Mixed-Use Urban Regeneration.....37
2.2.5. The Need to Evaluate Sustainable Urban Regeneration .......................................39

2.3. THE EXISTING SUSTAINABILITY ASSESSMENT OF THE BUILT ENVIRONMENT . 40
2.3.1. The Linear Spectrum of Views on Sustainability .................................................41
2.3.2. The Priority of Economics in the Circular Weak Sustainability Framework..............44
2.3.3. The Values Embedded in Sustainability Assessment ............................................53
2.3.4. The Reductionist Nature of Existing Sustainability Assessments .......................56
2.3.5. The Holistic Nature of Ecology ...........................................................................56
2.3.6. The Application of Reductionist Approaches in China and Environmental Crisis......65
2.3.7. The Need for the Integrated Evaluation of the Urban Regeneration......................66

2.4. INTEGRATED SUSTAINABLE EVALUATION FRAMEWORKS AND THEIR
PHILOSOPHICAL PARADIGMS .........................................................................................67
2.4.1. The Country-Specific Green Building Standards ...................................................67
2.4.2. The Inadequate Acknowledgement of the Maori Holistic Approach in New Zealand .71
2.4.3. The Holarchical Strong Sustainability Framework in Europe based on Dutch
Philosophy .......................................................................................................................75
2.4.4. The Debate on Reductionist Test of an Integrated Gaia Model .............................79
2.4.5. The Theoretical Exploration of the Ecological World View based on the African
Concept of Batho-Ubuntu ...............................................................................................82
2.4.6. The Need for a Holistic Sustainable Evaluation Framework Based on Chinese
Philosophy .......................................................................................................................84

2.5. SUMMARY ...............................................................................................................85

3. CHAPTER THREE: DEVELOPING AN INDIGENOUS APPROACH: THEORETICAL
FRAMEWORK ...............................................................................................................87

3.1. INTRODUCTION ......................................................................................................87

3.2. HISTORY OF CHINESE URBAN DEVELOPMENT ................................................87
3.2.1. Chinese Cities in the History ...............................................................................87
3.2.2. Rapid Development in China and the Learning from the West ............................91

3.3. INDIGENEOUS APPROACH ...................................................................................93
4.3.1. The Theory of the Qualitative Model Development Cycle.................................130
4.3.2. Nature of Research..........................................................................................134
4.3.3. Research Design............................................................................................135
4.4. RESEARCH METHODS ......................................................................................139
  4.4.1. Build Theoretical Framework ........................................................................139
  4.4.2. Preliminary Quantitative Studies on Case Selection ....................................140
  4.4.3. Data Collection..............................................................................................141
  4.4.4. Pilot Study.....................................................................................................146
  4.4.5. Cross-Case Qualitative Analysis ..................................................................146
  4.4.6. Model Application and Validation ..............................................................152
4.5. SUMMARY ........................................................................................................153
5. CHAPTER FIVE: CASE STUDY OF CHINESE CITIES ........................................155
  5.1. INTRODUCTION ..............................................................................................155
  5.2. PRELIMINARY ANALYSIS FOR CITY AND CASE SELECTION .....................155
    5.2.1. Quantitative Data Collection ......................................................................156
    5.2.2. Urban Population, Urban Density and Energy Consumption of the Second-tier Chinese Cities 156
    5.2.3. Identification of the Variables for Statistical Analyses ................................158
    5.2.4. Statistical analysis of the 85 cities ............................................................160
    5.2.5. The Selected Cities for this Research ......................................................164
  5.3. THE REGIONAL CONTEXT OF FOUR CITIES .................................................169
    5.3.1. The Chinese Planning System ....................................................................169
    5.3.2. The City of Harbin ....................................................................................170
    5.3.3. The City of Xi’an .......................................................................................175
    5.3.4. The City of Wuhan ...................................................................................181
    5.3.5. The City of Shenzhen ................................................................................187
    5.3.6. Comparison of Four Cities in Evolution of Modern Urban Form .............197
  5.4. THE HARBIN SITES: PROJECT PROFILES AND DECISION PROBLEMS ....198
    5.4.1. H-Case-A: Jinan Historical Building Redevelopment .................................198
7.4. CASE ONE: SHENZHEN SHANGBU REGENERATION ........................................... 290
   7.4.1. Project Introduction ......................................................................................... 290
   7.4.2. Application of the Conceptual HSEF to Shangbu Regeneration ..................... 292
   7.4.3. Outcomes from the Application on Problem Solving ....................................... 296
   7.4.4. Outcomes from the Application on the Design Synthesis ............................... 304
   7.4.5. Discussion on the Cyclical Time Inherent in HSEF ....................................... 320
   7.4.6. Evaluation of HSEF in Case One ................................................................. 322
7.5. CASE TWO: TIANJIN BINHAI PORT CITY ......................................................... 323
   7.5.1. Application of the Conceptual HSEF to Tianjin Port City ................................. 324
   7.5.2. Outcomes from the Application on Master Planning Appraisal ....................... 326
   7.5.3. The Comparison of the Scholarly and Institutional Perception ......................... 334
   7.5.4. Evaluation of HSEF in Case Two ................................................................... 341
7.6. SUMMARY ......................................................................................................... 341
8. CHAPTER EIGHT: CONCLUSION ........................................................................ 344
   8.1. OVERVIEW ...................................................................................................... 344
   8.2. RESEARCH FINDINGS ..................................................................................... 345
      8.2.1. The Requirement for Holistic Decision Making in Sustainability ................... 345
      8.2.2. Western Planning and Sustainability Assessment Framework ....................... 345
      8.2.3. Bridging the Eastern and Western Thinking and Developing Theoretical Framework .................................................................................................................. 346
      8.2.4. Research Methodology ................................................................................ 348
      8.2.5. Case Studies ............................................................................................... 348
      8.2.6. The HSEF Conceptual Framework ................................................................ 349
      8.2.7. Application and Validation of the HSEF Framework .................................... 351
   8.3. CONCLUSION .................................................................................................. 353
      8.3.1. Addressing the Research Objectives ............................................................. 353
      8.3.2. The Outcome: A Conceptual Framework for Decision Making in Sustainable Urban Regeneration ................................................................. 355
      8.3.3. Contribution to Knowledge ......................................................................... 358
   8.4. FURTHER RESEARCH ................................................................................. 360
8.4.1. Extending the Scope of Work ................................................................................. 360

