The Development of an Intellectual Capital Framework for Successful Adaptive Re-use

A thesis submitted in fulfillment of the requirements for the degree of Doctor of Philosophy

Kartina Alauddin
Bachelor of Quantity Surveying
M.Sc. (Project Management)

School of Property, Construction and Project Management
RMIT University
May 2014
DECLARATION

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to quality for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

..............................................................

Kartina Alauddin

May, 2014
Compared to new building projects, the adaptive re-use projects are unique and often create complexity in the design and construction process. The adaptive re-use project requires complete and accurate historical information and high levels of expertise from the project team members. Therefore, within the typology of adaptive re-use projects, the ability to capture and transfer the unique set of skills and experience from project to project is important to create the relevant knowledge. Previous adaptive re-use studies focused on project success, potential for re-use, benefits, and sustainability. However, research related to capturing and transferring skills and experience from adaptive re-use project settings has received relatively little attention to date. Thus, this study attempts to fill this gap by developing an intellectual capital framework specific for adaptive re-use projects. The study specifically investigates the importance of adaptive re-use projects, the components of project success for the problem solving process, the key components of problem solving in knowledge creation and knowledge transfer context, and the relationship between components of project success and key components of knowledge creation and transfer in problem solving process. The theoretical framework for this study was derived from knowledge management theory which guided the research questions and research design. Based on review of the literature, an Intellectual Capital Framework was developed which comprises trust, supportive attitude, communication, appreciation, collaboration and skills. These components were considered important for the creation and transfer of intellectual capital within project settings. The framework is further refined and informed by the empirical results.

The study adopted the qualitative approach to data collection; the data was collected from 14 semi-structured in-depth interviews across two case studies. Each case study involved two adaptive re-use projects completed by two separate University clients within a period of eight to thirteen years. The historical buildings were located in Geelong and Melbourne and were adapted to a university. The four buildings were considered to be unique examples of adaptive re-use projects in the state of Victoria. All found buildings were adapted to a new building use as a university. Data from the interviews was analysed using content analysis for within-case and cross-case analysis with the aid of NVivo Version 9.

The finding of the study highlights that trust is the core component in creating and transferring of intellectual capital among project team members during problem solving process. In addition, the findings of the study were that the key factors of creating and transferring skills and knowledge among team members in adaptive re-use projects were effectiveness and efficiency, similar project teams, project teams actions, sources of
information, generating new skills and knowledge and developing new solutions during problem solving processes. After refinement of the Intellectual Capital Framework, there are eleven components considered important for adaptive re-use settings namely, trust, collaboration, communication, skills, past experience, project team actions, sources of information, similar project team, effectiveness and efficiency mode, generating new skills and knowledge, and developing new solutions.

The contribution of this study is for both practitioners and academicians and is through the development of an intellectual capital framework for successful adaptive re-use projects. From the perspective of practitioners, the intellectual capital framework can be used as guidelines for the transfer and creation of their intellectual capital from project to project effectively. From the perspective of academicians, this framework can be used as template for future research in the field of adaptive re-use, project management and knowledge management. In conclusion, the study enabled the integration of knowledge management theory with project management theory within the specific contextual adaptive re-use project settings.
ACKNOWLEDGEMENTS

This thesis would certainly not have been successfully completed without the help and prayers of many individuals during the course of this PhD. Among the individuals involved, I would like to specifically mention the following people.

I would like to deeply thank my principal supervisor, Professor Kerry London, for her enormous help. She has always been around when I needed her and has guided me with her wisdom until I could manage by myself. All the knowledge that she has given was filled with dedication and enthusiasm. Through her, I also received a lot of positive influence not only for my study but also for the course of everyday life. Her encouragement continued to be a pillar of strength for me to complete this thesis. She always encouraged me in participate in attending conferences during the PhD period, not just nationally but also internationally. Thank you, Professor Kerry!

I would like to acknowledge my thanks to my second supervisor, Associate Professor Dr Tayyab Maqsood, for his guided and valuable recommendations for improving my thesis in relation to the knowledge management input.

I express my appreciation to the 14 participants who acquired time for the interview sessions during their busy schedules with other current projects. Their effort and willingness to participate in this research really supported and helped me to provide the richness of their experience in adaptive re-use projects. I would like to thank my fellow PhD students who have always supported me along my research journey with their constructive discussion and encouragement especially for Jessica Siva and Peng Zhang. I would also like to acknowledge Dr. Mohmad Mohd Derus and Ms Valerie Williams who helped me editing this thesis.

The journey of my PhD in Australia has given me valuable life experience. This would not have happened without financial support from the Ministry of Higher Education of the Malaysian Government and my employer, MARA University of Technology, Malaysia. Thank you very much!

My special thanks and appreciation goes to my husband who has sacrificed everything and supported me along this journey. Also, my lovely Izzah Damia, Izzah Danishah and Izz Daniyal, are really deep in my heart giving me happiness along the process of this PhD journey. I love you! To my parents and parents’ in-law, thank you for everything!!!
TABLE OF CONTENTS

DECLARATION ............................................................................................................................... ii

ABSTRACT ................................................................................................................................. iii

ACKNOWLEDGEMENTS ............................................................................................................. v

TABLE OF CONTENTS ............................................................................................................... vi

LIST OF TABLES ....................................................................................................................... xi

LIST OF FIGURES ..................................................................................................................... xiii

LISTS OF PUBLISHED PAPERS ............................................................................................... xv

CHAPTER 1 ................................................................................................................................. 1

INTRODUCTION .......................................................................................................................... 1

1.1 Background of the Research.................................................................................................. 1

1.2 Research Problem and Research Questions........................................................................ 3

1.2.1 Research Aim, Questions and Objectives ..................................................................... 5

1.3 Research Design ..................................................................................................................... 5

1.4 Structure of the Thesis ......................................................................................................... 7

1.5 Summary ............................................................................................................................... 9

CHAPTER 2 ............................................................................................................................... 11

ADAPTIVE RE-USE PROJECTS ............................................................................................... 11

2.1 Adaptive Re-use Terminologies ......................................................................................... 11

2.2 Adaptive Re-use Process .................................................................................................... 12

2.3 Adaptive Re-use Project Success Enablers ....................................................................... 14

2.4 The Sources of Complexity in Adaptive Re-use Projects ............................................... 16

2.5 Summary ............................................................................................................................ 18

CHAPTER 3 ............................................................................................................................... 20

INTELLECTUAL CAPITAL AND PROJECT SUCCESS COMPONENTS ....................................... 20

3.1 Terminology ......................................................................................................................... 20

3.2 Intellectual Capital in Construction Projects .................................................................... 21

3.3 Project Success Components ............................................................................................. 25

3.4 Summary ............................................................................................................................. 32

CHAPTER 4 ............................................................................................................................... 33

INTELLECTUAL CAPITAL FRAMEWORK FOR SUCCESSFUL ADAPTIVE RE-USE PROJECTS .......................................................................................................................... 33
4.1 Justification for a Knowledge Management and Success Factors Approach ........................................33
4.2 Positioning the Intellectual Capital Framework for Successful Adaptive Re-use Projects ..........34
4.3 The Generic Intellectual Capital Framework for Successful Adaptive Re-use Projects .............36
   4.3.1 KM Approach: Knowledge Creation Theory .................................................................38
   4.3.2 KM Approach: Knowledge Transfer .................................................................................39
   4.3.3 The Frameworks Gap ........................................................................................................40
4.4 Six Component of Success Factors to Support the Process of Problem Solving .....................41
   4.4.1 Trust ..................................................................................................................................42
   4.4.2 Supportive Attitude ............................................................................................................42
   4.4.3 Communication ..................................................................................................................43
   4.4.4 Appreciations ....................................................................................................................45
   4.4.5 Collaboration ......................................................................................................................45
   4.4.6 Skill and Expertise ..............................................................................................................46
4.5 Summary ..................................................................................................................................47

CHAPTER 5 .................................................................................................................................48

RESEARCH DESIGN AND METHODS .......................................................................................48

5.1 The Study Purpose and Research Questions ...........................................................................48
   5.1.1 The Purpose of a Study ........................................................................................................48
   5.1.2 The Research Questions .....................................................................................................49
5.2 Research Dimension and Methods ..........................................................................................50
   5.2.1 Research Dimension ..........................................................................................................51
   5.2.2 Research Methodology ......................................................................................................53
5.3 Case Study Design ....................................................................................................................57
   5.3.1 The Selection of Case Study ..............................................................................................58
   5.3.2 Unit of Analysis ..................................................................................................................61
   5.3.3 Case Study Selection .........................................................................................................62
   5.3.4 Data Collection Techniques ..............................................................................................64
5.4 Data Analysis ...........................................................................................................................71
   5.4.1 Data Analysing Strategy .....................................................................................................72
   5.4.2 The Process of Data Analysis .............................................................................................73
5.5 Validity of Data Findings ........................................................................................................79
   5.5.1 Triangulation ......................................................................................................................79
   5.5.2 Validity ..............................................................................................................................80
   5.5.3 Reliability (Trustworthiness/Dependability) .......................................................................81
5.6 Overall Research Methodology Process ..................................................................................81
5.7 Summary ..................................................................................................................................84

CHAPTER 6 ..................................................................................................................................85

CASE STUDY 1: WITHIN-CASE ANALYSIS AND DATA FINDINGS ............................................85

6.1 Overview of Case Study 1 ........................................................................................................85
Research Findings 1: Components of Success for the Process of Problem-solving Process in Case Study 1
6.3.1 Collaboration.................................................................94
6.3.2 Communication............................................................103
6.3.3 Skills..............................................................................106
6.3.4 Past Experience..............................................................111
6.3.5 Trust...............................................................................115
6.3.6 Supportive Attitude.........................................................118
6.3.7 Summary.........................................................................120

Research Findings 2 and 3: Key Components of Problem Solving in Relation to Knowledge Transfer and Knowledge Creation
6.4.1 Research Findings 2: Key Components of Problem Solving- Knowledge Transfer Context.........................................................122
6.4.2 Research Findings 3: Key Components of Problem Solving- Knowledge Creation Context..........................................................140
6.4.3 Summary.........................................................................147

Summary..................................................................................149

CHAPTER 7 .............................................................................151

CASE STUDY 2: WITHIN-CASE ANALYSIS AND DATA FINDINGS...................................................................151

7.1 Overview of Case Study 2..................................................151
7.1.1 The Historical Background of the Buildings..................152
7.2 Adaptive Re-use Projects Background..............................154
7.2.1 The Interviews...............................................................154
7.3 Research Findings 1: Components of Success for the Problem-solving Process in Case Study 2...........................156
7.3.1 Communication............................................................159
7.3.2 Collaboration.................................................................163
7.3.3 Past Experience..............................................................170
7.3.4 Skills...............................................................................173
7.3.5 Trust...............................................................................178
7.3.6 Supportive Attitude........................................................181
7.3.7 Summary.........................................................................184

7.4 Research Findings 2 and 3: Key Components of Problem Solving in Relation to Knowledge Transfer and Knowledge Creation........................................................................185
7.4.1 Research Findings 2: Key Components of Problem Solving- Knowledge Transfer Context.........................................................186
CROSS-CASE ANALYSIS AND DATA FINDINGS ................................................................. 213

8.1 Comparing Backgrounds of the Two Case Studies .................................................. 213
  8.1.1 The Location of the Historical Buildings ......................................................... 214
  8.1.2 The Types of Historical Buildings vs Their New Functions .............................. 215
  8.1.3 The Project-to-project Time Series Scenario Approach .................................. 215
  8.1.4 The Project Team Members’ Involvement in AR1 and AR2 Projects ................. 216

8.2 Comparing Research Finding 1 in Case Studies 1 and 2 on Five Components of
  Success in the Problem-solving Process .................................................................. 217
  8.2.1 Comparing the Component of Collaboration .................................................... 219
  8.2.2 Comparing the Component of Communication ................................................ 220
  8.2.3 Comparing the Component of Skills .................................................................. 221
  8.2.4 Comparing the Component of Past Experience .................................................. 221
  8.2.5 Comparing the Component of Trust .................................................................... 222

8.3 Comparing Research Finding 2 in Case Studies 1 and 2 on Four Key Components of
  the Problem-solving Process in the Knowledge Transfer Context .......................... 223
  8.3.1 Comparing the Key Component 1: Efficiency and Effectiveness Mode in the
       Problem-solving Process ..................................................................................... 223
  8.3.2 Comparing the Key Component 2: Same Project Teams in the Problem-
       solving Process .................................................................................................... 224
  8.3.3 Comparing the Key Component 3: Project Team’s Actions in the Problem-
       solving Process .................................................................................................... 225
  8.3.4 Comparing the Key Component 4: Sources of Information ............................... 226

8.4 Comparing Research Finding 3 in Case Studies 1 and 2 on Two Key Components of
  the Problem-solving Process in the Knowledge Creation Context .......................... 228
  8.4.1 Comparing the Key Component 1: Generating New Skills ............................... 229
  8.4.2 Comparing the Key Component 2: Developing New Solutions ........................ 230

8.5 Summary of Research Findings in the Two Case Studies ........................................ 231
  8.5.1 Findings from the Documentation Analysis ...................................................... 231
  8.5.2 Findings from the Interview Analysis: The Relationship between Findings 1, 2
       and 3 .................................................................................................................... 232

8.6 Summary ..................................................................................................................... 233

CHAPTER 9 ..................................................................................................................... 235

DISCUSSION, SYNTHESIS AND REFINEMENT OF INTELLECTUAL CAPITAL FRAMEWORK
FOR SUCCESSFUL ADAPTIVE RE-USE PROJECTS ....................................................... 235
LIST OF TABLES

Table 5.1: The rationale of literature selection ................................................................. 49
Table 5.2: Distinguishing research method and condition .................................................. 54
Table 5.3: Coordination of data collection method with research question ......................... 55
Table 5.4: The comparison of Case Study 1 and Case Study 2 ........................................ 64
Table 5.5: The selection of Nonprobability Samples in this study ..................................... 64
Table 6.1: Participant grouping, position and code name (for confidentiality) of key people 89
Table 6.2: The project team involvement in AR1 and AR2 .............................................. 91
Table 6.3 Frequency of participants’ view about the six components of success .................. 93
Table 6.4: Explicit resources in case study 1 ..................................................................... 99
Table 6.5: Evidence of the transferring of project team members’ knowledge in case study 1 124
Table 6.6: Evidence of effectiveness and efficiency of problem-solving process in case study 1............................................................................................................................................. 126
Table 6.7: Evidence of having the same project teams in problem-solving process in case study 1 ............................................................................................................................................. 131
Table 6.8: Evidence for the key of action in the problem-solving process in case study 1 ..... 135
Table 6.9: Evidence of sources of information referred to by project team members in the problem solving process for case study 1 ................................................................. 139
Table 6.10: Evidence of new skills that generated by project team members in the problem-solving process for case study 1 ................................................................. 142
Table 6.11: Evidence of new solutions developed by project team members in the problem-solving process for case study 1 ............................................................................................................................................. 146
Table 6.12: The summary of key findings in case study 1 ................................................. 147
Table 7.1: Participant grouping, position and code name (for confidentiality) of key people 154
Table 7.2: Project team Involvement in AR1 and AR2 projects ........................................ 155
Table 7.3: Frequency of participant’s view about the six components of success .......... 158
Table 7.4: Evidence of transferring of project team members; knowledge in Case Study 2 187
Table 7.5: Evidence of effectiveness and efficiency of problem-solving process in case study 2 ............................................................................................................................................. 190
Table 7.6: Evidence of having the same project teams in the problem-solving process in case study 2 ............................................................................................................................................. 193
Table 7.7: Evidence for key of component of action in problem-solving process in case study 2 ............................................................................................................................................. 196
Table 7.8: Evidence of sources of information that referred to by project team member in the problem-solving process for case study 2 ................................................. 201
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.9</td>
<td>Evidence of new skills that generated by project team members in the problem-solving process for case study 2</td>
<td>204</td>
</tr>
<tr>
<td>7.10</td>
<td>Evidence of new solutions that developed by project team members in the problem-solving process for case study 2</td>
<td>207</td>
</tr>
<tr>
<td>7.11</td>
<td>The summary of key findings in case study 2</td>
<td>209</td>
</tr>
<tr>
<td>8.1</td>
<td>Comparison of the Case Studies' Backgrounds</td>
<td>214</td>
</tr>
<tr>
<td>8.2</td>
<td>Comparison of components of success in Case Study 1 and in Case Study 2</td>
<td>218</td>
</tr>
<tr>
<td>8.3</td>
<td>Summary of negative responses from case studies 1 and 2</td>
<td>223</td>
</tr>
<tr>
<td>8.4</td>
<td>Positive responses about working with the same project teams in both case studies</td>
<td>225</td>
</tr>
<tr>
<td>8.5</td>
<td>Actions taken by project teams in both case studies</td>
<td>226</td>
</tr>
<tr>
<td>8.6</td>
<td>Related knowledge from sources of information in problem-solving process</td>
<td>227</td>
</tr>
<tr>
<td>8.7</td>
<td>Knowledge related to generating new skills</td>
<td>229</td>
</tr>
<tr>
<td>8.8</td>
<td>Summary of comparison of developing new solutions between case studies 1 and 2</td>
<td>231</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 3.1: Four types of Intellectual Capital .......................................................... 22
Figure 3.2: Components of Project Success ........................................................... 26
Figure 4.1: The “project-to-project time series” scenario ..................................... 35
Figure 4.2: Location of Intellectual Capital Project Success ............................... 36
Figure 4.3: Knowledge Management Approach into the problems solving process in gaining adaptive re-use success .......................................................... 38
Figure 5.1: General understanding of research dimension ..................................... 51
Figure 5.2: Case studies situation for each case .................................................... 56
Figure 5.3: The synthesising of multiple case study strategy between Yin and Stake .... 57
Figure 5.4: The selection of case studies ............................................................... 59
Figure 5.5: The case study method ......................................................................... 61
Figure 5.6: The group of participants ..................................................................... 63
Figure 5.7: Three-Principles of Data Collection .................................................... 65
Figure 5.8: Convergence and Non-convergence of Multiple Sources of Evidence .... 66
Figure 5.9: Thematic questions in qualitative interview ......................................... 67
Figure 5.10: Example of interview schedules ....................................................... 69
Figure 5.11: The Appropriate Data Analysis steps suggested for this study .......... 74
Figure 5.12: Two Levels of Data Analysis .............................................................. 75
Figure 5.13 Using NVIVO Version 9 in storing the sources of interview transcription .. 76
Figure 5.14 Using NVIVO Version 9 in coding the interview transcriptions .......... 77
Figure 5.15: Clarifying the validation terms for standards for the quality of conclusion .... 79
Figure 5.16: Overall Research Methodology Process .......................................... 83
Figure 6.1: The location of Geelong in Victoria, Australia ..................................... 86
Figure 6.2 Case Study 1 (a) The location; (b) An original space arrangement in AR1 and AR2 building ................................................................. 87
Figure 6.3: The flow of early development of AR1 and AR2 Woolstores ............... 88
Figure 6.4 components of significant of ESD in AR2 ......................................... 88
Figure 6.5: Subsections of success components in Case Study 1 ......................... 92
Figure 6.6: Number of references (quotes) about the cooperation and understanding in the interview data ................................................................. 95
Figure 6.7 Cooperation components that contributed to collaboration in interview data ...... 96
Figure 6.9: The components of communication in interview data ......................... 104
Figure 6.10: Number of references (quotes) about communication in interview data 105
Figure 6.11: Skills components in interview data ............................................... 108
Figure 6.12: Number of references (quotes) in interview data about the skills ....... 109
Figure 6.13: The experience components in interview data .................................. 112
Figure 6.14: Number of references (quotes) in interview data about component of experience .......................................................... 113
Figure 6.15: Trust components in interview data .................................................. 116
Figure 6.16: Number of references (quotes) in interview data about the trust ........ 117
Figure 6.17: The supportive attitude components in interview data .................... 119
Figure 6.18: Subsections in key components in problem-solving process ............... 122
Figure 6.19: Sources of information in case study 1 ............................................. 137
Figure 7.1: Building Plan: Building 20 and Building 1 ........................................ 152
Figure 7.2: Subsections of success components in case study 2 ........................... 157
Figure 7.3: Communication components in the interview data ............................ 159
Figure 7.4: Number of references (quotes) in interview data about the communication .... 160
Figure 7.5: Number of references (quotes) in the interview data about cooperation and understanding ................................................................. 164
Figure 7.6: Cooperation components that contributed to collaboration in interview data ................................. 165
Figure 7.7: Understanding components that contributed to collaboration in interview data 168
Figure 7.8: Past experience components in interview data ..................................... 171
Figure 7.9: Number of references (quotes) in the interview data about experience ...... 172
Figure 7.10: Skills components in interview data ................................................. 175
Figure 7.11: Number of references (quotes) in interview data about the skills .......... 176
Figure 7.12: Trust components in interview data .................................................. 179
Figure 7.13: Number of references (quotes) in interview data about the trust ........ 180
Figure 7.14: Supportive attitude components in interview data ............................ 182
Figure 7.15: Number of references (quotes) in interview data about the supportive attitude ................................................................. 183
Figure 7.16: Subsection of key components in problem-solving process .................. 186
Figure 7.17: List of explicit documents used by client and project team in case study 2 198
Figure 7.18: Sources of information in case study 2 ............................................. 199
Figure 9.1: A Diagram Synthesising the Research Findings ................................... 241
Figure 9.2: An Intellectual Capital Framework for Successful Adaptive Re-use Projects ... 247
Figure 10.1: Research Findings in Relation to Research Question 1 ........................ 259
LISTS OF PUBLISHED PAPERS


CHAPTER 1
INTRODUCTION

This chapter introduces the background and the rationale for this study. It also provides a brief overview of the literature review and the theory underpinning the research and the methodology used to explore the research question.

1.1 Background of the Research

Most of the countries in the world have listed many historical buildings with high quality architectural and historical significance. Some have been re-use and some have been abandoned and demolished (Douglas 2006; Bullen and Love 2010; Bullen and Love 2011a & b; Love and Bullen 2009). The listing process contributes to the value of historical buildings in terms of heritage and architectural significance. Many conservation scholars argued that historical buildings have many advantages if being re-use rather than demolished and replaced with new buildings (Latreille et. al 1982; Kincaid 2000; Kurul 2007; Bullen 2007; Bullen and Love 2010). These advantages include achievement of sustainable development, reduced pollution, reduce land price, speed up construction process, and contribute to the economics development of a country (Bullen and Love 2011 a & b; Douglas 2006).

Protecting the building integrity by way of restoration and re-using existing material, and structure is significant in the re-use of historical buildings. The re-use of historical buildings would involve the re-use of the original materials, structures and the entire building as well as integrating new materials to accommodate the new building functions (Cooper 2001; Bullen and Love 2011 a & b).

Involvement in re-use of historical buildings is not an easy process. Project teams have to go through various stages or processes that are quite different from the construction of a new building. The nature of each construction projects is temporary and could contribute to loss of knowledge and experience. The challenge is to ensure that the richness of knowledge and experience in historical building preservation practices are kept and well preserved. The knowledge and experience of the project team members is very valuable for the enhancement of problem solving capability in the next project. Therefore, managing the knowledge and experience gathered from a project is important to ensure that the
knowledge and experience of the project teams are not lost for future historical building projects.

In the process of redevelopment of historical buildings, the adaptive re-use concept has been applied to ensure that the new building function is compatible with the existing building historical evidence. This method involves the adaptation of the building which started with the acquisition and ended with the occupation of the building (Latham 2000). The uniqueness of the adaptive re-use concept is that it often relates to the design and construction of heritage and/or architectural significance of the building involved.

The adaptive re-use in historical building projects often raise complexity in the design and construction process as compared to new building projects. This includes incomplete and inaccurate design information (Shipley, Utz & Parson 2006; Karim et. al 2007) and lack of capable professional expertise (Ball 1999; Kurul 2007) that affect the design and construction process of this kind of project. Moreover, in the design and construction phases, availability of historical information, such as original drawings and documents related to the buildings are important in the development approval process. Hence, it is important for each practitioner in the adaptive re-use of historical buildings to understand and embrace the knowledge on heritage requirements in problem solving process.

Since all adaptive re-use projects are unique, therefore, understanding the complexity and the problem solving approach adopted by adaptive re-use project practitioners is crucial to the success of future adaptive re-use projects. However, the current major issue on adaptive re-use is the lack of professional expertise and cooperation between practitioners (Shipley, Utz & Parson 2006; Kurul 2007). Moreover, the issue has become more complex when the same team members were not engaged in the new projects (Shipley, Utz & Parsons 2006; Karim et al 2007).

Therefore, this study seeks to investigate and describe the process of managing the knowledge and experience acquired from one adaptive re-use project to the next, and including the intervening period between them. This study is positioned in the context of historical building and the enhancement of knowledge in relation to the whole adaptive re-use process.
1.2 Research Problem and Research Questions

The research problem is concerned with the lack of research related to success factors and knowledge management in adaptive re-use of historical building projects. Previous studies have not brought together the three important elements of adaptive re-use, success factors and knowledge management.

Therefore, the success factors approach and the knowledge management approach will be adopted as this study in regards to identifying the key components in problem solving within knowledge creation and knowledge transfer from project to project over time. This is critically important to be applied by the client, design team consultants and contractor. This study may produce a better approach within the combination of project management systems and the knowledge management process around the project teams’ skills. To underpin the research, the discussion on adaptive re-use success theoretically discovered that very little has been mentioned on project management and teams’ members’ skills particularly in facing the issues in the projects. To overcome the lack of empirical literature on success factors in adaptive re-use, this study reviewed the empirical studies on success factors in the common construction industry. The success factors approach was first introduced by John Rockart to define the important information that is required by chief executive officers in information systems (Rockart 1977). The success factors approach can be used as a concept as well as a methodology. The success factors concept refers to key areas where ‘things must go right’ for any competitive occasion. In relation to the success factors concept, Boynton & Zmud (1984) defined the success factors concept as a methodology approach or research method as a technique that attempts to make explicit key areas that prescribes managerial success.

The implementation of success factors and knowledge management as a research concept is considered as manageable in identifying the key areas that are vital for organisational success. The success factors also fit as a research method in regards to identifying the broader critical success factors (Gajendran, Brewer & Chen 2005). Thus, this study identifies the success factors that influenced from the late era 1990s and late era 2000s in managing the project teams’ knowledge and experience from project to project. Perhaps there have been a distinctive management approach, factors of success or other aspects of gaps or differences in the two different eras. Therefore, it is timely to propose the intellectual capital framework to help practitioners in this manner to protect their knowledge and enhance the performance of the management approach by project teams’ members and lead them to success from project to project.
The lack of empirical studies on the success factors and knowledge management in the adaptive re-use scope provided the idea for this study to investigate the potential factors that contribute to and are critical for adaptive re-use project success which can contribute to new knowledge and in this way solve any problem in running the project. This contributes to the idea of investigating the knowledge creation and knowledge transfer process to understand how the project teams used their skills and knowledge in solving problems. There has been a focus on explaining the effectiveness of adaptive re-use as the essential strategy in sustainable development with less investigation on the essential strategy of knowledge management. The teams’ members’ skills and experiences are the most valuable intellectual, human and social capital that will contribute to adaptive re-use projects (Erickson & Rothberg 2009; Chen, Partington & Wang 2008). However, the uniqueness of this study is to explore how the teams’ members manage their ‘rich’ intellectual capital across time periods: this is not covered by previous studies as they focused on one situation at one specific time period. We shall refer to this situation as the time-series scenario.

The process to capture and manage the intellectual capital of different expertise and knowledge needs to be explored since there is a lack of research exploring the complexity of project processes on adaptive re-use projects. The result from Erickson and Rothberg’s (2009) study indicated that intellectual capital can contribute to better results. They provided a strategy for knowledge management practice specifically based on time assessment. Their study was on information technology sectors. If we consider this longitudinal study (Erickson & Rothberg 2009) and apply the thinking to our current study, we need to acknowledge that the construction industry is made up of a whole series of fragmented, unique temporary projects. However, we need to develop our understanding of ways of threading the intellectual capital from one project to the next specific for this industry.

The research problem is concerned with; lack of empirical research to explore and analyse the process taken by the teams’ members to ensure that the intellectual capital can be managed in accordance with the longitudinal.

Input of the knowledge management approach is critical for adaptive re-use, since there is a lack of study on knowledge management in relation to the adaptive re-use challenges and success for future benefit. The multidisciplinary project teams involved in an adaptive re-use project have different roles, responsibilities, skills and experiences. Thus, the complexity of the adaptive re-use process also needs the awareness attitude which could come from their experiences on past projects. The collaboration and sharing of their experiences are appropriate in developing new knowledge for future projects particularly in the design and construction process.
1.2.1 Research Aim, Questions and Objectives

The aim of this study is to analyse the integration of project management systems (success factors) and the knowledge management process in relation to the project teams’ skills within the unique environment of adaptive re-use building setting. Two research questions are posed:

1. What are the components of success and the key components of knowledge creation and transfer that contribute to problems solving on adaptive re-use projects within the time series scenario?

2. How do the components of success and the key components of solving problems rely on each other to help the development of intellectual capital framework for successful adaptive re-use projects?

The objectives of this research include the following:

- To understand the practice and components of success in adaptive re-use projects.
- To identify the component of success for the process of problem solving in the time-series scenario of adaptive re-use projects
- To identify the key components of problems solving in the knowledge creation and knowledge transfer context
- To investigate the relationship between components of project success and key components of knowledge creation and transfer in problem solving process

1.3 Research Design

In this section, preliminary research design for this study is explained. It addressed the research aim, objectives and research questions. The study proposed the development of a conceptual model and refinement model based on qualitative approach through collection, analysis and synthesis the solid empirical data from case study. This study used qualitative methodology. According to O’Leary (2004), the qualitative method can be subjective, value-laden, biased and an ad hoc process that accepts multiple realities through the study of a small number of cases.

Case Study

The study applied two intrinsic case studies involved four completed adaptive re-use of historical buildings. The cases are undertaken because the study requires understanding the
problem solving process in adaptive re-use projects. Even though these cases has limited participants, the purpose of this examined the experience of participants who involved in exemplars cases in Australia particularly. Case studies have been selected to capture their component of success and key components for knowledge creation and transfer activities in adaptive re-use of historical buildings. It will be used to test the proposed conceptual framework for the preliminary research design used in this study. According to Kurul (2007), the case study approach is able to retain a holistic and meaningful view of real-life events. Through case studies, it can in fact be used to expose a theoretically-based study. The exploratory case studies can bring new understanding besides the theoretical. Most importantly, case studies can provide very strong supportive evidence for a proposed conceptual model for this study. The evidence from the real world provides anecdotal evidence for a theory. Besides that, the research provides concrete findings in generating new theory in relation to project success.

**Interview**

Four historical buildings had been successfully converted to university buildings were chosen. In addition, these four historical buildings have components of project teams’ members’ learning experience that can be used to strengthen the conceptual model with effectiveness evidence from past and future projects. The four historical buildings are heritage listed in Victoria. The detail of four historical buildings and the heritage listed are explained in Chapter 6, Section 6.1.1 and in Chapter 7, Section 7.11. The project teams and client are the same key people who were involved in both projects but in different eras. This study has conducted one-to-one interviews which are using face-to-face interviews and not over the telephone. The face-to-face interview is involved the project manager, architect, quantity surveyor, building surveyor, fire engineer, structural engineer, heritage advisor, town planner and contractors on the adaptive re-use of a historical building to explore the effectiveness of project management implementation as a mechanism for the activities of knowledge creation and knowledge transfer. The face-to-face interview allowed the researcher control during the interview session. On the other hand, the participants had the freedom to answer the questions and express his or her perspectives. Interviewing is a method of data collection where the researcher asks the participants’ questions with open-ended and semi-structured questionnaires. The face-to-face interviewing process has very specific communication with particular rules. The semi-structured questions include flexibility in questions and answers. The researcher will define a questioning plan but will pursue a more conversational style of interview that may see questions answered in an order more natural to the flow of interview process. An informal approach is used for the interview process. The informal approach establishes a more relaxed trust between researcher and
participants and creates a more natural environment conducive to open and honest communication (O’Leary 2004). The interviews were held in the participants’ offices and, depending on their time and run for about one to two hours per session of Question and Answer. The data from participants were recorded so it has interpreted in data analysis and discussion.

**Content Analysis**

Content analysis is interpreted the qualitative interview data according to two levels of case study scenario; *within-case* and *cross-case* analysis. This study used Nvivo Version 9 as a tool for data theming and coding. An analysis of the in-depth interview is facilitated the development of the Intellectual Framework for successful adaptive re-use projects for the effectiveness of the adaptive re-use strategy and project success based on the following project management and knowledge management perspectives.

**Document Analysis**

To support data analysis from the interview, the documents for both case studies are used to understand the completed projects. The documents are the drawings of the buildings, the project reports, the contract documents, conservation management plans and the heritage regulations and policies that were used for the development application for approval and along the project life-cycles until the completion and occupation stage.

**1.4 Structure of the Thesis**

This thesis contains ten chapters including literature reviews. The literature leads to conceptual model development chapters. The explanation of the research methodology chapter is a basis for this research as it flows towards data collections, analysis and discussion in regards to the development of an Intellectual Framework for successful adaptive re-use projects in managing the adaptive re-use of historical buildings. The outline of this thesis is as follows:

*Chapter 2- Adaptive Re-use*

This chapter describes the literature on the adaptive re-use approach. To understand the adaptive re-use, the terminology and the process of adaptive re-use are explained as well. Chapter 2 also describes the adaptive re-use enabler’s i.e. the skills, knowledge and experience are explained to show the importance of these aspects of the successful adaptive re-use projects. Finally, the sources of complexity occur during the design and
construction in terms of lack of knowledge and skills among team members is discussed in this section.

Chapter 3- Intellectual Capital and Project Success Components

Chapter 3 describes the knowledge management approach including the intellectual capital, knowledge creation and knowledge transfer theory. This chapter also synthesized six components of success in relation to the knowledge creation and knowledge transfer activities. The discussion on components of success leads to the development of the present conceptual model in chapter 4.

Chapter 4- Conceptual Model Intellectual Framework for Successful Adaptive Re-use Projects

The proposed conceptual model for this study is based on critically reviewing the knowledge management and success factors in adaptive re-use. The frameworks that have been developed in previous studies were based on a background of empirical studies. The proposed framework is synthesised appropriately with the knowledge management approach which contributed to the gaps from previous researchers in adaptive re-use and success factor. This conceptual model is used and developed to compare with real-world perceptions and experiences of similar project team members for different completed periods.

Chapter 5- Research Design and Methods

This chapter describes the research methodology approach that is employed in the present research. It discusses two cases of historical buildings based on historical views. The historical views consist of two sections, the history of the buildings and the history of transferring the process to the adaptive re-use scope since both projects were completed in 1996 and 2009. The participants or project teams were involved with both projects but in two different eras of the implementation of project management. This chapter also shows details of the projects and participants involved in the interview phases. The flow of data collection, data analysis and data interpretation methods and the development of the model are also covered in chapter 5.

Chapter 6- Case Study 1: Within-Case Analysis and Data Findings

Chapter 6 is involved with the empirical methodology in case study 1 to develop the Intellectual Capital Project Success contributed by the present research. The discussion and interpretation of data from interviews and project documentation are the backbone of this chapter.
Chapter 7- Case Study 2: Within-Case Analysis and Data Findings

The data analysis is based on the interpretation of the interviews same as discussed in chapter 6. The discussion and interpretation of data from interviews and project documentation are the backbone of this chapter.

Chapter 8- Cross-Case Analysis and Data Findings

This chapter is the backbone of present studies in contributing new knowledge and benefits for future adaptive re-use projects towards achieving project success. The analysis process compares the proposed conceptual model and the present empirical data toward developing the new knowledge and contributing that blends the theoretical and empirical evidence.

Chapter 9- Discussion, Synthesis and Refinement of Intellectual Capital Framework for Successful Adaptive Re-use Projects

The cross-case analysis approach is used to compare the outcome of case study 1 and case study 2 in developing the generic of Intellectual Framework for successful adaptive re-use projects.

Chapter 10 - Conclusion

The last chapter concludes the theoretical and empirical evidence from the present study. The conclusion is drawn as to whether the critical success factors are compatible with enhancing the management quality and performance in such a way as to achieve project success. It is also beneficial to all project teams' members in the uniqueness of adaptive re-use as a strategy in sustainable development. Further research and ideas to enhance adaptive re-use projects were found in the present research.

1.5 Summary

This chapter explained the background of the research and states the research objectives. Two research questions are also stated. It then provides a description of research design that employed in this study. Figure 1.0 shows the thesis organization for the whole thesis.
There are 2 research questions considered in this study.

Research question 1 and 2 arises in chapter 2 and 3.

Research questions 1 and 2 developed in chapter 4.

Results of study described in chapter 9 and research question 1 and 2 explicitly answered in chapter 9.

Figure 1.1 Thesis Organisation
CHAPTER 2
ADAPTIVE RE-USE PROJECTS

This chapter is structured to understand the adaptive re-use practice. This section describes the terminologies of adaptive re-use based on previous studies’ definitions. As the process of the development of historical buildings to provide new functions is different compared to new construction, the process is also described in this section. Next, the adaptive re-use enablers i.e. the skills, knowledge and experience are explained to show the importance of these aspects to the successful adaptive re-use projects. Finally, the sources of complexity occur during design and construction in terms of lack of knowledge and skills among teams’ members is discussed in this section.

2.1 Adaptive Re-use Terminologies

According to Burra Charter, conservation can be understood as the processes of looking after a place to maintain the cultural significance. The processes are including maintenance, preservation, restoration, reconstruction (redevelopment) and adaptation and will be commonly a combination of the processes. Each of processes types in conservation is different in concept, scope, process and outcome. Most important expertise, skills and knowledge required by members of the project team are also very different. Therefore, the terminology section focused on the adaptation and re-use.

The adaptation is the process of maintaining and modifying the fabric of the historical buildings to suit with the proposed compatible use. Therefore, this section is defined the terminologies of adaptive re-use prior to the basic understanding of conservation and adaptation.

Adaptive re-use is the process to find new functions or uses for older buildings that are not connected with the original purposes. Sometimes, this approach is known as building recycling (Latreille et al. 1982) where it involves interior spaces changing (Cys & Lawrence 2008) as a means of making it suitable for new functions. Adaptive reuse also involves altering or adapting the façade of the historical building to bring it more into line with its new purpose (Tatum 2003). According to Latham (2000), adaptive re-use is the process of retaining as much as possible of the original buildings, but at the
same time upgrade the building performance to suit modern standard and new requirements.

In Australia, the term adaptive re-use basically refers to defined by Burra Charter Article 1 which defined it as modifying a place to suit the existing use or a proposed use. In the same vein, Marquis-Kyle and Walker (2004) and Walker (2000) define adaptive re-use or which they called adaptation approach as the consideration of alternatives that should be done seriously and with good will. They further argued that adaptation should not down-grade the place and the components that make it significant.

Adaptive re-use terminology could also relate to the uniqueness, to something special and expensive (Holyoake and Watt 2002 cited in Bullen 2007). On the other hand, as defined by Kurul (2007), adaptive re-use is an approach with complicated process. Moreover, as argued by Clark (2008), it is important to understand that adaptive re-use is the process of changing the intent of a structure to meet the modern user’s needs and is different from restoration or preservation. On the other hand, re-use involves an existing structure of historical buildings on the site and possibly adding to it or extending it and it normally implies a change of function resulting from building obsolescence which is also appropriate to the meaning of adaptive re-use (Gorgolewski 2008).

In this study, adaptive re-use is defined as a process of transforming the functions, the structures and the fabric or building envelopes of historical buildings to new and contemporary ways in the design and construction process. The process is complex and needs to be managed with the appropriate management skill of multi project team members who collaborate with the historic and modern value of the design and construction components.

2.2 Adaptive Re-use Process

The processes of adaptive re-use as suggested by Latham (2000) in his book Creative Re-use of Buildings are practically involved in the whole process from acquisition to occupation. The processes that were suggested by Latham ensured that the creativity of project team members was created and that the creative processes of adaptive re-use were transferred including during the design and construction phase. The processes can be summarised as follows:
- Acquisition – the process of purchasing the buildings if the owner of the building is not the client.
- Understanding the building – the architect, the planner, the heritage consultants’ synthesising process leads from the many documents to understand the building.
- The client’s brief – it is critical to establish the requirements of the client. A well-considered brief will avoid later problems if it is client, and not building, oriented.
- Cost and finance – an accurate cost plan by a quantity surveyor is essential. The main issue is if the teams’ members fail to understand the true cost of adaptive re-use. This stage, the feasibility study, is critical to raising funds.
- Design – this stage provides critical direction towards the production of accurate information, presenting a clearly transparent and acceptable design solution.
- Approval – the approval process can lead to delays in the process and costly appeals in regards to preparing a very high standard proposal.
- Production – detailed design established with client approval. The critical components of the production stage are time to prepare adequate information, the choice of procurement route, good co-ordination between consultants, the selection of the contractor, and preparing and maintaining a realistic programme. Additional fee costs and programme delays are likely if client requirements are changed that cause design variations.
- Implementation – the construction process starts at this stage. This stage demands respectful, co-operative and productive communication between the design team and contractor. The early investigation, planning, discussion, design, detailing and production must be pulled into focus to inform the work necessary on-site. The end result still depends upon any unforeseen implementation being in accordance with all that has gone before.
- Occupation – the project is considered complete if the building is occupied. The building needs to be maintained.

Within this process, it can be argued that the client and project teams will manage the project without any problems or issues during the whole process. The potential learning from creating and transferring knowledge on the process and solving the problems at the same time need to get attention and are very important in achieving a successful adaptive re-use project environment. The next section will explore the characteristics of a successful adaptive re-use project environment.
2.3 Adaptive Re-use Project Success Enablers

Previous research in adaptive re-use project success enablers focused on the skills and knowledge of project teams in management. A skill is the ability of individual to carry out the task that can be divided into general and specific skills. In construction industry, skills can be defined as technical ability to do all the works due to their nature of discipline (Kurul 2007, Shipley, Utz and Parsons 2006). Meanwhile, knowledge consist of non-verbalised, intuitive, unarticulated knowledge and knowledge is specified as being written (Mc Adam and McCreedy, 1999) including drawings, historical information and other stated information related to the adaptive re-use projects. Many researchers agreed that the skills and knowledge in adaptive re-use project are critically important for project success (Watson 2009a, 2009b; Zawawi and Abdullah 2008). The skills and knowledge sparked from understanding the roles (Kurul 2007; Latham 2000; McGraw 1980), essential experience in relation to historic building projects (Ball 2002; Cys and Lawrence 2008; Kincaid 2002) and problem solving skills (Egbu 1997; Latham 2000; Shipley, Utz and Parsons 2006). To synthesise, in order to ensure the success of a project, each of the project team members need to prepare themselves with good knowledge and skills related to project management associated with historical significance. Hence, involvement in many adaptive re-use projects will acquire extra knowledge and experience in managing such project.

The skills and knowledge would lead to clear understanding of the project team members’ roles in running adaptive re-use process (Kurul, 2007). Earlier, McGraw (1980) asserts that understanding of the roles of the project team members could overcome the unforeseen circumstances during the building design and construction process.

The entrepreneurial skill of the client, as argued by Latham (2000), can be a key to success in adaptive re-use project. He further argued that the client can easily identify the source of funds and has a wider idea of how to gain income from the application of adaptive re-use project to historical buildings such as income from the rental of the new functional space. In addition, the background of the client, according McGraw (1980), does has a significant effect on their skills. In his study on adaptive re-use on a wide three-storey “U” and a single-storey rectangular historical building he found that these projects were successful because the architect was himself the client and the owner of that building. This is a great reason for architects have an opportunity to design based on the flexibility of the space. With the wide three-storey “U” and a single-storey
rectangular section, the architect was able to open up the floor space to the public and design it for multi-purpose functions such as an open gallery and conference rooms which can accommodate up to 200 people. Besides that, part of the floor space on the second and third floors was opened to potential tenants giving them opportunity to re-use based on their needs. This clever action as a private owner has brought a good result to their investment in the adaptive re-use of historical buildings and achieved success of the project in terms of the client’s skill. In addition, Kurul (2007) agreed that the clients who have an understanding of the risks and attitudes associated with the adaptive re-use project can contribute to the success of the project. The skills of clients can direct project team members to identify the solutions on any problems or conflict in the design stage and construction stage.

Ball (2002) commented that the architect with essential experience in designing the existing historical building for the new functions can easily produce creative new functions for the buildings. As an example, in the United Kingdom, an architect who has wisely used the small floor area of a historical building has successfully transformed it into modern business retail and students’ residences (Ball 2002). Cys and Lawrence (2008) also found that the application of creative design to the existing architecture of the historical building is one of the success factors in an adaptive re-use project. Profoundly, their study found that there are other designers such as interior designers and engineers who were involved in the designing of the building. This means that the skills needed to produce creative design in historical buildings is dependent on the nature of their design practice. The knowledge that the architect, interior designers, engineers have an impact on the project success in their own ways. The architect produces the creative design on the fabric of the historical buildings and the engineer controls the structural design. In line with this, Kincaid (2000) warned that the designers should maintain the historical significance and architectural value when applying their creative design in historical buildings.

The Australian Institute of Architects (2010) defined that the architect is the person who has the qualifications and professional training, great vision and experience to manage the entire architectural design and construction process to achieve project success. In relation to architect’s experience, Ali, Kamarulzaman and Salleh’s (2009) found that architect with great experience and understanding on the design of adaptive re-use projects in the context historical buildings with new functions have a great impact on the success of the project. The above study shows that there is a strong relationship between architectural and structural components in producing good final drawings and
at the same time maintaining the historical and architectural value of the building. In addition, Watson (2009b) concurred that the production of good final drawings could avoid costly amendments to the drawings during the construction stage.

Latham (2000) and Watson (2009a and 2009b) suggested that the project team needs a catalyst to encourage them to implement teamwork spirit in order to achieve project success. According to Shipley, Utz and Parsons (2006) the catalyst refers to the project manager. The project manager must have wide experience to manage the project team members. He has to possess knowledge and skill in the decision making process and dealing with problems related to communication and relationship aspects. Watson (2009a) added that the project manager not only should have skills, knowledge and experience but also he or she should be able to transfer them to the project team members during the construction process.

Problems solving is also one of the important issues related to the skills and experience of project teams in achieving project success. An example is the project manager using a critical time to think about how to well manage and control the project from inception until completion. He or she should think about and identify the creative solution for problems which have occurred along the process. Egbu’s (1997) studies found that project manager skills and knowledge are important in ensuring project success through good planning, controlling and monitoring.

Even though, the contractor or the builder has a major responsibility to successfully convert the historical buildings into new uses, and the construction process itself needs the contribution of skilled workers or trades (Shipley, Utz and Parsons 2006). However, surprisingly, there is lack of adaptive re-use literatures that focused on the aspect of skills, knowledge and experience of the contractor or builder.

### 2.4 The Sources of Complexity in Adaptive Re-use Projects

Identifying the sources of complexity in adaptive re-use projects is particularly important. The complexity in adaptive re-use is needed to be managing by special knowledge, skills and experience of project team’s members. Without a specific knowledge, skills and experience of project teams members, this can be as sources of the complexity in adaptive re-use projects. However, there was very little empirical research that investigated the important of knowledge, skills and experience in adaptive re-use.
Baccarini (1987) defined complexity as ‘consisting of many varied interrelated parts and can be operationalized in terms differentiation and interdependency. However, Baccarrini (1987) only described two complexity including organisation and technological complexity. He concluded that the complexity are integrated the organisation and technological. In 1999, Williams embarked the complexity to the new paradigms. The complexity has defined by Williams (1999) as structural complexity and uncertainty in complex projects. The sources of complexity in terms of structural involved with number of elements and interdependence of elements. Meanwhile, uncertainty sources involved with how well the project team defined the project goals and how well-defined are the methods of achieving the project goals. Williams (1999) has concluded the complexity that reflected to this study where he pointed that structural complexity as the team structures the work and refines the method of re-planned by the project sub-teams. He also pointed uncertainty complexity as elements which are resulting from lack of knowledge, no experience in goals development. Kurul (2007) identified that project complexity can be differentiated during the stage. As example, at initial scheme stage could possible influence the planning stage decision by the developer’s cost and risk attitude. This attitude contributed to the delay of the projects and limited time to find the innovative design solution and project information.

However, this study focused on two main sources of complexity that are critical for adaptive re-use projects. The two sources of complexity related to adaptive re-use projects are lack of skills and knowledge; and inaccurate and incomplete information.

**Lack of skills and knowledge**

Watson (2009a) state five threats to the project success or sources of complexity including poor planning and scheduling of activities and resources; over optimistic expectation by the client; lack of management expertise; lack of coordination of resources throughout the project; and unknown and unforeseen circumstances due to the unique nature of most of project. The lack of management expertise including the project teams could contribute as the sources of complexity in relation with adaptive re-use projects. The project teams should be sensitive to the lacking of skills, knowledge and experience because adaptive re-use project has a complex process compared than new construction. Kurul (2007); and Bullen and Lover (2011 a & b) argued that there are barriers in adaptive re-use because of limited project team members’ knowledge and experience in adaptive re-use processes and thus led to complexity. It can also lead to other sources where there are lacks of skill of project team members due to limited knowledge in adaptive re-use projects. Within the limited skills, knowledge and
experience, the design and construction problems are impossible to be well managed (Bullen and Love 2011 a & b). According to Shipley, Utz and Parsons (2006), lack of expertise of the project team members especially design team can lead to poor design and cause client dissatisfaction with the design. It is considered as serious issues and makes it vulnerable towards the entire adaptive re-use project.

**Inaccurate and incomplete information**
Inaccurate and incomplete information about the history of the buildings and the related information on design could contribute to the complexity in adaptive re-use project. It can be exemplified as inconsistent specification of workmanship and material clauses and such internal risks can affect the project implementation and project performance. Typically, the complexity in adaptive re-use project is mostly related with design development. As Pham (2006) stated that incomplete information during the design process is the source of complexity in adaptive re-use projects. The similar issues were stated by Gorgolewski (2008) that lacking clear information would provide a challenge to the architect in the early phases of design decisions and contribute complexity to the entire process. It is important to investigate and locate the original information, as it will reflect the design decision. Any delay would cause the architect to require more time in preparing the design and negatively affect the whole project schedule. This relates with issues on the managing adaptive re-use processes such as insufficient time of completion and risk of losing a historical significance of the original fabric resulting from negligence (Karim et. al 2007).

2.5 **Summary**

This chapter has discussed terminologies, process, enablers and sources of complexity of adaptive re-use project. Most of the literature generally discussed on the common aspects of adaptive re-use project success. The literatures do not explore how the skills, knowledge and experience that could be effectively created and transferred among the project team members during the process of adaptive re-use projects, intervening period and future projects. With respects to practitioners skills, knowledge and experience, there are lack of investigations that focused on the contractor's involvement in a successful adaptive re-use projects. In addition, the previous literatures also not discussed the other important factors in adaptive re-use including historical, social, technical, architectural in relation with knowledge, skills and experience. Hence, this study intends to fill these gaps through explore the significant of skills, knowledge and experience of project teams members in case studies. The
case is so unique and often a specialized market to capture learnings from projects. Hence, this lead to the review of knowledge management, intellectual capital and project success components in chapter 3 to link chapter 2 and chapter 4.
CHAPTER 3
INTELLECTUAL CAPITAL AND PROJECT SUCCESS COMPONENTS

Chapter 3 reviews on knowledge management that provides a structured way to comprehend the complexity and chapter 4 provides the conceptual model that structures a knowledge management framework specifically for this study. The purpose of this chapter is to understand knowledge management area and intellectual capital. Next, the project successes components that relate particularly to the construction industry are also explained including (a) trust, (b) supportive attitude, (c) communication, (d) appreciation and recognition, (e) collaboration, and (f) Skills and Knowledge. This significant aspect to this section is the linking of knowledge management to the project success factors literature and most importantly the role of intellectual capital.

3.1 Terminology

The following sub-sections explain the terminology of knowledge management and intellectual capital. This section is important as the first step to understand the significant of knowledge management and intellectual capital in adaptive re-use. The link of knowledge management and intellectual capital is described and synthesised in Chapter 4, Section 4.2 Positioning the Intellectual Capital Framework for Successful Adaptive Re-use Projects and in Section 4.3.3 The Frameworks Gap.

Knowledge Management

Before defining intellectual capital, it is common for many authors to relate this concept to knowledge management. The reason is that intellectual capital is one of the branches of knowledge management building blocks. Knowledge management has been defined in myriad ways. For example Kululanga and McCaffer (1993) described knowledge management as managing all the information of the organisation in an effective manner. Kamara and Augenbroe et al. (2002) refer knowledge management as the context and content of knowledge in organisations. They proposed that knowledge is a component of the system in the task-performing system. On the other hand, Wenger (2004) defines knowledge management as the effort of practitioners to manage knowledge well in a proper way. Based on foregoing definitions, this study defines knowledge management as project team members’ ability to manage their intellectual capital within cognitive functions and supporting the entire adaptive re-use process.
Intellectual capital has been defined as intangible assets, knowledge assets, core competencies, dominant strategic assets (Brooking 1999; Pretorius and Coetzee 2009). This definition is close to those of London and Chen’s (2004); Rastogi (2000); Mavis Yi-Ching and Yung Shui (2009) and Edvinsson and Malone (1997) who defined intellectual capital as the accumulation of skills, experiences, competencies and knowledge of project teams. These processes are cumulative and involved the creation and transfer process within the projects in relation to the collection process for the problem and how the teams manage to solve all the problems (Mavis Yi-Ching and Yung Shui 2009; Pretorius and Coetzee 2009).

This study synthesise the definition of intellectual capital as accumulative of skills, knowledge and experience of project teams members. Three components of intellectual capital is part of knowledge management approach which crucial in any construction process particularly in adaptive re-use projects. This study’s definition of intellectual capital is consistent with London and Chen’s (2004); Mavis Yi-Ching and Yung Shui (2009) and Edvinsson and Malone (1997).

3.2 Intellectual Capital in Construction Projects

The concept of intellectual capital has received extensively in construction industry. As define of terminology of intellectual capital in Section 3.1, the significant of accumulative skills, experience and knowledge need to be related with the adaptive re-use projects. The construction projects generate rich intellectual capital within a dynamic and changing environment. The changes requires highly creative and innovative particularly in problem solving skills particularly in adaptive re-use projects. The main problem in construction projects is the difficulty to accumulate knowledge and skills.

The Types of Intellectual Capital

According to Kululanga and McCaffer (1993) the greatest challenge in construction projects is difficulty in managing intellectual capital of project team members. Based on the explicit-tacit and individual-social dimensions of intellectual capital, four types of knowledge (see figure 3.1) have been identified from organisational context: conscious knowledge, automatic knowledge, objective knowledge and collective knowledge (Spender 1996).
Spender’s model which considers conscious knowledge is formal, facts or conceptual knowledge, and is reliant on the individual’s conceptual skills and intellectual abilities. Automatic knowledge is similar with experiential knowledge terms. This type of knowledge is practical-oriented where the individual takes an action based on individual conceptual knowledge which is developed from practical experience. Objective knowledge is also regarded as a shared body of professional knowledge that has been documented and stored in writing, drawings, procedures, regulations and contracts. Collective knowledge is similar to embedded social knowledge or organisational routines and shared norms in any process involved. Through intellectual capital, it would be proved that the experiences of individuals and project throughout the process is of utmost importance and crucial to successful of project.

The study of the development and understanding how to better exploit the intellectual capital through knowledge management initiatives was not an easy task (Serenko et al. 2010). A variety of knowledge components would contribute to the intellectual capital management in any type of organisation. This is to signify the difficulty in order to identify, to investigate and to analyse the value of intellectual capital in organisations particularly in complex and temporary construction projects.
Mavis Yi-Ching and Yung Shui (2009) synthesised and conceptualised intellectual capital into human, organisation and social capital components. Mavis Yi-Ching and Yung Shui (2009) conducted their study to investigate the linkages between intellectual capital and organisational commitment. Within the cross-level design of a questionnaire survey which involved the top management and employer level, Mavis Yi-Ching and Yung Shui identified that organisational capital is stronger than human capital and social capital. Their conceptual model seems a more reliable result because it has been tested and provides empirical evidence through the questionnaire survey. However, this study argues that it can be more reliable if they tested and analysed it in the intrinsic and instrumental case study where the result could be more specific based on hands-on experience in relation to the intellectual capital processes with a sense of time and history. Hence, this study contributes to the intellectual capital processes with a sense of time and history where it was uncovered in Mavis Yi-Ching and Yung Shui’s study.

As noted by Erickson and Rothberg (2009), intellectual capital theory in measuring and managing intangible assets has been developed over the past twenty years. They also stated that much of the early work relating to intellectual capital had involved human capital particularly the skills of individuals. Thus, they used a longitudinal study for their case study and tested conceptual works in technology industries to examine the levels of intellectual capital over time and established better strategies for knowledge management practice. The results showed interesting answers from the computer-related technology-oriented industries, where there was a very clear difference between industries in terms of the intellectual capital level over time (1996 to 2006). In respect to the sense of time that is used in Erickson and Rothberg’s (2009) analysis, it is compatible with this study. However, the argument is on the applicability of the case study: this study is more focused on complex construction projects that are more complicated and which involve temporary organisations, not ongoing organisations in manufacturing industries. In terms of intellectual capital, it is more complicated and difficult to manage it and ensure it can be used and that there is an improvement when the project teams jump from project to project. This argument strengthens this study and shows that it is critical to investigate the knowledge creation and the knowledge transfer process in relation to project teams intellectually.

The process of capturing and managing the intellectual capital among multidisciplinary team members with different expertise and knowledge needs to be investigated since there is a lack of research on the specifics of complex projects involved with historical components, such as adaptive re-use projects. Most previous studies focused on the content of knowledge either tacit or explicit knowledge in general construction, procurement projects
and specifically on a key person but not on the entire process (Yuan and Yang 2009; Kivrak et al. 2008)

"In Kivrak et al.’s study a conceptual framework for capturing knowledge was proposed in relation to a particular actor, namely the contractor. The research was limited in that only one project was investigated although the researchers claimed that reusing the knowledge captured in one project for another project would be beneficial. This was similar to Yuan and Yang’s (2009) framework to promote specific infrastructure projects and sustainable knowledge, which insisted that knowledge, was different for each project particularly when involved with the time or era movement. Sometimes, unexpected knowledge appeared between the projects that could have happened in the intervening situation. Everybody knows what their valuable intellectual capital is particularly when it involves their roles and skills. However, it is difficult to know how to capture and manage it particularly when it involves communication and collaboration especially in a historical project approach.

The process of capturing and managing the intellectual capital among multidisciplinary team members with different expertise and knowledge needs to be investigated since there is a lack of research on the specifics of complex projects involved with historical components, such as adaptive re-use projects. Most previous studies focused on the content of knowledge either tacit or explicit knowledge in general construction, procurement projects and specifically on a key person but not on the entire process (Yuan and Yang 2009; Kivrak et al. 2008)".

This is an important first step in developing a platform for the study proposed in this research. It is acknowledged that knowledge should be captured from one project to the next but it is important to understand the process of achieving this. In reality adaptive re-use projects can take years to come to fruition and are not common. The intervening years between projects represents time where knowledge can be captured, enhanced, transformed, developed and then transferred to the next project. It would make a particular contribution to the theoretical and empirical research work in this field of research if we could capture real life instances of these types of scenario whereby a project team works on one adaptive re-use project and then at some time later forms an association again and works on another project. This if cause may be unique but then as the practice is so unique in itself and the market so closed this scenario may very well exist more often that we suspect. Investigating and analysis sequential adaptive re-use projects located as events in a time series scenario such as this would provide an invaluable case study and contribute to the body of knowledge in this field.
3.3 Project Success Components

Over the years, the term “success factors” has become well known as the best concept or method to pinpoint the project success of any particular organisation or industry such as in business organisations (Rockart 1977), information system management (Boynton and Zmud 1984), research and development and construction (Pinto and Covin 1989) and project organisations (Ruuska and Vartiainen 2003). The initial approach towards critical success factors is based on the concept of “success factors” first discussed in the management literature in 1961 by D. Ronald Daniel (Rockart 1977, p. 85). In business organisations, the success factors refer to areas of activity that should receive constant and careful attention from management. Boynton and Zmud (1984) defined success factors as those few things that must go well to ensure the success and have special and continual attention to bring out high performance.

The research interest on success factors in the construction industry has been diverse and taken up by many researchers and practitioners since the 1980s pioneering research by Slevin and Pinto in 1987. Next, the study of success factors led to a comparison of the construction industry with other industries. Pinto and Covin (1989) were the catalysts for the research in success factors for the construction industry as they made a comparison with the research and development (R&D) industry to explore managerial perceptions about characteristics and success factors for both industries.

The project success is achieved when all requirements are been implemented wisely. Based on past studies (De Wit 1988; Belassi and Tukel 1996; Chua, Kog and Loh 1999; Baccarini and Collin 2003; Nguyen and Ogunlana 2004; Yang et. al 2009; Alzahrani and Emsley 2013), the project is said to be successful not only focused on the achievement of time, cost and quality but includes the variety of factors, including project management system, communication, collaboration, skill, appreciation and trust. The term success in project management is too comprehensive. Therefore, this study focused on the success of the project affected by the project team members experienced in adaptive re-use project.

Based on the review of project management literatures, there are six important components of project success namely, (a) trust, (b) supportive attitude, (c) communication, (d) appreciation and recognition, (e) collaboration, and (f) Skills and Knowledge. Figure 3.2 shows the interconnection of the six components.
Trust

Trust is a complex component in construction industry and it is difficult to clearly define it (Kadefors 2004; Ling and Tran 2012). A number of studies in construction literature have elaborated trust as cooperative behaviors among two or more persons; and willing to do any action to achieve their sharing objective (Hwang and Burgers 1997; Wood and McDermott 1999). According to Girmscheid and Brockmann 2010, trust can also be defined as the degree of benefits from long term relationships. The long term relationships could build trust among project team members, could enhanced the project outcomes, and could developed better relationship quality (Ndubisi et al 2011; Ling and Tran 2012). Furthermore, Ling and Tran (2012) described trust important in problem solving and contributed to the building trust among project team members. Moreover, trust could avoid any blaming situation and contribute to the development of mutual trust among project team members. However, all the previously mentioned trust could establish or build in the project but failed to connect with the temporariness of construction projects. Hence, this study would relate the trust with the long term relationships in different project setting. In adaptive re-use projects, trust elements important in problems solving and decision making process. However, there is no previous research relate the trust elements in adaptive re-use projects.
Supportive Attitude

Supportive attitude of the top management is considered critical to problem solving process and project success (Pinto and Covin 1989). Supportive attitude is defined as the level of involvement and commitment of the top management in giving their support towards the project implementation (Iyer and Jha 2006). The top management may include the funding agencies, government agencies, clients, consultants and contractors. According to Khang and Moe (2008) and Iyer and Jha (2006), top management supportive attitude should be demonstrated throughout the overall project and mobilise all the required resources effectively. Commonly, the supportive attitude from top management starts at the early stage of the construction projects. However, in order to be effective, Iyer and Jha (2006) argued that the top management should be able to demonstrate this attitude right from the project planning stage. The main responsibility of the top management is to support the preparation of the project resources which include money, materials, machinery, manpower with the appropriate technical background, and project management. Since the resource requirements in construction projects are predictable, therefore, top management are encouraged to prepare all those resources right at the beginning of the project and continuously maintain their commitment to support the project until it has achieved the objectives (Pinto and Covin 1989).

Another aspect of supportive attitude of the top management is the implementation of strategies to provide and ensure a comfortable working environment within and around project sites to the project teams. According to Nguyen and Ogunlana (2004), a secured and comfortable working environment increase workers’ motivation and productivity. They further asserted that such environment can only be achieved with high commitment from the top management. A number of researchers (Belassi and Tukel 1996; Nguyen and Ogunlana 2004) relate top management with project champion. Belassi and Tukel (1996) defined project champion as the functional manager who supports the project manager to achieve project objectives.

In adaptive re-use projects context, top management are needed to support special resources needed; besides money, manpower, management, materials and machinery, namely historical information such as original drawings, historical documents and others to understand the nature of the historical buildings before the commencement of the conversion process.
Communication

The communication factor in managing the project and teams' members is critical to achieve project success. This is related to the protection and guarantee of the project information. Brewer, Gajendran and Chen (2005) used the model of success factors for Information and Communication Technology (ICT) and tested it with three construction projects to identify the relationship between the critical success factors and strategies for the temporary project organisation. They found that the critical issues in the organisation guarantee and protection were related to the security of communication channels. The project organisation should control the involvement and engagement with an ICT-mediated supply chain. However, there was one respondent who was worried that project information and all project records that used email as communication tools could easily be accessed and then manipulated by irresponsible parties in order to get contracts and so forth (Brewer, Gajendran and Chen 2005). The organisation should prepare the strategy to secure the soft and hard project information and project documents to avoid manipulation by other potential project teams' members (Brewer, Gajendran and Chen 2005).

The previous study in the construction industry for partnering procurement shows that the establishment of communication to resolve conflict is a strategy to achieving project success. Strategies such as the commitment to improving communication within the team, receiving adequate commitment from top to bottom, support from all levels of management and the consistent endorsement by top management can deal with any problem that occurred in the construction industry and lead to project success (Chan et al. 2004). Baccarini and Collins (2003) found that communication was crucial for every level of the project management process. All teams’ members also communicated among themselves during the construction process by using “up, down and laterally” and not one-way communication. In addition, the effectiveness of communication must be strong, at the right time and the right place, constructive and open to discussion among project teams’ members (Baccarini and Collins 2003). Nguyen and Ogunlana (2004) found that the associated success factors in communication were related to the community’s involvement, clear information or communication channels and frequent progress meetings.

The involvement from the community is in the form of support and understanding about the project especially during the implementation or construction period (Nguyen and Ogunlana 2004). This is a good example of a success factor which is important for the adaptive re-use project. Clear information and communication channels can be achieved with the establishment of an effective information system for construction projects. This information system offered concerned project teams’ members access and sharing of their ideas and
project vision. Hence, the corrective and preventive actions can play a part within frequent progress meetings. Nguyen and Ogunlana (2004) summarised their finding that communication was a critical factor in effective project monitoring and control to achieve overall success for construction projects. Good channels in the communication system involve the use of effective agents such as the site meeting focused on construction progress. In addition, information can be delivered via fax, phone or email and video-conference. The advantage of having a good chain of communication channels will facilitate and accelerate the resolution of problems or issues arising during the implementation stage (Chan et al. 2004). Proper and frequent communication among project teams’ members needs to be monitored by the project manager. This is critical to keeping a steady relationship and to promoting the management process. Yang et al. (2009) proposed the communication factors as sustainable support to the teams’ members’ management success. Communication factors can successfully affect project success if project teams’ members keep their relationship steady and communicate properly and frequently.

**Appreciation and Recognition**

Westerveld (2003) mentioned that every successful completed project should notice appreciation for the work that has been done by the individuals or as a project team. Appreciation can be categorised from different key persons including the client, project personnel, users, contracting partners and other teams’ members. According to Westerveld (2003), different types of appreciation can include internal and external organisation appreciation for a successfully completed project. He explained each form of appreciation by the client, project personnel, users, contracting partners and teams’ members.

**Appreciation by the client**

The client initiates the project to fulfill a specific need. What aspects and factors does the client value in judging the success of the project?

**Appreciation by project personnel**

The workers of the project will be concerned with reaching their personal goals as well as having a good working atmosphere

**Appreciation by users**

Users are concerned with their overall influence in the project and the functionality of the end product
Appreciation by contracting partners
Contracting partners try to make a profit from the project. They are also concerned with getting new orders and having learning possibilities.

Appreciation by teams’ members
This includes those parties that are not directly involved in the project but which have a large influence, for example environmental groups, citizens and government agencies. These parties manage their specific interest.

Appreciation by all project teams’ members possibly can be affected in maintaining the quality of work, time and cost that have been specified in the contract. Even though the method of appreciation may be just a letter of appreciation, it can provide a good motivation to bring the project to success. Thus, this study suggests that appreciation from the organisation can be a success factor in adaptive re-use project. Iyer and Jha (2006) investigated the performance of construction projects in India and found that the factor of recognition by the client or the owner of the project is critical and can lead to project success. Collins and Baccarini (2004) have also been conducting research on projects that had appreciation or recognition as critical success factors before the Iyer and Jha study. However, the recognition was not focused on the internal project’s organisation, but was engaged with external recognition.

“The criterion of project recognition refers to peers’ opinion, positive publicity received about the project, awards won by the project (if any), board recognition, recognition by peers and competitors, good market or public opinion of the product and publicity is favorable” (Collins and Baccarini 2004, p. 219)

In this study, appreciation can be important for the adaptive re-use project. The appreciation should come forward from the internal organisation and externally for the adaptive re-use project to encourage the successful transformation of historical buildings to new and modern building functions especially from the users and other teams’ members such environmental groups, communities and government agencies that are linked with heritage.

Collaboration
Collaboration can be categorised as the willingness of the project team to work together as a ‘team’. To achieve project success, it was critical to ensure that members in project teams were willing to work together as a ‘team’. Not just in construction industry commonly, adaptive re-use projects also need collaboration particularly in problem solving process.
decision making process required knowledge and skill collaboration among the project teams in establish good and creative decision (Shipley, Utz and Parsons, 2006). According to Baccarini and Collins (2003), to develop a ‘working together’ environment, the members had established their relationship with realistic expectations among themselves. Enthusiasm for working in groups is very important in practice for all project teams’ members to ensure that all parties realize and understand the project’s mission. The entire project team should be working to the same goals in a cooperative environment with a strong team work ethic. All members must be compatible and work harmoniously. Alliances between teams’ members as opposed to adversarial relationships were critical as was working in this fashion: honesty and integrity must exist on both sides (Baccarini and Collins 2003).

**Skills and Knowledge**

The skills and knowledge of project teams is synthesized from Iyer and Jha (2006), Zou, Redman and Windon (2008), Westerveld (2003) and Baccarini and Collins’ (2003) findings which indicated that the project manager can have the following skills and knowledge:

- skills in chairing the construction site meetings and able to handle the meeting and ensure that all project teams participate in that meeting
- technical skills and monitoring skills
- effective and good leadership skills to encourage and influence the project team
- injection of trust with power to ensure that the project team is committed and that work runs with harmony between all project teams
- organising skills and knowledge for project resources arrangement
- skills and knowledge to give a lot of ideas which can be issued and shared for project benefits
- skills to run the project specifying tasks and responsibilities on the project
- skills and knowledgeable to understand the project with authority and respect of the project teams

Baccarini and Collins (2003); Collins and Baccarini (2004); Iyer and Jha (2006); Chen and Chen’s (2007) findings synthesised the skills in relation to the project teams as follows:

- Project teams with skills in motivate and drive themselves to manage the project
- Project teams with skills in establishing the relationships with realistic expectations among them
- Project teams with skills in managing the conflict among them
• Project teams with skills in communication delegating
• Project teams with skills in managing the relationship

Baccarini and Collins (2003) and Iyer and Jha’s (2006) studies in relation to client skills and knowledge are related to the decision making and monitoring of the progress of the project. Those skills are considered critical in achieving project success.

• Client with skills and knowledge in decision making
• Client with skills and knowledge in monitoring the progress of the project

In relation with adaptive re-use projects, Shipley, Utz and Parsons (2006) found that professional experience and skills became obstacles factors. It is often difficult to find adequately skilled and experience practitioners in adaptive re-use. The lack of knowledge and skills in adaptive re-use could contributed to the increasing the construction cost. This is clear that the skills and knowledge of project team member’s important element in adaptive re-use success.

3.4 Summary

Overall, the four types of intellectual capital i.e conscious knowledge, automatic knowledge, objective knowledge and collective knowledge could be adopted in adaptive re-use projects with time series scenario. These components provide could be link with the knowledge creation and knowledge transfer activities in achieving success. This chapter also reviewed components of success into six significant components of success. Synthesising the component of success leads this study to a different view which is not based on the list of factors, but focused on knowledge theory including the intellectual and human capital of the project. The six components are summarised as (a) trust; (b) collaboration; (c) communication; (d) skills and experiences; (e) appreciation and recognition of others’ work and (f) supportive attitude to the overall projects.

Chapter 2 and chapter 3 are important link in developing a platform for the proposed of the intellectual capital framework for adaptive re-use success in Chapter 4. The knowledge can be created and transferred to the next project. The proposed framework is the integration of components of success and knowledge management for adaptive re-use projects. Therefore, investigating and analysis sequential adaptive re-use projects located as events in a time series scenario could provide an invaluable case study (see Chapter 6 and Chapter 7) and contribute to the body of knowledge in this field.

The next chapter will discuss the development of the Intellectual Framework for successful adaptive re-use projects.
CHAPTER 4
INTELLECTUAL CAPITAL FRAMEWORK FOR SUCCESSFUL ADAPTIVE RE-USE PROJECTS

Based on review of literature in chapter 2 and 3, this chapter proposed the intellectual capital framework for successful adaptive re-use projects. This chapter described the justification for two approaches including knowledge management and success factors which input components in intellectual capital framework for this study. The positioning of intellectual capital framework is also explained in this chapter. The description of conceptual framework and framework gaps are including in this chapter. Finally, this chapter explains a summary for chapter 4.

4.1 Justification for a Knowledge Management and Success Factors Approach

In research problems, a knowledge management approach facilitates the exploration of the problem solving process in adaptive re-use projects over time. This also enables the definition of knowledge creation and transfer as it happens among project teams. Alavi and Eleidner (2001) state three situations to support the knowledge process; identify and make visible the roles of knowledge; develop an intensive-culture to encourage knowledge sharing; and build knowledge infrastructure in an organisation.

Lindner and Wald (2010) mention that the main obstacle in the knowledge management of information, particularly for the organisation of construction projects, is the potential to lose knowledge that was generated when a project was completed. They suggested a systematic process to generate, store and retrieve temporary knowledge from a temporary organisation to create permanent knowledge. The result from the systematic process, Lindner and Wald believed, is that the knowledge can later be retrieved and used for future projects (Lindner and Wald 2010).

There is an argument that will be highlighted in this study that it is more critical and difficult to manage the intellectual capital of project teams’ members who will be working together again after many years since the completion of the first project. There are two reasons
contributed from this argument. First is the potential loss of technical and pedagogical components in relation to tacit knowledge. In relation to the adaptive re-use project, there is the need for a deep understanding on heritage and the adaptive re-use approach in any action on the project. The potential to lose and blunt the knowledge particularly on heritage matters can happen to project teams' members. One of the criteria that could blunt their heritage knowledge is when they are involved with more common construction projects and do not practise the adaptive re-use project after the completion of the first adaptive re-use project. As intellectual capital is important for knowledge management; the collection of skill, competence, experience and knowledge of project teams' members could affect the second project’s decisions in the design and construction stage.

The second reason is related to increasing and sharpening the project teams' members' tacit knowledge. There are many factors that can contribute to the enhancement of the technical and pedagogical components in intellectual capital. As an example, the results from the first project could contribute to the design and construction decisions and problem solving to ensure that the second project has better results that are appropriate with new eras.

4.2 Positioning the Intellectual Capital Framework for Successful Adaptive Re-use Projects

The literature identified that adaptive re-use is very complex in terms of problems solving which are faced by the project teams with regard to project management issues and success. Due to a lack of research on success factors in adaptive re-use area, the aim of the study presented in this thesis is well justified. This study will support the researchers who have claimed its importance in this field of research and contribute to developing a theoretical argument supported by much needed evidence from empirically-based research. It contributes to two significant areas related to the research problems. This required further investigation using case studies of the ‘project-to-project time series’ scenario. The time-series scenario refers to using similar project teams in a different project time frame which is applied in this study. Figure 4.1 presents the scenario of ‘project-to-project time series’ in identifying knowledge creation and knowledge transfer in two adaptive re-use projects in which the client employed similar project teams for both projects that happened in different periods.
Figure 4.1 provides this study with the theory that it is critical and difficult to manage the intellectual capital of project teams who will be working together again after many years apart since the time when the first project was completed.