8.4.2. Reaching Beyond the Scope of Research............................................................... 363

BIBLIOGRAPHY ..................................................................................................................... 365

GLOSSARY OF CHINESE TERMS ...................................................................................... 390

APPENDIX 3A: EVALUATION CRITERIA, INDICATORS AND MATRIX ......................... 397

APPENDIX 4A: PROCEDURES FOR METHODOLOGICAL PEER REVIEW OF ETHICS
APPLICATIONS .................................................................................................................... 400

APPENDIX 4B: ETHICS APPLICATION .............................................................................. 404

APPENDIX 4C: METHODOLOGICAL REVIEW ETHICS APPLICATION DETERMINATION408

APPENDIX 4D: ETHICS APPLICATION APPROVAL ........................................................ 409

APPENDIX 4E: INFORMATION STATEMENT FOR INFORMANTS (IN CHINESE AND
ENGLISH) ............................................................................................................................ 410

APPENDIX 4F: INFORMATION STATEMENT FOR ORGANISATIONS (IN CHINESE AND
ENGLISH) ........................................................................................................................... 417

APPENDIX 4G: CONSENT FORM FOR INFORMANTS (IN CHINESE AND ENGLISH) ....... 423

APPENDIX 4H: CONSENT FORM FOR ORGANISATIONS (IN CHINESE AND ENGLISH)... 425

APPENDIX 4I: INTERVIEW SCHEDULE- PROJECT DESIGNERS .................................. 427

APPENDIX 4J: INTERVIEW SCHEDULE- PROJECT MANAGERS .................................. 431

APPENDIX 4K: TRAVEL AND INTERVIEW SCHEDULE FOR THE RESEARCH PROJECT . 436

APPENDIX 4L: SAFETY APPLICATION ............................................................................. 438

APPENDIX 5A: MORPHOLOGY EVOLUTION OF HARBIN AND SHENZHEN ................ 445

APPENDIX 5B: RESOURCES FOR PILOT STUDY .............................................................. 447

APPENDIX 5C: SUSTAINABILITY CROSS CHECK FOR PILOT STUDY ......................... 448

APPENDIX 6A: CODING SCHEME (IN CHINESE AND ENGLISH) ................................. 469

APPENDIX 6B: CODING REFERENCES FOR S-CASE-A (IN CHINESE AND ENGLISH) ..... 485

APPENDIX 6C: CODEBOOK TABLE ................................................................................... 508

APPENDIX 6D: RELATIONSHIPS (IN CHINESE AND ENGLISH) ................................... 511

APPENDIX 6E: CLUSTER ANALYSIS COEFFICIENT (≥0.1) .......................................... 531

APPENDIX 6F: REFINED CODEBOOK ............................................................................. 533
LIST OF TABLES