There are two areas of success factors and knowledge management (see figure 4.2). The skills are potentially valuable intellectual capital that needs to be protected and adapted for future work. Apparently, the client is the same client, but the project teams change according to the projects. However, this scenario can be changed by using similar project teams for the subsequent project for the client’s benefit particularly to achieve project success through meeting the cost, time, and quality of the projects. The research identified two significant knowledge management areas and one success factor area related to the research problems that further required exploration through case studies with the situation of the time-series scenario. These include:

**Knowledge Management and Intellectual Capital**

1. The knowledge transfer theory provides the nature of the transferral of individual or social knowledge from project to project. The resources and the requirement of knowledge to be transferred supports problem solving in the projects.

2. The knowledge creation theory is the process of solving problem in adaptive re-use projects. Creating new knowledge within the problem solving process involves the client and all project teams.
Success Factors

1. The success factors theory illustrates each factor that is critical to the success of the construction project. This is important for a better understanding of the components that support project success.

![Diagram of Intellectual Capital Framework](image)

Figure 4.2: Location of Intellectual Capital Project Success

4.3 The Generic Intellectual Capital Framework for Successful Adaptive Re-use Projects

The generic framework integrates components of success factors in solving the problems within the knowledge creation and knowledge transfer process for the purposes of achieving the research objectives. It generates questions for catechising the literature reviews (chapter 2 and chapter 3) and qualitative interview data coming up with a new knowledge contribution within the knowledge management approach by using the unique case studies in the time-series scenario. To show that this proposed framework is appropriate to the research objectives, the research questions are again stated here:

1. What are the components of success and the key components of knowledge creation and transfer that contribute to problems solving on adaptive re-use projects within the time series scenario?
2. How do the components of success and the key components of solving problems rely on each other to help the development of intellectual capital framework for successful adaptive re-use projects?

Answering the above questions requires the collection of qualitative interview data with key persons who are involved with adaptive re-use projects. In order to evaluate the process of knowledge creation and knowledge transfer over time with similar key persons, the appropriate research methodology is applied in this study and will be discussed in detail in the next chapter. According to the literature reviews in chapters 2 and 3, this proposed framework is synthesised appropriately with the knowledge management approach. This proposed framework could overcome the lack of previous research in integrate the knowledge management in adaptive re-use areas. The next section will discuss the generic components of intellectual capital for adaptive re-use success (see figure 4.3). There are two approaches in using the Intellectual Framework for successful adaptive re-use projects; the knowledge management approach and the success factors approach. The related theory on knowledge management and success factors is discussed in the next sections accordingly as described in chapters 2 and 3.
Knowledge creation theory normally explained the nature of knowledge assets and strategies for managing knowledge. The theory also can be used to complement the knowledge-based view of the firm and the dynamic processes in organisational knowledge creation (Nonaka and Krogh 2009). According to Farshchi and Brown (2011), the creation of new knowledge could lead to new solutions either in problem solving, the process and any innovation particularly in the built environment sector. The knowledge of project teams will be collected all the time increasing their experience in every project series. However, Farschi and Brown (2011) claim that the flow of knowledge and dynamic process can be hindered by the problems faced by each project team or any agency involved in the construction industry in design and construction phases.
Tacit and Explicit

Nonaka and Krogh (2009) synthesised knowledge creation in relation to both tacit and explicit individual knowledge that represents their true belief and the actuality of skilful action to define, prepare, share, shape and learn to solve the task or problem. Tacit knowledge is tied with individual sense, experience, movement skill, intuition and unarticulated mental models. Meanwhile, explicit knowledge is involved with the drawings, printed and coded documents and formulated in written sentences. In addition, Nonaka and Krogh (2009 p.640) stated that “in organisational knowledge creation theory, tacit and explicit knowledge should not be seen as separate entities but rather mutually complementary and based on the same continuum”.

Based on Nonaka and Krogh’s paper on tacit knowledge in organisational knowledge creation theory, other scholars were motivated to investigate knowledge management in temporary organisations. One example of a paper that could be appropriate in current research is “success factors of knowledge management in temporary organisations” (Lindner and Wald 2010). They tested the influence of cultural, organisational, structural and process-related factors on knowledge management effectiveness. The difference between the current research and Lindner and Wald’s paper is in terms of success factors. They focused on knowledge management success factors. The current study focuses on success factors that are critical for project success and assumes this in the context of teams’ members' knowledge. However, the pinpoint is to examine and analyse the knowledge processes around the context in relation to project teams’ members’ intellectual capital over time. The knowledge creation theory could explain how new knowledge is created in adaptive re-use projects through the process of solving the problems within the project-to-project time series scenario.

4.3.2 KM Approach: Knowledge Transfer

Knowledge transfer has been defined as another factor that affects the knowledge transfer approach when similar client and project teams collaborate again for another project after certain time gaps for each project. This is potentially critical, when particularly involved with project types of similar characteristics. After certain time gaps and considering what might be lost in relationship to one project, electronic media was considered the best approach to start transferring the information and knowledge before face-to-face contact takes place when the project starts. It is crucial for knowledge transfer among project teams’ members from the completed earlier project for there to be ‘brainstorming’ activities and a transfer to future projects to get better results in terms of project success (Maqsood 2006). Perhaps, this is
necessary to combine soft and hard knowledge (Sajjad 2008) in the ‘community of practice’
approach to ensure that the management of accumulative intellectual capital from the earlier
project and new knowledge for the future project is in good hands. The significance of
knowledge transfer and a sharing approach in managing the intellectual capital particularly in
the construction sector is appropriate to what Sajjad pointed to in his study. The combination
of soft and hard mechanism for knowledge transfer in adaptive re-use projects could be
critical and not critical. The project teams’ members such as the client project manager,
architect and contractor have different skills and experience that could be shared for the
purposes of project success.

Knowledge Dimensions
There are two dimensions of knowledge, tacit and explicit. The tacit dimension refers to
action, experience and involvement in any situation or circumstances. According to Nonaka
(1994), tacit knowledge is comprised of both cognitive and technical components. The
cognitive components are related to mental maps, beliefs, paradigms and viewpoints of the
individual in any organisation or circumstances. In terms of the technical components, these
are related to the skills, the expertise and the application of the know-how process which are
more related to this research.

The explicit dimension is easily reduced to writing. Frequently explicit dimension takes the
forms of documents, drawings, reports, historical information, heritage abstract etc. Both
knowledge dimension; tacit and explicit information are critical in problem solving process in
adaptive re-use.

In this study, knowledge transfer is involved with two knowledge dimensions; technical
knowledge and cognitive knowledge. The level of knowledge transfer included the project
teams transferring the project between project teams and across project teams. It also
involved knowledge transfer happening between projects and across projects over time. In
this study, this is considered as the time-series scenario.

4.3.3 The Frameworks Gap

The analysis of the selected frameworks in this section is as stepping stones to create an
essential framework of project success for the adaptive re-use projects within the success
factors and knowledge management approach. The rationale of this discussion is in
accordance with the concept of temporariness; construction projects are dependent on the
project life-cycle phases. In previous research, the literature on project success had little
insight from knowledge management. Thus, the study’s aim is to propose the conceptual framework for adaptive re-use towards knowledge transfer and creation process. It is important and crucial to explore how the multidisciplinary project teams’ members transfer their knowledge in two different phases of the eras (refer Figure 4.1). Therefore, the literature review in chapters 2 and 3 led to the discussion on the development of the conceptual model in chapter 4 (see figure 4.2 in section 4.3). The relationship of adaptive re-use success factors will merge with the knowledge management approach to develop the most approachable and appropriate framework for adaptive re-use success.

4.4 Six Component of Success Factors to Support the Process of Problem Solving

Adaptive re-use projects have a unique and complex process and are defined as temporary organisations with specific goals, detailed historical procedure, restricted time, budget and quality to deliver ‘old fashioned’ historical buildings to become new and modern buildings (Kurul 2007; Shipley et al. 2006). Project members including the architect, project manager and project teams are responsible for planning, monitoring and controlling and completing each adaptive re-use project. In the normal construction procurement approach, project members disseminate from the project to other projects. However, there is a practice where the project teams will be re-appointed for other subsequent common construction projects (Wasan and Chotchai 2006). Knowledge is experiential and embedded in such individuals and transferred among project teams in one project and within the group. However, over time and between the different projects and groups, the knowledge creation and transfer process would be big challenges to be managed.

Figure 4.3 in section 4.3 illustrates the intellectual capital model for adaptive re-use success. As the project period is temporary with a limited time and budget, decision-making particularly for the problem solving process is a crucial factor. The effectiveness of the problem solving process could also be hindered if the project teams are unfamiliar and have a lack of experience with the problems. However, the impediments could be avoided and the speed of solving the problems enhanced by appointing a similar project team in subsequent projects.

Six components of intellectual-social factors can be captured in four types of intellectual capital synthesised in the previous chapter. These are trust and transparency, supportive attitude, communication, appreciation, collaboration, and skills. All the six components are useful to adapt and determine the characteristics issues, project management issues, beneficial and impediment issues which could be ‘influencing factors’ in achieving project
success. The influencing factors are suggested as the more appropriate status for both success and failure factors in the knowledge management context (Ajmal, Helo and Kekale 2010). The management of knowledge including cultural support from top management to encourage the individuals to communicate and share their knowledge, skills, appreciation, collaboration and trust are fundamental to the creation, capture and transfer of knowledge particularly in projects (Ajmal, Helo and Kekale 2010).

4.4.1 Trust

The knowledge management process involves sharing knowledge among practitioners within the design and construction stage. Mavis Yi-Ching and Yung Shui (2009) identified human capital and social capital as positively related to organisational commitment and a continuing investment in human capital to improve the project team’s skills and knowledge. To do that particularly in adaptive re-use projects, the component of trust is critically embedded and positive in project organisation. The positive interactions among project teams’ members provide cooperation and yet consider trust as their basis in social capital. The correlation of trust in the activity of sharing project teams’ intellectual capital is positively critical in construction projects particularly in adapting the historical building (Ma, Qi and Wang 2008). A negative impact on organisational commitment is organisation capital. They found that the formal and well-established organisation structure and power chain was the reason for the passive creation and creativity of employees and reduced organisational commitment. According to Baccarini (1999), for the implementation and gaining of trust and transparency among the project teams, it is very critical that all the project teams must understand clearly about the projects in which they are involved. The development of trust among the project teams does not happen in a short time in one project only, but it really needs more time and could develop from project-to-project. The development of trust among the project teams could obtain transparency in any decision making particularly in solving any problems in the projects involved.

4.4.2 Supportive Attitude

Supportive senior management roles such as the client, project manager and architect need to show a strong commitment to managing the information obtained during the project with good management. In addition, the leader must also show their full commitment to the other members so that all the experience gained during the project is seen as invaluable information and should be kept for possible future use. As intended by Kululanga and McCaffer (1993) in their framework, a committed leader should be a catalyst for positive change, especially involving the management of knowledge in a construction project. This states that the fundamental factor for success in relation to knowledge management
activities is support from top management. Based on Martensson’s (2000) study, the success of knowledge management as a strategic management tool comprised critical components such as support from top management, communication, incentives and knowledge sharing (idea of collaboration and cooperation). This study refers to top management support as a supportive attitude and the incentive as appreciation that should be given individually as practice in adaptive re-use projects. According to Hanisch et al. (2009), the role model function of top management can be a starting point to support any knowledge management activities. Hanisch et al. also indicated from expert interview data that the integration of knowledge goals can be achieved through reward systems and the process of transferring the knowledge among the project team could occur during workshops or courses attended by them which were provided as a reward by the organisation or top management support. Bishop et al. (2008) defined eight critical success factors in knowledge management which including establishing top management support and support from the team. His teams indicated that it is critical for top management to understand the necessity and ensure that the benefits of the knowledge management initiative are communicated across the business. As mentioned in Slevin and Pinto’s (1987) framework, the supportive attitude was a part of their ten critical success factors in construction projects. The supportive attitude is the willingness of top management to provide the necessary resources and authority or power to achieve project success (Slevin and Pinto 1987). Hence, this study argues that top management is represented in the client, consultants and contractors’ attitude to support each other in achieving the project goals not as in normal practice where top management are not involved with the whole process particularly in problem solving activities. Westerveld’s (2003) framework also provides the component of supportive attitude as critical in achieving project success. Westerveld mentioned that the supportive attitude in terms of project management support is affected by the characteristics and the uniqueness of the projects. According to Nguyen and Ogunlana’s (2004) framework, again the component of supportive attitude in terms of information and data to support actions at all levels of decision making was part of the components in achieving project success. This component strongly supported this study because the characteristics of adaptive re-use projects are different from common projects as is the uniqueness of the selected case studies according to suggested phenomenon, for example the time-series scenario.

4.4.3 Communication

A critical component of project success in relation to knowledge management occurs in information and communication technology. Recently, the construction world has linked and related good communication to information technology support. The better the IT support the
better the information and communication within the organisation (Hanisch et al. 2009). To achieve this, the acceptableness of IT by the people in the organisation is very important as is the encouragement by corporate culture for the use of any software and application devices provided (Hanisch et al. 2009). Easy-to-use standards and processes in relation to the activities of knowledge management could be one of the success factors in organisations. As referred to by Hanisch et al. (2009 p.156) who found that “Easy-to-use standards and processes should be chosen on purpose, since the aim is an easy usage with as little as possible additional effort”. They suggested that it was very important to have only one contact person in the company who could help and lead in assisting with any difficulties in relation to knowledge management activities such as the creation and transfer of any particular new ideas and skills.

The cultural factors are of fundamental importance in achieving project success. The differences in culture in terms of knowledge are probably affected to the working style and communication problems which occurred during construction. Therefore, trustful cooperation needs to be built among the project teams. Hanisch et al. (2009) found from expert experience from the data interviews that the supportive corporate culture which placed project teams according to the geographic distribution in the process of knowledge exchange helped them to achieve the success of the project. The main point that can be highlighted is that cooperativeness, openness and trust are very critical to achieve success factors in knowledge creation and knowledge transfer activities (Hanisch et al. 2009).

In terms of the critical success factors’ approach in project management areas, as discussed in the previous critical success factors framework, communication is critical and important in achieving project success. Each framework that has been discussed has mentioned that communication was critical for project success except in the Project Excellence Model by Westerveld (2003). Therefore, this study assumes that communication is also critical in the adaptive re-use project. There is a rationale for the application of this component in this proposed framework. Slevin and Pinto (1987) highlighted that communication was critical in providing an appropriate network and necessary data to all key actors in project implementation and this was tested empirically and provided as evidence from 408 project managers. Meanwhile, Baccarini mentioned that communication in construction was linked to the understanding of project teams with projects whose criticalness had been approved in the DeWit studies in 1988 (Baccarini 1987). Based on a COMs approach, Nguyen and Ogunlana (2004) emphasised the critical value of communication in achieving project success. Communication involves regular client consultation and the responsiveness of the
client. It is appropriate within these case studies where the regular or similar consultants were used in two different adaptive re-use projects.

4.4.4 Appreciations

Kululanga and McCaffer (1993) stated that the benefit of knowledge management or intellectual capital implementation is the best way to sensitize the need for knowledge creation among employees. In accordance with appreciation as one of the critical success factors, the mixed approach of knowledge management and critical success factors can be a strategy for the project to be successful in the end. Westerveld’s (2003) framework results show that an appreciation factor is critical in achieving project success. This was empirically tested and used by the IPMA as benchmarking tools in helping project teams to reflect their strengths and improvement and contributed to this study that the appreciation factor is critical in adaptive re-use problem solving activities. However, appreciation is developed after the project was completed. This study has a different approach according to knowledge management situations, where the appreciation should start as early as possible and could be continuous from project to project. Appreciation among the project teams can be as simple as mentioning appreciation in terms of saying “good work” and not necessarily in terms of things or tokens. Recognition among the project teams for each other’s work could be developed continuously particularly in time-series scenarios. Hence, the knowledge management approach is critical in exploring the critical success factors for adaptive re-use projects for historical buildings. The existing models that have been discussed in chapter 3 contributed to the development of the conceptual model in this chapter. This conceptual model has adopted some components from the four project success factors frameworks and added the components of knowledge management and history factors in regards to delineating the study objectives.

4.4.5 Collaboration

According to Dave and Koskela (2009), the construction project is unique and requires collaboration among multidisciplinary project teams’ members for each stage involved. They also stressed that each of them may or may not work together again when starting a new project. This is a big issue where the knowledge that was gained with the previous project cannot be fully transferred because of knowledge leakage. It becomes critical when the type of tacit knowledge obtained from the individual expertise and experience is not transferable. The critical point is to ensure that the type of tacit knowledge is converted into explicit knowledge for the continued use and benefit of future projects. The project teams’ members are a group of professional people working together with shared responsibilities and resources to achieve project objectives. Most project teams’ members are engaged in
several projects differently. Such projects traditionally built a new building and sometimes were involved with the difficult and complex process of re-using heritage buildings for new purposes.

Collaboration makes sure that the clear target is around the project teams and ensures that they are travelling in the same direction (Baccarini 1999). Collaboration is also critical in leadership and team work which are essential to run the projects with the suitability of individual or group roles and responsibilities. The cooperation of the leader and project teams greatly influence the working habits in organisations (Westerveld 2003). This is really critical in ensuring that this collaboration is developed continuously from one project to another to support the richness of intellectual capital in adaptive re-use projects.

Hence, the present study’s contribution is to define how critical and important it is to maintain or use similar project teams’ members in terms of project management and the link with knowledge management for further projects. The reason is that the knowledge created in the first project can be transferred for another similar project type. It could provide better changes and enhancement in terms of design and construction within the project organisation. Significantly, this research has chosen unique case studies where the client has appointed the same architect and contractor to manage projects within different eras.

4.4.6 Skill and Expertise

According to the problem solving process, the project team skills are critical in making the right decision to avoid any big issues in completing the projects. It involves skills in the preparation of project schedules, in technical tasks for which the teams have the availability of required expertise and the aid of technology tools to accomplish the action steps, monitoring and feedback in which the information flow is comprehensively controlled at every stage in the design and construction process and the ability to handle unexpected crises and deviations from what has been planned (Slevin and Pinto 1987). Baccarini (1999) tested that the skills of the project teams facilitate the appropriateness of the specific roles and are in the right place and at the right time for achieving project success. Similar to Westerveld’s result in the Project Excellence Model, the skills and the expertise of project teams are very important particularly in project management skills. The intellectual capital in relation to skill and expertise need to developed and accumulated without any interference from project to project in ensuring the creation and transferring process have occurred (Westerveld 2003). The skills component will aid in handling the complexity of the design and construction process in adaptive re-use projects (Kurul 2007).
4.5 Summary

The Intellectual Framework for successful adaptive re-use projects embraces components of trust, supportive attitude, communication, appreciation, collaboration and skills in knowledge creation and knowledge transfer in problem solving for the purposes of achieving research objectives. The development of research questions helps this study to deliver empirical data from qualitative interviews from the experts in each case study. The research questions are stated as:

1. What are the components of success and the key components of knowledge creation and transfer that contribute to problems solving on adaptive re-use projects within the time series scenario?

2. How do the components of success and the key components of solving problems rely on each other to help the development of intellectual capital framework for successful adaptive re-use projects?

This study contribution is providing new ways of thinking in which the success factors in general construction support the issues in adaptive re-use success. The complexity and problems of adaptive re-use will be support the success factors as component that contribute to the process of solving problems. The project team activities in solving the problems considered having richness of intellectual capital in relation with creation new knowledge as mechanism in developing new solution and the transferring their knowledge from project to projects.

There is transition in the construction industry in project team skills used in solving the project problem. The changes really require higher creative problem solving skills in relation to the project management approach particularly in specific and unique projects rather than in common projects. The collection of empirical data is based on an appropriate research methodology in regards to investigating the accumulative intellectual capital of similar project teams for different projects carried out at different times. The research methodology including the method of data collection, data analysis and interpretation brings more clarity of understanding of the problem solving process in adaptive re-use projects in terms of trust, supportive attitude, communication, appreciation, collaboration, and skills.

The next chapter will discuss the research methodology in this study which is the qualitative research consisting of case study design and qualitative interview data method.
CHAPTER 5
RESEARCH DESIGN AND METHODS

Chapter 2 reviewed the terminology of adaptive re-use and success factors that are important for adaptive re-use projects. In chapter 3, the intellectual capital and success factors literatures in the common construction industry have been reviewed. Chapter 4 is explained and synthesized and suggests a pragmatic model associated with the processes that occur in the management of intellectual capital teams’ members. A privilege is the process involving the creation and transfer of knowledge over time. The importance of chapter 4 is because it is the background to the selection of case study design and for this purely qualitative research. The purpose of this chapter is to present the research design development to answer research questions. Hence, this chapter is divided into five sections that describing the research purpose and research questions; justify the research dimension and methodology; describing and justify the case study design, data analysis strategy and validity of data finding. At the end of the chapter an overall methodology process of research design and summary section.

5.1 The Study Purpose and Research Questions

5.1.1 The Purpose of a Study

Based on the reasons that have been described previously, this study has defined two principles purposes.

Firstly, this study aims to explore the components of success that contribute critically to the process of problem solving in time-series scenario of adaptive re-use projects. This study wishes to help project teams in managing the complexity of adaptive re-use projects by helping them in the development of solution in successive way and investigate the sources of information that help project teams along the process of problem solving.

The second purpose of this research is to investigate how the components of success contribute to the knowledge and new skills that the project team created in develops the new solution for unfamiliar and familiar problems occurred in two related adaptive re-use projects. It will also investigate how the components of success helping project team to solve the
problems in new projects through knowledge transfer from other adaptive re-use projects. This study wishes to help client and project team in understand the component of success in problem solving process in relation with the activity of creating knowledge and knowledge transfer particularly in the complex process of adaptive re-use project.

5.1.2 The Research Questions

The study began with a literature review. Three areas of literature were including (i) adaptive re-use literature, (ii) project management literature and (iii) knowledge management literature. The rationale of each of these literature reviews is explained in table 5.1.

Table 5.1: The rationale of literature selection

<table>
<thead>
<tr>
<th>Adaptive re-use literature</th>
<th>Project Management literature</th>
<th>Knowledge Management literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of adaptive re-use issues or context that is focused by previous studies on the adaptive re-use environment. This is focused and cited most on adaptive re-use practice, benefits and impediments and the success criteria in adaptive re-use projects.</td>
<td>This literature is reviewed with the purpose of investigating previous studies in relation to the success factors.</td>
<td>This literature is used to support the development of a conceptual model for this research. It relates to the knowledge management process and the components of intellectual capital particularly in a temporary organisation such as a construction organisation.</td>
</tr>
</tbody>
</table>

Table 5.1 presents two research gaps including; the lack of understanding of the processes of managing the intellectual capital are involved with how the teams’ members create and transfer their intellectual capital towards challenges and success in adaptive re-use projects. This study seeks to address the problem that there are few past adaptive re-use studies that explore the role of intellectual capital and knowledge management as an important part of project success. The previous adaptive re-use studies are lacking in injecting knowledge management into their research outcomes. This study focusses on what components are most important and critical for project success. The Lack of empirical studies on adaptive re-use projects related to success factors particularly in relation with the problem solving process that appears to be so prevalent on these types of projects is needed to develop this field of research. Therefore, the first research question in this study is:

**What are the components of success and the key components of knowledge creation and transfer that contribute to problems solving on adaptive re-use projects within the time series scenario?**

Secondly, this study wanted to know the complexities of the selected projects and focused on analysing the entire activity of the problem solving process within the intellectual capital and project success areas. Therefore, this research examines the process of intellectual capital development over time and displays the project team’s perspectives about and
experience of their knowledge creation and knowledge transfer in developing the solution within the components of success. The project team’s experiences are linked over time (project to project and intervention period) and there were potentially change, improvement, and enhancement which positively impact on project team’s intellectual capital. This study sets the goal of investigating these impacts within the process activity in the knowledge creation and knowledge transfer phenomenon. Therefore, the second research question is:

*How do the components of success and the key components of solving problems rely on each other to help the development of intellectual capital framework for successful adaptive re-use projects?*

By answer the research question, this study aim to develop the Intellectual Capital Framework for successful adaptive re-use projects that will help and contribute new knowledge to the project teams in managing the complexity of adaptive re-use projects.

### 5.2 Research Dimension and Methods

In the general situation of a qualitative research method, priority is given to spending substantial time, on site, personally in contact with activities and operations of the case, and involved with reflecting and revising meanings of what is going on (Stake 1994). However, it is unnecessary for the researcher to be involved with the case study activities and operation, but the researcher will interview the client and project team who did see the activities and operation and will find documents which record the case events. The qualitative methodology is naturalistic, ethnographic and phenomenological which helps the researcher to see what is natural in happenings, in settings and in expressions of value. Qualitative research methods have been developed to serve the view that phenomenon, particularly when humans are involved, involve complex interactions and are seldom simply caused. To understand the event, all aspects of the situation need to be considered and this inclusiveness tends to mean that each situation is unique. The result is that qualitative researchers consider many variables in a case or a few cases. They probe deeply into a situation, describing the full range of influences associated with the phenomenon. They see benefit in understanding a particular phenomenon and hope that some of the understanding developed will transfer to other phenomena (Stake 1994).
5.2.1 Research Dimension

This section describes the justification of research dimension that is selected for the whole of the research. Figure 5.1 addresses the general understanding of the research in the dimensions of the purpose of a study, the time period in research and techniques of data collection.

<table>
<thead>
<tr>
<th>The purpose of a study</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Description</td>
</tr>
<tr>
<td>• Exploratory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time dimension in research</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Case Study</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data collection techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Qualitative Data</td>
</tr>
<tr>
<td>• Field Research</td>
</tr>
<tr>
<td>• Interviews</td>
</tr>
<tr>
<td>• Documents/Records</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data analysis techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Within-case Analysis</td>
</tr>
<tr>
<td>• Content Analysis</td>
</tr>
<tr>
<td>• Cross-case Analysis</td>
</tr>
</tbody>
</table>

Figure 5.1: General understanding of research dimension

**Justification of selected the purpose of a study**

The basic types of purpose for a study consist of exploratory, descriptive and explanatory (Nueman and Kreuger 2003; Yin 2009). Exploratory research is exploring a new topic or issue and learning about it. The researcher in the exploratory research type will set a goal to formulate research questions that can be answered at the end of the research throughout the research process. Descriptive research has many similarities with exploratory research with examples being to create new ideas or a set of categories to be researched. Descriptive research is involved with a “picture of the specific details of a situation, social setting, or relationship” (Nueman and Kreuger 2003, p22). Explanatory research discovers the issue that is already known (exploratory) and has a description of it (descriptive), but begins to wonder and desires to know why it happened. Therefore, exploratory and descriptive are the
best approaches to apply in this study. This study combines the exploration and description research for the following reasons:

- Discovering new issues that are not covered yet in any previous study in the areas of adaptive re-use project success and knowledge management.
- Formulate research questions to be answered which consist of WHAT the solution taken is that related to the new issues and HOW to analyse and answer the research questions and not to know WHY it happened.
- More creative, open-minded and flexible and exploring all sources of information about the limited situation of the case study
- Suitable for qualitative data. This study applies in-depth interviews to the participants among the professionals who are involved in case studies.
- More open to using a range of evidence such as all the documents and reports that the project or organisations used that are associated with the answers to the research questions
- Develop ideas about the phenomenon and describe it. This is the idea of what and how is the process of problem solving managed well between two different projects in different time zones of construction and completion
- Present details of a specific situation or relationship. The situation and relationship between the sequences of projects within similar client and project teams are described. The situation of the intervening period between two projects is described too
- The subjects to be studied are well defined which refers to the client and project teams of two adaptive re-use projects and conducts research on that and describes it

**Justification of selected the time dimension of research**

The awareness of time while doing research will help the study to conduct research. This is because every research question or issue incorporates time in different ways (Nueman and Kreuger 2003). This study explores the moving picture of events, people or social relations over a period of time. In relation to the nature of data to be collected with qualitative interviews, case study research is the most appropriate approach where the qualitative methods just need to focus on one or a few cases within a limited time period. However, the data is usually detailed, varied and intensively investigated based upon a set of factors or thematically. The description of the case study is based on the logic of the analytic instead of an enumerated or percentage orientation. Other reasons for the selection of case study according to the time dimension for this study are as follows:

- Examine the case in-depth
• Most suitable for qualitative data
• Appropriate with limited number of case studies, one or a few cases
• Focusing on only several factors or themes
• Connect the micro level (individual or group or events) of the case to the macro level (case)

The detailed discussion on the case study approach for this research is explained in section 5.3.

Justification of selected data collection techniques
This section is a brief overview of the data collection techniques that will be used in this study. The techniques of data collection involve quantitative data and qualitative data (Nueman and Kreuger 2003). Since this study is a case study in-depth research approach with a limited number of projects and period of study, the qualitative data is gathered through field research techniques. The process of qualitative data collection is generating the qualitative interviews and documentation or records that consist of the case study evidence to answer the research questions. The details of qualitative interviews and documentation are explained in section 5.3.1.

Justification of selected data analysis techniques
In brief, multiple case studies were used in the case study design of this study. The appropriate approach of within-case analysis and cross-case analysis are used. To be more descriptive and exploratory, content analysis is suggested for use in analyzing the interview data from two cases with the aid of NVIVO Version 9.

5.2.2 Research Methodology
Research methodology is a part of methodological design which is refers to the plan for conducting research (O’Leary 2004). There are two types of research methodology, qualitative and quantitative methodology. Qualitative research is appropriate in helping a deep understanding of the phenomena or activity of certain situation or cases from the perspectives and views from the research participants. It is suitable with the application of exploration, discovery and description approach of situation (Bloomberg and Volpe 2012). One specific form of qualitative research methodology is case study. Case study is the thorough of description and analysis of a unique phenomenon or multiple unique phenomena, a program and a process of the situation. According to Yin (2009) case study can be exploratory case studies, descriptive case studies, or explanatory case studies purposes. There are three conditions that are reflected in the selection of these purposes.
The three conditions consist of (a) the type of research question, (b) the extent of control an investigator has over actual behavioural events and (c) the degree of focus on the contemporary. Table 5.2 distinguishes the importance of each condition for each research method.

Table 5.2: Distinguishing research method and condition

<table>
<thead>
<tr>
<th>Research method</th>
<th>Type of research question</th>
<th>Requires control of behavioural events?</th>
<th>Focuses on contemporary events?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>How, why?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Survey</td>
<td>Who, what, where, how many, how much?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Archival Analysis</td>
<td>Who, what, where, how many, how much?</td>
<td>No</td>
<td>Yes/No’</td>
</tr>
<tr>
<td>History</td>
<td>How, why?</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Case Study</td>
<td>How, why?</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: Yin 2009

Table 5.2 presents the suitability of archival analysis and case study for this research. The archival analysis method with the research questions of who, what, where, how many and how much is related to contemporary events by an examination of archival records. Meanwhile, the case study is more important compared to experiment, survey and history because the sources cannot manipulate the actual and natural behaviour. Moreover, the case study contributes to acquiring the evidence by interviewing the person involved in the events. According to Yin (2009), the case study’s unique strength is its ability to deal with a full variety of evidence such as documents and interviews. The case study also deals with event links needing to be traced over time, rather than mere frequencies or incidence.

Justification of selected research method

This study generalizes the theoretical propositions or analytic generalization and does not enumerate frequencies in analysing and discussing data collection from interviews and documents. Yin (2009) restated the definition of case study technicality as an empirical inquiry that investigates a contemporary event in depth and within its real-life context, when the boundaries between event and context are not clearly evident. In addition, the case study inquiry copes with the technically distinctive situation, relies on multiple sources of evidence and converge the data in a triangulation fashion. The benefit of case study is to guide the data collection and analysis through the development of theoretical propositions. Table 5.3 reveals the links of this study to related basic questions which show the methods of data collection and who will be involved in qualitative interviews.
Table 5.3: Coordination of data collection method with research question

<table>
<thead>
<tr>
<th>Methods</th>
<th>WHAT</th>
<th>WHO</th>
<th>HOW</th>
<th>Situation 1</th>
<th>Situation 2</th>
<th>Situation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation</td>
<td>Interviews</td>
<td>Explicit Data</td>
<td>Client/Project Manager (PM)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– written</td>
<td>– Experience</td>
<td>Tacit Data</td>
<td>Consultants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>evidence</td>
<td>evidence</td>
<td></td>
<td>Contractor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Any records as written evidence</td>
<td>Involvement, Knowledge, Skill, Expertise</td>
<td>In-depth</td>
<td>Face to face</td>
<td>Interview</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interviews to obtain unwritten evidence</td>
<td></td>
<td>interview</td>
<td>schedule</td>
<td></td>
</tr>
</tbody>
</table>

Research Context:
- Issues – adaptive re-use projects
- Project Success – project management
- Intellectual Capital Processes – knowledge management

Time and Involvement:
- Situation 1 – Project 1 (internal)
- Situation 2 – Intervening Period (external)
- Situation 3 – Project 2 (internal)

Known as ‘project-to-project time series’ scenario (see Figure 4.1 in Section 4.2)

Knowledge Management Process:
- Client/PM
- Project Teams

The selected case has the potential to contribute the best processes in capturing and managing the rich and valuable intellectual capital of key important persons within the adaptive re-use issues and project success context. Two types of data collection method were used that were appropriate to the case study research method: (a) project documentation and (b) interview with key important groups who were involved with project AR1 and project AR2 and the intervening period of both case studies.

1) The documentation in this project is categorised as explicit knowledge where all the information on issues and success in the project were written as project records. This is considered trusted evidence of the project situation and it is possible to link and relate evidence between the projects. The types of documentation are the conservation management plan (CMP), drawings, site meetings reports and other documents.

2) The interview is the main method for examining the evidence in terms of tacit knowledge that was unidentified in documentation or written records. The key important person who was practically involved with the three situations has been figured out in this research (WHO). The questions for interview are prepared and are considered semi-structured and potentially answer WHAT and HOW research questions suitable for the qualitative case study method through investigating the hands-on experience and knowledge of key important persons.
This study identified that the context of intellectual capital that is important in adaptive re-use projects is based on knowledge types that were differentiated early by Nonaka and Konno (1998) as tacit and explicit knowledge. However, the theoretical application drives this study to synthesize and review the adaptive re-use literature, project management literature and knowledge management literature to develop and define the context and basis for the questionnaires’ development. The context of the study is related with the components of success that contributed to the process of problem solving in relation with creating new knowledge and transferring knowledge in Project Adaptive Re-use 1 (AR1), Intervening period and Project Adaptive Re-use 2 (AR2).

The backbone of this research is to understand and analyse the processes of gathering and managing the rich and valuable project teams’ intellectual capital within knowledge creation and knowledge transfer activities over time in solving the problems of the project. The sense of time has been used and created in this study through three situations of possible intellectual capital processes involved with longitudinal period interactions.

Figure 5.2: Case studies situation for each case
Figure 5.2 creates a possible way to understand and define the question of HOW. This illustration also can explain how the key important person involved in all situations developed the parallel process for obtaining the answer on the intellectual capital process activities in the entire situation.

Therefore, case study method is particularly appropriate with this study in exploring and describing the components of success in helping the process of problem solving in relation with knowledge creation and knowledge transfer activity. Case study method also assists this study to investigate and answer the research questions.

5.3 Case Study Design

This study decided to adopt the multiple case study research method. Multiple case study method is involving investigation of the phenomena, population and condition in the series cases or projects (Stake 1994). The case can explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies. Next, the case can describe an intervention and the real-life context in which it occurred. The third application is to illustrate the topics within the evaluation in the descriptive mode. The last strategy is to enlighten the situations in which the intervention being evaluated has no clear and single set of outcomes. Figure 5.3 presents the four strategies adopted in this research.

![Diagram showing the four strategies of case study design: Explain, Describe, Evaluate, Enlighten.]

Figure 5.3: The synthesising of multiple case study strategy between Yin and Stake (Stake 1994; Yin 2009)
Multiple case studies provide benefit in doing cross-case analysis. Cross-case analysis is about the 'guts' of the case and seen as the whole between the cases (Thomas 2011). Therefore this study is selected multiple case studies as appropriate strategy in this research.

5.3.1 The Selection of Case Study

The case studies used in this study are a unique situation. In accordance with the research questions that have been developed in this study to understand the situation, the case study examines the components of success in helping project team develop solution for adaptive re-use projects that have been implemented in different periods. Nonetheless, the unique factors would also like to reveal the knowledge creation and knowledge process of the similar project teams for two different adaptive re-use projects. This condition is important to the influence of knowledge management which may be through the creation of new knowledge or skills and the transferral process to the next project. The study named this as a time-series situation. This is more important and critical because the uniqueness of the project involves the use of historic buildings where many preferred historical matters to be included in giving a new function to that building and the process is complex.

This study chooses two cases involved with the adaptation of the unused historical buildings to new uses as university. There is no limitation on the types of historical buildings but it focused on the same new uses or functions as the prestige building for two big universities. This study is naming the cases as Case Study 1 (CS1) and Case Study 2 (CS2) as presenting the university. Each cases have two completed adaptive re-use projects which having the process of adaptation at different time or year. Furthermore, each of adaptive re-use projects identify as Adaptive Re-use 1 (AR1) and Adaptive Re-use 2 (AR2) for Case Study 1 and Case Study 2.

Figure 5.4 shows two cases that have been identified that changed the historic building which was left un-used and given a new life by adapting historic buildings with a more significant function for academics in particular. Both cases include the two situations in a project that was carried out in different periods, but most of key person is from the same project team under the same client. Four adaptive re-use projects have been through a number of processes associated with the process of creating and transferring new ideas on the sequence of projects.
The confidentiality and privacy factors covered all collected data such as the real name of the projects which will be replaced by the AR1 and AR2. The AR1 project is represented as the first or past project. The AR1 project was implemented with the client as the owner of the building and appointing project teams in accordance with their expertise in converting unused historic buildings to their new function as a university. However, the critical factor here was to ensure that the historical values of the building were protected because the buildings were recorded as heritage. Project AR2 represents the project that is linked with the following unique factors:

- **The client (University)** – Each of the case studies consists of two adaptive re-use projects which were under the one roof of the organisation of the client. There is a similar client but the process of transforming the historical buildings happened at a different time zone. Over this time, more potential factors could contribute to changes in decision making or other particular policies and regulations in the client’s organisation. Therefore, it is worthwhile for this study to explore this situation.

- **The similar project teams** – The normal practice in the procurement method is to have different project teams for different projects where usually the selection of consultants and contractors is obtained through various steps and gives additional people for the period of projects. This situation is affected by everybody being multidisciplinary needing to cope with each other’s needs to develop a new relationship particularly in terms of ‘trust’ and ‘believe’ to work together intellectually and socially. Therefore, this project has unique factors where the client has employed similar project teams for both projects for each case study. The differences in the cases’ situation are the client essentials who applied it intentionally and the client who applied it unintentionally. It is worth exploring the reason behind these situations.
Characteristic of the project with the same functions where the historical buildings were converted to university buildings. A total of four adaptive re-use projects used the listed historical buildings which contained a high level of history interest. The suitability of the historical buildings is also worth investigating: why in the first place were these historical buildings considered appropriate for the university functions?

In between project AR1 and AR2; there are the potential of scenario that may affect the project teams' experience in relation with the movement of their knowledge and expertise in adaptive re-use practice.

This study adopts the replication approach in multiple case study design. The replication approach is attempted to duplicate the exact conditions of the research on first case. The application of this approach in this study started with the development of conceptual model, and then selects the case studies according to the research questions and defined the specific measures and data collection process and analysed as the whole case in within-case analysis approach. Both the individual cases in within-case analysis result would be focused to the comparison of cases chapters through the cross-case analysis with the similar approach of data findings. The final report would consider from the cross-case analysis between Case Study 1 and Case Study 2. The strategy apply in this research is using the similar descriptions of data for both cases in order to get the rational of data findings. Figure 5.5 shows the flow of replication approach in two cases for this study.
The adaptive re-use projects selected have similar project teams, which comprise the most important key people such as the project manager, architect, and quantity surveyor, building surveyor, fire engineer, structural engineer and contractor. They provide some recent experience in adaptive re-use processes particularly in solving the issues from this project to subsequent related projects. Since this research aims to explore the knowledge creation and knowledge transfer of the project teams’ intellectual capital, a time-series would be useful to answer research questions and achieve project objectives.

### 5.3.2 Unit of Analysis

The purpose of unit of analysis is to identify the ‘focus’ or ‘heart’ of a study within the boundary of research. There are two designs of unit of analysis; holistic design and embedded design. In a case study approach, embedded refers to the case study containing more than one sub-unit of analysis. Meanwhile holistic design is beneficial if the sub-units cannot be found but it lacks any clear measures (Yin 2009). This study has adopted the case study approach with embedded design with multiple units of analysis in multiple-case study.
This study allocates the components of success in helping the process of problem solving in the whole process of transformation of historical buildings to new functions as the unit of analysis. The main unit of analysis was the project as a whole; the sub-units were the key process of problem solving that were attached within the context of knowledge creation and knowledge transfer that happened in two sequential adaptive re-use projects for each case. To validate the research question with the data, the similar client and project teams working for both projects has occurred but in different time zones for completion. Each adaptive re-use project case reveals an individual project’s story about how the project has created and transferred the intellectual capital from project to project. The embedded sub-units reveal how the project teams developed the solution with assists from the components of success in adaptive re-use projects over time.

5.3.3 Case Study Selection

This study has identified two cases that appropriate with ‘time-series’ scenario in adaptive re-use projects. This kind of project is full with the complexity in terms of the whole process of adaptation of historical buildings to new uses or new functions (Kurul 2007). In relation of the quality of data, this study refers to the following rationales:

Selection of Participants

The participants in this study were limited to people who were involved directly with the projects. The total of participants was about fourteen that involved in two projects in each case study (see figure 5.9).

In case study 1, this research interviewed nine key and critical participants including a project manager, the architect, the quantity surveyor, the building surveyor and fire engineer from nine different perspectives and experience. They were involved in two adaptive re-use projects under the same client with similar project characteristics. The projects were adapted in different time zones with project AR1 starting in 1993 and project AR2 starting in 2006. The intervening period between projects is about 13 years in which a lot of knowledge creation and transfer process possibly occurred.

In case study 2, this research selected five key participants including project managers, the architect, the structural engineer and the builder. They were involved in two different adaptive re-use projects under similar clients. The related reason for the selection of this case study was because it involved adapting the historical buildings to similar new functions as university buildings. The obstacle of the researcher was faced related to the Case Study
2 is difficult to keep track the similar project teams that involved in first projects. This study has identified two important project teams, client and structural engineer involved with AR1. The architect is from the same company in AR1 and AR2. The architect, project manager and contractor were involved in AR2. However, this study have confidence with the point of views from the client and structural engineer because they are both highly and rich experience and their involvement will supported other project teams point of views about the Case Study 2. The difference of these participants in this case is that the client for this project did not use the similar approach as in case study 1 but the selection of project teams happened instinctively for both projects. The client said that the approach of engaging similar consultants for their projects was not the university’s policy. This project has been chosen in helping to discuss the different of time-series scenario with the long gap and short gap between the projects.

These two case studies provide a unique scenario for this research to analyse the situations. In the first situation, the client has purposely used similar consultants for their subsequent projects. In the second situation the client has been consulting with similar consultants for their subsequent projects without planning it.

Figure 5.6: The group of participants
Davies (2010, p 128) outline three main reasons for the suitability of a smaller number of participants in the qualitative research approach compared to quantitative research which are:

- Increasing the sample size in qualitative research does not necessarily create new evidence
- Unlike quantitative research, there is no need to have a large sample to provide significant statistics or estimates
- The nature of qualitative research results in detailed data, therefore the sample size needs to be relatively small for analysis.

In summary, two case studies provide four adaptive re-use projects located in suburban and urban areas restricted to Victoria, Australia. A comparison of these two cases is summarised in table 5.4.

Table 5.4: The comparison of Case Study 1 and Case Study 2

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Adaptive Re-use Projects</th>
<th>Types of Historical Buildings</th>
<th>Year of Execution</th>
<th>New Functions</th>
<th>Adaptation Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Study 1</td>
<td>Project AR1</td>
<td>Woolstores</td>
<td>1891-1954 (7 stages of construction)</td>
<td>University</td>
<td>1993</td>
</tr>
<tr>
<td>(Suburban area)</td>
<td>Project AR2</td>
<td></td>
<td>1934</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Study 2</td>
<td>Project AR1</td>
<td>Old College and Magistrate Court</td>
<td>1911-1913 and 1887</td>
<td>University</td>
<td>Not Stated</td>
</tr>
<tr>
<td>(Urban area)</td>
<td>Project AR2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: University Website

5.3.4 Data Collection Techniques

Principles of data collection
According to Yin (2009), three important principles for data collection really need to be developed and understood by the researcher involved with the case study research approach. The three principles are related to the evidence obtained in any case study. These include using multiple sources of evidence; creating a case study database and maintaining a chain of evidence (see figure 5.7).
Every principle is linked to achieve the full circle of data collection principles and benefit the research. This study adopted two sources of evidence from two case studies. First was an open-ended interview which qualitatively used a schedule of semi-structured questions based on the theoretical literature review synthesis. Second was documentation from the project’s background and other project records and heritage documentation. This situation used separate sub-studies in which documentation and interview data used triangulation where information was collected from multiple sources but aimed at corroboration on the same phenomenon. There are two conditions for corroboration of phenomena; *convergence of evidence* and *non-convergence of evidence* (Yin 2009). Convergence of evidence relates to the situation where the researcher has really triangulated the data. Meanwhile, non-convergence of evidence provides a situation in which the researcher has multiple sources as part of the same study but which address different facts. Figure 5.8 distinguishes between the two conditions.
This study adopted the convergence of evidence because it involved the qualitative interviews and used project documentation for the purpose of the case studies' background. All the evidence used in this research was used to develop the conclusion at the end of the chapter.

**Interviews**

According to Mason (1996), data collection is considered more appropriately termed as generating the data with qualitative interviewing. The qualitative interviewing approach delivers the principles and issues raised in a discussion. This approach also generally involves other associated methods such as generating and using documents from the case study. Yin (2009) supported the interview approach as an essential source of case study evidence by giving the reason that most case studies are about behavioural events or human concerns. This study has three logical reasons and rationale in using qualitative interviewing that have been adopted from Mason (1996). First, this study used qualitative interviewing referring to semi-structured forms of interviewing. The semi-structured list of questions is based on preliminary thematic questions or parts which contributed to the identification of the components of success in problem solving process in the scope of
creating and transferring the knowledge of client and project teams in a *time-series* scenario (see figure 5.9)

Second, the ontological position is involved with the client and project teams’ knowledge, views, understanding and experiences which are meaningful properties in exploring the components of success for process of problem solutions and the key points for problem solving in reality.

Third are the epistemological reasons for conducting interviews. This study was interested in the ways in which client and project teams within the *time-series* scenario worked out and solved the project problems. Next, client and project teams’ understanding, responses and
knowledge are articulated through qualitative interviews and not considered social interactions.

**Interview Schedules**

One of the qualitative methods in data generating is semi-structured interviews. This involves the process of interviewing that follows a question guide but has scope to deviate from the list on the interview schedule. This study provides a list of interview schedules according to four areas that would be explored (see example in figure 5.9). There are three major groups involved in the interviews who were directly involved with the adaptive re-use project. These are the client, consultants and contractor. All participants invited to participate in this research needed to read the plain language statement and sign the consent form as agreement to be interviewed. With careful consideration, the interview schedules were designed according to the themes or parts that were relevant to the research questions, research problems and research objectives. The questions in interview schedules were straightforward and in plain language that was easy to understand and were tested on persons who were not in the research area (Davies 2010). The questions that were used for data gathering were the same. A semi-structured interview is more natural in terms of flexibility on question order and wording. It is also flexible in that the interviewer can modify the order and details of how topics are covered (Bernard and Ryan 2010 p.29). The participants are also more likely to provide information which they might not wish to disclose in a group meeting accordingly the selection of the one-to-one nature of the interview process. The semi-structured interview is a good approach to adopt in researching experiences particularly in solving project problems (Smith and Bowers-Brown 2010). The semi-structured interview also allows the researcher to have the trigger questions to pursue for further information that are related to the main questions.

According to the research questions in this research, investigate the components of success that critical in problems solving process and explore how the components of success help project team develop the solution for project problems in relation with knowledge creation and knowledge transfer particularly for adaptive re-use projects. The example below shows the general views of participants within the main questions and trigger questions that are related to their experiences and roles.
Interview Process

Fourteen interviews in total for both case studies were digitally recorded and subsequently transcribed by the researcher manually. The interviews were conducted lasting about 60 to 120 minutes at the location and time suggested and agreed by participants themselves. According to the location of the four projects in two case studies, in Melbourne and in Geelong, Australia, the interviews were conducted in English. In Case Study 1, nine key persons that involved in AR1 and AR2 are interviewed. They are two project managers, architect, building surveyor, quantity surveyor, fire engineer, contractor, heritage advisor and town planner. The feedback from the project team in Case Study 1 is really good. Location of the buildings is in suburban area. Meanwhile, in Case Study 2 where are located in urban area have five participants involved in this study including project managers (client), project manager (independent PM firms that representing client in the project), architect, structural engineer and contractor. There are limitation and difficulty to get more project team member due to lack of cooperation and busiest with their work application. On the other hand, most of project team member basically located in urban area and really busy and responsible with more projects compare than project team in Case Study 1. The researcher take more longer
time to get an appointment with each of five participants in Case Study 2 compare than nine participants in Case Study 1. Within the difficulty, the researcher had overcome the problems and gets an interview at least three to five months each of participants to get an agreement to be interviewed.

Documentation

The documentation method provides complementary information and understanding of any related regulations to assist the project teams in obtaining building permits. This includes, for example, building regulations, fire safety guideline, design guideline, heritage regulations and the conservation management plan that were used in transforming the historical building for university purposes. Reviewing the related documents is considered useful for writing the research report as it relates to the interview data and provides the background of Case Study 1 and Case Study 2.

Data Sampling

In qualitative research, the sampling of data basically is based on the *non-random samples* or also known as *nonprobability samples*. In nonprobability samples there are about seven types of data sampling, haphazard, quota, purposive snowball, and extreme case, sequential and theoretical. The principle of each data sampling method is explained in table 5.5. Therefore, this study adopted two methods to define the aim of research.

Table 5.5: The selection of Nonprobability Samples in this study

<table>
<thead>
<tr>
<th>Type of sample</th>
<th>Principle</th>
<th>This study adopted two appropriate sampling types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haphazard</td>
<td>Get any cases in any manner that is convenient</td>
<td>Nil</td>
</tr>
<tr>
<td>Quota</td>
<td>Get a pre-set number of cases in each of several predetermined categories that will reflect the diversity of the population, using haphazard methods</td>
<td>Nil</td>
</tr>
</tbody>
</table>
| Purposive      | Get all possible cases that fit particular criteria, using various methods | This is used for judgement of an expert from four adaptive re-use projects in two cases. Three situations in purposive sampling
1. Selected the unique case study and especially informative
2. Select the group that has higher skills and is knowledgeable on solving problems and adaptive re-use and achieving project success within knowledge creation and transfer scope
3. This is for in-depth investigation of case study and gains deeper understanding of the situation or process of knowledge creation and knowledge transfer in solving the problem |
<p>| Snowball       | Get cases using referrals from one or a few cases, and then referrals from those cases, and so forth | Nil |
| Extreme Case   | Get cases that substantially differ | Nil |</p>
<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequential</td>
<td>Get cases until there is no additional information or new characteristics (often used with other sampling methods)</td>
<td>Nil</td>
</tr>
<tr>
<td>Theoretical</td>
<td>Get cases that will help reveal features that are theoretically important about a particular setting/topic</td>
<td>To answer the research questions on what are the components of success in the process of problem solving to achieve project success in relation with knowledge creation and knowledge transfer, the theoretical types of sampling are considered more appropriate in this study. This consists of people, situations, events and time periods</td>
</tr>
</tbody>
</table>

- People: the skills, expertise and experience of client, architect and contractors in managing different projects at different times but it is in a continuous sense for each project (this is where knowledge management theory is involved in this part of research)
- Situations: similar client and similar project teams for different projects at different time zones. The situation which happened in the intervening period between each project is considered not covered yet in the previous studies in the areas of adaptive re-use, project management and also knowledge management.
- Events: the issues or problems that are considered a main key to the success of adaptive re-use projects. How the project teams used their skills, knowledge, human relationships and experience to solve the problem in inter-project and intra-project.
- Time periods: four projects (two projects in case study 1 and two more projects in case study 2) were adapted and completed in different time periods.

Source: Neuman & Krueger (2003 p.209)

All fourteen interviewed has been transcribe manually by the researcher using Microsoft word. After each transcribing completed, the transcription is transferred to NVIVO Version 9 to do the next step in data analysis process. The process of open coding using free nodes and identified according the meaning of each sentences. Each sentence is being read thoroughly and the process is repeated if the research does not comprehensively understand the meaning of participants' views. Next step of the research design related with data is data analysis. The following section is described the data analysis strategy that this study applied.

5.4 Data Analysis

Data analysis involves examining, sorting, categorising, evaluating, comparing, synthesising and contemplating the coded data as well as reviewing the raw and recorded data (Neuman and Kreuger 2003,p.442). In relation to descriptive and explanatory purposes, this study understands how the social explanation is reflected in the analysis of qualitative data in this
study. A descriptive explanation involves the construction of explanatory accounts of what is going on in the operation of a set of social processes (Mason 1996). Within this situation, this research is very clear about the explanatory factors that need to be described and ensures that the generated data is relevant to the research questions.

5.4.1 Data Analysing Strategy

The strategy for data analysing is important to develop first to assist the next step in analysing all the data. Yin (2009) emphasised that the data analysing strategy will help the researcher to treat the evidence fairly, produce compelling analytic conclusions and rule out alternative interpretations. It also provides a tool and manipulates the qualitative data interview more effectively and efficiently and ensures the collected data is analysable. Yin (2009) explained four general analytic data analysing strategies including relying on theoretical propositions, developing a case description, using both qualitative and quantitative data, and examining rival explanations. Relying on theoretical propositions considers the development of propositions which are reflected in research questions, the literature reviews and which may be new propositions. Developing a case description refers to the development of a descriptive framework for organizing the case study. This strategy serves as an alternative strategy when having difficulty with the theoretical proposition's condition. Using both qualitative and quantitative data is particularly when the data involves statistical analysis and at the same time the qualitative data is also important for the case study. The examining rival explanation is the fourth strategy in analysing data by defining and testing the rival explanations. Generally this is involved with the previous three strategies; initial theoretical propositions, rival descriptive frameworks and examining rival conditions with both quantitative and qualitative data.

This study adopted the theoretical propositions that has been emphasised by Yin (2009). This study is related to intellectual capital particularly the issues or the problems and the potential problem solution that have been taken in different situations or the phenomenon where similar project teams have been involved with a similar client but in two different projects conducted over time (this study used the term “project-to-project time series” scenario). There would be some particular happenings in relation to the processes of maintaining the accumulative intellectual capital among project teams. These involve knowledge creation and knowledge transfer between the projects and the intervening time. All these phenomena and situations are traced from what happened in adaptive re-use projects around Melbourne and Geelong which involved the transformation of historical buildings to the university’s purposes. For each project, the purpose of the case study was to
explore and describe the components of success that probably helping project team in develop the solution for the problems that occurred from the different point of view of the disciplines and how the project teams solved the problems through getting input from the components of success such collaboration, trust, communication, skills; and what were the knowledge resources that help project teams developed the solution such as document of heritage and building and fire requirements. This involved exploring and describing the hidden phenomena in relation to the continuous-learning-relationship in the first project and the sequential project particularly involved with the process of knowledge creation and knowledge transfer. This strategy is very useful in guiding this study particularly in the case study data analysis process which represents the questions of ‘what’ and ‘how’.

5.4.2 The Process of Data Analysis

Managing the data analysis process is the most potential barrier to any researcher in qualitative methodology. Miles and Huberman (1994 p.43) supported that the lone qualitative researcher or the novice researcher student are notorious for their vulnerability to poor study management. However, over the decade, new software continues to be developed for helping and managing the richness of qualitative data particularly from the interview approach. There are thousands of words that need to be described with the meaning of each word or sentence or the whole paragraph of transcription explored. One popular software product that is always used as aid tools for analysing data is Nvivo. The latest version is Nvivo 9. This study used Nvivo 9 software to assist with the interview data and to follow the next process of data analysis. Miles and Huberman (1994) have listed about fourteen processes to manage the data in qualitative studies using computer software. To be more flexible, the fourteen processes of Miles and Huberman (1994) are revised purposely in this study according to the new environment of computer software.
Level of Data Analysis

According to the nature of the case studies selected, this research employed the multiple case study method. Two steps were adopted by this study for the level of data analysis from two case studies which were involved with four adaptive re-use projects: Level One – within-case analysis, and Level Two – cross-case analysis (see figure 5.12).

Figure 5.11: The Appropriate Data Analysis steps suggested for this study

Uses of Computer Software in Qualitative Studies (Miles and Huberman 1994 p.44)

- Making notes in the field
- Writing up or transcribing field notes
- Editing: correcting, extending or revising field notes
- Coding: attaching key words or tags to segments of text to permit later retrieval
- Storage: keeping text in an organised database
- Search and retrieval: locating relevant segments of text and making them available for inspection
- Data “Linking”: connecting relevant data segments with each other, forming categories, clusters or networks of information
- Memo-ing: writing reflective commentaries on some aspect of the data, as a basis for deeper analysis
- Content analysis: counting frequencies, sequence or locations of word and phrases
- Data display: placing selected or reduced data in a condensed, organised format, such as a matrix or network, for inspection
- Conclusion drawing and verification: aiding the analyst to interpret displayed data and to test or confirm findings
- Theory building: developing systematic, conceptually coherent explanations of findings; testing hypotheses
- Graphic mapping: creating diagrams that depict findings or theories
- Preparing interim and final reports.

Uses of Computer Software (Nvivo 9 and Microsoft Word) in Qualitative Interview Data

Stage 1: Data Managing and Coding

1. Storing and transcribing the data from tape recorder (interview transcripts).
2. Classified and viewed the verbatim transcripts with ‘free nodes’

Stage 2: Group Codes and Connect Ideas

3. Theming and Coding: group codes and connect the points by getting the repeating ideas from individual transcripts.

Stage 3: Themes organisation with Content Analysis (Frequencies of points) into Conceptually Coherent explanations of findings

4. Organising identified the component of success and the key components of problems solving process in each cases

Stage 4: Discussion (Content Analysis)

5. Discussion within the case scenario. This is not the final report but it will continue with the next level of data analysis, the comparison between the cases in Cross-case Analysis in assisting and exploring the similarities and to differentiate between the first level results (within the case analysis result).
Level One
There are about two cases involved in this research. The first level of data analysis, the within-case analysis approach, is adopted to analyse the qualitative interview data based on content analysis. This study adopted content analysis to theme and codes the interview transcriptions with the aid of qualitative analysis software Nvivo 9 for stage 1 to stage 3.

Stage 1: Data Managing and Coding
This involves storing the interview transcriptions from a total of 14 participants from two cases or four adaptive re-use projects. Before theming and coding the data, all the transcriptions will be read through to understand the whole situation and provide the specific key themes that are relevant to the research questions. All the transcribed interviews is imported to the NVIVO as the ‘sources’ and has been named according to their position in both projects.
The next step is to classify the verbatim transcripts and view them by the group (Case Study 1) and individual (position). Using “free nodes” in Nvivo, the analysis of the content of verbatim transcription identified the text related to the research questions and research objectives. The text is named with a meaningful heading under “free nodes” applications and this process is continuous for the whole verbatim text transcriptions.

**Stage 2: Group Codes and Connect Ideas**

Each of the verbatim transcripts from the individual interview will repeat the similar process in stage 1. Following this, the process in stage 2 involves group codes and connecting the points by getting the repeating ideas from individual transcripts. All the repeating points from individual participants will combine into “thematic nodes” in Nvivo 9. The process is started with the review of all the sentences and it code to the main theme named with a meaningful title according to the theoretical framework.
Stage 3: Themes organised with Content Analysis (Frequencies of Points) into Conceptually Coherent Explanations of Findings – Within Case Analysis

The next stage is organising the frequencies of points in thematic nodes into a larger group that expresses a common theme. The frequency provides the criticalness of the points that are represented from each individual practically involved with those projects. To organise the themes in Nvivo 9, each of the identified themes is categorised according to the critical success factors components. The repeating ideas of each main themes has been categorised as the following list: 

Figure 5.14 Using NVIVO Version 9 in coding the interview transcriptions
<table>
<thead>
<tr>
<th>Parent Nodes (SFs Themes)</th>
<th>Child Nodes (Repeating ideas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration</td>
<td>Comfortable</td>
</tr>
<tr>
<td></td>
<td>Consistency</td>
</tr>
<tr>
<td></td>
<td>Cooperation</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
</tr>
<tr>
<td></td>
<td>Understand</td>
</tr>
<tr>
<td></td>
<td>Respect</td>
</tr>
<tr>
<td></td>
<td>Enjoyable</td>
</tr>
<tr>
<td>Communication</td>
<td>No repeating ideas</td>
</tr>
<tr>
<td>Past Experience</td>
<td>Confidence</td>
</tr>
<tr>
<td>Skill</td>
<td>Dealing skill</td>
</tr>
<tr>
<td></td>
<td>Good and Smart skill</td>
</tr>
<tr>
<td></td>
<td>Leadership skill</td>
</tr>
<tr>
<td></td>
<td>Responsibility</td>
</tr>
<tr>
<td>Supportive Attitude</td>
<td>Appreciation</td>
</tr>
<tr>
<td>Trust</td>
<td>No repeating ideas</td>
</tr>
</tbody>
</table>

**Level Two – Cross-Case Analysis**

**Stage 4: Discussion and Explanation**

Miles and Huberman (1994) mention two fundamental reasons for using cross-case analysis for multiple case studies; to enhance generalizability, and to deepen understanding and explanation. The multiple cases will help the researcher to answer reasonable questions with adequate samples and careful analysis in the process of generalizing the points. Multiple cases also pin down the specific conditions and help the researcher form the more general categories of how those conditions may be related (Miles and Huberman 1994). The cross-case analysis is looking for the pattern of solving problems in relation with components of success, knowledge creation and knowledge transfer in adaptive re-use project. The next step is comparing the similarities and differences among two cases. The examination of similarities and differences among multiple case studies can strengthen a research theory (Miles and Huberman 1994). This research elaborated the similarities and differences to generalise the related points with formalised project success factors and a body of knowledge to form the theories.

Cross-case analysis obtains a similar process and the stage 4 and stage 5 as at Level 1 of data analysis. The cross-case analysis identifies the similar and different in related points between the cases particularly for knowledge creation and knowledge transfer towards
adaptive re-use success, for example, the processes of problem solving in relation to the time series scenario; scenario 1 = Project AR1, scenario 2 = Intervening period; and scenario 3 = Project AR2.

5.5  Validity of Data Findings

McCaig (2010) pointed out that ‘validity is defined as correctness or credibility of an account, explanation or interpretation that you may come up with. In other words why should anyone believe your conclusions?’ In particular research related to the case study method, bias is one of the barriers in data presentation and conclusion (Yin 2009). There is much confusion of terms in relation to validating the data. However, Miles and Huberman (1994) clarify the similarity of validity terms (see figure 5.15).

![Figure 5.15: Clarifying the validation terms for standards for the quality of conclusion (Miles and Huberman 1994)](image)

To ensure that this research is equitable and the thoroughness of the findings in this study, multiple case studies were used to establish reliability and generalise the data findings. This study used triangulation (Miles and Huberman 1994; Yin 2009), validity (internal, external and discourse analysis) (Miles and Huberman 1994; Yin 2009) and reliability (trustworthiness) (Miles and Huberman 1994; Yin 2009)

5.5.1  Triangulation

The research finding can be supported by triangulation through showing the independent measures of agreeing with it and at least not contradicting the finding. According to Denzin’s classic distinction, the triangulation can be identified as data source, theory, methodological and investigator types (Miles and Huberman 1994). This research used three types of
triangulation and added data analysis triangulation (Yin 2009) to construct the validity of data
findings.

- **Data source triangulation**: this research used two multiple data sources and two
  methods of data collection. The detail of data sources and methods is explained in
  section 5.3.

- **Theory triangulation**: this research has reviewed three areas of literature including
  adaptive re-use areas, critical success factor areas and knowledge management
  areas. All these areas of literature are related and strong synthesis has been
  discussed in chapter 4.

- **Methodological triangulation**: This study used a case study design with multiple
  cases. This method provides an opportunity to investigate deeply about the
  uniqueness and interrelationships of each case.

- **Data analysis triangulation**: The analysis of data is derived from two levels of analysis
  which consists of four stages of analysis. The strong finding was obtained from
  content analysis, discourse analysis and data mapping that occur in within-case and
  cross-case analysis.

### 5.5.2 Validity

McCaig (2010) described two main types of validity in relation to research design; internal
and external validity. Validity is closely related to data sampling and sampling techniques
which ensure the validity of the data finding. In order to ensure the validity, this study used
internal and external validity and construct validity that related to the samples of data and the
techniques used to gain the data from case studies.

**Internal validity**

Internal validity has a strong relationship to the theories’ development and uses data
collection techniques and the data analysis method to test the proposed theories. A concept
of critical success factors and knowledge management is employed in relation to the process
of solving the problems of the projects involved. According to the nature of descriptive and
exploratory study, this study constructed a theoretical framework (conceptual model in
chapter 4) and cross checked this with the findings from the qualitative interviews of the case
studies which were really helpful in improving internal validity.
**External validity**

External validity is more related to the generalised data findings from each participant or group and the same test can be applied and could achieve similar results from different researchers (McCaig 2010). Hence, this study attempts to understand the complex and unique phenomenon of the selected case studies. The achievement of external validity is through the development of systematic case study design in the case study design section (refer section 5.3).

**Construct validity**

There are about three tactics used to increase the construct validity in this study. The data collection process for this study involved multiple sources of evidence, including conducting interviews with the project teams who were involved with both projects for each case study. The interviews were conducted using a face-to-face approach. Within the face-to-face interview, the researcher can be sure that the views have been provided by the project teams for whom the questions are intended (Bernard and Ryan 2010). The researcher ensures that the participants do not flip ahead to anticipate questions or change answers by providing the list of the interview schedule that has a plain language statement about this research.

5.5.3 **Reliability (Trustworthiness/Dependability)**

Reliability or trustworthiness or dependability are to minimise the biases in a study. This study used reliability of the research process as a goal to maximise the trustworthiness of data. To be more practical and related to this study, the case study tactic as suggested by Yin (2009) was adopted. This tactic involved the development of case studies’ documentation in a proper manner. All the documentation related to the case studies, interview transcripts in Word documents, interview recordings for data gathering and data analysis is stored electronically and stored on University Network systems. On the other hand, these systems provide high levels of manageable security and data integrity. They also can provide secure remote access and are backed up on a regular basis and provide disaster recovery processes in case any large scale incident occurs. In other words, the data will be properly managed in designated files and folders with appropriate software.

5.6 **Overall Research Methodology Process**

The literature on adaptive re-use and critical success factors is reviewed and synthesised in chapter 2 and chapter 3. It considers all the related issues in adaptive re-use around how the
adaptive re-use success is supported by critical success factors with much empirical testing. After chapter 2 and 3, the gap in the literature has been defined. This study considers that the knowledge management approach is really critical in the adaptive re-use project environment but it has not been covered much by previous researchers in the adaptive re-use scenario. Then, chapter 4 was developed to synthesise and propose the Intellectual Framework for successful adaptive re-use projects which is involved with the knowledge management approach. In regards to systematically executing the proposed framework for adaptive re-use projects, the case studies and qualitative interview methodology were discussed and proposed which contain a case studies strategy and techniques for the data gathering, displaying and analysing approach. Figure 5.16 illustrates the overall process of this case studies research.
Figure 5.16: Overall Research Methodology Process

Phase 1
- Developing Research Question
  - research problems
  - research objectives
  - CHAPTER 1

Phase 2
- Literature Review & Synthesis
  - adaptive re-use
  - knowledge management project success
  - CHAPTER 2
  - CHAPTER 3

Phase 3
- Conceptual of Intellectual Capital for Adaptive Re-use Successful Framework
  - CHAPTER 4

Phase 4 (Real World Investigation)
- Data Collection (semi-structured qualitative interview and document analysis)
- Data Analysis (content analysis)
- Cross-Case Analysis
- Framework Refinement: Development of Intellectual Capital for Successful Adaptive Re-use Projects
  - CHAPTER 5
  - CHAPTER 6
  - CHAPTER 7
  - CHAPTER 8
  - CHAPTER 9

Phase 5
- Conclusion
  - CHAPTER 10
5.7 Summary

Chapter 5 has revealed and discussed in detail the methodology for the entire study. Based on the research questions and research objectives, a preferred method of this study is descriptive and exploratory and entirely qualitative in practice. To achieve the qualitative research approach, multi-case study were used as a strategy for this study. This selection was appropriate to the uniqueness of this study which is based on the situation which used a project-to-project scenario and appropriate time series to achieve the objectives of the study. Study techniques for data collection and data analysis have also been described in this chapter. This chapter concludes that the quality of trusted data in this study was strengthened by the issues of triangulation, reliability, internal validity, external validity and construct validity. The next chapter will discuss the background of the case studies, analyse data and display all the key findings to answer the research questions which are the objectives of the study. Chapter 6 describes the data findings and discussion of Case Study 1 and for Case Study 2 is in Chapter 7.
CHAPTER 6
CASE STUDY 1: WITHIN-CASE ANALYSIS AND DATA FINDINGS

This chapter presents the within-case analysis and data findings of case study 1 in relation to the application of the components of success and the key points in problem solving from the project teams' points of view. This study adopted within-case analysis with main unit analysis and sub-unit analysis on the Adaptive Re-use 1 (AR1) and Adaptive Re-use 2 (AR2) projects comprising case study 1 that was located in Geelong, Australia. This chapter discusses in detail the research design used for this research. Both projects had the same key people in the project teams and their involvement was crucial to the success of the projects. These key people were two project managers (from the client), architect, quantity surveyor, building surveyor, fire engineer and the contractor. They provided all the essential input required for the research particularly in terms of the decisions that were made throughout the duration of the projects. The data collection technique (section 5.3.4) and data analysis technique (section 5.4) were explained and justified in chapter 5. This chapter discussed the overview of case study 1, data findings on components of success and key components of problem solving. Finally, the summary of this chapter is also described.

6.1 Overview of Case Study 1

The overview refers to the interpretation of case study 1 in which all the information was gathered from project documents (including the history of the buildings) as well as other information about adaptive re-use projects. All the information was from explicit sources including heritage citations and conservation management plan. In this section, the historical background of the original development of the two buildings and the relationship between projects are described.

6.1.1 The Historical Background of the Buildings

Case study 1 is referred to as the AR1 and AR2 projects. The buildings are adjacent and are situated in the city of Geelong located 75 km south-west of Melbourne. Geelong is Victoria's second largest city and fastest growing region. Elegant architecture on historic buildings is symbolic in Geelong which is described as the "city by the bay" (Travel Victoria 2004).
The town of Geelong was established in 1837 and grew quickly as a port for wool exports (Brown 1957) with the standard infrastructure of hotels, churches, a general store and woolstores. The wool was stored in the many woolstore buildings that surrounded the port before it was sold or exported (Geelong Regional Commission 1987). Most of the wool mills and woolstores for wool production such as rope works, wool-scourers and tanners were located near the port. The woolstores particularly were still standing and active in production until other industries gained prominence in Geelong’s economy starting from the 1970s (Eureka 2010). Between the 1970s and 1980s, many new industries come to prominence in the economic and development growth in Geelong. This situation impacted on the wool industries: people preferred to work in other production and services industries such as car manufacturing, cement and glass works, and oil refineries and fertilizer works due to the better pay. Affected by that, wool manufacturing and selling declined between 1970 and 1980. The wool mills became inactive and closed: woolstores were abandoned and left empty. In 1977, the local government established the Geelong Regional Commission to oversee unified planning and development policies that included finding alternative uses such as a conservation program using the adaptive re-use concept for the abandoned woolstores. Since then, the National Trust has identified and classified the Woolstores building area and registered the area as the Woolstores Conservation Area in August 1980 (Geelong Regional Commission 1987). That report identified three woolstores and other buildings that provided support facilities such as power generation, industrial activities and a public house. This area was proposed for urban conservation and listed under the Register of the National Estate and consisted of three groups of woolstores, the Dennys Lascelles group, the Strachan group and the Dalgety and Co. group. Late in 1980, only Dalgety and Co. group still remained untouched compared to the other two groups. Most of the Dennys Lascelles group of woolstores had been demolished (Geelong Regional Commission 1987).
Through history, the woolstores in this area have been erected at various times using different construction method. In the early 20th century, most of the woolstores were built using solid red bricks (skin) with timber frame on the inside as well as for the floor structure. This includes the AR1 and AR2 building. The development history of AR1 and AR2 stated that built between 1891 and 1954 (see figure 6.3). Both buildings were built through seven major stages which involved with floor additional.
6.2 Adaptive Re-use Projects Background

In 1993, the AR1 and AR2 projects’ buildings were taken over by the client (the university) to be its campus for the School of Architecture and Building and the Faculty of Nursing. The AR1 project was officially occupied on 3 April 1996. The AR2 project’s building was put through a reconfiguration and expansion of the existing floors and structure which began in 2006. The AR2 project was completed in January 2009 and created an exciting multi-purpose environment with variable dimensions of spaces. The review of the documentation shows evidence that the knowledge transfer activity occurred between the AR1 and AR2 projects. Figure 6.4 shows the significant environmentally sustainable design (ESD) components that occurred in the AR2 project as a reflection of the knowledge transfer activity from the AR1 project. The application of element in ESD for AR2 is reflected from the group of project members that involved in AR1. The knowledge transfer activity occurred while the similar project team members involved in decision making process for AR2. The elements of ESD were developed because of the learning and experience from AR1 and apply for the improvement in terms of sustainability for AR2. Since the AR1 was not apply the ESD elements, the project team members gathered the knowledge and experience from AR1 and transfer that knowledge to the AR2. As example, the AR1 surrounding has minimum natural day lighting; the similar project teams have decided that AR2 should have the maximum natural day lighting.

This analysis captured two factors of evidence; the first was the consistency of the design principles of the AR2 project refurbishment with the client’s objectives on environmentally sustainable design (ESD) initiatives. The result became a key component of good design practice for this project. The second factor was related to the contributions of the AR2 project design and how it significantly related to the re-use objectives.

<table>
<thead>
<tr>
<th>Element of significant in AR2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-use the building (the single most significant element)</td>
</tr>
<tr>
<td>A central atrium to maximise natural day lighting</td>
</tr>
<tr>
<td>Rainwater harvesting to flush toilets</td>
</tr>
<tr>
<td>Efficient fixtures, fittings and equipment chosen for plumbing, electrical and mechanical works</td>
</tr>
<tr>
<td>Solar/gas domestic hot water system</td>
</tr>
<tr>
<td>Re-use of salvaged materials including steel and timber</td>
</tr>
<tr>
<td>A thermal comfort range used as design parameters instead of defining a constant temperature for inside. This significantly reduces the amount of energy to cool the spaces</td>
</tr>
</tbody>
</table>

Figure 6.4 components of significant of ESD in AR2 (Deakin Website 2012)
6.2.1 The Interviews

Interviews were scheduled with the key people who were critically involved in the AR1 and AR2 projects. There were nine key people interviewed (see table 6.1).