Table 2-1: Types of urban infill development (Source from GA, 2008; Meyer, 1999; Ryan, 2004) ... 31
Table 2-2: Types of mixed-use developments (Source: the author) .......................................................... 32
Table 2-3: The spectrum of views on sustainability (Source from Brandon & Lombardi, 2005; Knight-Lenihan, 2007; PRISM & Knight, 2000) ...................................................................................... 41
Table 2-4: The summary of the spectra categories, adapted from Knight-Lenihan (2007) ...................... 60
Table 2-5: The summary of aims and limits (Source: the author) .............................................................. 62
Table 2-6: Research on sustainability assessment in China (Source: the author) .................................. 69
Table 2-7: The proposed framework for sustainable decision-making (Source from Brandon & Lombardi, 2005) ............................................................................................................................ 77
Table 2-8: The ecological system based on the African concept of Ubuntu (adapted from Plessis, 2009) ................................................................................................................................................. 84
Table 2-9: Integrated framework and their philosophical paradigms (Source: the author) .......... 86
Table 3-1: The three main relational qualities of the Buddhism framework, its operation and cycles (Source from MacKee, 2008) ........................................................................................................... 98
Table 3-2: The comparison of the sustainability holarical layers between integrated theory and Taiji (Source: the author) ................................................................................................................ 102
Table 3-3: Comparison of Eastern versus Western approaches (Source from Hong & Lang, 2001) . 113
Table 3-4: The hierarchical organisation of modalities (Adapted from Chen, et al., 2010; Enyedi, 1996) .................................................................................................................................................................. 117
Table 4-1: The stepwise methodology for the development of composite indices (Adapted from Carvalho, et al., 2009) ......................................................................................................................... 126
Table 4-2: The methodology of the research (Source: the author) .......................................................... 139
Table 4-3: Ladder of analytical abstraction (Adapted from Carney, 1990) .............................................. 148
Table 5-1: Climate zoning index in the construction industry in China (Adapted from Zhang, 2006) ................................................................................................................................................... 160
Table 5-2: Climate indicators (Source from Climate Consultant 3.0, http://www.aud.ucla.edu/energy-design-tools) ................................................................................................................................................. 161
Table 5-3: 85 Cities correlation analyses (Source from the author, published in Dong, et al., 2010) 162
Table 5-4: Details of clusters (Source from the author, published in Dong, et al., 2010) ..................... 163
Table 5-5: The selected cities for this research (Source from the author, published in Dong, et al., 2010) ................................................................................................................................................ 166
Table 5-6: Example of districts grading for Wuhan (Source from Zhang, 2006) ............................... 166
Table 5-7: Population density map of selected cities (Source from the author, published in Dong, et al., 2010) ....................................................................................................................................... 167
Table 5-8: Results of the urban form indicators of four selected (Source from the author, published in Dong, et al., 2010) ........................................................................................................................................ 168
Table 5-9: Comparison of the four master plans of Xi’an (Adapted from Wang, 2000; XCUCRC, 2000; Zhai, 2008; Zhai & Ng, 2008) ........................................................................................................................................ 179
Table 5-10: Comparison of the master plans for Wuhan (Adapted from WUPB, 1982, 1988, 1996) 185
Table 5-11: Planning goals and objectives in the Master Layout Plans (Source from Ng, 2002). .... 190
Table 5-12: The types of sites and code of interviewees (Source: the author) ......................... 222
Table 5-13: Strengths, weaknesses and gaps analysis (Mixed-use strategy vs. sustainability goals) (Source from the author, published in Dong, et al., 2010) .................................................................................................................. 225
Table 5-14: Mixed-use in Shenzhen and Wuhan (Source from the author, published in Dong, et al., 2010) ........................................................................................................................................ 229
Table 6-1: The example of word frequency analysis in the journals of Taiji theory (Source: the author) ........................................................................................................................................ 241
Table 6-2: Coding scheme for TQ 1.1(excerpt) (Source: the author) ........................................ 244
Table 6-3: The coding references of S-Case-A (excerpt) (Source: the author) ......................... 246
Table 6-4: Example of codebooks for TQ 1.1-TQ1.4 (excerpt) (Source from the author, published in Dong et al., 2011) ........................................................................................................................................ 247
Table 6-5: Relationship description (Source: the author) .......................................................... 248
Table 6-6: The relations of node- Metro Development Level (Source: the author) ..................... 249
Table 6-7: Relationship description (Source: the author) .......................................................... 251
Table 6-8: The types of cluster analysis diagrams (Source from NVIVO 9) ............................. 255
Table 6-9: The summary of cluster analysis (excerpt) (Source: the author) ............................ 255
Table 6-10: Refined codebook (excerpt) (Source: the author) .................................................. 261
Table 6-11: The themes of the new groups in the framework (Source: the author) ................... 262
Table 6-12: The similarity and dissimilarity (Source: the author) Note: D=Dissimilarity, S=Similarity, Similarity metric= Pearson correlation coefficient .......................................................... 265
Table 6-13: Extract yin and yang ubiquity (Source: the author) ............................................... 276
Table 7-1: Process of building theory from case study research (Source from Eisenhardt, 1989) .... 285
Table 7-2: The planning process of Shangbu Regeneration (Source from UDRI, 2009) ............. 292
Table 7-3: The similarity and dissimilarity coefficients for Case One: Shangbu Regeneration (Source: the author) .................................................................................................................. 295
Table 7-4: Application of the HSEF to Case One: Shangbu Regeneration (Source: the author)...... 296
Table 7-5: The extreme yang on problem solving of Case One (Source: the author) ............... 299
Table 7-6: Zhen (1 yang) on problem solving of Case One (Source: the author) ...................... 300
Table 7-7: Xun (1 yin) on problem solving of Case One (Source: the author) ........................... 303
Table 7-8: The extreme yin on problem solving of Case One (Source: the author) ................. 305
Table 7-9: The extreme yang on design synthesis of Case One (Source: the author) ............... 308
Table 7-10: The extreme yin on design synthesis of Case One (Source: the author) .................310
Table 7-11: Zhen (1 yang) on design synthesis of Case One (Source: the author) ......................315
Table 7-12: The Xun (1 yin) on design synthesis of Case One (Source: the author) ...................318
Table 7-13: The comparison of four schemes (Source: the author) ......................................320
Table 7-14: Comparison of the six section plans (Source: the author) ....................................321
Table 7-15: Demographic figure of Binhai Port City (Source from TUPB, 2010) ......................325
Table 7-16: The similarity and dissimilarity for Tianjin Binhai Port City (Source: the author) ....327
Table 7-17: Application of the HSEF to Case Two: Tianjin Binhai Port City (Source: the author) ..327
Table 7-18: The extreme yang aspects of Case Two (Source: the author) ..............................328
Table 7-19: The extreme yin aspects of Case Two (Source: the author) ..................................330
Table 7-20: The seven industrial functional areas (Source: the author) ....................................331
Table 7-21: The 1 yang and 1 yin aspects of Case Two (Source: the author) ............................334
LIST OF FIGURES