Table 6.1: Participant grouping, position and code name (for confidentiality) of key people

<table>
<thead>
<tr>
<th>Participant</th>
<th>Code Name</th>
<th>Position/The Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>PM1</td>
<td>Manager, Project Delivery</td>
</tr>
<tr>
<td>Client</td>
<td>PM2</td>
<td>Senior Project Manager</td>
</tr>
<tr>
<td>Consultant</td>
<td>BS</td>
<td>Building Surveyor</td>
</tr>
<tr>
<td>Consultant</td>
<td>FE</td>
<td>Fire Engineer</td>
</tr>
<tr>
<td>Consultant</td>
<td>QS</td>
<td>Quantity Surveyor</td>
</tr>
<tr>
<td>Consultant</td>
<td>ARCH</td>
<td>Architect</td>
</tr>
<tr>
<td>Contractor</td>
<td>CTR</td>
<td>Contractor</td>
</tr>
<tr>
<td>Heritage Advisor</td>
<td>HA</td>
<td>Heritage Advisor, Local Council</td>
</tr>
<tr>
<td>Town Planner</td>
<td>TP</td>
<td>Senior Strategic Planner, Local Council</td>
</tr>
</tbody>
</table>

(Source: Case study 1)

The methodology chapter (chapter 5) has described that the client group, the consultant group and the contractor group were the groups selected for interview due to their involvement with the AR1 and AR2 projects. The project team’s identity and team members’ names were not mentioned for reasons of confidentiality. There were two project managers in the client’s organisation. One was responsible for project delivery in the Property Services Department (PM1) and the other was involved in everyday routine on-site as senior project manager (PM2). The architect (ARCH), building surveyor (BS), fire engineer (FE) and quantity surveyor (QS) represented the consultant group. They were selected as the client has remarked that these consultants played a vital role in both projects. The third group, that is, the contractor (CTR) group was involved in both traditional and construction management procurement. The contractor also had a track record with good experience in relation to projects which transformed historical buildings. One obstacle for the interview process for case study 1 was the difficulty of tracking down all individuals, particularly the retired contractor. However, the researcher managed to locate them all using contact details from clients and other consultants who had still maintained communications even years after the project was completed. During the data collection process, this study identified that the local council’s heritage advisor (HA) and town planner (TP) would also contribute significant value in the data analysis. Valuable data was thus obtained by interviewing these two important individuals from the local council particularly in relation to heritage and building permit advice. The town planner mentioned that she was not involved in the AR1 project because
she joined the local council after 1995. However, the town planner and heritage advisor had rich perspectives on the AR2 project’s process regarding heritage, permit issues and local council planning. Their perspectives were important in supporting the client group, consultant group and contractor group perspectives in the design and construction stage particularly in the problem-solving process. The main aim of this study was to explore and describe the components of success in the process of problem solving in relation to knowledge creation and transfer among the client and project teams within the adaptive re-use time series scenario.

The analysis of the interview data involved the components which had potentially contributed to the problem-solving process in relation to critical success factors (CSFs) and the knowledge management approach where it helped in identifying and interpreting the problem-solving process in relation to the knowledge creation and transfer that happened between the AR1 and AR2 projects.

The data were displayed according to the data management process using NVivo 9. The transcribed data were carefully read to understand the information provided by the participants. Data interviews were transcribed from the audio-taped version to the written version with MS Word 2003. To ensure that the transcribed interview data were valid, the researcher repeated the process by listening for the second time while reading and checking with the first draft of the transcription. Through this process, any redundant or uncertain words and sentences could be amended before the next stage. After the process of data validation, the interview transcripts were exported into NVivo 9 for open coding processes. Each sentence from all nine interview transcripts was read carefully to capture the essence of that sentence that would be used later in open coding. Open coding in NVivo 9 involved collecting all the interview transcripts and grouping them into open themes where the researcher used a conceptual model (in chapter 4) with analytic and descriptive coding methods as a guide to identify the related themes. The analytic coding was started by assigning codes to possible variables, a process which integrated the literature review findings with the conceptual model (chapters 2, 3 and 4). Descriptive coding assigned demographic characteristics to each participant by describing their different perceptions about the variables of the critical factors that contributed to adaptive re-use success, knowledge creation and transfer activities, and issues in adaptive re-use projects.

The next sections present the data findings and discussion obtained from nine in-depth interviews with people who were fully or partly involved in the AR1 and AR2 projects (see table 6.2).
Table 6.2: The project team involvement in AR1 and AR2

<table>
<thead>
<tr>
<th>Respondents Roles</th>
<th>Involvement AR1</th>
<th>Involvement AR2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Project Manager 1</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>(has knowledge about AR1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2  Project Manager 2</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>3  Architect</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>4  Building Surveyor</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>5  Fire Engineer</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>6  Quantity Surveyor</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>(has knowledge about AR1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7  Town Planner</td>
<td>X</td>
<td>√</td>
</tr>
<tr>
<td>8  Heritage Advisor</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>9  Contractor</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(In early projects)</td>
</tr>
</tbody>
</table>

Three major findings emerged from case study 1:

1. The majority of the participants described the six components of success that occurred during their practice within the time series scenario as being trust, collaboration, communication, skill, past experience and a supportive attitude. Five of these components of success were considered critical for the process of problem solving. The component of supportive attitude (56%) was eliminated because it was not critical in supporting the project team’s problem-solving process. This case study indicated that the criticalness depended on the total frequencies’ percentage being between 80% and 100%.

2. All participants indicated that their involvement in the time series scenario (the AR1 project, intervening period and the AR2 project) affected how they solved problems in the AR1 and AR2 projects. Knowledge transfer activity contributed to identifying the key components of problem solving in terms of how these key components affected the process of problem solving. Transferring knowledge
activities that supported intellectual and social routines within the problem-solving process included:

a. The same project team members
b. Effectiveness and efficiency mode
c. The team members’ actions
d. Sources of information.

3. The majority of participants emphasised that generating new skills and developing new solutions for the problem-solving process were the major contribution of the knowledge creation activity to the AR2 project.

6.3 Research Findings 1: Components of Success for the Process of Problem-solving Process in Case Study 1

According to the research findings from the semi-structured interviews, there were six components of success which contributed to the process of problem solving in the AR1 and AR2 projects. These were an intellectual and social sense of: collaboration, communication, trust, skills, past experience and a supportive attitude in the project team’s problem-solving process. Therefore, this section is categorised into six subsections which reflect these six components of success which helped the project team through the process of solving project problems. The interview data were analysed using content analysis and are described in figure 6.5.

Figure 6.5: Subsections of success components in Case Study 1

These six were selected and identified for coding as appropriate components that contributed to the process of problem solving in case study 1. This section summarises the components that probably contribute to the problem-solving process in relation to the
intellectual and human capital of project teams. The identification of the components of success was classified through NVivo Version 9 with logical ideas and evidence from the theoretical framework and literature review. The theoretical framework (chapter 4; section 4.5) that has been developed based on the highly synthesised literature reviews (chapter 2 and 3) in relation to the knowledge management approach.

The interview transcripts in NVivo9 were read thoroughly in the process of identifying the coding and setting a theme for the nodes. The researcher had to ensure and deeply understand their views and work out the groupings for the appropriate and related nodes. After the process of data coding and theming, this study identified the new component of experience that had arisen from participants’ views. However, there was no mention by any participant that could relate to a supportive attitude being a component of success in adaptive re-use projects in relation to problem solving. Therefore, this study identified collaboration, communication, skills, experience, supportive attitude and trust as the components of success that helped them through knowledge transfer and knowledge creation with the process of problem solving in case study 1. Table 6.3 presents the summary of the components of success as indicated by participants. This schedule was used by this study to identify the criticalness of the success components in the project team’s views according to their experience in the AR1 and AR2 projects.

Table 6.3 Frequency of participants’ view about the six components of success

<table>
<thead>
<tr>
<th>Items</th>
<th>Project Team</th>
<th>Collaboration</th>
<th>Communication</th>
<th>Skills</th>
<th>Experience</th>
<th>Trust</th>
<th>Supportive Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Client</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Client</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ARCH</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BS</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>QS</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>FE</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CTR</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>HA</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>TP</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9 (100%)</td>
<td>9 (100%)</td>
<td>9 (100%)</td>
<td>9 (100%)</td>
<td>8 (89%)</td>
<td>5 (56%)</td>
<td></td>
</tr>
</tbody>
</table>

Legend of repeating meaning of the main components of success
1. Cooperation
2. Understanding

93
The purpose of this table was to investigate the frequency of the said components of success in their interpretations. A higher frequency (f) would potentially become a critical component of success in their activity of problem solving. For the components of success where there was more than one mention about the same components, this study calculated the average of the frequencies. For example, to derive the average for skills:

\[
\frac{\text{total cooperation} + \text{total understanding}}{\text{number of repeating ideas}} = \text{frequency}
\]

\[
\frac{9 + 9}{2} = 9
\]

The critical components of success in case study 1 according to the number of frequencies are shown in table 6.3. Discussion for the next section is based on the number of frequencies or the critical level of the success components. The discussion will start with collaboration (f = 9), communication (f = 9), skills (f = 9), experience (f = 9), trust (f = 8) and supportive attitude (f = 5).

6.3.1 Collaboration

Evidence from all nine participants demonstrated that collaboration depended on the components of cooperation and understanding which were the most important components in creating collaboration in the process of problem solving. From the frequencies of the nine sub-components of collaboration, this study focused on cooperation and understanding because both sub-components had 100% of references in the interview data quoted in NVivo 9 that described the meaning of collaboration in case study 1 during the process of problem solving (see figure 6.6)
Figure 6.6: Number of references (quotes) about the cooperation and understanding in the interview data
Source: Case Study 1

Cooperation

Figure 6.7 illustrates the evidence that cooperation is considered as a collaboration sub-component in project team involvement in the adaptive re-use project.
This was the best variable for describing collaboration in case study 1. The project team was working together cooperatively in preparing the project documentation. The early challenge in case study 1 was the lack of information about the woolstore building particularly for the AR1 project. It was critical to protect the historical building particularly at the design stage. According to the building surveyor, adaptive re-use of the historical building (case study 1) required a lot of information especially on the background of the building such as early construction information and the building’s history. The building surveyor said:

Reference 1 (PM 1 Client):
Obviously the contractor that we working on, so, they work to do very closed in team. There wasn't like an external consultant company and aren’t arguing over prices, that was not on that because we all in one project to one project team

Reference 2 (PM 1 Client):
Deakin (Client) works in this group, we working in the cooperative way, so the consultants team, that we works in this day, then the head contractor is actually engaged form the part of the team, so it is not the situation we were get into conflict because the whole ideas that we acknowledged everybody has to work together to actually deliver to what we need to deliver within the budget and within the program

In that sort of building because you basically need to have a lot of background, any information, a lot of designing, assistance in the design. So, normally at the normal building permitted you would do the designer will go with the design the building similar to us to look through to make sure it comply. Probably we give a little bit advice throughout the process.

Figure 6.7 Cooperation components that contributed to collaboration in interview data
This study found that the project team successfully discovered all the information needed to assist the designers in designing case study 1. The evidence of the historical and early construction information is described in section 6.1.

The other evidence of cooperation between the project teams in case study 1 was the problem solving of situations between the contractor and building surveyor. The contractor and quantity surveyor assisted each other in issues related to the process of costing and pricing. This involved numerous discussions and negotiations related to the tender process. The negotiation on the tender process was referred to as an ‘open-book’ tender by the client and project team. Within this approach to the tendering process, the client and the project team including the contractor worked together and cooperated in relation to the project cost without too many arguments about the tender. Project manager 1 said:

### … the arrangement we had with the architect, the engineers, the quantity surveyor and the builder what basically ended it up like “open-book” arrangement. We would deliver them to final document. It priced and submit the pretty much all the pricing to the quantity surveyor and was always an ‘open negotiated’ and all those provisional sum were pretty much just negotiated and agree with price and profit and overhead and all the associated with it. So the relationship with the builder was always a ‘partnering orientation’ on the Dalgetys building (AR1). And all everything was open and just submitted through agreed between the owner, consultant, the quantity surveyor and the builder. So, the arrangement was very good. The builder saw something the potential problems, they come to us and negotiated and worked with it and get it out before became the problem cause we actually we had NO major problems at all during construction on this job (AR2).

The client’s perception also demonstrated that, with good cooperation among the project team, ‘fighting’ did not really happen much in case study 1. The contractor selected for doing the adaptive re-use projects (AR1 and AR2 projects) was the local contractor and subcontractors were really keen for make sure the project went well and followed the client’s requirements. This was related to the contractor’s strategy of making sure their services continued for the future AR2 project because the client was satisfied with the job done in the AR1 project. The evidence for this finding was related by project manager 2 (client) in statements in his interview:

### Well, [it was] the biggest job the builder [had] undertaken so was pretty keen and the local builder and the local subcontractors that this project felt really high profile at that time, so everyone was really keen for the project to go well and, from my point of view, it went very well with all, the architect was able to basically deliver what we wanted. The consultant engineers were on board and understood what we wanted on that. The builder was able pretty much deliberated … And I think because we also had a unique project because the architect had delivered anything as big as on that sort of building and certainly the builder had worked on a sort of building that was this size, much the same. So I think that all were pretty keen to actually do a very good job because the cooperation was very good.
The next discussion in the data finding related to the understanding of the project team that related to the collaboration component in helping them around the process of problem solving in case study 1.

Understanding

All of the project team’s perceptions demonstrated evidence that the factor of understanding in the AR1 and AR2 projects was considered critical in achieving project success in a complicated adaptive re-use project. Figure 6.8 shows the evidence from one of the project team (architect) who described the understanding on the history of the building during his involvement in case study 1.

Reference 7 (ARCH):

...If someone were to involved in a historical building project, he or she should understand the history of the building...that’s right...it’s still can be seen its not been covered up or demolished, it’s still there to be interpreted, they can still see the wool bail, bail elevators, and also see a wool drop because we kept them there that’s why we kept them so that people can interpreted them, how they used to work, that’s why we kept the ceiling through office in the public area we keep the floor joist exposed so people can see how the building is used to be raw and unfinished. That’s what we kept it that way rather than put ceiling everywhere and makes it more easier, high roles with services in easy way we didn’t do that.

Reference 8 (ARCH):

He (heritage advisor) is I talked through thought the concept, as we talk about as you learn, we learn some their principles from doing the (AR 1) project and other woolstores project we done. So, you build up your understanding on what matters and what doesn’t, how far you can push things, what’s good to keep and what’s necessary to keep. So we were come out with the concept and talk through with him. There were some components to the building that we mentioned on the citation for the building, building heritage citation like the rain water he.

Figure 6.8: Understanding components that contributed to collaboration in interview data
This study found that the understanding factor contributed to many variables or meanings. Data analysis showed that the understanding of the project team could be categorised into four types of understanding which comprised understanding in relation to: project regulations, the project, the building history, and the skills and knowledge of other project members.

1. **Understanding of regulations** related to and important in adaptive re-use projects including Australian building regulations, heritage requirements, recycling regulations, fire safety and fire engineering regulations, etc.

Adaptive re-use involves many regulations and requirements that need to be fulfilled to ensure that the project is a success. This study identified that regulations and requirements in this project which were categorised as explicit sources included Australian building regulations, heritage requirements, recycling regulations, fire safety and fire engineering regulations, etc. Table 6.4 shows the explicit sources that were referred to and used by the project team to solve any problems at all stages.

**Table 6.4: Explicit resources in case study 1**

<table>
<thead>
<tr>
<th>Explicit resources types</th>
<th>The documents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Information</strong></td>
<td>Pricing and costing information</td>
</tr>
<tr>
<td></td>
<td>Estimating books</td>
</tr>
<tr>
<td></td>
<td>Previous project record in cost</td>
</tr>
<tr>
<td></td>
<td>Information of supplier prices</td>
</tr>
<tr>
<td><strong>Heritage Information</strong></td>
<td>Conservation management plan</td>
</tr>
<tr>
<td></td>
<td>Heritage requirement</td>
</tr>
<tr>
<td></td>
<td>Recycling heritage building guideline</td>
</tr>
<tr>
<td></td>
<td>Heritage refurbishment documents</td>
</tr>
<tr>
<td></td>
<td>Heritage citations</td>
</tr>
<tr>
<td></td>
<td>Woolstore industrial heritage area policy</td>
</tr>
<tr>
<td></td>
<td>Local heritage policy</td>
</tr>
<tr>
<td><strong>Fire Engineering Information</strong></td>
<td>Fire engineering requirements document</td>
</tr>
<tr>
<td></td>
<td>International fire engineering guidelines</td>
</tr>
<tr>
<td></td>
<td>Fire Brigade documents</td>
</tr>
<tr>
<td><strong>Regulation Information</strong></td>
<td>Building regulations document</td>
</tr>
<tr>
<td><strong>Additional Information</strong></td>
<td>Client’s brief report</td>
</tr>
<tr>
<td></td>
<td>Contractor’s Report</td>
</tr>
<tr>
<td></td>
<td>Meeting’s result and report</td>
</tr>
<tr>
<td></td>
<td>Any documents from project AR1</td>
</tr>
<tr>
<td></td>
<td>Consultant’s expertise report</td>
</tr>
<tr>
<td></td>
<td>The city greater of Geelong planning scheme</td>
</tr>
</tbody>
</table>
Project manager 2 (client) mentioned his perceptions about the importance of understanding the regulations, particularly as this involved working with the same consultants for the AR1 and AR2 projects. Project manager 2 said:

The understanding of one the consultant that we used on what basically used at every job down here is the BUILDING SURVEYOR and the Building Surveyor that was involved in this job originally he works for a company since that the company started run the business. And he been… that guy has been involved all the way through till now because he understand all the building regulation requirements and so the assessment of the fire engineering and we had the same guy involved doing fire engineering who did this building as did the (AR 2) building. So that we had the consistency right through off. The people who have into interpretive the regulations and how they done the buildings because the fire engineering is basically the basis of this building being allowed to occupied because we are being timber frame what is the case timber floors … without the fire engineering, the building could not be allowed to be occupied. All that we are not transferred but the learning from the (AR 1) building we taken across and use as a part the whole process of the (AR 2).

The project manager mentioned that the building surveyor was the person who was involved and important for both AR1 and AR2 projects. The building surveyor understood all the building regulation requirements particularly those related to the fire engineering regulations which addressed the safety of the building and its occupants from fire. The continued success of the AR1 and AR2 projects was an important link to ensure consistency in the application of the regulations which applied to the project teams when dealing with problem solving.

2. Understanding of the project. The components to be understood by the project teams to bring the project to success were the following:

- Understanding of the buildings'/projects' background (both projects)
- The situations of the projects before, currently and after
- The project teams' operations on the project and understanding of the consequences (good or not good) for every action.
- Client’s requirement and client's goals for the projects – "university business" (client PM2).
- The way of working with the client's organisation and management – for example, when claiming for some work – knowledge about technological tools and importance of using these tools.
- The building plan for re-use (planner) – using the drawing to collaborate in making decisions and issue of the planning permit.
- Tracking the construction cost and whether it was still within the budget.
- Previous problems in the AR1 project.
Understanding the project related to the project background and ensured that all of the project team understood the objectives of adaptive re-use and the client’s needs and goals for the projects. Project manager 2 said that:

I tried to make sure we had consistent personnel involved from the consultant ‘cause some of the bigger consultants were really sure you might get the same company but not the same people. And we tried to make sure that we kept where possible the same people involved. Not just the same company involved because it is important for those skills. It’s just having corporate knowledge, just having the knowledge base may not necessarily be able to be documented. You might have someone involved to do the job, he may instead be going that way … The university itself had very straight design standards, needed to have more people try to understand what we want and get the consultant to understand the university business and how we go about it and what we wanted to do …

The client for the adaptive re-use project was concerned about making sure of their requirements as the university followed the consultants in transforming the woolstores to new uses. Important components mentioned by the client were to make sure there were consistent personnel in terms of their skills and knowledge. Case study 1 demonstrated that the knowledge management activity happened from the client’s point of view.

3. Understanding the history. The components of history that the project teams’ understanding brought to the project were to maintain the integrity and value of the building heritage in the adaptive re-use project based on the following points:

- The history of the buildings thus providing an understanding to the public about the building when it was completed (meant that the historical value was still there, the public would still know that the building had been a woolstore)
- The components or specifications in heritage citations about the buildings
- The local government and heritage overlay requirements in maintaining the heritage integrity of the buildings (client PM1).

To prove the data finding related to the importance of understanding the history of the buildings, the architect said:

Evidence from the project team in relation with the important of understand on the Conservation Management Plan was a framework within which we worked then there are the building regulations and Deakin’s (Client) brief and then the heritage requirements and our own sensibilities in terms of hanging onto the sense of the wool stores that was our key thing is to still have a sense that people could interpret what the wool stores was like and even tough that brought to certain compromises of acoustically with timber floor where people walking above up where people were working and the fact that the building leant and the fact that there was all sorts of little compromises towards being a brand new occupancy, the character and the social history
and the charm of the building that we were able to hold onto and contrast with new materials and new elements that we introduced meant that the building was legible you could read the history of the building and that history continues into the future now as opposed to being lost because we were able to incorporate the existing fabric to a fairly significant degree with the new materials that we added and we deliberately chose those, the contrast, so we knew what was the original and what was new, you could tell that that was a new interventions but this is the original fabric, you could see what the original building was like that was very important to us.

Understanding the history of the building was important in the process of adaptation by the architect and other consultants in interpreting the original fabric with interventions of new components. The project team, especially the architect, ensured that the users and the public understood the character, the social history and the charm of the buildings in how they looked in their new use. For that to happen, it was important that the consultant understood all the related regulations, particularly the client’s requirements. In achieving this, the architect used the explicit resources and also tacit knowledge through architect’s sensibilities in achieving a successful adaptation.

4. Understanding the skills and knowledge of project teams. Skills and knowledge are critical in overcoming the complexity of adaptive re-use projects. By having each member of the project team understand the skills and knowledge of other project team members, the collaboration was easy to develop.

The evidence for the component of understanding the skills and knowledge of project teams can be referred the building surveyor and architect points of view. The building surveyor said:

```
… if you work with a particular consultant even a particular architect, you get to know how they were and get to know the sort how the things they like to designing including the buildings, how their way to go about doing things.
```

The architect’s point of view about the understanding of the project team’s skills and knowledge was reviewed as a principle of the consultants; as the architect said:

```
We have to know little bit about everything. We are not expert in mechanical services or electrical, but we have to know enough so we manage and direct those consultants and integrate all of the teams where what we doing. So, the way conductor conducting to the all plays in the teams and all centre back to us, to building and back to the client, that is the traditional architect roles, we manage the Quantity Surveyor for the client, and manage the engineers and everyone else. We instruct the builders on behalf client, client doesn't instruct the way we do, client might me didn't agree, something that client change we wrote the instruction, if the consultants need to change part of their services like we have another steel beam, we move the mechanical duct there to there, they might give us the information but we wrote instruction to the builder because we have to know
```
what's going on and again coordinated make sure is not at all squeeze other element in the building because we have an overview on everything where each discipline have their own focus, so we need to know little bit on everything. So we make sure that change doesn't fit this personally.

This study finds that each member of the project teams had developed their understanding to grasp the skills and knowledge of other members in the project team. It is important to work together in having good collaboration among the team when understanding the other skills and knowledge by cooperating and synchronising the ideas to develop the solution to any problems in the projects. The data analysis also demonstrated the activity of knowledge management where there was the activity of tacit knowledge changing to explicit knowledge through verbal instructions changing to written instructions to the contractors according to the client's needs and changes in the work.

To sum up the project team's cooperation and understanding in helping them through the problem-solving process in case study 1, the cooperative approach among the project teams in any decision making and the understanding of the projects and the project teams' contribution to human capital and intellectual capital were critical components in collaboration in the process of solving the projects' problems.

6.3.2 Communication

Evidence from the interview data in figure 6.9 proves that the component of communication helps the architect and their group to overcome the complicated process of design for the adaptive re-use projects. This study defines the mechanism of communication as consisting of coordination amongst consultants and ongoing discussion and meetings from time-to-time which has been applied by the architect through the design process.
Communication is also about protection and guarantees of the project’s information safety. The literature mentioned the components of communication associated with project success. This study found that communication components were important and were related to clear information and communication channels, open discussion and frequent progress meetings. This study decided to define the results of the interview data based on the most quoted (references) in the interview transcripts. The data shows that the fire engineer (eight quotes), architect (seven quotes) and quantity surveyor (six quotes) were quoted the most regarding communication during their interviews. The project team member that had the least number of quotes on communication was project manager 1. This study found that project manager 1 was not involved in day-to-day communication activity on-site. (see figure 6.10).

Figure 6.9: The components of communication in interview data

Reference 4 (ARCH):
we coordinate with all the consultants and we all did various things for example (architect’s group) write the specification for the original project and I manage the preparation of all the drawings and... and I and DMG would meet in the (architect firm) from time to time meet to discuss the details, the particular bit and then instruct the team in pulling the documentation together and then once it was tendered M and I still had the ongoing discussion and working with the property services as their client contact

Reference 5 (ARCH):
A lot of meetings involve and that the way we integrate about the earthquake, the sprinkler pipe like as the mechanical engineer. It starts with the blank sheet of paper and how do we do this and it’s not easy and very complicated process.
Case study 1 participants had the perception that communication could be potentially important in adaptive re-use projects. The most important part of communication was how the communication was undertaken and how it affected project success in relation to knowledge creation and transfer in a time series scenario.

The architect mentioned the importance of communication as per their experience in problem solving for the project which was easier and quicker when working with the same contractor for both AR1 and AR2 projects. For an architect, *detailed information* from the client’s brief is part of their communication throughout the design stage and clear information is a very good communication tool. More *open negotiation* and *ongoing discussion* are a requirement in the process of solving problems when integrating new and old elements of a historical building. However, the architect and other project team members also considered communication as the methodology throughout the process of preparing the *model of the project* (technology), the negotiation and discussion to develop solutions that were affordable and workable, and when making decisions and getting agreement from all project team members on the best solution for the problem. This process was considered as a new approach and applicable for the adaptive re-use projects in a time series scenario. Meanwhile, the fire engineer also referred to the component of communication in other project team members’ experience. He referred to the architect as having the key role in
coordinating the communication activity. As the project information came in as a puzzle, it was the responsibility of the architect to put the puzzle together correctly. The fire engineer stated that:

We all did a piece of the puzzle and the architect’s job was to make sure everybody had correctly done the puzzle and the building surveyor’s task was to check all the documents were correct.

From his experiences in both the AR1 and AR2 projects, the quantity surveyor considered communication as an important component in the process of problem solving that related to the project’s budget and cost. This particularly showed that the quantity surveyor considered his knowledge in relation to cost management as the main component for better communication in the adaptive re-use projects.

The interview data from case study 1 showed that communication activities were critical for adaptive re-use projects in overcoming the complexity of integrating new and modern building elements with the old elements of heritage buildings. The materials of the existing buildings comprised timber and steel structures which were to be retained. The difficulties for project team members was to ensure that the existing structure would still provide safety for new users and also from the fire threat and this created a challenge for them to solve. However, through the mechanism of communication, project team members had successfully associated fire prevention strategy with heritage protection goals. From the interview, the fire engineer stated that:

I designed one of the required, the fire sprinklers, required fire stairs, fire stair width, required, the smoke detection system, required, the fire rating the steel column, ... and one other reason when we sprayed painting because we had to put plaster to concrete where of architect design focused to protect the heritage character.

This proves that communication was a critical component in helping project team members through the process of solving problems, negotiation and discussion. Frequent meetings by project teams proved to be of assistance in developing solutions for problems that occurred during the projects.

6.3.3 Skills

Skills were critical for making the right decisions which thus avoided any big issues in completing projects. This involved individual and group skills which were aided by technological tools to accomplish the action steps, and monitoring and feedback for which the information flow was comprehensively controlled at every stage of the design and construction process and the ability to handle unfamiliar problems. This study’s approach in
data analysis was to identify the meaning of project team members' views which were probably critical for the success of case study 1. Figure 6.11 shows the identification of the skills components where this was meaningful according to their perception in helping them to solve familiar problems and to develop new solutions for new and unfamiliar problems. The responsibility and leadership sub-components were repeated ideas in terms of the skills. The rationale of this analysis was that the skills of encouraging and influencing project team members to be committed, work in harmony and be responsible on the project were critical in the problem-solving process. Figure 6.11 shows one example of the evidence of skills as described by the contractor in his interview.
The detailed summary of project team members’ perceptions in relation to skills is stated in Appendix A. The data show that the interview transcripts of the building surveyor (11 quotes), project manager 2 (eight quotes), contractor and architect (seven quotes) had contained the skills components which had helped them to solve problems in case study 1 (see figure 6.12). The building surveyor, project manager 2, architect and contractor were identified by the researcher as the most responsible and led their own groups very well.
The project team members’ perception in case study 1 indirectly mentioned that skills were critical in adaptive re-use projects. The complexity and difficulty of adaptive re-use projects, particularly of case study 1 in adapting a woolstores building into a university building, identified that the main criterion of the project team members was that they had to have a high level of skills in managing both familiar and unfamiliar problems.

According to the problem-solving process, the project team members’ skills were critical in making the right decision to avoid any big issues in completing the projects. This involved skills in preparing project schedules with the aid of technological tools to accomplish the action steps. It also involved monitoring and feedback in which the information flow needed to be comprehensively controlled at every stage in the design and construction process and the ability to handle unexpected crises and deviations from what had been planned. The intellectual capital in relation to skills and expertise needs to be developed and accumulated without any interference from project to project to ensure that the knowledge creation and transferal process has occurred. The skills component will aid in handling the complexity of the design and construction process in adaptive re-use projects. The data findings showed that project manager 1 and project manager 2 (client) had mentioned consultant and contractor skills as being a critical component in developing solutions. This situation was considered relevant as the client and the owner of the project employed the project teams including consultants and the contractor according to their skills to help manage the
intellectual capital of the projects and to meet the client’s needs. The evidence of this finding appeared in the following quote from project manager 1:

The skills and good knowledge about the heritage buildings was the best solution for any big or small problems that happened in this project especially for the AR2 project because the transferring activity of knowledge had happened.

However, the data analysis also showed that there were project team members who gave their views about the skills of other project team members. The evidence from the data showed that the architect was a great decision-maker solving any problems that occurred in the project. In the contractor’s view, it was the skills of the architect who was always ready with solutions for any problems or issues that occurred in case study 1, as the contractor said:

... The architect making the cracked things looks good and always works with the Town Planner. This is good because architect always kept the planning of Geelong and at easy to get sign on. He was good. Sometimes they are worried whether they get through but architect had been already has it.... Those features were good and then architect we worked with is the best we’ve had. So it would be hard without architect because done refurbishment project with architect has more protective on what we doing. The Architect was good.

This study also found that the architect always shared his vision about the buildings and came up with decisions that were agreed upon by all project team members. In relation to this finding, the fire engineer said:

... the architect knows the consultant and the people working together well. We know each other well enough. I think the architect gets our respect because the architect is one of the best architects that I've worked with. He trusted us to help him with an architectural vision. So architects can come up with crazy things sometimes but then acquire other consultants to support that vision. I think it is not just because we knew each other but we respected each other as members of a team.

In terms of client relationship skills, the evidence demonstrated as the contractor described that having a good relationship with the client was critical in a project. It was important to ensure continuity in the relationship and to be appointed for future projects through having good relationships with the client. As the contractor said:

You have higher skills, the awareness is also higher even if you haven’t seen this before but you have experienced that ... your client relationship skills will be wide and from my perspective it will be right up there ... you have to come from a position of strength because of the client ... Anyway, the client knows what you want and knows that you are organised and not just a rebel ... you are strong, then you get respect, both ways are fine and it is going to happen.
All nine participants also mentioned their responsibilities for achieving the success of the projects. All of them related that responsibilities were the reason why they were employed by the clients as well as by the contractor. Besides their own responsibilities, each project team member was responsible for other project team members as well. The architect coordinated all of the consultants with the client, the contractor coordinated with the client and the consultants and consultants coordinated with the contractors.

In summary, skills were developed from the roles and responsibilities in the AR1 project and were transferred to the AR2 project. The entire problem-solving skill came together with the experience from the previous project and was easily conveyed to the next project because of the good results of the previous project.

6.3.4 Past Experience

The component of experience in the interview data can be directly defined. There are two repeating ideas in terms of the meaning of the ‘experience’ of the project team members in case study 1. Experience and communication also occurred with similar frequencies. All participants defined experience in their interviews as an important component when involved with adaptive re-use projects. The project team members’ experiences were developed from their involvement with two sequential projects and from other projects undertaken between the AR1 and AR2 projects. Figure 6.13 shows the experience components from case study 1 from project team members’ viewpoints.
This study found that the architect, project manager 2, building surveyor and fire engineer had the most experience in case study 1. They were experienced with projects that were related to historical buildings’ renovation, demolition, refurbishment and adaptive re-use. Each of the project team members’ perceptions (quoted) on their involvement with case study 1 included the value of experience either direct or indirectly (see figure 6.14).
This study found that the individual and group experience had been accumulative over years of practice. The architect and his firm had over 30 years' experience in relation to these types of project, as stated by the architect:

We (firm) worked with the Geelong College in the late 60s which was 40 to 45 years ago and that was called heritage overlay because the heritage building was associated with the Geelong College so we continued visiting that. We dealt with the heritage building council for getting permits and we recently did a project where we were restoring the tower (the original bell tower) and that required the super powers of Heritage Victoria as part of the planning approval. Also, we worked with the National Wool Centre, Queenscliff Tower Hall, probably the original project was 10 years ago, and has the Conservation Management Plan for the Tower Hall itself. We had to recognise that and work with it. We worked with the heritage advisor and we did a lot of that sort of work. I was not continuously working with heritage building but as the heritage architect (individual) expert, I have been involved with projects related to heritage buildings over a 30-year period.

As a result of this experience, the architect has developed the confidence and understanding in dealing with the authorities for all necessary permits including heritage, building, planning and overlay permits. One of the situations that makes adaptive re-use projects so difficult and complex is the requirement by the authorities that relate to the building or the area of the building’s location. Case study 1 was located within the heritage development area. The
experience with the AR1 project helped the architect to solve any issues pertaining to the planning permit application for the AR2 project. Supporting evidence was provided by the town planner when she stated:

```
Council has just recently developed a new policy for that part of Geelong and that is called the Geelong Western Wedge. In this zone, we are promoting larger development, mixed use development where we aim to have a lot of residential and mixed use and land uses and the AR2 project is at the start of the wedge along Mercer Street. That zone heads down along Mercer Street along the bay and cuts back through. So, it was a little bit of a balancing act to figure out how the building contributed to the new controls as council was trying to encourage this and they did because it was in the education zone and was mainly used for education. The annex (new part of the AR2 project’s building) itself gave them a bit of extra floor space and opened up the building with some light and natural ventilation and those sort of things when it had just been a red brick box with a small opening in it. So, yes, it was really, probably into the area of large development and was quite a simple application to look at because the architect had done a lot of hard work and good work trying to get to the point and had met most of the council's requirements.
```

The town planner also mentioned that the architect really understood the requirements of the application and was experienced in handling controversial situations in relation to the building adaptation and planning permit applications. She also said:

```
It was a fairly easy application in the sense that the architect had put a lot of hard work into it before lodging it, so a lot of information was already there (experience). It was really just myself and the heritage advisor working to get an understanding of the plan and the changes they were wanting to do to the external part of the building. So, they were putting in a few new windows and they were putting in a large contemporary extension, what they called an annex, with the glass section on Cunningham Street overlooking the bay and that was the most controversial part of the building.
```

The detailed perceptions of each project team member about experience and confidence is provided in Appendix A at the end of this thesis.

Accumulated experience contributed to the increasing level of confidence in terms of the knowledge and intellectual capital used to develop solutions for any problems incurred during the adaptive re-use projects. Data analysis showed that the continuity involved in the AR1 and AR2 projects developed the experience accumulatively and increased the level of confidence in making decisions and developing innovative solutions to overcome project problems. The architect and contractor had more than 30 years' experience dealing with heritage buildings in the surrounding local area and had successfully transformed historical buildings into a museum, shopping centre and academic buildings. The confidence level in dealing with local authorities had increased due to the accumulated experience from similar projects and the success of previous projects.
This study considered that accumulative experience would allow the successful synchronisation of knowledge about existing building materials, services and new ideas. The learning process from the previous intellectual capital would gradually build up a knowledge base and create better decision-makers with a shorter problem-solving time period. This would lead to a higher level of professionalism in conducting a future project.

6.3.5 Trust

The section repeats the process of analysis and discussion as used for communication. Figure 6.15 shows the interview data that contained sentences which had the meaning of ‘trust’ as experienced by project team members in case study 1. The sentences in bold refer to the mentions of trust in each of the interviews as quoted in NVivo Version 9. This study defined trust as meaning loyal and good quality consultants who maintained relationships for a longer period. Trust also related to the reliance on the project team members in ensuring that the project was successful with continued success for future projects. The level of trust was higher due to working with the same team for the same client on sequential projects. This component of trust obviously helped the project team members in the process of problem solving because they understood how to use the components, how the components or process operated and understood the condition of the building elements.
The component of trust is critically embedded and positive in any organisation. Positive interactions among employees provide cooperation and yet consider trust as their basis in terms of social capital. The correlation of trust in the activity of sharing project team members’ intellectual capital is critical in construction projects (Ma, Qi and Wang 2008). Trust cannot be developed in the short time duration of one project. This study’s approach was confined to involvement with continuous projects or a ‘time series’ scenario that could help to develop trust in each of the project team members. The data show that the architect (six quotes), fire engineer (four quotes) and project manager 2 (four quotes) were the persons who mostly mentioned trust. This study found that these three key project team
members worked together for a longer time and really understood and knew about each other better in any stage from the AR1 to AR2 projects (refer to figure 6.16).