Figure 1-1: The objectives (Source: the author) ................................................................. 10
Figure 1-2: Research process (Source: the author) .......................................................... 11
Figure 1-3: The structure of the thesis (Source: the author) ............................................. 16
Figure 1-4: The map of appendices (Source: the author) ................................................. 20
Figure 2-1: Diagram of urban debates (Source: the author, published in Lehmann, 2010, p. 73) ................................................................. 29
Figure 2-2: Big places and key ports: evolution and separation over time (Source from Norcliffe, et al., 1996) .................................................................................................................. 37
Figure 2-3: The shift from sustainable development to sustainability and evaluation (Source: the author) ...................................................................................................................... 40
Figure 2-4: Weak and strong sustainability (Source from Brandon & Lombardi, 2005; PCE, 2002) ................................................................. 42
Figure 2-5: O’ Riordan’s spectrum (Adapted from O’Riordan, 1981) .................................. 43
Figure 2-6: Dobson’s typologies (Source from Dobson, 1998, after the naming by Knight-Lenihan, 2007) ................................................................. 44
Figure 2-7: SD assessment framework (Adapted from Knight-Lenihan, 2007) .................. 45
Figure 2-8: Weak sustainability model (Source from PCE, 2002) ..................................... 46
Figure 2-9: OECD indicator model (PSR model and DSPIR model) (Source from Kumar, 2006) ................................................................. 47
Figure 2-10: SPSIR Model (Source from Kumar, 2006) ..................................................... 48
Figure 2-11: The interconnectedness of constituent parts (Source from Roberts, 2006) ...... 49
Figure 2-12: PICABUE definition of sustainable development and the underlying principles (Source from Cooper, 1997) ................................................................. 51
Figure 2-13: Pentagonal Model (PM) (Source from Nijkamp, 1998) .................................. 52
Figure 2-14: Quantifiable city model (Source from May, et al., 1997) ............................. 52
Figure 2-15: Sustainable community indicators (Source from Hart, 1999) ..................... 55
Figure 2-16: Reductionist tools and non-reductionist framework (Source: the author) ..... 63
Figure 2-17: Different certification methods for buildings (Source from Birgisdóttir, 2010) ................................................................. 71
Figure 2-18: The Prism of Sustainability (Source from PCE, 2002) .................................. 74
Figure 2-19: Strong sustainability’ model (Source from PCE, 2002) ............................. 76
Figure 2-20: Features of Dooyeweered’s framework (Source from Brandon & Lombardi, 2005) ................................................................. 77
Figure 2-21: The BEQUEST evaluation matrix (Source from Bentivegna, 1997; BEQUEST, 1998-2001) ................................................................. 78
Figure 2-22: The 3-Q Model: quality integration for urban sustainability (Source from BEQUEST, 1998-2001) ................................................................. 79
Figure 2-23: Wilber’s integral map of reality (Source from Wilber, 2003) ....................... 81
Figure 2-24: (a) The Gaia Model (Source from Lenton & van Oijen, 2002) (b) The holarchy of sustainability (Source from Jiliberto, 2004).................................................................................................................82
Figure 3-1: History of urban construction in China (Source: the author) ..................................................91
Figure 3-2: The awareness of sustainability in China (Source: the author) .................................................92
Figure 3-3: Influences from the West (Source: the author) ........................................................................93
Figure 3-4: Confucianism individual-society-cosmo moral relationship (Adapted from Tucker, 1991).
.................................................................................................................................98
Figure 3-5: Taiji (supreme ultimate) and its natural law (Adapted from Bruun, 2003) ................... 99
Figure 3-6: Five-element theory and its internal promoting and counteracting relationships (Source from Kim, 2010) ....................................................................................................................................100
Figure 3-7: Compass (luo-pan) and its conceptual layers (Adapted from Bruun, 2003) ................... 101
Figure 3-8: The three celestial layers of Taiji model (Source from Bruun, 2003; Choy, 2006) .... 101
Figure 3-9: The splitting of Taiji (Guo, 2007) .........................................................................................103
Figure 3-10: The rotation of yin and yang (Source: the author) ............................................................105
Figure 3-11: The mutual generation (left) and contrasting forces (centre) in Taiji and their integrated diagram (right) (Source: the author) ........................................................................................................105
Figure 3-12: Searching for an indigenous approach in China (Source: the author) ....................... 108
Figure 3-13: (a) The hierarchical structure of Taiji (Source: the author); (b) Properties and symbols of Eight Trigrams structure (Source from Chen, et al., 2010, pp. 183-184) ...................................................... 109
Figure 3-14: Nested view: Eastern versus Western science (Source from Hong & Lang, 2001, p. 130)
......................................................................................................................................................111
Figure 3-15: Eastern versus Western approaches (Source from Hong & Lang, 2001, p. 130) ........114
Figure 3-16: Taiji (negative-positive essence) and its variations into an integral environment system (Source from Enyedi, 1996)..............................................................................................................115
Figure 3-17: Four ways of constructing reality (Source from Riedy, 2005, pp. 36) .........................116
Figure 3-18: The theoretical generation of eight hexagrams from one (Source: the author) ............118
Figure 3-19: The hierarchical organisation of modalities (Adapted from Chen, et al., 2010) ...........118
Figure 3-20: The ordinal sequence of eight trigrams on the Taiji compass (Source: the author) ......120
Figure 3-21: The abstraction of Holistic Sustainability Evaluation Framework for China (Source: the author).................................................................................................................................121
Figure 3-22: The evolution from philosophy to the conceptual framework (Source: the author) ......121
Figure 3-23: The evolution of the conceptual model (Source from the author and Sargent, 1998) ...122
Figure 4-1: (a) The process of quantitative sustainability indicators determination; (b) The Process of qualitative sustainability indicators determination (Source from Kinderytė, 2010) .................125
Figure 4-2: The approach to Sustainability Index for Integrated Urban Water Management (SIUWM) development (Carvalho, et al., 2009) ........................................................................................................127

xiii
Figure 5-10: Comparison of density distribution of selected cities (p/km²) (Source from the author, published in Dong, et al., 2010)................................................................. 168
Figure 5-11: Selected types of the pilot study (Source: the author)........................................... 169
Figure 5-12: Levels of government under the state council and Chinese planning system (Adapted from Saich, 2001; Yeh & Wu, 1998)................................................................. 171
Figure 5-13: The location of Heilongjiang Province in China (b) the metropolitan and the urban area of Harbin (Source: the author)................................................................. 172
Figure 5-14: The master plan in 1956 and 1982 (Source from HUPB, 1953; HUPB, 1982)........... 172
Figure 5-15: The evolution and direction of urban development, Master Planning of Harbin (2000-2020) (Source from HUPB, 2000)................................................................. 174
Figure 5-16: The location of the sites on the density map of the built-up city area (Source: the author)................................................................................................................... 175
Figure 5-17: (a) Locations of Shaanxi province in China (b) Xi’an in Shaanxi province (Source from Zhai & Ng, 2008)......................................................................................... 176
Figure 5-18: Xi’an central urban area (Source from Zhai & Ng, 2008)........................................... 177
Figure 5-19: Existing situation of Xi’an city (a) 1934 & 1949 (b) 1990 (Source from Zhai, 2008) .. 178
Figure 5-20: (a) First Xi’an Master Planning (1953-1972) (Source from XUPB, 1953) (b) Xi’an city in 1980 after major development proposed by the 1953 Master Planning (Source from Wang, 2000) ................................................................. 180
Figure 5-21: The second Xi’an Master Planning (1980-2000) (XMUPMB, 1983).......................... 180
Figure 5-22: The third Xi’an Master Planning (1995-2010) (Source from XMUPB, 1994)........... 181
Figure 5-23: The fourth Xi’an Master Planning (2008-2020) (Source from XUPB, 2008) ........... 182
Figure 5-24: (a) Location of Wuhan city in China (b) The metropolitan and urban areas of Wuhan (Source: the author)......................................................................................... 182
Figure 5-25: The evolution of the urban form in 1949, 1980, 1996 and 2002(Source from Cheng & Masser, 2003)............................................................................................................. 184
Figure 5-26: Wuhan Master Plan (1996-2020), Urban Density Plan (Source from WUPB, 1996).... 186
Figure 5-27: The location of the sites on the density map of the built-up city area (Source: the author) ......................................................................................................................... 187
Figure 5-28: (a) Locations of Guangdong province in China (b) Locations of Shenzhen in Guangdong (c) Shenzhen Special Economic Zone, Longgang and Bao’an Districts (Source from Ng, 2002). ... 189
Figure 5-29: The urban structure of 1986’s Master Plan (Source from CAUPD, 1986)................. 191
Figure 5-30: The urban structure of the 1996 Master Plan (Source from Shenzhen, 1996)......... 192
Figure 5-31: Shenzhen Master Plan (2007—2020) (Source from SUDRI, 2007)......................... 194
Figure 5-32: The urban regeneration regions in the 2007 Master Plan (red - development area, orange: improvement area, green- clearance area) (Source from SUDRI, 2007)................................. 194
Figure 5-33: the FAR division of Shenzhen in 2001 (a) and 2007 (b) (Source from SUDRI, 2001; SUDRI, 2007) .................................................................................................................................................................................. 196
Figure 5-34: The Location of the sites on the density map of the built-up city area (Source: the author) ........................................................................................................................................................................................................... 197
Figure 5-35: The of urban form evolution of Harbin, Shenzhen, Wuhan and Xi’an since 1949 (Source from Cheng & Masser, 2003; HUPB, 1953; HUPB, 1982, 2000; Shenzhen, 2001, 2007; Zhai, 2008) ........................................................................................................................................................................................................... 198
Figure 5-36: H-Case-A (Source: the author) ................................................................................................................................................................................................................................................................. 199
Figure 5-37: The regulatory plan and detailed plan of H-Case-B (Source from HITIAD, 2008) ... 200
Figure 5-38: The conserved industrial heritage in H-Case-B (Source: the author) ......................... 201
Figure 5-39: The conserved industrial heritage in H-Case-C (Source: the author) ......................... 202
Figure 5-40: X-Case-A (Source: Xi’an Daming Palace National Heritage Park Construction Department) (Source from Fang, 2009; XUPB, 2008) .................................................................................................................................................................................. 203
Figure 5-41: X-Case-B, recession sites of old industrial areas (Source from Cheng, 2011; XUAUDRI & XUPRI, 2008) .................................................................................................................................................................................. 206
Figure 5-42: The process of the plan development (Source from WPDI, 2005) ............................. 208
Figure 5-43: The integrated plan (Source from WPDI, 2005) ....................................................... 209
Figure 5-44: W-Case-B (Source: Wuhan Planning & Design Institute) ........................................ 210
Figure 5-45: W-Case-B (Source: Wuhan Planning & Design Institute) ........................................ 211
Figure 5-46: W-Case-C (Source from Tuan, 2010) ........................................................................ 212
Figure 5-47: W-Case-D (Source from Gezhouba, 2009) .............................................................. 213
Figure 5-48: W-Case-E (Source from ZIAD, 2009) ................................................................. 215
Figure 5-49: S-Case-A (Source from SOM & FG, 2008) ............................................................ 216
Figure 5-50: S-Case-B (Source from UPDIS, 2004) ................................................................. 217
Figure 5-51: The development strategy and spatial planning of S-Case-B (Source from UPDIS, 2004) .................................................................................................................................................................................. 218
Figure 5-52: S-Case-C (Source from KG, 2010) ............................................................................. 220
Figure 5-53: Comparative analysis on S-Case-A, S-Case-C and W-Case-D (Source: the author) .................................................................................................................................................................................. 223
Figure 5-54: Applicability check of indicators (Source from the author, published in Dong et al., 2010) .................................................................................................................................................................................................. 224