![Figure 6.16: Number of references (quotes) in interview data about the trust](image)

Source: Case Study 1

Eight of the nine participants referred to the meaning of trust in their perspectives on the problem-solving process. The architect mentioned the most about trust in his work when dealing with adaptive re-use projects. This was followed by all other project team members except for the contractor. The contractor never directly mentioned nor referred to trust in his interview. The rationale of this finding was that the nature of a contractor’s work always depends on the documentation provided by the consultants. As project manager 2 (client) stated:

*With the contractor, it didn’t really matter because the contractor had the documentation and then just followed the documentation in his work.*

Meanwhile, for the consultant and the client, trust was the backbone of their relationship and to working in harmony particularly with the same consultants. The more decisions that had been decided together built up the sense of trust over time. Understanding was developed through the component of trust not only to accept but also to reject any decision. As the principal consultant in case study 1, the architect said:

*Definitely, the relationships are very important. You just take on somebody else as consultants and you are not working with them all the time, you go down in their order of priority sometimes. So, with the consultants, we keep giving them work or finding work for them to help out our teams; there is loyalty built up and trust and reliance, so we could rely on them …*
This was the reason that contributed to the social and intellectual capital of the consultants and client who worked really well and in harmony during case study 1. All of these components were considered relevant and provided evidence of the success of the AR1 project and further contributed to the success of the AR2 project.

The findings also showed that knowledge creation and knowledge transfer activities in the problem-solving process occurred in case study 1. The same teams working together led intellectually and socially to the development of trust not only in a person’s capability but also in the knowledge of other project team members in dealing with any of the problems of the projects.

This study also found that mutual trust occurred in the consultants’ project activities in case study 1. Mutual trust is referred to as the condition where one person trusts the other person and the person who is being trusted, develops trust towards the initial person. It is a kind of reverse psychology. In proving that there was a sense of mutual trust among the consultants, the project manager 2 (client) said:

\[\text{The relationship I had with the project manager basically was to sort things out and we needed to get someone within the university or whatever to sort it out. It was pretty much done like that and that was the same relationship that we had here: in fact, I trusted him (architect) and he trusted me. That's probably the main thing involved in solving any issues that came up. It was design issues, maybe those working on the project, all the potential issues.}\]

This study has contributed to new knowledge in demonstrating that trust components are critical for managing intellectual capital in relation to knowledge creation and knowledge transfer in the problem-solving process in adaptive re-use projects.

6.3.6 Supportive Attitude

Supportive attitude refers to top management support as having a supportive attitude and incentives as appreciation that should be given individually and this was not focused on the physical component of rewards. The interview data analysis showed that the physical component (rewards and incentive) was not involved in case study 1. Figure 6.17 shows one example of the evidence that there were components of a supportive attitude among the project team members which helped them in the problem-solving process in case study 1.
The frequencies of the quotes from the interviews or mentions made showed that five project team members had supportive attitude components in their views. The supportive attitude was expressed through verbal appreciation between personnel in terms of knowledge and skills. Supportive attitude as part of the appreciation components was proposed in the conceptual framework as one of the factors that contributed to project success. The data in NVivo Version 9 showed that 56% of the project team members had been quoted with

Reference 1 (Fire Engineer):
The building is the one of the most enjoyable project I worked on because everybody supported everybody else and gone on well and that partly because me, , (building surveyor) and (architect) were similar ages and we male, so we are similar people.

Reference 2 (Building Surveyor):
Pretty much so, again in Dalgetys, because of the new types of project it was, we supported each other. It was very strong collaborative approach.

Figure 6.17: The supportive attitude components in interview data
regard to supportive components. The component of supportive attitude in supporting actions at all levels of decision making was one of the components for achieving project success. This component was below 80% in the overall frequencies and was considered to not be strong in supporting the problem-solving process. However, this component was described as evidence was provided that it was one of the components.

This study categorised the supportive attitude components into the decision-making process, design process, construction process and top-down support. In terms of the decision making process, the architect was supportive of the client when the client made the decision that was important and critical for the AR2 project to employ the same project team members. Meanwhile, the building surveyor was showed to be supportive of the architect’s design decision through getting involved and giving advice on the architect’s design decision. The contractor had two ways of demonstrating supportive attitude components, firstly, by being supported by the client and architect in their work on site through being paid well for their work. Secondly, supportive attitude was demonstrated when the contractor showed a supportive attitude to the subcontractors’ works by working together and taking responsibility for the subcontractors’ work. Also, the main contractor helped the subcontractors in preparing the claim forms according to the client's required method. The analysis showed that the approach in case study 1 related to supportive attitude among the client and project team members was a top-down method demonstrating support through which top management from both the client’s organisation and the project's organisations were really supportive of the people who carried out the projects on a practical level.

6.3.7 Summary

This section described the six components of success that contributed to the problem-solving process in case study 1. This study identified that the most critical of the components of success in helping project team members to develop solutions to solve problems began with collaboration (understanding and cooperation); then through communication; experience; skills; trust; and a supportive attitude. However, supportive attitude was not critical (its frequency of 56% was below the required 80%) and was considered not strong enough to prove that it was really critical in adaptive re-use projects.

Communication, experience, trust, skills and collaboration were the components of success that were important in adaptive re-use projects as shown by the evidence from case study 1. In relation to the knowledge management approach, the intellectual capital of project team members was involved in the activity of transferring and creating new knowledge and skills between the AR1 and AR2 projects. In regards to the engagement of the same project
teams, in particular, the architect, building surveyor and contractor for the AR1 and AR2 projects, the communication process was easier because of the familiarity of the team members with each other’s knowledge and skills components. Mutual trust was developed by the team because they had been working together for a longer time and understanding of their working styles, knowledge and skills had been developed together from the AR1 project through to the AR2 project enabling the teams to support each other and collaborate in the problem-solving process. The experience developed in the AR1 project and from other adaptive re-use projects helped project team members’ activity in case study 1. This study has demonstrated that five of the six components that were the most critical in helping the project team to solve problems also contributed to the success of the AR1 and AR2 projects.

6.4 Research Finding 2 and 3: Key Components of Problem Solving in Relation to Knowledge Transfer and Knowledge Creation

This chapter has investigated the components of success from the point of view of project team members from their involvement in adaptive re-use projects within a time series scenario. The five components of success critical in the problem-solving process and identified from the point of view of the client, consultants, contractor and other participants were communication, past experience, trust, skills and collaboration. Adaptive re-use projects are unique and involve a complex process particularly for problem solving to achieve the sustainability objectives. An understanding of the project requirements in terms of heritage protection and also building regulations would make a large contribution to reducing the complexity and difficulty in adaptive re-use projects. Also, the appointment of the same project teams in sequential project would help team members to ensure that the intellectual capital of individuals, projects and organisations are successfully transferred not only for adaptive re-use projects but also for other types of sustainable projects for which they are useful.

This section describes key components of problem solving in relation to the components of success according to the project team members’ perceptions. The analysis of this section compares participants’ perceptions on every key component of the problem-solving process and identifies the components of success in their perceptions. The sub-unit analysis refers to individuals’ perceptions. The two contexts which represent six key areas of the data findings in relation to the problem-solving process in case study 1 are knowledge transfer and knowledge creation. The next section has been categorised as shown in figure 6.18.
6.4.1 Research Findings 2: Key Components of Problem Solving - Knowledge Transfer Context

This section specifically describes the experiences of project team members in transferring skills and knowledge from the previous AR1 project and similar projects in the intervening period to the new AR2 project. In this case, the situation involved the knowledge transfer activity from the AR1 project to the AR2 project and from other projects in between the AR1 and AR2 projects to the AR2 project to resolve familiar and unfamiliar problems in the AR2 project.

The involvement of the architect with heritage projects between the AR1 and AR2 projects can be described as really helpful to the architect in problem solving for the second project. The architect indicated that he definitely used that experience even though it was actually very hard to articulate exactly how and to which problems and solution. From the design point of view, the architect learned to transfer to new project how to replace new materials in their contact with old materials with a very successful earlier project and providing a terrific result for new projects. Learning from his experience in solving problems in other projects, the architect developed new skills and knowledge on how to integrate new materials with old existing materials. However, the architect also indicated that solving problems must come together with allowing the building to retain its integrity through the same ideas which were simply applied in the design and planning for another project. Even though each project and historical characteristic was different, all the adaptive re-use project principles were the
same. The architect mentioned that problem-solving *experience* in each project was a base for building up knowledge and skills.

However, the *building surveyor* described this situation differently from the architect's viewpoint. He mentioned that the projects had very similar project characteristics but that a different approach had been applied in the AR2 project. According to the building surveyor, a many things that ran were familiar and they had backup support with the unfamiliar problems where everybody had to work together and *collaborate* as a team. Within this strategy, all unfamiliar problems or circumstances would not be so difficult to solve using what they named as the 'trial and error' approach and this was successfully applied to the projects.

According to *project manager 2*, there were knowledge and skills transfer activities from other adaptive re-use projects and the AR1 project in terms of the design solution. However, the client also indicated that it was impossible to use the same process in another building that had a different structure but it certainly helped in terms of the principles if the project was with a similar type and similar age heritage building. To be more specific, the project team members' knowledge transfer from the previous project’s learning experience was about the building’s fire engineering strategy and obviously the other approach could not be used. This was because this building originally contained major timber and steel structure which were retained in the building for its new uses. The occupants’ safety from fire is most critical in adaptive re-use projects and the AR2 project definitely could not rely on traditional fire protection systems. The new solution in the AR2 project was the application of fire engineering which provided fire modelling of the building at the early stage of the project.

One factor that assisted the client to transfer skills and knowledge from other heritage projects was the level of relationships skill with the contractor. The client had developed a relationship with the same contractor through working on several university projects. In describing the relationship with the contractor, it could be said that they *trusted* each other in solving any issues that arose during the adaptive re-use process. Certainly, the client indicated that being involved in a “time series” scenario was really helpful in the AR2 project. The obvious outcome was that the project team and client could immediately recognise potential problems and knew how to work on old buildings and this provided the way to find the solution even though the solution was not immediately available.

Table 6.5 describes the evidence of knowledge transfer components in case study 1. The architect, building surveyor and project manager 2 described the knowledge transfer that happened in case study 1 based on their learning experience from other adaptive re-use projects and from the AR1 project. The collaboration, trust and working together with the
same team provided the factors involved in transferring their knowledge to help develop new solutions in the new AR2 project.

### Table 6.5: Evidence of the transferring of project team members’ knowledge in case study 1

<table>
<thead>
<tr>
<th>Project Team Member</th>
<th>Transfer of Knowledge</th>
<th>Relations with Component of Success (Key Findings 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>“We learned the consequences for example the big hole in bricks building is the different style building to that but some of the same sorts of problems arise and from the design point of views, it is how you replace new things in the contact of the old, means the successful project, so, you learn from the experience solving problems down there, what give you the terrific result, you know the new material contrast but appropriately respectful to the old buildings. So, you solve the problems with the manner which is allow the building to maintain integrity and take the process on the site, so the same sort of ideas, you apply when you designing and planning for another project.”</td>
<td>Past Experience Skills</td>
</tr>
<tr>
<td>Building Surveyor</td>
<td>“Because is very similar project but only the approach was different. I think the solution was very similar. Probably I think Fire Engineer slightly different approach to some other things. But with the thing run for me, I think as a senior building surveyor in this industry probably thirty years doing building surveying, it probably get a level where the comfortable with things. So you took learn of it… So that point of view we think the unfamiliar I had support to assisted me to appreciate unfamiliar things. So I think the two approach of fire engineer is very well in that point of view. As long as everybody works as a team and those unfamiliar thing can become not so hard, not so difficult. I probably become confidence with the people together around you.”</td>
<td>Collaboration Communication</td>
</tr>
<tr>
<td>Project Manager 2</td>
<td>“I think the probably help us to solve any sort of issues the best was the relationship I have with the Builder or basically the Construction Manager. Because it was the same Construction Manager that I worked with on the Science Building and the Medical School and the same guy came in and work in here for a while, to say, I think affected we were work had together five years something like that and again on the science building job and the medical school job again I was working basically on the site office. … the relationship I have with Project Manager basically was with the sort out the things and we need to get someone within the university or whatever to sort it out. It was pretty much done like that and that was the same relationship that we had here, impact that I had trusted in him, and he had trusted me, that’s probably the main thing solving in any the issue that came up.”</td>
<td>Trust</td>
</tr>
</tbody>
</table>

In case study 1, this study revealed four key components of problem solving in relation to knowledge transfer:
Key Component 1: Efficiency and Effectiveness Mode

This section analyses the project team members’ points of view about the efficiency and the effectiveness in solving problems in case study 1. The evidence from the interviews shows that the problems could not be solved more quickly or easily due to the complexity of adaptive re-use projects. Particularly for the consultants, their experience showed that to solve the problems required more time and was difficult because the design process was too long, the preparation of the fire engineering analysis required a sophisticated process and the amount of repetition involved in testing the load and strength of existing materials was high. Nevertheless, the contractor and the town planner had dissimilar views to the point just made. Their experience indicated that problems had been solved more quickly and easily because the components of collaboration and the skills of other project team members provided reasons for this to happen.

The detailed description of the project team members’ interview results is discussed in the following paragraphs. The quantity surveyor mentioned that it usually took a longer time to measure and estimate the project because it needed to include a lot of ideas and the adaptive re-use project was more difficult compared to conventional projects. However, the quantity surveyor claimed that the process was the same for both types of projects when comparing the cost planning and consulting on the processes with other project team members in relation to the project cost. The quantity surveyor also claimed that the problem was not able to be solved more quickly and easily because they needed to wait for the final drawing and that it was not easy to gain the information they needed when costing the job. Within the right communication strategy and the skills and expertise to handle it, the problems in the costing preparation were solved even if not in the quickest and easiest way. Similar perceptions that the problems could not be solved in easier ways and in a quicker time arose in the interviews with the fire engineer. The reason behind this related to the fact that in preparing the engineering report for the AR1 project, it took about four months to get approval for the building permit. This also took more time because the process of preparing the fire engineering analysis was becoming more sophisticated and harder to check. However, the result was more accurate even if it took longer. This example shows that the input of project team members having good skills in their jobs contributed to the problem solving process even it took a longer time and was more difficult. Project manager 1’s perspective was that project team members required more time and not easier ways to solve problems particularly at the testing stage. Defining the result from testing really depended on the trial and error process. The testing process was carried out on a small section of the building: if the result from the testing showed that it really did not work, the project team scrubbed the idea or modified it and moved onto the next section with this fully documented
for the construction company’s tendering purposes. According to the project manager 1, this problem-solving process considered that the component of skills had a better result for projects.

The contractor had different abilities for solving problems. The contractor could resolve problems on the spot when working together with the consultants on site particularly when involved in the AR1 project. In other words, working together saw the development of good collaboration during construction which benefited the contractor and solutions were developed in quicker and easier ways.

In agreeing with the contractor’s perception, the town planner indicated that her experience was that problems were resolved really quickly. The skills of the architect or the principal consultant handled all the problematic issues encountered by the town planner or local council from the heritage point of view with this providing evidence in support of this rationale. The architect also understood his design and always came up with answers and usually the local council did not change anything in the end.

The evidence from this study’s findings are summarised in table 6.6 which compares positive and negative points of view from the project team members in case study 1 on the requirement to solve problems more efficiently and effectively.

Table 6.6: Evidence of effectiveness and efficiency of problem-solving process in case study 1

<table>
<thead>
<tr>
<th>Project Team Members</th>
<th>Quicker and Easier (Positive Views)</th>
<th>Positive Responses</th>
</tr>
</thead>
</table>
| Contractor           | “I might say that back the (AR1) one; the structural engineer play the work well. That would help because I can walk and resolved problem stand there what to do and resolved on the spot when working out together. Probably working together being little bits better and at the end of the day you will presence what (client) going to disclosed.” | Working together  
Collaboration with consultants |
| Town Planner         | “Because I am only dealing with the conceptual side of things, problems was resolved really quickly. (architect) is fantastic architect done his thought through a lot of issues around moving windows, the annex, so, if there were any questions I have and I rang and (architect) solved done. That well thought out development from the heritage point of view when council regulations, the problems in hands up were really minor. I didn’t often require. If we did want changes we want just spoken to (architect) and he understood why he did, why he didn’t usually we didn’t require the change in the end. There were a really well thought out concept. So, from the town planning point of view is not all the problem at all.” | Skills  
Communication  
Collaboration  
Immediate feedback |

Quicker and Easier | Negative Responses
| Quantity Surveyor | “Obviously, it probably takes a longer time to measure and estimate a project like that because there were a lot of ideas which increased from [the conventional]. So, it was more difficult than a new building and more difficult than a general refurbishment. However, the process was still the same when we compared the cost planning, and consulting on the processes with other members of the team. So, for the estimate situation, we needed the drawing and as the quantity surveyor needed to wait for the final drawing and everything was not there in front of us, it was not easy to gain what we required.” | Measuring and estimating difficulty |
| Fire Engineer | “The [AR1] building approval took a few weeks. The [AR2] building approval took a month to gather the approval from the fire brigade because we were doing more detailed analysis. The fire brigade and [building surveyor’s] office came up with more detailed questions. So, the [building surveyor’s] office got the engineering report independently peer reviewed by other engineers and that review process took about four months whereas the original [AR1] approval went to the [Building] Referees’ Board and took about four weeks. So, we get more sophisticated in our analysis and it’s harder to check. So, it takes and costs more money, takes longer to get right. But hopefully the answer is better; the better answer takes more effort, doesn’t it? The downside of this level of analysis is it takes more time to both design and check.” | Building approval complexity Building analysis difficulty |
| Project Manager 1 | “… the length of that process because they were looking at from the design perspective, they were trying to maximise the number of actual floors within the building … So, they were working out which floor to take it out, which floors had any movement and they wanted to say that they did that and had physically worked out how they were actually going to do it on site and keep it safe and also obviously keep the structure of the building so would not fall down around them. So, it took a long, long time and a lot of probably stressful nights for the structural engineer, in particular, to work it out. I knew roughly what they wanted to do which was that they were working out how best to go about it and in some cases it took a little bit on trial and error on the first floor just to see how it worked.” | Construction process difficulty |

**Key Component 2: The Same Project Team**

The analysis of the interview data revealed that the components of skills, communication, experience, collaboration and trust were considered helpful in the process of developing solutions in the AR1 and AR2 projects. The discussion indicated that most of the project team members talked about other team members rather than talking about their own experience. Most of the project team members were conscious that the architect was the
team member that they most wanted to work with again, and that working together was a really strategic way to transfer knowledge intellectually and socially from the AR1 project to the AR2 project. The architect was also the principal consultant and had the ability to lead the team members to collaborate in every process involved in identifying the problem’s solution. This study revealed that having the same key important person in the project team helped significantly in developing the solution through collaboration, communication, right skills, high level of experience and trust developed over time. The next paragraph describes the perspectives of project team members on the having same team for both the AR1 and AR2 projects.

The quantity surveyor certainly pointed out that having the same team in sequential projects particularly helped in developing solutions. In terms of identifying the person or individual to work with again, the quantity surveyor mentioned that that person was the architect. This was very important as the work of the quantity surveyor was related to cost and had a strong relationship with the design work. The quantity surveyor needed to know how the architect was arranging and integrating the existing components of the historical buildings with his design work. In terms of one component of success being having the same team to develop solutions, this made it easier to communicate with other project team members because those same people were better known than other project team members and could envision more what the architect had designed because they had seen it before. The quantity surveyor also had experience in working with the same contractor which really helped in terms of project costing and certainly helped in understanding possible problems in the AR2 project due to the results of the AR1 project.

In terms of the modification complying with the building regulations in the AR1 project, the architect mentioned that working with the same building surveyor was a great help. As with the AR1 project, the building did not comply with the building regulations because it was a new construction. The client’s requirement was to retain the building character because this existing building came with a heritage value which necessitated collaboration with building surveyor and the Building Referees’ Board. The skills and experience of the building surveyor in relation to the fire engineering solution led to a report which detailed the strategies which allowed the steel and timber frame building to be retained without the risk of collapse. The architect’s viewpoint related to his role as the principal consultant which involved leading the way to finding solutions: an example was the design principle in which he needed to consider the fire safety strategy due to the nature of the existing timber and steel structure that needed to be kept.

The building surveyor had experience in working together with the architect and the fire engineer. In defining what he meant by helping, the building surveyor meant that having the
same project team members really helped to develop solutions, particularly in relation to the design and the fire safety strategies. If the team members changed, the situation became difficult, and the explanation about the building condition needed to be repeated because the new team member had not had experience with the AR1 project. The building surveyor agreed that working with the same team, particularly the architect and fire engineer, from the AR1 project on the AR2 project (in the AR1 project, the fire engineer was the partner of the building surveyor) really helped. This took into consideration that the same team knew where the building surveyor was heading in terms of his vision. Different approaches were taken in the AR1 and AR2 projects for building safety issues: the AR1 project used the Building Referees' Board while the AR2 project went with the fire engineering approach. The quantity surveyor confirmed that the architect was able to better develop the second project even though using a different approach because of the architect's high level of skill and expertise.

The contractor did not have any problems working with different consultants in the AR2 project. However, he mentioned that having the same team for the AR2 project was a dynamic strategy within the project. The contractor’s concern in the AR1 and AR2 projects was his ability to be part of the team for the AR2 project. Most important for him was to ensure that his work provided the client and consultants with a satisfactory result. Certainly, the contractor did the job according to what the client and consultants needed without any prejudice and provided the owner with the best result. This was because the client and the consultants were liable for the final result and the contractor needed to prove that he had the strong dynamics to do the job. The contractor considered the component of trust to be important in relation to working with the same team.

The fire engineer mentioned that was really helpful in any decision making to not just work with the same company but also to work with the same individual. He stressed that this situation was very rare considering the long period involved. There was evidence that case study 1 was a unique project as it applied a time series scenario to the same teams and especially the same individuals. Having the same individuals was very helpful because the original AR1 project’s building was a long way from the Building Code. The AR1 project was a very different situation because the team had to deal with very complicated heritage issues. In this situation, the fire engineer provided evidence that having the same team in the AR2 project helped them to prepare a draft of the work because it had been approved before in the AR1 project through collaboration.

The heritage advisor who was involved in both the AR1 and AR2 projects was clear from having a conflict of interest in working with the same project team. Moreover, the heritage advisor admired the work of the architect not simply due to the AR1 and AR2 projects' results but also having considered the architect’s experience in other adaptive re-use
projects such as the National Wool Museum. The heritage advisor had had experience working with the architect for a long period of time and had trust in the architect’s work and knowledge. He did not seem to be biased towards one architect in recommendations for council projects and ensured that the recommended architect was able to provide good outcomes. In relation with to case study 1, the heritage advisor had obviously only worked with the same architect and was really satisfied with the decisions and actions taken by the architect in solving problems as they related to heritage matters.

As the client, project manager 1 agreed that having the same team, particularly in terms of the consultants, really helped. The consultant team had worked together on the AR1 and AR2 projects which had benefits because they knew exactly why certain things had been done in the building and why they could not do certain things in the AR1 and AR2 projects. However, project manager 1 mentioned that it was not important to have the same contractor for the job because the contractor had the documentation and simply followed the documentation prepared by the consultants.

The similar perspective between project manager 1 and project manager 2 regarding having the same teams in the AR1 and AR2 projects definitely provided the evidence that these appointments benefited the client and the project. As the project manager who had significant experience on site, project manager 2 considered that it was most important to work together again with the same key people in project teams. He named the key important people with whom it was critical to work again in the AR2 project were the architect, building surveyor and fire engineer. This was because the design parameters in adaptive re-use projects was dictated by fire engineering and building surveying requirements. The interaction between the architect, building surveyor and fire engineer led to innovative solutions which were acceptable from the client’s point of view. Moreover, collaboration and trust between the architect, building surveyor and fire engineer identified innovative and creative solutions because they were well cooperated each other in the design and fire engineering approach for historical building.

The heritage advisor and town planner shared similar perceptions about their working experience with the same architect during the AR1 and AR2 project periods. The skills of the architect in the AR1 and AR2 projects really impressed the town planner from the planning point of view. The town planner also indicated that the only architect with the rich experience from case study 1 was the architect involved in these projects. For every problem or issue that was brought up by the town planner related to planning permit issues, the architect always came up with the solution and this was done in accordance with the local council's requirements for the applications. The effectiveness of the architect in his work really impressed the town planner and certainly helped her in her role with the local council.
Table 6.7 shows evidence of the project team’s perceptions about how having the same team for the AR1 and AR2 projects helped them in the problem-solving process. There were two categories of perceptions: positive and neutral. Positive perceptions demonstrated that the project team members had positive experiences in working with the same project team members in both projects. The same team members provided benefits in terms of more effective communication and greater understanding the problems which made the problem-solving process more efficient. A neutral perception referred to project team members who accepted both situations either working with the same or in a different project team. This study identified that the contractor and heritage advisor were unaffected by the appointment of the same project team members.

Table 6.7: Evidence of having the same project teams in problem-solving process in case study 1

<table>
<thead>
<tr>
<th>Project Team Members</th>
<th>The Same Team</th>
<th>Positive Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity surveyor</td>
<td>“Yes, the same architect and the same builder. It certainly helped … if you work with a particular consultant, even a particular architect, you get to know how they work and get to know the things they like to design including the buildings, the way they go about things. So, that whether it’s a refurbishment or a new building or whatever, if you work with the same team, it is easier to communicate ‘cause you know them better and you can envision more what they like to design because you’ve seen it before. With these two buildings, I know there were many similarities between these projects, the same sort of steel frame timber floor construction and the same sort of brick façade. So, the issues surrounding the way you go about achieving fire requirements, getting services into the building and fitting it out, there were a lot of the same sort of difficulties. Experience from the Dalgetys (AR1) job where experience with the same architect and builder certainly helped them to understand some of the problems that were encountered in the Dennys (AR2) job. So that cooperation was done with the documentation, any information and discussion from the early days, rather than having to discover the track.”</td>
<td>Effective Communication Knowledge transfer activity Understanding the problems</td>
</tr>
<tr>
<td>Architect</td>
<td>“Well, we had the same building surveyor. That was a great help because the original Dalgetys (AR1) project was handled by the series of modification to the building regulations. The building didn’t comply with building regulations because it was not a new construction … it was because the existing building had heritage value and Deakin [the client] wanted to keep that building character; we were able to get around the building regulations by choosing different devices like the fire regulations to just file to retain the building and we did that with the building surveyor and Building Referees’ Board in the Dalgetys (AR1) project. In Dennys (AR2) we had the fire engineer come in and do the fire engineering …”</td>
<td>Understanding the building regulations</td>
</tr>
</tbody>
</table>
We identified the engineering solution for which we modelled the building in the fire scenario. The report came up with the strategies which allowed us to keep that steel and timber framed building without collapse while for fire, we used the chute and you cannot build that kind of way under the Structural Engineers documentation."

**Building Surveyor**

"I suppose the work of changing the consultant when the work changed would be a little bit difficult but with the same consultant, people knew where you were heading. The difference being that the approach was quite different. So one was with the Building Referees' Board and the other was using the fire engineering approach. What the difference is that the architect was able to develop the second project better. He was the main player in getting the project up and running anyway. Whereas in the first one, he came to us in needing a hand with the building appeal board of the Building Referees' Board. So, he had to await the decision, whereas with the second one, he worked with the team to develop after having the right to do so."

**Past Experience**

**Fire Engineer**

"Not just the same company but the same individuals which was very rare over that long a period. Having the same individuals was very helpful because the original (AR1) building was a long way away from the Building Code; it was very different because we all had heritage issues to deal with. So, when the consultants came together again in the (AR2) project, we all knew at least a draft of the work because it had been approved before … we learnt something along the way."

**Past Experience**

**Project Manager 1**

"I think it particularly helped. It helped because they were all certainly the consultant team because they knew exactly why certain things were being done in the building and why they couldn't do certain things. With the contractor, it didn't really matter because the contractor had the documentation and then just followed the documentation. It certainly did help with the consultant team though."

**Past Experience**

**Project Manager 2**

"Definitely helped. We didn't have totally the same team but really the key people were all the same people. The architect was the same, the building surveyor was the same, and the fire engineer was the same … And so, with the interaction between the architect, the building surveyor and, the fire engineer, they would come up with those solutions that would be acceptable … I said that we were fortunate seeing as we had the same fire engineer and building surveyor and architect because they probably were the most critical ones to have involved in both of the projects."

**Collaboration**

**Town Planner**

"This was probably a larger one than what I had dealt with in my time as a town planner up to that point, so, not everyone had an architect as experienced as [redacted] who I dealt with … That is the way the legislation works. You don’t get any favours being a 30 million dollar development or just being small developers, the legislation require that they be considered exactly the same."

**Past Experience**

**Same Teams**

**Neutral Responses**

**Contractor**

"It was dynamic. Knowing the team was OK. I did not have any problem with new consultants coming to join the team in [redacted] (AR2) But I..."
knew them well in their (AR1) project. ... Deakin [the client] had preferred consultants and contractors ... nowadays, if they [client] are satisfied, you will be on their list or it might be that they know of you but are careful prescribing and nominating contract activities because they take the liability and if you can do the work and prove that you have strong dynamics there, I don't think they bother with the arguments. What is most important is them getting the job done with whatever is the best result.”

Heritage Advisor  “I don’t have any influence that gets the job or do anything like that. Not at all, I should be clear from the conflict of interest. One other thing was that I was admiring the work of [architect’s firm] as they have results on the board and the National Wool Museum is another example of that ... So, [architect] and his team is one of a number of architects who are all designers or architects who I do work with and have over a long period of time. So, I have recommended all of them at different stages and I recommended them at the same time with the same people which was my job at council to provide recommendations on architects or designers who might be able to provide good outcomes.”

Conflict of interest free

**Key Component 3: Project Team’s Actions**

This discussion has found that the problem-solving process has the components of skills, collaboration among the project team members and the right way of communication through discussion to identify the solution. The building surveyor and contractor mentioned their own actions rather than that of other project team members. However, the client was more specific and related it to this research where they employed and used the same architect to again do the design and lead the project for the AR2 project. This was considered appropriate with what this study had developed and contributed to new knowledge. The detailed outline of project team members’ actions is described in the next paragraphs.

The skills of the building surveyor in modifying the explicit requirements of the project to suit the recycling or adaptive re-use case was considered to be a critical process in the AR1 project. The description of this action particularly focused on the building surveyor carrying out his responsibility to overcome the issues or problems related to fire safety management. The original structure of the buildings for the AR1 and AR2 projects was made from a timber and steel frame. It was considered that the need for compliance with fire safety was really important. However, back to the 1990s, the fire engineering approach did not yet apply to adaptive re-use projects. In the next action to address this issue, the building surveyor in carrying out his responsibility developed the Building Referees’ Board report to obtain the building permit. However, the same problems did not happen in the AR2 project because in the 2000s, the fire engineering approach was being used in adaptive re-use projects. The
benefit of the fire engineering approach is the application of building information modelling (BIM) of the fire strategy in the AR2 project which provided a good result for the project.

The contractor applied three strategies in his management in the project to ensure that all the problems could be solved. The contractor ensured that he always kept track of industrialisation to get the right trade or skills for the subcontractors’ work and provided the best result as this also reflected on him as the main contractor for both projects. Understanding the client’s requirements and needs was considered the most important aspect for the contractor in overcoming any problems and he could thus avoid problems in the AR2 project. The contractor also always ensured that he worked together with the consultants to get the right expertise and to receive advice from them for any problems that occurred during the construction process. The components of collaboration and skills were in the processes in which the contractor was involved.

As the client, project manager 2 considered that employing the same architect for both projects was the best action to take. There was evidence that the architect was the person who had a higher level of skill and expertise than others in his job. The reason behind employing the same architect for both the AR1 and AR2 projects was because the architect was the right person who could come up with solutions for dealing with issues of differences in the building components of both projects. The next action in making this decision was to use the same construction technique for the AR2 project because of the successful approach that had been proven in the AR1 project. Project manager 1 focused on discussions with the local council as the key action which ensured that the integrity of the buildings was maintained. She was the top management person but was involved more with the client’s organisation and had minimum direct project involvement on site because that was the responsibility of project manager 2.

The architect took action by making sure that all the consultants involved provided ideas about his vision for design for the historical building adaptation. The involvement of the building surveyor helped the architect to understand the building regulations with which they needed to comply in the transformation of the historical building. The collaboration components were considered and involved in figuring out the design solution. Through collaboration, the ideas of each project team member were synchronised leading to the development of the best solution for the projects. The architect also had to upgrade his knowledge when dealing with the historical buildings through an in-depth understanding of the building’s history in the process of interpreting the building for people so that they would understand how the original function of the building worked. In that way, people still knew about the original functions of the woolstore even though the building had been adapted to university uses.
Action taken by the *quantity surveyor* was through the component of *communication*. The quantity surveyor along with other consultants was involved in broad discussion in determining the best solution for any problems which had occurred in project. Meanwhile, the fire engineer provided his perception about the key actions taken by the architect by bringing back together the same project team for both the AR1 and AR2 projects. The architect’s strategy was to develop the teams so that everybody already knew each other to make sure that collaboration and communication were more effective and efficient.

This study carried out data analysis about the project team members’ actions in solving problems according to their own disciplines and skills. There were project team members who referred to their own skills in describing the actions they took to address any challenges that they were facing. However, some project team members described other project team members’ actions when discussing their perceptions about the problem-solving process. Table 6.8 shows evidence of the project team members’ perceptions about the key component of action in the problem-solving process for case study 1.

**Table 6.8:** Evidence for the key of action in the problem-solving process in case study 1

<table>
<thead>
<tr>
<th>Project Team Members</th>
<th>Key of Action</th>
<th>Actions</th>
</tr>
</thead>
</table>
| Building Surveyor    | "When we did the first building the (AR1) building with the woolstores building, we didn't have the fire engineering in those days. So we had to go to what we call the building referees board. So regulation there, we set for those regulations are not going to suit this building. So we prepared the packages of modification applications to modify the regulation to suit that recycling case."
|                      | Building Surveyor – modification building permit application to modify the regulation to suit the adaptive re-use project |
| Contractor           | "I always go through it at least three strategic cross roads. And it takes the wrong ways or whatever they point it would be, it better than it happened. Whether would be down the tracking industrialization or types of labor or whatever would be the one. The other one is understanding what the client really needs. If you take the wrong way project one of the fall apart, it the target to back on the track. Or hear the government project costing twice as much as they should, tax paid, money is going like this (fingers). You know half the reason why probably tenders on the right time. Working together and the expertise and I think it important always to give the young one to go into the world and always sharp and it still a lot of administration. And also important is the whole culture things for working around."
|                      | Contractor – Own strategies Tracking industrialisation Understanding client's requirements Working together Expertise |
| Architect            | "I still had the ongoing discussion and working with the property services as their client contact and then we would go back through the various groups to solve their problems and things but in terms of the actual contract the day to day running of the project, that's what I did, so I was answering the question on site, inspecting the works, sorting out the problems, writing the site instructions to the contractor...as architects we had to understand"
|                      | Architect – principle consultant described the other consultants actions and his own Answering questions on site Inspecting the works Sorting out the problems Writing the site instructions to contractor Understanding the building regulations |
the building regulations and how big the fire compartment that we can have so we worked with [building surveyor], he was working with [building surveyor] which is the building surveyor but he was working for them and now he’s going on with himself, they helped us understand the regular building requirements”

<table>
<thead>
<tr>
<th>Project Manager 2</th>
<th>“… some other problem we came across in the [Dennys (AR2)] in the [Dalgetys (AR1)] job … were obviously we won’t have problem in the [Dennys (AR2)] one because we direct, the important that we were have the same architect involve… so, detailing and the things that we were learn on this project in the [Dalgetys (AR1)] project would be able transfer over to that and that the documentation reflected some other those problems solved. Consent we even that totally different building and that.. Some of the detailing issues that the architect accounted here a similar to what on stunning there.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Engineer</td>
<td>“… he (architect) recommended us because he want build the people that the team know each other. So it thinks that one the key roles for an architect to a project manager to make sure you pick the right team.”</td>
</tr>
<tr>
<td>Quantity Surveyor</td>
<td>“So, you have to be upfront somewhere in measuring the items that you talking about. To use the case of the point moving the floors up and down, basically we were involve in consultant thing to discuss broadly about the methodology how it might occur and that the floor to be moved by bay … to make out the quantity or the quantum of work you can talk to the construction manager try to work out how might be done. You can talk to sub-contractor and call the expertise to work it out on how might be done, fill the what might cost and then put all them on paper”</td>
</tr>
<tr>
<td>Project Manager 1</td>
<td>“… we saved the woolstores and parts of that had to obviously then be negotiated with the City of Greater Geelong and the heritage overlay to make sure we didn’t lose the integrity of the building.”</td>
</tr>
</tbody>
</table>

**Key Component 4: Sources of Information**

This section describes the sources of information that help project teams to develop solutions. The sources of information refer to the explicit information sources or written documentation. This study has identified five main sources of information that were referred to in case study 1 by the client and project team members which were related to adaptive re-use projects. The sources of information are stated in table 6.3 in section 6.3.5. The five main sources were cost information, heritage information; fire engineering information, regulation information and additional information (see figure 6.19).
The information used in developing solutions can be described according to the actions taken by each project team member in the adaptive re-use projects. For the *quantity surveyor*, all explicit documents about cost information were wisely used together taking into account all the difficulties that were associated with a heritage building versus a new building. It was important to add the component of *skills* when handling the costing difficulties, to calculate the costs from the correct sources and to use the right place to cost it in order to give value for money to the client.

As the *building surveyor* for both projects, his *experience* was valuable for showing the relationship of information related to both projects. He mentioned that having a lot of experience with the important guidelines and tools in the AR1 project really made the knowledge and information in the AR2 project easier to manage. Some innovative requirements changed in the AR1 project and they used that information as the starting point for the AR2 project. The AR2 project used the fire engineer as an important consultant to establish some of the ground rules for its quite different approaches. However, developing *confidence* for the AR2 project helped a lot in addition to the explicit information.