Figure 6-1: (a) The holistic approach for evaluating sustainable regeneration in China (b) The internal logic of the holistic approach for evaluating sustainable regeneration in China (Source: the author) 237
Figure 6-2: The process of KWIC analysis (Source: the author) .................................................. 243
Figure 6-3: The relations of node- Metro (□= node, ◊= memo, →= relation type and direction) (Source from the author, published in Dong, et al., 2011) .................................................................................................................................................................................. 248
Figure 6-4: Connecters in the model (a) All Connections in the model (b) 9+ connections in the model (c) 5+ connections in the model (d) Relationships of the sub-nodes in TQ 1.1 (Source from the author, published in Dong, et al., 2011) .................................................................251
Figure 6-5: The chart of matrix inquiries (Source from the author, published in Dong, et al., 2011) 253
Figure 6-6: The dendrogram chart (Source from the author, published in Dong, et al., 2011)............257
Figure 6-7: (a) 2-D cluster map (b) 3-D cluster map (Source: the author) ........................................258
Figure 6-8: The decomposition of the 2D cluster map (Source: the author) ..................................258
Figure 6-9: The 3D cluster map in the 3D Taiji theory (Source: the author) .................................259
Figure 6-10: The circle chart- node clustered by coding similarity (Source from the author, published in Dong, et al., 2011) .................................................................................................260
Figure 6-11: The conceptual framework (Source from the author, published in Dong, et al., 2011) 262
Figure 6-12: The Holistic Sustainability Evaluation Framework (HSEF) (Source: the author) .........263
Figure 6-13: The number of nodes in 16 groups (Source: the author) ...........................................264
Figure 6-14: The similarity and dissimilarity circle map (Source: the author) .................................265
Figure 6-15: H-CASE-A (0.1<Similarity <1, -1<Dissimilarity < -0.2, Blue line indicates Similarity; Red line indicates Dissimilarity) (Source: the author) ............................................................266
Figure 6-16: H-CASE-B (0.1<Similarity <1, -1<Dissimilarity < -0.2) (Source: the author) ..........267
Figure 6-17: H-CASE-C (0.2<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) ........267
Figure 6-18: S-CASE-A (0.1<Similarity <1, -1<Dissimilarity < -0.2) (Source: the author) ..........268
Figure 6-19: S-CASE-B (0.1<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) ..........269
Figure 6-20: S-CASE-C (0.1<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) ..........269
Figure 6-21: W-CASE-A (0.1<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) .........270
Figure 6-22: W-CASE-B (0.1<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) ........270
Figure 6-23: W-CASE-C (0.1<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) ........271
Figure 6-24: W-CASE-D (0.1<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) ........271
Figure 6-25: W-CASE-E (0.1<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) ........272
Figure 6-26: X-CASE-A (0.1<Similarity <1, -1<Dissimilarity < -0.1) (Source: the author) ..........273
Figure 6-27: X-CASE-B (0.1<Similarity <1,-1<Dissimilarity < -0.1) (Source: the author) ..........273
Figure 6-28: The four critical aspects of 13 cases (Source: the author) ........................................274
Figure 6-29: The aggregation of the nodes and the shaded nature (Source: the author) .................277
Figure 6-30: The aggregation of the nodes and the shaded nature (Source: the author) ...............278
Figure 7-1: The validation for a typical system development (Source from Yang, et al., 2011) ........283
Figure 7-2: The map of the design process (Adapted form Lawson, 1990) ....................................290
Figure 7-3: (a) Site location of Shangbu Region (b) Shangbu Region (yellow region) and Huaqiang North Street (green line) (Source from UDRI, 2009) .........................................................292
Figure 7-4: Shangbu Regeneration Master Plan in 2005 and 2009 (Source from SUPRI, 2005; UDRI, 2009) ...........................................................................................................................................293
Figure 7-5: Number of coding references for Shangbu Regeneration (Source: the author) ........294
Figure 7-6: The similarity and dissimilarity for Shangbu Regeneration (Source: the author) ........295
Figure 7-7: The four critical quadrants of the HSEF framework in the problem solving stage of Case One (Source: the author) ................................................................. 297
Figure 7-8: The four critical quadrants of the HSEF framework in the problem solving stage of Case One (Source: the author) ........................................................................ 298
Figure 7-9: The pursuit of stakeholders for high-density, high-capacity development (Source from UDRI, 2009) ................................................................. 299
Figure 7-10: (a) Cost adjustment (b) Area rewards (Source from UDRI, 2009) ................. 301
Figure 7-11: Public policy leverage for commonwealth and non-commonwealth (Source from UDRI, 2009) ................................................................................. 302
Figure 7-12: The four critical quadrants of HSEF framework in the design synthesis stage of Case One (Source: the author) ........................................................................ 306
Figure 7-13: The four critical quadrants of HSEF framework in the design synthesis stage of Case One (Source: the author) ........................................................................ 306
Figure 7-14: Building height control and street block control (Source from SUPRI, 2005) ...... 307
Figure 7-15: Road traffic and developing 3-D transport system (Source from SUPRI, 2005) ...... 309
Figure 7-16: Graded premium system (Source from SUPRI, 2005) .................................. 309
Figure 7-17: Planning target (Source from SUPRI, 2005) .............................................. 311
Figure 7-18: Street block control (Source from SUPRI, 2005) ...................................... 311
Figure 7-19: The analysis of open spaces (Source from SUPRI, 2005) ......................... 313
Figure 7-20: The planning concepts of Shangbu Area (Source from SUPRI, 2005) ........... 314
Figure 7-21: Spatial guidance (Source from SUPRI, 2005) ..................................... 316
Figure 7-22: Master spatial control and wall height control (Source from SUPRI, 2005) .......... 316
Figure 7-23: (a) Control of classified architectural renovation (b) Land reserves (Source from SUPRI, 2005) ................................................................. 319
Figure 7-24: The cyclical stages within the application of the conceptual HSEF in Case One (Source: the author) ................................................................. 322
Figure 7-25: The location of Tianjin Port City (Source from TUPB, 2010) ......................... 324