How the *contractor* developed the solution through the information was by preparing the best possible answer before any meeting with the client and consultants. The contractor’s meetings with the subcontractors were named as brainstorming sessions before the main
contractor was involved with the consultants and client, meeting them on another day. In meetings with the client and consultants, a lot of questions and ideas really needed to be correctly communicated through discussion, ensuring that everything in the report of the outcomes from the meeting was developed on site to solve any problems. The main thing was to always encourage the project team members to keep on raising the issues in the meetings and to develop together the way to resolve them.

In the case of adaptive re-use projects, the fire engineer claimed that the requirements for this kind of project were usually tougher than for a new building. The tougher situation meant that the fire engineer’s group required some documentation to convert an old heritage building and to look at this process from the position of the study. The main thing was to always ensure that all requirements related to the fire and recycled heritage building information and documentation came from the Australian Government and international fire engineering guidelines but were written by the Australian Building Codes Board.

The heritage advisor used the information as a guide in developing the issues to respond to the planning permit application giving advice to the architect and also to the town planner who were responsible for issues in the planning permit. The advice in terms of heritage from the heritage advisor was not based on personal opinion but referred to the heritage policy and the planning scheme. Meanwhile, the town planner when making decisions regarding to the application for the planning permits for both the AR1 and AR2 projects referred to the zone and heritage overlay controls documents. Coordination between all these criteria and documentation was the way to identify solutions in relation to the planning permit application.

The client (project manager 2) indicated that the AR1 and AR2 projects did not have enough information in terms of the loading and testing reports on the existing buildings particularly at the early stage before construction started. However, the client thought that the project team members successfully solved the lack of information by being directly involved in the process of actually getting the information: this process was more accurate instead of gathering theoretical information from other project team members. This study found that to do the testing and to be practically involved in identifying the information required good skills. The results from the AR1 project in particular developed the design criteria for certain components of the building.

Table 6.9 shows evidence of the sources of information that were used and applied by project team members in case study 1 for both the AR1 and AR2 projects. There were sources of information that applied only to the AR2 project but not to the AR1 project. This study found that the sources of information that obviously did not apply in the AR1 project were the fire engineering requirements. The reason for this was because the AR1 and AR2
projects had different approaches in relation to fire safety. However, the data findings demonstrated the sources of information used in case study 1 as the entire information that was appropriate in the within-case analysis.

Table 6.9: Evidence of sources of information referred to by project team members in the problem solving process for case study 1

<table>
<thead>
<tr>
<th>Project Team Members</th>
<th>Sources of Information</th>
<th>Types of Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity Surveyor</td>
<td>“We have pricing information in our office that comes from a few forms that you can get. You can buy books that told you how much this thing is worst. We have other costing information from job that priced previously and information supply prices that things that we gathering and collecting in our normal daily work. The tricky is to apply correctly to what you estimate for. So, it cost certain amount per cubic meter of concrete to pour and slams into the building but it might not the cost is same in this building because it might be used the pumped it up to six floors or something like that. So, you attempt the information you got to applied to what you are trying to price. So, you have to take into account the difficulties associated with this sort of building versus new building.”</td>
<td>Knowledge on costing and pricing</td>
</tr>
<tr>
<td>Building Surveyor</td>
<td>… There was a lot work done in Sydney and Melbourne, the called as recycle guideline and that develop in CSIRO [Commonwealth Scientific and Industrial Research Organisation] and also … Building Regulation peoples in Canberra… So that very important guidelines and tools for that approach and for the second project really was you have a lot of experience because of the first that made the second one was easier. So that the case we defined now. The requirement for the first, is a bit a lot of innovative of changing as well …. The type of information on the first one there was a lot of that with the information are available. With the second one again used the first one as the starting base. The second project probably used the Fire Engineer as an important consultant to establish some of the ground rules that could be done. So, there is probably.. I think it quite different approaches but again you develop up your own confidence in the building as well, what you could do, what you couldn’t do. So I think pretty different. It suitable.”</td>
<td>Knowledge on adaptive re-use regulations</td>
</tr>
<tr>
<td>Contractor</td>
<td>“Absolutely I will prepare for the meeting, get the answer for the consequences at the night before and get the result in the meeting when attended the meeting tomorrow, that’s it….What we called that brain storming session. You know that in there a lot of question, many ideas and easy put them up and discuss and that come work too. But I think is more important keep people raise the issue and think about it and we get to resolve it”</td>
<td>Knowledge on other supportive information</td>
</tr>
<tr>
<td>Fire Engineer</td>
<td>Fire engineering needed hundreds of documents that we refer to but, specifically for heritage refurbishment, the organisation that wrote the Building Code also wrote some guidelines for recycling heritage buildings (I can email them to you). We have requirements that are usually</td>
<td>Knowledge on fire engineering</td>
</tr>
</tbody>
</table>
tougher than for new buildings that mean we have a document about converting an old building for which you should do this, somewhere halfway in between. So we look at the document as the study’s position … The information and documentation came from the Australian Government. That is the government document on how to recycle heritage buildings and we also use things like international fire engineering guidelines which is written by the Australian Building Codes Board. So, that these two documents are what the fire brigade want us to use. So, the international fire engineering guidelines used by the Australian Government and also in Canada and the USA and New Zealand and that document is written and supported by the fire brigades. The Building Codes people and Engineers Australia and the Building Surveyors' Institute. So, those were the two documents for the approval part of the design process.”

Heritage Advisor  “That is not my personal opinion in the guidance advice about the heritage policy and the planning scheme. This woolstore industrial heritage area policy as well as an overreaction in local heritage policy and the same in the Greater City of Geelong planning scheme. So, those documents were used to guide me in giving advice to the architect and to the planner responsible for the permit. Now, other things that were also discussed briefly, I did a few site visits. Going back to that heritage principle as much as necessary but it’s as little as possible.”

Knowledge on heritage

Project Manager 2  “No, there was no structural table which showed the strength and anything to do with the timber. So that hadn’t been tested: they actually did it as part of fire engineering. They tried to burn it and actually charted it to come up with some sort of criteria which the structural engineer could use in their design because there was NO Australian Standard or anything about what and how the material should react under certain conditions. So those some basic tests were done to actually show that OK this iron backed column and its equivalent was stronger than steel and stood up better under certain conditions. So, that the testing done in the 1990s came up with design criteria for certain elements that were actually in this building.”

Knowledge on additional information

<table>
<thead>
<tr>
<th>6.4.2 Research Findings 3: Key Components of Problem Solving- Knowledge Creation Context</th>
</tr>
</thead>
</table>

Following is a discussion of the findings in relation to the key components of problem solving in the knowledge creation context. Two key components were involved as set out in the next sections:
Key Component 1: Generating New Skills

The architect described that it was most important in creating new skills to thoroughly understand and know a lot of tricks and strategies for approaching, planning and detailing an old building. The evidence from the AR1 project was that it achieved a good result which was satisfactory in terms of the architecture and integrated well the old and new materials in one building. Learning from experience in the first project led to the application of all skills in designing for subsequent projects. Confidence also developed from the accumulated experience related to the material and the services, and the synchronisation of ideas into the design which respected the buildings and gained from the success of the previous project. More important was the architect’s confidence related to the new skills of leading and being able to coordinate the project team members. The architect learned lessons from this kind of project and applied these in the successful design and fire engineering approaches as new skills that were needed to deal with the fire engineering requirements. The architect indicated that it was important to create new skills through developing experience and confidence for the next project particularly in any application or approval process.

The quantity surveyor’s roles were related to the cost: the new skill was to develop the knowledge to work out the difficulties. One example of working out the difficulties was moving an existing floor up and down in the building particularly in the AR2 project. New skills in terms of pricing requirements particularly for demolition and alteration of major existing external walls were relevant to the adaptive re-use projects. This obviously provided experience for the quantity surveyor which could be used when moving on to another similar job or projects in which he could be involved in the future.

As with the building surveyor, he really appreciated his involvement in these two projects. He appreciated the development of new knowledge and skills gained through his experience working on adaptive re-use projects. The new knowledge and skills that the building surveyor appreciated were related to the fire safety to the building and its occupants in adaptive re-use buildings, for example, active systems of fire safety, smoke exhaust systems, sprinkler systems and evacuation systems. The building surveyor claimed that these projects were unique and that nothing like these building’ adaptation existed in Victoria and that they had become a landmark building project. The good skills and expertise were developed through the difficulties of the project, and the transfer of the skills could be used for further skills development in other projects.

The contractor’s view clearly mentioned new skills that he had developed in these projects. The new skill for the contractor was increased understanding of the client, the architect and the building surveyor. The most important new skills for contractors to develop that had
occurred during the project were client and consultant relationship skills. Starting from these relationship skills, contractors had the awareness of knowing the building characteristics, the fire strength, the steps to take and to make sure that all bases were covered, always following the work program to achieve the success of adaptive re-use projects.

*Project manager 2* was the person who represented the client and had previous experience in other projects involving heritage buildings. The new skill that project manager 2 developed in the area of fire safety issues was learning about the principles and the construction of fire stairs where the components used were precast concrete panels and steps. The knowledge about the fire stairs concept was the way to pour and form fire stairs from the stairs master system inside the building. This approach was used in the AR1 project. However, the skills from the AR1 project that had been developed around the fire stairs were used in the AR2 project. The work was done very effectively by opening up the roof and dropping the precast panels and precast stairs inside the building without the stairs master system format. There was evidence on the improvement of skills through using technology in construction.

Being a *town planner* in a local council involves facing a lot of applications within a year while finding that the process was exactly the same for every application and that there was no improvement in terms of developing new skills. However, the evidence from the interview with case study 1’s town planner showed that she had developed a better understanding of commercial buildings. She had also developed new skills for dealing with the refurbishment and adaptation of existing heritage buildings for commercial purposes and was not just focused on residential purposes. Nevertheless, as a town planner in local government and only involved at the early stage of projects, it was not necessary to develop new skills when solely focused on town planner duties in a local council. The experience of learning new skills also related to dealing with the architect and to a significant amount of information about commercial sites, including financial and design information, that helped the town planner to develop her skills for other projects.

The evidence of new skills generated by project team members in the problem-solving process in the AR1 and AR2 projects is as stated in table 6.10.

Table 6.10: Evidence of new skills that generated by project team members in the problem-solving process for case study 1

<table>
<thead>
<tr>
<th>Project Teams Member</th>
<th>Generating new skills</th>
<th>Types of new skills</th>
</tr>
</thead>
</table>
| Architect            | *The specific skills other than the gradual increase in experience and knowledge and confidence in knowing how to tackle the project and how to approach it, how to research the material to apply it to another project, you know how to do something in a particular way such as examples* | • Research on the building materials  
• Tackling the building heritage situation  
• Knowing how to deal with the local authorities in relation to heritage regulations |
when you were successful before and had a good
result. It just is meant for the decision-making and
approval processes because you have to be
confident that it has been done that way before.
And dealing with the heritage advisor, the more
you do, the more experience you have. It is all
about the more confidence you have in what you
have been doing … But there were elements in
how we installed services into the building and
how we integrated new services and new finishes
with the heritage buildings where we learned
lessons to do with what design approaches were
successful and how we could use the regulatory
system to overcome the fact that the building
didn’t comply with the building regulations and to
bringing it up to the standards.”

- Integrating and matching new services and finishes with heritage buildings

Quantity Surveyor  | “The sort of pricing requirement and things like
that that might be required, demolition and
alteration of major external walls or the sorts of
things that have been mentioned before. This was
particularly on this job, obviously I got my
experience from that now so I can take that as
experience with me if another similar job should
come up … as a quantity surveyor probably the
result is always because the cost of materials then
the building cost in general is always a moving
target. Mostly going up and sometimes going
down. So, we are always updating our knowledge
with regard to process job things and new
products coming out in the market, so any of that
knowledge would be used on this project (AR2).”

- Pricing requirements for heritage buildings with special kind of materials and current price

Building Surveyor  | “New skill was probably in understanding the
client, the architect and the building surveyor. You
going back to your little team and ask them about it
and across the board skill development and
understanding of the skills and knowledge. Well
you know the characteristics of the building and
you know the fire strength and you know all the
steps that you need to take and you’re doing the
conceptual on that, you don’t miss many bases
like that; you always get in the row and your
program analyst too and are always interested on
this, in this, and this. You do develop higher skills,
the awareness also was higher as you haven’t
seen this before but have experienced that. Your
client relationship skills will be wide and from my
perspectives it will be right up there.”

- Generated from the intervening period between AR1 and AR2 projects, including
  skills in building recycling knowledge (the building surveyor mentioned these skills and
  was involved with other recycled building projects in Melbourne and Sydney)

Contractor  | “…understanding what the client really needs…hear
the government project costing…working together
and the expertise and I think it important as the
whole culture for working around”

- Understand client requirements in relation with heritage buildings and step for next process

Project Manager 2 | “…the thing was that we probably did this when
we were coming to do the (AR2). It was
that the fire stairs were in there and they were all
done in precast panels and precast steps and
stairs which had fire stairs in there. There was
pouring and all was done from a stairs master
system put in there (in AR1). In (AR2)
what happened was they basically opened up the
roof and just dropped down the precast panels
and precast stairs. Everything just pretty much
moulded together. So something that certainly
changed from thinking about what we did here as
supposed to what we did in (AR2)
because there and partly to do with the way that
the technology was going that was just getting
access into the building.”

- Thinking about the fire safety base using technology (building model preparations)
Town Planner: “I got through Dennys Lascelles (AR2) just a better understanding of commercial buildings and dealing with the refurbishment and reconfiguration of existing heritage buildings for commercial purposes and not residential purposes. … my main dealing was in getting to know the architect’s style and the way that Deakin [the client] operated was interesting. There wasn’t really a skill set that I did know already have. Well, I didn’t have to learn new skills as far as I doing my job went. That was probably ancillary to that and lot of information about the commercial side of things and financially, how a building like that needs to function to earn make money and those sorts of things that were kind of outside my job but were interesting to know and certainly contributed to the design of the building. So, I played the role in how the design provides function and works from the commercial point of view.”

Skills related to the heritage buildings being used for commercial purposes

Key Component 2: Developing New Solutions

The quantity surveyor mentioned that there was an excellent working relationship between the architect and contractor. They prepared a good report, understood each other, understood the particular adaptive re-use construction, and their ideas were synchronised in developing new solutions. The quantity surveyor also indicated, based on his own experience, that working together with the same team members was the best strategy for collaboration when compared with working with a new person in the AR2 project. The experience of working with a new team member that had a different methodology in their principles of working could create difficulty in terms of working in harmony and it could be difficult to achieve synchronisation of ideas (knowledge collaboration). The appointment of a new consultant in sequential projects was particularly not suitable for adaptive re-use projects in a “time series” scenario because a lot of catch up was needed to understand the new team member’s ideas and philosophy. In terms of communication, these projects had in-house communication systems including email, telephone calls and normal consulting which were all ways for all of the information of the project helping to develop new solutions particularly in the AR2 project.

As principal consultant, the architect claimed that the teams helped each other to develop new solutions through meetings and making sure that everybody played a key role. With the aid of technology (building modelling), the fire engineer modelled the building scenario which helped the teams to understand how the building would act in a fire and to identify the solution which would stop the floor from collapsing, protect the structure and propose the duration of the evacuation time if a fire really happened. The project team also negotiated to propose other solution options that were affordable and worked well with the fire strategy.
The architect indicated in his interview that as principal consultant and designer of the project, he needed to know a little bit about how other project team members worked and to know enough to manage, direct and integrate the teams in relation to the architectural works. The building surveyor expressed similar ideas when he described that the architect relied on discussion with other project team members to get information and to develop the solutions for problems. In terms of information from other project team members, the architect collected all the information in meetings and wrote instructions to the contractor for solving any problems that occurred in the adaptive re-use projects. In the AR1 and AR2 projects, the key roles of project team members were the same and they had good quality work. They were very loyal to the architect and client and continued to work together building relationships. The architect understood the project team members’ knowledge and work philosophy. The continuing relationship was definitely very important because it built up loyalty, trust and reliance in developing new solutions for any issues that occurred in the projects.

In his interview, the building surveyor indicated that it was important to have the same project team for the sequential project because it provided the link between the two projects. The links and continuity in terms of intellectual and human capital were also important in providing ideas for developing new solutions for any problems that occurred in both projects. The main advantage in having the same project team was that the project management process was not lost because the adaptive re-use in the AR1 and AR2 projects was for buildings that were very difficult to adapt.

The experience of the fire engineer was that the project team members really helped each other in developing new ideas for solutions to problems related to fire safety in old buildings. This was reflected when gaining the synchronisation of ideas between project team members where every idea could affect the other consultants’ decisions.

According to project manager 2, the project team members certainly helped each other and this could be described as having good collaboration in developing ideas for new solutions. Some challenges were presented to project team members when creating new ideas to overcome the redness of the existing and original external façade. The development of new ideas was brilliant when the architect and consultants came up with the innovative solution of putting glass walls on the annex that was attached to the original façade. It looked vibrant and exclusive compared to standard university buildings. It also could be describes that the integration of new and old elements in adaptive re-use projects really needed the collaboration and the skills to come up with innovative solutions among the project team members. The project team members also worked together to sort out the mechanical system of the buildings that reassembled the building’s energy because this was really
significant as adaptive re-use projects were one method of achieving sustainable development.

Table 6.11 provides evidence from the interview data that described the new solutions developed by project team members in case study 1. The new solutions were focused on intellectual and social factors such as working together, communication, the same teams, trust and collaboration.

Table 6.11: Evidence of new solutions developed by project team members in the problem-solving process for case study 1

<table>
<thead>
<tr>
<th>Project Team Member</th>
<th>Developing New Solutions</th>
<th>The New Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity Surveyor</td>
<td>“The architect and the builder had an excellent relationship working together on the Dalgetys (AR1) project. So, they had built up good rapport, understood each other: they understood the particular construction and idea synchronisation so they worked well together. Personally I was involved on a contract with the architect before and with Deakin (the client). The main difficulty in the relationship was related to the structural engineer initially directly appointed by Deakin (client) … Because of the change in consultant, there was a lot of catch up, once he changed the design so we needed to go to the site and had to match his design and needed to redraw and the contract was coming and had to be fixed up by adding steel … We had in-house communication systems. It was email with particular systems.”</td>
<td>Developed good explicit rapport on the project solution Synchronisation of ideas in good collaboration Never changed the consultants, changing members in AR2 affected collaboration and trust</td>
</tr>
<tr>
<td>Architect</td>
<td>“We talked it through in the meeting … all those people played as= key role. The fire engineer modelled the scenarios to understand how the building would act in a fire … So, the fire strategy dictated how we introduce existing building and we looked at it and negotiated and talked through other options to come up with the solution which was affordable and looked good and it worked. So, there were alternatives and not only one way and provided other alternatives that were talked through, we came to an agreement and what was kept was modelled on that scenario and worked for us and was OK with one option and was chosen with the dictated option. … so the team members were the same, very loyal, we got good quality consultants who we kept going back to build up relationships with them, they understood how to use things and you understood how they operated and understood what was good and not good, and vice versa … with the consultant we kept giving work to or found work for because it helped out our teams, there was loyalty built up and trust and reliance so we could rely on them, if we wanted them to stop doing that, the architect’s work was finished on our project, we both got to say how to manage themselves.”</td>
<td>Fire strategy based on fire engineering approach to suit existing building structures and elements (timber and steel)</td>
</tr>
<tr>
<td>Building Surveyor</td>
<td>“The principle of the original design, so that it was very important that it had a link between the two projects. I think if we didn’t have the same teams, you could get lost in the process because it was a very difficult building.”</td>
<td>Same team helped to develop solutions – knowledge about the previous project was never lost.</td>
</tr>
</tbody>
</table>
“Well, the sub-group design team that I worked with was the architect, the building surveyor and the other services engineers, so that group had to work together because every time the mechanical engineers put in some exhaust system, put in the fresh air system, I had to be worried that because this affected the blowing area in this room … We had to help each other and we did help each other because everything one consultant does can affect the other consultants.”

“Project Manager 2

The teams worked together to sort out the mechanical system in there and in here and the system were really working in there … we had something similar with the job this way, and even … if it doesn't provide the immediate solution, it might provide the way to get to that solution. So, just the knowledge about the old building, how they got together and how the building was actually originally built could help you, maybe to address any problem might come up, some small problem. Just knowing how the pieces of the window actually are affixed to the brickwork and that sort of thing. That is how knowledge happened; whether that knowledge was unique or not, the knowledge there was the same. What with (same architect) just his knowledge of the building and how it worked together was just amazing.”

Knowledge about the old building, how they could get together and how the building was actually built originally.

6.4.3 Summary

The key findings in case study 1 are summarised in table 6.12.

Table 6.12: The summary of key findings in case study 1

<table>
<thead>
<tr>
<th>Project Teams’ Involvement</th>
<th>PM1 and QS not involved in AR1. PM1 had knowledge about AR1 because she was Project Director in Property Services Department. TP not involved and didn’t have knowledge about AR1</th>
<th>Architect and BS involved in a lot of heritage building projects with the same client. They were involved subsequently with other small projects in the same buildings. A lot of knowledge about the buildings (AR1 and AR2) were found in the Architect and BS practices</th>
<th>All participants (9) involved in AR2 but contractor was no longer operating on the project before its end (contractor’s organisation had internal problems)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three Major Research Findings</td>
<td><strong>Research Finding 1</strong></td>
<td><strong>Components of Success</strong></td>
<td><strong>Research Finding 2</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Critical (80%-100%)</strong></td>
<td>• Collaboration (100%) • Communication (100%) • Skills (100%) • Past Experience (100%) • Trust (89%) • Supportive Attitude (56%) – Eliminated: percentage below 80%</td>
<td><strong>Key Components of Problems Solving in Relation to Knowledge Transfer</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Research Finding 2</strong></td>
<td></td>
<td>• Key Component 1: Efficiency and Effectiveness mode • Key Component 2: Similar Project Teams</td>
</tr>
</tbody>
</table>
This chapter presented three major research findings revealed by this research in case study 1. As is typical of qualitative research, extensive evidence of quotations from project team members' perceptions are included in the report. The involvement of project team members showed that project manager 1, the quantity surveyor and contractor were not involved in the AR1 project. All nine project team members were involved in the AR2 project but the contractor was only involved at an early stage. This situation happened because the contractor’s organisation had internal problems and stopped their services to the industry at that time. Even though project manager 1 and the quantity surveyor were never involved in the AR1 project, project manager 1 had knowledge about the AR1 project background. This indicated that project manager 1’s views were significant in the data findings.

The primary finding of case study 1 was that five critical components of success help project team members in the problem-solving process. The five components had 80% to 100% frequencies in project team members’ views and comprised collaboration, communication, skills, past experience and trust. Supportive attitude was eliminated based on its frequency of 56%. In discussing the types of knowledge that contributed to the adaptive re-use problem-solving process, the majority of project team members expressed the view that knowledge was explicitly and tacitly related to heritage knowledge such as understanding the conservation management plan, heritage requirements, recycling guideline, heritage citations and the heritage policy, all of which supported the identification of solutions in adaptive re-use projects. Most participants reported that the knowledge about integrating new and old building elements for university functions was critical in helping project teams in the problem-solving process. Most participants expressed the view that they had a high level of trust between project team members and were loyal to each other in terms of the knowledge and skills collected within the time series scenario.

The second research finding in case study 1 indicated that knowledge transfer activities in a time series scenario were affected by four key components in the problem-solving process in the AR1 and AR2 projects. The majority of participants responded negatively indicating that it was not easy to solve the problems in adaptive re-use projects. They talked about difficulties in measurement and estimating, and complexity in permit applications and construction which were challenges for project teams and were not situations that were easy
to solve. In discussing the importance of having the same project teams in the AR1 and AR2 projects, the majority of project team members gave positive responses to having the same team members in both projects. This positively affected communication which became more effective, increased the level of understanding about the building regulations, and past experience and good collaboration were considered supportive in the problem-solving process. Actions were taken by project team members according to the skills that they had accumulated from the AR1 project and the intervening period. In discussing the sources of information, 21 types of explicit documents contributed to the project team members’ knowledge on costing and pricing, adaptive re-use regulations, fire engineering approach, and heritage policy and regulations.

The third research finding in case study 1 was that new skills and new solutions were created within the time series scenario. In terms of generating new skills, the building surveyor generated new skills related to his building recycling knowledge in the intervening period when he was involved with other heritage projects in Melbourne and Sydney. The majority of project team members indicated that the new skills generated were more related to heritage matters such as skills in doing research on existing building materials, skills in dealing with the authorities for any application, and understanding the building characteristics and fire strength of the building elements (most of the existing structure was made from timber and steel). All these skills provided new knowledge for project team members during the problem-solving process. In discussing the new solutions that were developed in the AR2 project, most of the project team members expressed the view that fire strategy was important knowledge to match to the existing structure and fabric that were mostly covered with timber and steel. The majority of participants responded that having the same team members’ support in developing new solutions for the AR2 project was because they had knowledge about the previous project.

6.5 Summary

Chapter 6 explained the data analysis and discussed case study 1 which involved two adaptive re-use projects within a “project-to-project time series” scenario. This study interviewed nine participants including the client, consultants and contractor. The data analysis used NVivo Version 9 to identify the components of success in the transcribed interviews. Through the thematic maps for content analysis of the components of success in the problem-solving process, this study identified six components of success, four key components in the knowledge transfer context and two key components in the knowledge
creation context that were important in the problem-solving process related to knowledge creation and knowledge transfer in three scenarios of a “time series scenario.

The next chapter presents the data analysis and discussion of findings for case study 2 in which this study used the same principle of analysis as in case study 1. The rationale for this approach was due to the appropriateness of the following approach in data analysis and discussion through cross-case analysis between similar items.
CHAPTER 7
CASE STUDY 2: WITHIN-CASE ANALYSIS AND DATA FINDINGS

This chapter presents the within-case analysis and data findings of case study 2 in relation to the application of components of success and key points in problem solving from the project team members’ points of view. This study has adopted within-case analysis with main unit analysis and sub-unit analysis of the Adaptive Re-use 1 (AR1) and Adaptive Re-use 2 (AR2) projects in case study 2 located in the city of Melbourne, Australia. This chapter is structured to enable detailed discussion of the research design used in this research. One difficulty faced by the researcher was with regard to finding the same consultants involved in the AR1 and AR2 projects. Two reasons contributed to these difficulties: the first related to the consultants moving to other firms and the researcher being unable to track them down as the client and the other consultants refused to share the contact details in accordance with respecting the individual’s privacy. The second reason was that individuals refused to be interviewed without giving any reasons. This study has successfully interviewed the client’s representatives who were directly involved in the AR1 and AR2 projects. This study has found that the richness of experience of both of the client’s representatives helped in the case study 2 analysis. The other consultants who it was thought would be able to contribute to the development of this analysis were the structural engineer, project manager (client’s representative), architect and contractor who were involved in the AR2 project. The architect was from the same architectural firm but was a different person to the one involved in the AR1 project. However, this architect’s views also addressed the information about the AR1 project. The data collection (section 5.3.4) and data analysis techniques (section 5.4) were explained and justified in chapter 5. The overview of case study 2 is described in this chapter. The discussion of data findings on components of success and key components of problems solving also presented in this chapter. Lastly, the summary is described in last section.

7.1 Overview of Case Study 2

This overview of case study 2 refers to the interpretation of case study 1 in which all the information including the history of the buildings and the information about the adaptive re-use projects was gathered from the project documents. All these categories of information were from explicit sources including the heritage citations and the conservation management
plan. This section describes the historical background of the early development of the two buildings and the relationship between the projects.

### 7.1.1 The Historical Background of the Buildings

Case study 2 involved two historical buildings that were adjacent to each other and located in the city of Melbourne, Australia. These two historical buildings have been transformed into university buildings. The original function of the buildings was formerly the Magistrates Court (Building 20) and the Francis Ormond Building (Building 1). These two buildings were heritage-listed with the Heritage Council of Victoria. The detailed historical backgrounds of the buildings are explained in the following section.

**Former Magistrate Court (Building 20)**

The former Magistrates Court was located at the site which was originally used for the old Supreme Court built in 1843. The similar functions of the Supreme Court and then the Magistrates Court demonstrated a continuous association with the law until the use of this building for these functions was discontinued and replaced with university usage in 1994. The building was built between 1911 and 1913 and was known as the Metropolitan Petty Sessions Court. The building was originally designed by GBH Austin of the Public Works Department in accordance with the French Romanesque style to appropriately express law
and justice in Melbourne. According to its history, the former Magistrates Court was recognised as one of the important historic buildings in Melbourne (RMIT website 2012).

**Former Francis Ormond Building (Building 1)**

The Francis Ormond Building was registered as H2157 and categorised as a heritage place by the Heritage Council of Victoria. According to the statement of its cultural heritage significance, this building formerly used as Melbourne’s Working Men’s College was opened in 1887. The early development of the Francis Ormond Building had two stages. The first stage was built laterally to Bowen Street between 1885 and 1886 by J Moore with a construction cost of £11,000 and comprised workshops, main lecture halls, classrooms and the caretaker’s quarters. The second stage was built between 1890 and 1892 and comprised the Latrobe Street wing, corner tower, offices, college council and instructor’s room, other classrooms and laboratories. The architecture for the first stage of the building was designed by architects, Percy Oakden, Leonard Terry and Nahum Barnet: the architects for the second stage of construction were Oakden, Addison and Kemp with the cost being £13,700 (University document, Department of Planning and Community Development, Heritage Victoria 2008).

Francis Ormond was a Scottish immigrant who came from farming background and became a great educational philanthropist. The building was architecturally and historically significant to the State of Victoria and became a major example of the work of the prominent Melbourne architects, Terry, Oakden and Barnet and the firm of Oakden, Addison and Kemp. This building also has historical significance due to its association with the development of education above primary school level for the working classes in the late nineteenth century. This building became known as Building 1 when the university took over the building and it was fully adapted to become an administration building (University document, Department of Planning and Community Development, Heritage Victoria 2008).

According to the RMIT website, these two historical buildings (Building 20 and Building 1) were linked together to become RMIT’s corporate headquarters. The internal spaces of these two buildings consisted of rooms and offices for the University Council, Vice-Chancellor, Chancellor, Secretariat and Senior Executives. The three main courts in Building 20 were adapted to become: firstly, a museum operated by National Trust (Court 1) and, secondly, Court 2 was used for seminars, meetings and special functions. Meanwhile, Court 3 was used for the RMIT Council meetings.
7.2 Adaptive Re-use Projects Background

The process of refurbishment for Building 20 (the AR1 project) and Building 1 (the AR2 project) was started and completed within different time frames. From the document analysis, this study found that the AR1 project refurbishment was completed in 2002 while the AR2 project was completed in 2010. These two buildings had an eight-year gap in terms of their development by the client. The engagement of the same key project team members for the AR1 and AR2 projects was not the client’s intention. The obvious key project team members who were involved in both projects were architects from the same architectural firm. An architect was appointed as the principal consultant for both AR1 and AR2 projects because they had the proven ability to undertake the specification and management of the sympathetic restoration work was required due to the heritage requirements. The buildings adapted in the AR1 and AR2 projects received awards from the Royal Australian Institute of Architecture (Victorian Chapter) and the Australian Property Institute (Heritage Property Presidents’ Commendation Award) in 2005 providing evidence that the projects were viewed as successful in the heritage area.

7.2.1 The Interviews

The schedule for interviews was constructed particularly for the key people who were critically involved in the AR1 and AR2 projects (case study 2). Five participants were interviewed (see table 7.1).

Table 7.1: Participant grouping, position and code name (for confidentiality) of key people

<table>
<thead>
<tr>
<th>Participant</th>
<th>Name Code</th>
<th>Position/The Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>Client 1</td>
<td>Deputy Director, Projects</td>
</tr>
<tr>
<td>Client</td>
<td>Client 2</td>
<td>Manager, Client Services</td>
</tr>
<tr>
<td>Consultant</td>
<td>PM</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Consultant</td>
<td>ARCH</td>
<td>Architect</td>
</tr>
<tr>
<td>Consultant</td>
<td>ENG</td>
<td>Engineer</td>
</tr>
<tr>
<td>Contractor</td>
<td>CTR</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

Source: Case study 2
The identities and names of the project team members were not revealed for reasons of confidentiality. Two people in the client’s organisation were involved in the interviews, namely, the Deputy Director, Projects and the Manager, Client Services from the Properties Services Department. The architect (ARCH), structural engineer (ENG) and project manager (PM) represented the consultant group and were chosen because the client indicated that these consultants played a vital role in both projects. The third group comprised the contractor (CTR) who was the only person and from the only firm not involved in the AR1 project. The KC contractor was selected due to their strong connection with the building in the AR1 project.

The interview data interpretation has focused on the components which have potentially contributed to the problem-solving process in relation to the critical success factors (CSFs) and knowledge management approach where these have helped the problem-solving process in relation to the knowledge creation and knowledge transfer that happened in the AR1 and AR2 projects.

The data management, data analysis and data findings processes for case study 2 were similar to what was presented in case study 1 (chapter 6). This section uses the content analysis method to present the data findings and discuss the adaptive re-use success components that helped project team members to solve project problems in the AR1 and AR2 projects. The results and the discussion on the components of success in case study 2 is conjunction with the interview transcripts have been derived from five key project team members involved within this time series scenario.

The following sections present the data findings and discussion obtained from five in-depth interviews from project team members who were either fully involved or partly involved in the AR1 and AR2 projects (see table 7.2).

Table 7.2: Project team Involvement in AR1 and AR2 projects

<table>
<thead>
<tr>
<th>Respondents’ Roles</th>
<th>Involvement AR1 project</th>
<th>Involvement AR2 project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  PROJECT MANAGER</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>2  EXTERNAL PROJECT MANAGER</td>
<td>X</td>
<td>√</td>
</tr>
</tbody>
</table>
Three major findings emerged from case study 2:

1. The majority of the participants described that six components of success occurred during their practice within the time series scenario which were trust, collaboration, communication, skill, past experience and supportive attitude. Five of these components of success were considered critical for the problem-solving process. The component of supportive attitude (60%) was eliminated because it was not critical in supporting the project team members in the problem-solving process. This study determined that criticalness depended on a total frequencies’ percentage between 80% and 100%.

2. The majority of participants indicated that their involvement in the time series scenario (AR1 project, intervening period and AR2 project) affected how they solved problems in the AR1 and AR2 projects. Knowledge transfer activity was contributed to by the identification of the key components of problem solving in terms of how these key components affected the problem-solving process. Transferring knowledge activities that intellectually and socially supported the routines within the problem-solving process included:
   a. Same (or similar) project teams
   b. Effectiveness and efficiency mode
   c. Team’s actions
   d. Sources of information

3. The majority of participants highlighted generating new skills and developing new solutions for the problem-solving process as the major contribution of knowledge creation activity in the AR2 project.

7.3 Research Findings 1: Components of Success for the Problem-solving Process in Case Study 2

According to the research findings from the semi-structured interviews, there were six components of success which contributed to the project team members’ problem-solving
process in the AR1 and AR2 projects. These involved both the intellectual and social sense and were collaboration, communication, trust, skills, experience, and supportive attitude. Therefore, this section has been structured into six subsections which correspond to the six components of success which helped project team members to solve project problems. The data interview analysis used content analysis and is described in figure 7.2.

These six components were selected and identified for coding as they were appropriate components that contributed to the problem-solving process in case study 2. This section provides an explanation that summarises the components that related to the intellectual and human capital of project team members and probably contributed to the problem-solving process.

The interview transcripts in NVivo Version 9 were carefully read to identify the coding and themes, and named in the nodes section as thematic nodes. The researcher read each sentence a few times to ensure a deep understanding of their views and to determine the appropriate and related nodes for the grouping process. After the data coding and data theming processes, this study identified the new components that had appeared from the views of participants, namely, awareness and experience. This study identified that collaboration, communication, skills, experience, trust and supportive attitude were the components of success that helped project team members in the problem-solving process in relation to knowledge transfer and knowledge creation in case study 2. Table 7.3 presents the summary of the components of success from the participants’ views which was used by this study to identify the criticalness of the success component according to project team members’ experience in the AR1 and AR2 projects.
Table 7.3: Frequency of participant’s view about the six components of success

<table>
<thead>
<tr>
<th>Items</th>
<th>Project Team Member</th>
<th>Component of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>collaboration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Past Experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trust</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supportive Attitude</td>
</tr>
<tr>
<td>1</td>
<td>Client</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>2</td>
<td>PM</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>3</td>
<td>ARCH</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>4</td>
<td>ENG</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>5</td>
<td>CTR</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Legend of repeating meaning of the main components of success
1. Cooperation
2. Understanding

This table illustrates the investigation of the success components’ frequency according to their interpretations by project team members. A higher frequency (f) would potentially become a critical component of success in their problem-solving activity. For the components of success for which there were more than one mention, this study calculated the average of the frequencies: for example, to calculate the average for skills:

$$\text{frequency} = \frac{\text{total cooperation} + \text{total understanding}}{\text{number of repeating ideas}}$$

$$\left[\frac{5 + 4}{2}\right] = 5$$

The critical components of success in case study 2 according to the frequencies with which they are mentioned are as shown in table 7.3. Discussion in the next section is based on the number of frequencies or the critical level of the success components. The discussion will start with communication (f = 5), followed by collaboration (f = 5), experience (f = 5), skills (f = 4), trust (f = 4) and supportive attitude (f = 3).
7.3.1 Communication

In figure 7.3, bold text has been used to present the evidence from the interview data regarding communication components which helped the architect and their group to overcome the complicated construction process. This study has defined as communication activities the discussions between the consultants and contractor when developing a solution.

Reference 2 (ARCH):
so you have extend yourself a bit further and that sometimes to do with perhaps the consultant, they are not speaking, not cooperative so that one puts the extra work in work, so you end up probably putting in some extra work there or just because of the situation. It becomes I guess, for example, this way, has this coming crisis about materials that sort of pops up quite a bit and so you end up learning more about that sort of thing and then you become more. It is also part of your role but it does expand your role I guess as you end up dealing with analysing to work out the best way to resolve the problem.