Figure 7-26: Number of coding references for Tianjin Binhai Port City (Source: the author) ...... 325
Figure 7-27: The similarity and dissimilarity for Tianjin Binhai Port City (D=Dissimilarity, S=Similarity, Similarity metric=Pearson correlation coefficient) (Source: the author) ......... 326
Figure 7-28: Ecological corridor; Entertainment port (Source from TUPB, 2010) ............... 329
Figure 7-29: Overall spatial configuration; Binhai New Area Industrial Zone (Source from TUPB, 2010) ................................................................. 331
Figure 7-30: The application of the conceptual HSEF to Binhai Area in academic publications (Source: the author) ................................................................. 335
Figure 7-31: The detailed references in the application of HSEF to Binhai Area in journals (Source: the author) ................................................................. 336
Figure 7-32: The application of HSEF to Binhai Area in master planning (Source: the author) .......... 337
Figure 7-33: Application on the master planning focuses (Source: the author) ............................. 337
Figure 7-34: Typology1: supreme yang+ supreme yin (a) journals (b) master plan ....................... 338
Figure 7-35: Typology 2: supreme yin (a) journals (b) master plan ............................................ 340
Figure 7-36: Typology3: supreme yang in master plan ............................................................. 341
Figure 7-37: Typology4: supreme yin+ 1yin (a) journals (b) master plan ..................................... 341
Figure 7-38: Typology5: 1yang+1yin in journals ................................................................. 342
Figure 8-1: The objectives (Source: the author) ............................................................................. 355
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACI</td>
<td>Applicability Check of Indicators</td>
</tr>
<tr>
<td>AHP</td>
<td>Analytic Hierarchy Process</td>
</tr>
<tr>
<td>ANN</td>
<td>Artificial Neural Network</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td>BEQUEST</td>
<td>Building Environmental Quality Evaluation for Sustainability through Time</td>
</tr>
<tr>
<td>BREEAM</td>
<td>Building Research Establishment Environment Assessment Method</td>
</tr>
<tr>
<td>CASBEE</td>
<td>Comprehensive Assessment System for Built Environment Efficiency</td>
</tr>
<tr>
<td>CAUPD</td>
<td>China Academy of Urban Planning and Design</td>
</tr>
<tr>
<td>CBA</td>
<td>Cost Benefit Analysis</td>
</tr>
<tr>
<td>CBD</td>
<td>Central Business District</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CEPA</td>
<td>Closer Economic Partnership Agreement</td>
</tr>
<tr>
<td>CIAM</td>
<td>Congrès International d’Architecture Moderne</td>
</tr>
<tr>
<td>CRQ</td>
<td>Central Research Question</td>
</tr>
<tr>
<td>CVM</td>
<td>Contingent Valuation Method</td>
</tr>
<tr>
<td>CWM</td>
<td>Community Wildlife Management</td>
</tr>
<tr>
<td>DGNB</td>
<td>Deustche Gesellschaft fur Nachhaltiges Bauen</td>
</tr>
<tr>
<td>DPSIR</td>
<td>Driving force – Pressure – State – Impact – Response</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>ELHDZ</td>
<td>East Lake High-tech Development Zone</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FAR</td>
<td>Floor Area Ratio</td>
</tr>
<tr>
<td>GB</td>
<td>Green Building</td>
</tr>
<tr>
<td>GBCAS</td>
<td>Green Building of Beijing Olympic</td>
</tr>
<tr>
<td>GBP</td>
<td>Good or Best Practice</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Production</td>
</tr>
</tbody>
</table>
GIS                          Geographic Information System
GNP                          Gross National Production
HDI                          Human Development Index
HQE2R                        High-Quality Environment and Economy in Regeneration
HREC                         Human Research Ethics Committee
HSEF                         Holistic Sustainability Evaluation Framework
HSEFA                        Holistic Sustainability Evaluation Framework for Asia-Pacific Regions
IBA                          Berlin International Building Association
IDOCT                        City of Textiles
IK                           Indigenous Knowledge
IQ                           Interview Question
ISEE                         International Society for Environmental Ethics
KWIC                         Key Words in Context
LCA                          Life Cycle Assessment
LCC                          Life Cycle Cost
LEED                         Leadership in Energy & Environmental Design
MCA                          Multi-Criteria Analysis
MFA                          Material Flow Analysis
MOST                         Management of Social Transformations Programme
NABERS                       National Australian Built Environment Rating System
NGOs                         Non-Government Organisations
NSA                          National Sustainability Assessment
OCT                          Overseas Chinese Town
OECD                         Organisation for Economic Co-operation and Development
OSI                          Overall Sustainability Index
PCE                          Parliamentary Commissioner for the Environment
PERD                         Population, Environment, Resource, and Development
PICABUE                      Early Stage of BEQUEST
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>Pentagon Model</td>
</tr>
<tr>
<td>POD</td>
<td>Probability of Detection</td>
</tr>
<tr>
<td>PRISM</td>
<td>The Prism of Sustainability</td>
</tr>
<tr>
<td>PSR</td>
<td>Pressure-State-Response</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>RESCUE</td>
<td>Regeneration of European Sites in Cities and Urban Environment</td>
</tr>
<tr>
<td>SA</td>
<td>Schema Analysis</td>
</tr>
<tr>
<td>SCR</td>
<td>Sustainable Cost Recovery</td>
</tr>
<tr>
<td>SD</td>
<td>Sustainable Development</td>
</tr>
<tr>
<td>SEA</td>
<td>Strategic Environmental Assessment</td>
</tr>
<tr>
<td>SEPA</td>
<td>Swedish Environmental Protection Agency</td>
</tr>
<tr>
<td>SEZs</td>
<td>Special Economic Zones</td>
</tr>
<tr>
<td>SI</td>
<td>Sprawl Index</td>
</tr>
<tr>
<td>SIUWM</td>
<td>Sustainability Index for Integrated Urban Water management</td>
</tr>
<tr>
<td>SSDI</td>
<td>Semi-Structured Depth Interview</td>
</tr>
<tr>
<td>SSIs</td>
<td>Semi Structured Interviews</td>
</tr>
<tr>
<td>SUD</td>
<td>Sustainable Urban Development</td>
</tr>
<tr>
<td>SWG</td>
<td>Strengths, Weaknesses and Gaps Analysis</td>
</tr>
<tr>
<td>SWOT</td>
<td>Strength, Weakness, Opportunities and Threats Analysis</td>
</tr>
<tr>
<td>TA</td>
<td>Transferability Analysis</td>
</tr>
<tr>
<td>TEDA</td>
<td>Tianjin Economic Development Zone</td>
</tr>
<tr>
<td>TOD</td>
<td>Transit Oriented Development</td>
</tr>
<tr>
<td>TQ</td>
<td>Theory Question</td>
</tr>
<tr>
<td>TRC</td>
<td>Temporary Residence Certificate</td>
</tr>
<tr>
<td>ULI</td>
<td>American Urban Land Institute</td>
</tr>
<tr>
<td>UNCSD</td>
<td>UN Commission for Sustainable Development</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organisation</td>
</tr>
<tr>
<td>WETDZ</td>
<td>Wuhan Economic and Technological Development Zone</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>WHS</td>
<td>World Heritage Site</td>
</tr>
<tr>
<td>WSUD</td>
<td>Water Sensitive Urban Design</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENTS

First and foremost, I would like to express my deepest gratitude to my supervisors, Dr. Jamie Mackee and Dr. Michael Mak, for their enormous supports, especially for their continuous patience and encouragements, guiding and understanding in the course of this research and keeping me on the track of completion.

The particular thanks are dedicated to Prof. Steffen Lehmann of the University of South Australia, for his supports and encouragements in his supervision at the initial stage of this study. He firstly introduced to me the area of sustainable urban regeneration, providing a number of references and critical discussions on this matter. I would also like to thank the staffs in the School of Architecture and Built Environment at the University of Newcastle, particularly Prof. Tony Williams for his valuable supports and advices to my studies and life in Australia.

As a part of the study, I conducted a number of field studies in China, which have been crucial for the development of this research. I also wish to express my appreciation and thank to all interviewees in Harbin, Wuhan, Shenzhen and Xi’an, and my respected teachers in Harbin to whom I am greatly indebted.

This thesis has had the benefit of professional editorial advice from Ms Thushara Dibley. I would like to express my appreciation and thanks to her devotion to the proofreading my thesis before submission. During the process of development of this research, I participated in a number of international conferences on the subject of sustainability and many discussions undertaken within the fieldwork have provided relevant feedback to this study, increasing my understanding of the subject and facilitating access to relevant information. As a consequence of this, I also wish to express my appreciation and thanks to the academics I met at the conferences, especially those who peer-reviewed my papers.

Finally, I sincerely wish to thank my relatives and friends who put up with me and encouraged me during this period, facilitating the completion of my work.
DECLARATION

This thesis 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. In the course of this thesis, some parts of the research resulted in several publications. The publications are:


Dong, W., Mackee, J., & Mak, M. (2013). Validating the Holistic Sustainability Framework by the Application on Shanagbu Regeneration in China. Paper accepted for presenting at the the 9th International Conference on Environmental, Cultural, Economic and Social Sustainability, Hiroshima, Japan.

I hereby certify that the work embodied in this thesis is the result of original research and has not been submitted for examination to any other University or Institution.

(Signed):

APPROVAL OF THE HUMAN ETHICS COMMITTEE

The Human Ethics Committee of the University of Newcastle granted approval for the Semi-Structured Interview component of this research (Reference No: H-2009-0383).
ABSTRACT

Urban planning and design are crucial for sustainable urban development. Among recent explorations towards sustainable future of the cities, urban regeneration projects have been promoted in China for its contribution to intensified and diversified urban form. However, the existing methodologies for evaluating urban regeneration within the context of China are mostly appropriated from the Western models. These evaluation methods have problems in their utilisations in China due to their reductionist underpinning and lack of sensitiveness to local situations in Chinese cities. These limitations motivate the development of a holistic framework which can integrate system theory and indigenous philosophy in the decision making for the built environment. Taiji Theory is regarded to be the appropriate philosophical paradigm in the context of China for its focus on harmonising the relationship between human and nature. The synergies established between the system theory and Taiji philosophy are summarised as four relational qualities between the dichotomous pairs. Based on this, the establishing of Holistic Sustainability Evaluation Framework (HSEF) for Chinese Cities provides new understanding of how traditional philosophical paradigms could be applied to sustainability evaluation methods, based on the indigenous philosophies of China.

This thesis develops the framework based on empirical experience, employing both statistical inference and inductive approaches. Case studies are adopted to provide empirical foundation for the framework in the urban projects. With the qualitative data from thirteen large urban design projects collected in four Chinese cities, this thesis found that the identification of the primary relationships on the site could facilitate the rational choice of trade-off strategies in the regeneration project, which further strengthening the framework. Practical applications of the framework are used to test the validity of HSEF in different local practices.

This thesis has presented empirical evidences that the indigenous Chinese Taiji philosophy is applicable to sustainability evaluation through a structured holistic framework and operationalised model. It is argued that the benefits from this conceptual framework provide an alternative paradigm as a culturally sensitive approach to the sustainable decision making of urban regeneration projects in China.