Reference 3 (ARCH):
The meeting is often with the group. It really is that you need to have good communication with the consultants and the builder and really it becomes a solution made just by you. I mean some of those things are simple but rarely: it’s often the way that you consult with different people. Usually you have to consult with different consultants to make sure they are comfortable with your solution and often you do that and maybe I come up with something that should it be an email or what you discuss that’s fine and all that keeps going. But this is definitely a teamwork. That’s why it is important that the people get along and work well together is often and good too. And often call in the consultant if we get the problem or any ideas to help us.

Figure 7.3: Communication components in the interview data
This study has found, in case study 2, that communication components were important in finding solutions to problems. Communication activities in meetings involved the process of issuing the drawings and instructions, and reviewing drawings and the construction process. This study decided to define the results of interview data based on the most quoted (references) in the interview transcripts. The data have shown that the project manager (12 quotes), client (eight quotes) and architect (four quotes) were the people who were most quoted about communication in their interviews. The project team member who had the least views on communication was the contractor. This study found that contractor was satisfied with the client in terms of fairness. The client was fair to the contractor with regard to unforeseen problems about the cost that were not stated in the contract. This fairness was due to the detailed discussion which arose as a result of the good communication between the contractor and project team members (see figure 7.4).

Figure 7.4: Number of references (quotes) in interview data about the communication

Source: Case study 2

All participants’ perceptions in case study 2 had mentioned the importance of communication in adaptive re-use projects. The most important aspect of communication was how it was done and how that affected the project’s success in relation to knowledge creation and knowledge transfer in a time series scenario.

In the adaptive re-use process, the architect gained experience in dealing with and analysing work to find the best solution in order to resolve the project’s problems. One of the
communication activities which was undertaken in case study 2 was discussion in meetings. The architect mentioned that meetings were often held with the project team members. The architect chaired the meetings to ensure that the consultants and contractor had good discussions thus ensuring that they were comfortable with her solution: this definitely needed teamwork among the project team members. If small project problems appeared, the architect contacted the consultants and contractor by email and telephone to confirm that the solution was acceptable and to gain advice from the consultants. Moreover, the architect conducted and coordinated the meetings in order to define the solution and to grasp ideas from the consultants to help her solve the large problems. As the architect said:

\[
\text{I have done most of that through email and the phone. If there are really big problems, it needs a meeting or the coordination meeting. Yes, generally it was done over the phone or via email because that's probably most efficient. Usually it's getting confirmation that the solution is OK generally or a little bit of advice is required. You need specifications or something and you ring or email them and get them to provide that.}
\]

Two participants from the client’s organisation attended one interview session. One was involved in the AR1 and AR2 projects, and the other one was only involved in the AR2 project. He mentioned that he was only involved in the AR2 project to manage the communication activity. He dealt with a lot of communication about the impact of the building works and the building occupancy, and leading up to moving into the building. He was the main communication person between Property Services (the client) and the consultants and was part of the project control group at all stages. In terms of meetings, the client was involved in design meetings that were conducted every week at the early stage. The quantity surveyor and building surveyor also attended the design meetings as client representatives and became a part of the design team. Every fortnight, the client attended the meeting and provided guidance, identifying and resolving all the project problems at the design level. The client considered that the informal learning in the communication between the project manager and project team members was the knowledge management activity. Discussion in meetings and negotiation occurred in the process of upgrading the building for the university. The client was also in a good relationship with the municipal authority (Melbourne), having regular meetings with them, discussing the client’s inspiration and plan, and matching these together for the future.

The project manager talked about the different forms of communication used in adaptive re-use projects compared to those used in conventional projects. He mentioned that obviously in this project, there was a lot of communication which particularly involved the architect and the project manager. This study highlighted that problems in adaptive re-use projects were
identified with instructions given to allocate the right consultant to the right work. Usually, this situation did not happen in conventional projects, probably due to conflict between the work and the roles undertaken. As the project manager mentioned:

**Once the problem was identified, if the time constraints were already the problem, it was identified and instructed to allocate the consultant who needed to work on it whether it was a clash between the mechanical system and the air conditioning or whether it was just architectural details such as the implications of the time needed for the materials.**

Hence, the time constraints were considered with regard to the problems, and good communication was helpful in the case study 2 projects in avoiding clashes in the consultants’ responsibilities. As the key to problem solving, the project manager ensured that he was always organised, keeping track and keeping records of project activities. He also ensured that he understood and was clear about the differences in the consultants’ expectations and with regard to communication with the project team members during the adaptation process. As the project manager said:

**All the problems came up and it’s really got to be, the key is being organised, keeping track, keeping records on what was going on on-site but working by communicating with the project team and being clear about the expectations of the various consultants.**

Again, from the project manager’s point of view, identification of the person who had responsibility for certain areas of work was the first step in a problem’s solution or in answering a query from project team members. As the project manager in case study 2 projects, he coordinated and assessed the time frame and cost: he also responded to the complexity of issues with the strategy on how to appoint individuals, avoiding clashes and controlling clear lines of communication and responsibility.

The structural engineer was another consultant who provided his overview related to communication. The structural engineer worked for a company which was worldwide with many branches. The structural engineer highlighted the benefits of this situation in getting answers or solutions for any structural problems which occurred in case study 2. As he said:

**We have 10,000 people around the world: somebody starts before I go home. I enter the house network and type in part of my problem; when I come back next day, I might have people who have responded to what the issue might be. Every ARUP Engineers has access to that. Right, so, somewhere, some of them have done it, and people have sort of worked for that. As soon as someone asks the question, I think, in the end, you offer your opinion because when next time, we ask for something, someone will give us an answer. That’s probably the best and biggest tool that we have.**
The structural engineer mentioned the communication process as depending on their success in applying technology to find the solution for structural problems. All of the structural engineers in his firm could access the worldwide network system and provide an opinion on any problems.

To summarise, in determining that communication was a critical component in helping project team members in the problem-solving process, this study identified some key strategies including being organised, coordination, assessment of the lines of communication and allocation of problems to the right person with the right responsibilities, in conjunction with technology as a tool for finding successful solutions for adaptive re-use projects.

7.3.2 Collaboration

Evidence from all five participants demonstrated that collaboration depended on the components of cooperation and understanding. This study found that cooperation and understanding were the most important components in creating collaboration in the problem-solving process. In accordance with the frequencies of the five sub-components in collaboration, this study focused on cooperation and understanding because both sub-components had 90% to 100% of the references in the interview data describing the meaning of collaboration during the problem-solving process in case study 2 that were quoted on NVivo Version 9 (see figure 7.5).
Figure 7.5: Number of references (quotes) in the interview data about cooperation and understanding
Source: Case study 2

Cooperation

Figure 7.6 presents the evidence that cooperation was considered to be a collaboration sub-component in project team members’ involvement in adaptive re-use projects.
This study found that the client played a vital role in facilitating cooperation among the project team members. In case study 2’s situation, the client considered all the problems as collective problems and not as individual problems when in the process of identifying the solutions. The problem was not directed only to one person: each problem was solved by cooperation from all of the project team members. As the client said:

A lot of how you lead these projects as a client is not a matter of finger pointing; so, if you have a problem, your problem, it is a collective problem.
This study also found that the project manager’s views showed that he understood the meaning of cooperation in managing design and construction, and managing coordination among the consultants in case study 2, particularly for the AR2 project. The project manager had the important role of superintendent or project manager and was engaged with the client’s teams’ members. Understanding the situation and the people who were involved in these projects was an important factor in ensuring that the project team members worked together on any situation of the project. As the project manager said:

… you need to understand a little bit about people and how to keep them in and foster them, actually working together because a lot of engineers would come to meetings, be a board, always coming and sitting through the meetings.

The project manager always asked questions of the project team members if there were any project problems and requested their ideas and recommendations in the process of solving those problems. He considered that this was the best way to gain cooperation from others. An example of gaining cooperation is identified in the solution as stated below:

Project Manager with Contractor:

I actually specifically remember clearly talking to the builder. I was sent the landscaping project back to our builder to get recommendations as to who they knew to take on the concrete person’s role.

Project Manager with Architect:

We talked to the architect and we worked out who was the best consultant to come and have a look at the dampness on the wall.

The leaders of the project (the architect and project manager) managed project team members’ cooperation by approaching the project issues, the contractual obligations and adaptive re-use issues by giving instructions to gauge the situation and working together to solve the problems.

The sense of knowledge transfer in the component of cooperation was found in the structural engineer’s experience in case study 2. As the structural engineer said:

From the builder’s point of view, outside of this particular project, the builder and the engineer probably worked really closely together and did some planning. So, we learnt a little bit from the builder and they learnt from us.

The learning experience between project team members occurred in the process of developing solutions for problems. This tended to show that knowledge creation and knowledge transfer in case study 2 related to collaboration among the project team members in the problem-solving process.
The next discussion in the data findings related to the *understanding* of project team members in relation to the collaboration component as it helped them in the problem-solving process in case study 2.

*Understanding*

Four project team members’ perceptions provided evidence that the factor of understanding in both the AR1 and AR2 projects was considered critical in achieving project success in complicated adaptive re-use projects. Figure 7.7 shows the evidence from one member of the project team (the architect) that described the *understanding of the future problems* in case study 2.
This study found that the understanding factor contributed to the meaning of project success. Data analysis showed that the understanding of project team members could be categorised into four types of understanding: understanding the building and location, understanding the people, understanding the potential problems and understanding the process to which the architect and project manager had contributed their views.
1. Understanding the building and the location

The architect conducted site visits to understand the problems related to the building and the location of the project. This site visit was important because the discussion was occurring between architects and contractors to identify the most appropriate solution to the problem. After the site visit, the architect returned to the office and wrote up the solution in the form of explicit information as a record of the problem-solving process. As the architect said:

“The site visit was more about having a look on-site, having an understanding of what was happening and discussing the solution with the builder from various aspects and sort of solving it and probably going back to the office and writing it up.”

2. Understanding the people

The architect and project manager had the same opinion about the importance of understanding the human factor when solving problems that arose in the project. In understanding the human factor, the architect expressed the importance of working together with the same people for the next project. The advantage was that knowing the individual, it was easy to understand how they worked. In this way, the architect could discuss with and seek agreement from other project team members to resolve problems. As the architect said:

“There is property in the system that is involved with RMIT. So, there is an advantage in using the same consultant. The advantage, in terms of knowledge, is getting along and probably all those things that familiarity generally makes better among the team because you don’t have to go through that process of working with someone for the first time. Generally, it is OK with new people and generally it is fine. It’s always good to see the familiar face of a person and work with him. It seems to, I guess people have expectations and usually if you have worked with someone before, you are familiar and understand each other’s expectations and get on better.”

The project manager also noted the importance of understanding the individual as mentioned in the following statement:

“I think you need to foster them and particularly in the project manager role, you need to understand a little bit about people and how to keep them in and foster them, actually working together because a lot of engineers would come to meetings and be a board, always coming and sitting through these meetings.”

3. Understanding potential problems in future projects

The architect explained that it was easy for her to understand the potential problems for the next project because she had previously experienced the same
type of project. In other words, the architect had increased her level of sensitivity in identifying possible problems for the next project and it was easy for her to provide the solutions. As she said:

"The more projects you do like this, the more you understand how likely it is to work and you can look for problems you found from previous projects: you are able to identify them perhaps a lot earlier in future projects. It can help. It heightens your sensitivity to problems especially when you are working on a problem on one project during construction and you are working on another project in the design phase. You can sort of, "oh ... in the design phase, I wish to look for this because that happened in this project and maybe we could check this condition and sort of do it that way"."

4. Understanding the complexity of the process

The study also found that the project manager understood the complexity of adaptive re-use projects as this related to the work processes. Understanding the work done by project team members as well as the ways in which they solved problems contributed to the project manager's advantages in overcoming the complexity of the process in the AR2 project. As the project manager said:

"I think you have a lot of experience particularly working through different problems because also if an issue arrives, anything from the flushing to the air conditioning system and you start to get an appreciation on how they work and you start to understand the complexity."

Moreover, the project manager mentioned that by having the appropriate project team member (with the right skills and knowledge) to identify the solution or to provide answers for any problem was the best way for him to solve problems.

To sum up, the collaboration component in case study 2 was depending on cooperation and understanding among the project team members in the problem-solving process. Human capital and the intellectual capital were created in the adaptive re-use cycles in case study 2. This showed that knowledge management in the problem-solving activity had occurred thus helping in the success of both projects.

7.3.3 Past Experience

The majority of the participants mentioned that past experience had affected project success particularly for the AR2 project. Past experience had the strongest link to the effective and efficient solution of problems by project team members. The decisions became more like
common sense in relation to the heritage situation because they were familiar with the construction techniques in adaptive re-use projects. Figure 7.8 shows the past experience components in project team members’ views in case study 2.

Reference 2 (ENG):

Almost our role was very much to help the architect and the client to achieve and to know what to do. It was about, probably less what we were looking for, less innovation and more about using the experience, how I can cut the hole here but I need to support the building. It’s more about construction techniques and more common sense. But you do have to work with this, you have to be more practical about how it works on the structure especially brickwork and that sort of work. But we can create the hole in the wall, if we have the wall and punch the wall, it comes up with the method to support everything, so you put the structure in and the wall out. We can do that and say at that level, come along, you don’t have to worry about punching the hole and putting the blocks in and knocking the support down, so that we can do smart kinds of things.

Reference 3 (ENG):

I think with this experience, I was doing this for several years without the people being here for a long time. If you have got people around you, you can always solve the problems. You have got to be thorough, you have got to be practical; you have got to go through things about what the builder can do and get to do this safely. I don’t think we came across issues on other jobs that we couldn’t solve. The structure is the structure; it doesn’t matter if it’s an old structure or a new structure, you can stand up and afford them. You do the right thing to support them and you end up ascending from that. If you know how, if you know the building techniques, that’s a big part of it, if you practice hands-on, you can solve problems, often with adapting things or even what is done to new versions, so it is nothing to come up with the solution too.

Figure 7.8: Past experience components in interview data
This study found that the architect, structural engineer and the two client representatives had the most experience in working on projects which involved historical buildings. Their experience ranged from between 15 to 30 years of being involved in the construction industry particularly with projects that were related to the renovation, demolition, refurbishment and adaptive re-use of historical buildings. Quotes from each of the project team members indicated their perceptions about the meaning of their past experience which either directly or indirectly affected their involvement with case study 2 (see figure 7.9).

![Figure 7.9: Number of references (quotes) in the interview data about experience](image)

Source: Case study 2

This study found that the individuals’ and group experience had been accumulative over years of practice. The architect’s views indicated her significant experience in adaptive re-use projects when she said:

"The more projects you do like this, the more you understand how likely it is to work and you can look for problems you found in previous projects. You will be able to identify them perhaps a lot earlier in future projects. It can help. It heightens your sensitivity to problems especially if you are working on a problem on one project during construction and you are working on another project in the design phase."

The architect’s experience was developed project by project throughout the years. The sense of learning from previous projects was apparent when she realised that she was able to understand and identify potential problems earlier in the future projects which comprised case study 2. She developed the solutions from her experience because she understood the
historical buildings' situation on workmanship and material. Then, she built up her knowledge about this style of working and was able to manage this kind of project.

In terms of the construction and refurbishment process, the contractor had to have heritage experience as a prerequisite to undertaking adaptive re-use projects. Adaptive re-use projects are different and complex, and it was difficult to find a contractor who was prepared and able to do the heritage style of work. Any problems that occurred in the projects were solved by the contractor in cooperation and communication with and with advice from the right consultants. As the contractor said:

“We need to get the contract, the experience and be capable of matching or storing all details, the skirting details, architectural details, a lot of hard plastering in there. So, that was quite different, it's more complex and defined and is easy to find a contractor who can do basic work but it's harder to find a contractor who is prepared or able to do the heritage style of work.”

Similar to the view expressed by the contractor, the project manager also mentioned how past experience had helped him and project team members to understand the complexity of the adaptive re-use project (AR2). As the project manager said:

“I think you have a lot of experience particularly in working through different problems because also if an issue arrives, anything from the flushing to the air conditioning system, and you start to get an appreciation of how they work and to understand the complexity.”

In summary, this study found that all five participants in case study 2 had past experience working with historical building types of projects including adaptive re-use projects. The project team members highlighted that understanding the complexity (construction techniques and the material) of the projects both structurally and architecturally had helped them to identify problems before and at the beginning of the AR2 project thus being able to develop solutions for future adaptive re-use projects.

7.3.4 Skills

This study identified that 80% of the participants had cited that their skills in heritage projects had helped them as project team members to solve familiar problems and to develop new solutions for new and unfamiliar problems. The client mentioned that the effectiveness of the architect's leadership in the AR1 project was one of the reasons for the success of the AR2 project. This situation demonstrated that the architect had leadership skills in designing and in coordinating all project team members in a time series scenario which involved a different
level of understanding and experience which was related to heritage disciplines. As the client said:

“So, the thinking of some designers abroad is in terms of how the building should function rather than just about the design and very good engagement with the teams’ members and the clients. Others are more focused on design and not as skilled in engaging with the people who will often occupy the buildings.”

In terms of the component of responsibility, the contractor mentioned that he had engaged all of the subcontractors, hiring them and drafting their contracts, administrating the contracts throughout the project and that this needed skills. The skills required involved managing the different methods of construction: unpredictable problems needed some special skills among subcontractors in order to solve these problems. A significant challenge in the AR2 project involved the contractor and subcontractors having to wear special suits and masks to protect them from the lead paint (an unpredictable problem). This required the contractor to have a high level of skill to ensure that the suits were appropriate and that they protected all those who were involved from harm. This situation does not happen in new building construction.

In addition, the project manager’s (client) view demonstrated how he appointed people, controlling the communication and responsibility lines, and reporting that he really needed the skills to do that. Figure 7.10 shows evidence about the consultants’ skills as described by the client in his interview.
The data show that the interview transcripts of the client (eleven quotes), project manager (nine quotes), structural engineer (six quotes), contractor (five quotes) and architect (four quotes) demonstrated how the component of skills had helped them to solve problems in case study 2 (see figure 7.11).
The architect’s experience in managing the projects in case study 2 demonstrated the existence of skills in her work related to problem solving. The project situation involved a range of personalities and disciplines among project team members, some of whom cooperated willingly and some of whom did not. Therefore, the architect used her leadership skills to develop collaboration and communication in the meetings that were held. This ensured that any decision which delivered a solution to a problem was agreed by all project team members. Using this experience, the architect undertook analysis to obtain ways to solve project problems: as she said:

"I guess that probably in this project as always, you can only document so much and then it’s a lot of things that come up because the fact is, it is an old building. And so, I think your primary role thus remains the same but you find that probably your knowledge, your in-depth knowledge into other areas extends, so you have extended yourself a bit further. Sometimes, that is to do with the consultant, perhaps they are not speaking, not cooperative so that one puts in the extra work. So you end up probably putting in some extra work there or just because of the situation: it becomes, I guess, for example, in these ways, has this material-coming crisis that sort of pops up quite a bit and so you end up learning more about that sort of thing and then becoming more experience. It is also part of your roles but it does expand your roles; I guess you end up dealing with analysing to work out the best way to resolve the problem."

Meanwhile, the client stated that the architect, project manager and quantity surveyor should have been able to do their jobs because they had high levels of skills in the work that was
entrusted to them. Although the client provided explicit guidelines for all works related to the adaptation, to carry this out, it had to be in line with their skills. As the client said:

"That is, guidance in how to design. Doesn't tell them everything, they still need to get their artistic skill and their planning skill on their own but it does guide. We also have, we point to the contracting conditions which includes the structure for how they want to report, what is their reporting, how often and what their responsibility is, what is the project manager’s responsibility, the quantity surveyor spells out what each of them must do, so they know what the other consultancy requirements and the contracts are."

In connection with the client’s statement, the contractor’s perception indicated that the documents provided by the client and consultants provided direction for them in each job, but skills in communication with the client were important to them in their work routine. Discussion about the client’s needs, how they wanted the work done and what the client wanted helped the contractor to improve their communication skills.

"It certainly taught me more about dealing with the client because rather than just taking their information, delivering them the job, we constantly needed to talk about what they wanted, how they wanted it done, how they wanted it to look, so, helping my people skills. It certainly helped, managing skills because every little bit of the job had to be managed rather than just learning and trying to manage so working and coordinating. Yes, the management of the job and scope writing to suit the client, I guess helping the project team relationships."

The structural engineer’s perceptions demonstrated that he had skills in his area of work particularly in problem-solving situations and in decision making. When problems occurred that were structural in nature, the engineer provided the solutions using mathematical models (calculations) using physics to come up with logical answers. The structural engineer said that in his work, he could not apply ‘trial and error’ decisions for any structural problems due to concerns about safety issues for the buildings and their occupants.

"Structural is physics, the role of the structure is physics, right, you have the load, you have material, material can support a certain amount of load and you can do your mathematics to prove it. That is the simple sense. When you get something really complex, you have to build very conventional mathematical models to prove it. There is no trial and error, no, no. With trial and error, we would be in court".

The structural engineer also mentioned that his skills in internal system networks had also increased due to calculating the answers for any problems that occurred in the projects in case study 2. The structural engineer’s firm had branches around the world with good communication tools between their employees in every country. These internal communication tools helped the structural engineer to find answers every time he encountered problems. The answers came from colleagues who had experience related to adaptive re-use works, for example, in areas of Europe where many historical buildings have been transformed to new uses.
“The other thing we do, when we finish the job and work out what we have learned, we share it in here and it is documented. So, when the next project comes along, some other things for that one e.g. leadership problems. What’s left on that and it is a lot, so the biggest reason why we share knowledge is for the end result, which is appraisal, reviews so that you go through the whole network, and skills networks. So, again, if somebody else asks me a question on the skills network about working on old buildings, I respond, so, straight away that knowledge goes around the world, that sort of thing. There are three ways that we do this. But I might not transfer that knowledge to anyone who is competitive around that. So, I want to write down the entire lesson, how you can learn about that is natural in this industry.”

In summary, skills were developed from the roles and responsibilities undertaken in the AR1 project and transferred to the AR2 project. The entire problem-solving skills came together with the experience from the previous project and were easily conducted to the next project due to the good results of the previous project.

7.3.5 Trust

Figure 7.12 shows the interview data containing the sentences which mentioned the trust that project team members had experienced in case study 2. The sentences in bold refer to the mention of trust quoted from each of the interviews in NVivo Version 9.
The component of trust is critically embedded and positive in any organisation. The positive interactions among employees provide cooperation and yet trust is considered as the basis of social capital. As mentioned before in case study 1, trust cannot be developed in the short time duration of one project. This study’s approach was confined to involvement with continuous projects or a ‘time series’ scenario that could help to develop trust in each of the project team members. The data showed that trust was important in case study 2. However, the structural engineer (six quotes) was the participant with the most significant number of quotes about trust (see figure 7.13).
This section explains the meaning of trust as expressed by the structural engineer based on their experience of working with the same architect and client for a longer period. The architect and the engineer knew each other, had built their professional relationship and had developed trust between them. Developing trust was the hardest part of each project. In case study 2, the structural engineer trusted the architect in the sense of giving advice on architectural and structural design: and he said:

“Some people don’t like to be told or specify to do thing but with [the principle of architect’s firm], he’s really good to work with, he knows to give advice, would give his advice to us, I give the same advice myself, to do or not to do to, and that’s is different … when you work alongside someone, the more you know each other. And you can feel this together.”

The engineer also mentioned that even though they were not working with the same architect as in the AR1 project, they were working with the same architectural firm. They still had trust in each other and were satisfied with the solution that they had developed together. As the structural engineer said:

“… we do trust each other, even though we are not same company… We were involved in coming up with the solution. We loved it when we came up with the solution because that was the purpose that we were paid for. That’s how it works.”
Therefore, the sense of mutual trust in case study 2 occurred and contributed to the components of success in the adaptive re-use projects.

From the project manager’s viewpoint, he appreciated the design and re-use of historical buildings and understood the architect’s roles and the process. This was because the ideas from the architect and project manager were different: the architect was focused on design while the project manager was focused on making it happen and on the leading objectives. Trust was then developed between the architect and project manager as they aggregated their ideas during problem-solving situations. The importance of human factors was mentioned in the project manager’s views about the trust between the architect and himself. As the project manager said:

“They were already designing and that phase had already happened and I think with the heritage buildings have the sort of human factor that has people attached to them and a lot of stuff happened in the design phase. So, it’s probably worthwhile talking to the designer and getting the idea about the process because their ideas are different from ours because we focus on making it happen and on leading objectives. We appreciate the design and re-use, but if you are in the project manager situation, you actually see that because it is not your role and you have to understand that.”

The project manager and the structural engineer talked about the trust between the architect and themselves. This study found that mutual trust occurred between the architect and the consultants. The architect trusted that the consultants would do their job and they understood each other as they supported the process of identifying solutions for problem, for example, in the electrical works. As the architect said:

“Trust absolutely. You expect people to do their job and there is that level of expectation and also understanding about what you want and about the other consultants. You understand what you like and decide, for example, with the electrical consultant, we might like to specify certain types of switches or something like that and so they would know that’s what we like and you know you don’t have to go through that process. You have a level of understanding of one another.”

This study has contributed to new knowledge by identifying that mutual trust components are critical in managing intellectual capital in relation to knowledge creation and knowledge transfer in the problem-solving process, as demonstrated in the case study 2 projects.

### 7.3.6 Supportive Attitude

This section explains the data findings about the supportive attitude component which participants overall felt only contributed 60% to project success in case study 2. This study considers that a supportive attitude was not critical since this component was identified with
the least frequencies of views by participants. Figure 7.14 shows one example of the evidence that the supportive attitude component was mentioned by the project team members as having helped them in the problem-solving process in case study 2.

Reference 2 (Client):
They wouldn't have authority to do that; it was quite a sum of money and that was beyond the delegation. So, that was the structure of the project control group, a steering group committee which included the Vice Chancellor and other senior people and that sort of related to that size of project.

Reference 2 (Contractor):
So, it was a lot more difficult filing the paper; and running the money; and needing to discuss it properly ... The client was quite fair; I think, with regard to unforeseen conditions, was quite fair. So, that's good. I think they realised: it wasn't hard for seven more years internally and it's taken so many years to be drawn, maybe nine years, it was a long time.

Figure 7.14: Supportive attitude components in interview data

The frequencies of quotes or references from the interviews showed that three project team members mentioned components of supportive attitude in their views. The supportive attitude was mentioned through verbal appreciation from some personnel to other personnel in terms of their knowledge and skills, in terms of recognition from design and re-use.
competitors. The contractor was the project team member who most frequently provided views about the importance of a supportive attitude from the client and consultants in their job roles.

This study found that the contractor sensed a supportive attitude from the client in terms of payment particularly for unforeseen conditions. Many variations were involved during the work because of unpredictable situations which obviously were not stated in the contract documents. Fortunately, the client supported and was fair to the contractor with the variations in the cost of the work: after appropriate discussion, this really helped the contractor to solve cost cycle problems within the contractor’s organisation. As the contractor said:

“So, it was a lot more difficult filing the paper, and running the money; and needing to discuss it properly ... The client was quite fair; I think, with regard to unforeseen conditions, was quite fair. So, that’s good.”

In another situation, the contractor played the role of the main actor and supported the contractor groups. He encouraged the other members to be more attentive to the project and this helped them as a group in solving the problems.
The client took action to support the project team members by providing the project control group, a steering group committee to control the whole process of the adaptive re-use project in terms of cost and time. Further to that, the client in case study 2 achieved recognition through the heritage award owing to the project team members' good work. Owing to the good result of the AR1 project and the client’s satisfaction with the architectural works, the client employed the same architect’s firm for the AR2 project. As the client said:

"So, we have continuity across the architecture and the succession to Building 20. We got a heritage award from that building. So we got recognition for the university as well as for his practice (architect) which is a good thing and we are trying to do the same thing with Building 1."

In summary, this study found that a supportive attitude also contributed to the success of the AR1 and AR2 projects in case study 2. The two ways in which a supportive attitude provided motivations for the project team members to achieve a successful project were, firstly, there was support within the project organisation and secondly, there was support within project team members’ organisations, that is, the contractor supported the personnel within their own organisations.

7.3.7 Summary

This section has described the six components of success that contributed to the problem-solving process in case study 2. This study has identified that the most critical of these components of success started with communication, then collaboration (understanding and cooperation), experience, skills, trust and a supportive attitude.

Communication, experience, trust, collaboration and skills were the components of success that were important in adaptive re-use projects as shown by the evidence from case study 2. However, the supportive attitude component was not really convincing in these findings with only 60% responses. This study indicated that 80% to 100% responses were critical for problem solving in a time series scenario. In relation to the knowledge management approach, the intellectual capital of project team members was involved in activities involving the transfer and creation of new knowledge and skills between the AR1 and AR2 projects in a similar situation to that in case study 1. In regards to the engagement by the client of the same project team, particularly the architect (from the same company) and the structural engineer (from the same company), the communication process related to the ways in which discussion was organised and coordinated during the project period. Mutual trust was developed by the team because they had been working together for a longer time. The understanding of their working styles, knowledge and skills had developed in the AR1 project through to the AR2 project facilitating the project team members’ support of each other and their collaboration in the problem-solving process from the client’s perspective. This study
has demonstrated that five components of success with 80% to 100% responses were the most critical in helping the project team to solve problems thus contributing to the success of the AR1 and AR2 projects.

7.4 Research Findings 2 and 3: Key Components of Problem Solving in Relation to Knowledge Transfer and Knowledge Creation

This chapter has investigated the components of success from project team members' points of view about their involvement in adaptive re-use projects within a time series scenario. The five components of success identified from the client, consultants’ and contractor points of view were communication, experience, trust, supportive attitude, skills and collaboration which were identified as critical in the problem-solving process. The adaptive re-use project is unique and has a complex process for achieving the sustainability objectives particularly with regard to the problem-solving process. An understanding of the project requirements in terms of heritage protection and building regulations would be a significant contribution to reducing the complexity and difficulty in adaptive re-use projects. Also, the appointment of the same (or similar) project team members in sequential projects would help project team members to ensure that the intellectual capital of individuals, projects and organisations was successfully transferred not only for adaptive re-use projects but also this would be useful for other types of sustainable projects.

This section describes key components of success in relation to problem solving according to the project team members' perceptions. The analysis of this section is presented comparing participants' perceptions on every key component of the problem-solving process and identifying the components of success in their perceptions. The sub-unit analysis refers to their individual perceptions. There are six key areas of data findings in relationship to the problem-solving process in case study 2. The discussion on data findings is according to the knowledge transfer and knowledge creation contexts. This next section has been structured in line with the success components as shown in figure 7.16
7.4.1 Research Findings 2: Key Components of problem solving - Knowledge Transfer Context

This section explains one specific aspect that is related to project team members' experiences in transferring skills and knowledge from a previous project and other similar projects in the intervening period to a new project. In this case, the situation involved the knowledge transfer activity from the AR1 project and from other projects in the intervening period to the AR2 project in order to resolve both familiar and unfamiliar problems in the AR2 project.

The client's actions were taken to ensure that the knowledge from the previous projects transferred to the new project was protected as intellectual property. All the processes and information from the previous projects were documented and signed by the architect. That approach provided certainty to the client that the knowledge would be retained and enshrined as the client's intellectual property.

Based on minor personal experience, the contractor explained that he transferred knowledge to this project and used the knowledge. He mentioned that his experience in other heritage
projects helped him to solve problems because he could identify potential problems in the case study 2 project.

The architect has broadened her knowledge every time a new solution was developed in the AR2 project. Her perception was that in dealing with the solution, the level of expectation had upgraded her knowledge and that this would be transferred to future projects.

Documentation of previous projects’ processes and results was the best way of transferring knowledge within the structural engineer’s organisation. The learning experience about previous projects’ problems and how they were solved was shared among the engineers helping them to develop solutions for new projects.

Table 7.4 describes the evidence of the knowledge transfer components in case study 2.

Table 7.4: Evidence of transferring of project team members; knowledge in Case Study 2

<table>
<thead>
<tr>
<th>Project teams members</th>
<th>Transfer of knowledge</th>
<th>Relationship with Component of Success (Key Findings 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>“Probably knowledge base, I guess with those projects you never stop learning. There is always something different because they always tend to have their own little life and things happen in a way that perhaps you don’t expect and somehow, so, you build up a lot of knowledge and sometimes dealing with, I think it is probably more dealing with the solution, and the level of expectation does broaden your knowledge …”</td>
<td>Past Experience Skills</td>
</tr>
<tr>
<td></td>
<td>“It is not always but in a lot of solutions; it would be part of the solution that you draw from your experience of how the building works, how things are made. There are a lot of factors that are important to your solution. Sometimes it is a completely new product but generally it’s not just that, perhaps all theories are applied to the new situation. So, with the bank of knowledge, you are adapting it to suit another situation. So, this is adaptive, definitely, you sort of need to adapt. And obviously things work somewhere else and also on what you want it to look like and there is static involved as well. That’s always the difference as well but if you are using it in the office you tend to use a particular style and are able to work with that. So, you build up some knowledge.”</td>
<td></td>
</tr>
<tr>
<td>Client</td>
<td>“So, in that period, we don’t do anything. Also in that period, we’ve changed Vice Chancellor (VC). I think two or three times, at least two changes of Vice Chancellor. So, part of the master plan of the design was to have the Chancellery in Building 1. So, with the changing of the VCs, there was some shifting in, I guess, culture and policy and the priorities of that time were shifting. So, that was the cause again. So, it was only, I guess, in 2007, when we were in the position to reinitiate the project ...”</td>
<td>Communication (explicit sources)</td>
</tr>
</tbody>
</table>
In terms of retaining knowledge and how we learnt from one project and some of that had been done 10 years ago, how you cannot lose that and you apply or consider it in what are you trying to do today. A good example is Building 9 on Barwon Street which the same architect did. We asked him in the early 90s to look at the opportunity for businesses around the campus. Where we could grow and could not grow. Some of that is in the master plan for the campus.

**Contractor**

I got a small one, in Toorak, it was very small, it was a very cosmetic upgrade and it was not structural, just painting and historic. So, it helped me to solve the problems. I can see how if I wanted to do more work to the building, it would help, definitely. That’s knowing about it: if I knew that, I could expect things that would delay me more, then I could leave more time for that and planning and management. So, without looking at the job, it would take me 10 months. I can go, hang on, I know I can find this here, I can’t find that pair, this could take longer, so, I can plan and time myself with more techniques, probably less than a month. So, that definitely helps.

**Structural Engineer**

The other things we do, when we finish the job and we work out what we have learned, we share it in here and it is documented. So, when the next project comes along, some other things for that one e.g. leadership problems. What’s left on that and it’s a lot, so the biggest reason why we share knowledge is for the end result, which is appraisal, reviews so that you go through the whole network, and skills networks. So, again, if somebody else asks me a question on the skills network about working on old buildings, I respond, so, straight away that knowledge goes around the world, that sort of thing. There are three ways that we do this. But I might not transfer that knowledge to anyone who is competitive around that. So, I want to write down the entire lesson, how you can learn about that is natural in this industry …”

This study revealed four key components of success in problem solving in relation to knowledge transfer in case study 2:

**Key Component 1: Effectiveness and Efficiency Mode**

This section analyses the project team members’ points of view about their efficiency and the effectiveness in solving the problems in case study 2. The evidence from the interviews showed that the problems could not be solved in quicker and easier ways due to the complexity of the adaptive re-use project.

The architect's view was that the client had not prepared a clear briefing about the problem-solving process in this project. Due to the unclear briefing from the client, they had difficulties...
in getting the right information at the right time, as mentioned by the architect. Furthermore, the old buildings had too many differences in their components and really needed a longer time for making any decision or solving problems. The architect did not answer any question straightaway at the site, needing to go back to the office to discuss it and using a few resources to find the answer before making any decision.

_The contractor_ mentioned that many unknown conditions and unpredictable problems occurred in the project’s working environment. The historical building components for the AR1 and AR2 projects had contamination. This situation meant that it was considered to be a danger zone and hazardous. The contractor needed to provide protection for the workers including masks and special suits to provide safety from contamination. One example of a contaminated component was the roof material. As this was affected by contamination, the workers undertook these works in special suits finding it difficult to breathe particularly in summer: this was considered as a safety issue about which the contractor needed to be aware. This example demonstrated that this project was very complex. Consequently, the contractor mentioned the unusual situation which involved changing the project team’s also one of the reason. Furthermore, the contractor was also having problems in subcontractor terminations due to payment delays and many changes in the works and the project team.

The _project manager_ mentioned that the process used to identify solutions was neither effective nor efficient. The number of people involved in any decision and the need for approval of that decision were appropriate for the problems. As the project manager said, “we were having input because at this stage, most of the consultants, the architect worked for her company and the mechanical engineer worked for different companies, the hydraulic engineers had one issue which impacted on all of them”.

The _structural engineer_ mentioned two different views about effectiveness and efficiency. For the positive view, the structural engineer mentioned that communication was an important component and that it was easy to get answers. For the negative view, the structural engineer mentioned that it was difficult to get decisions or agreement from the contractor owing to the different work methodology with regard to the structure. Furthermore, the structural engineer was confronted with the existing structural problems which needed to be merged with the new structure. This situation was not easy particularly in terms of identifying the right support for the existing conditions.

The evidence from the project team members’ points of view and this study’s findings are summarised in table 7.5 as positive and negative point of views about the effectiveness and efficiency of the problem-solving process in case study 2.
### Project Team Member

<table>
<thead>
<tr>
<th>Positive Reasons</th>
<th>Negative Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quick and easier</strong></td>
<td><strong>Information difficulty</strong></td>
</tr>
<tr>
<td><strong>Effective Communication</strong></td>
<td><strong>Unknown and unpredictable situation</strong></td>
</tr>
<tr>
<td><strong>Contractor</strong></td>
<td><strong>Client</strong></td>
</tr>
</tbody>
</table>

| Structural Engineer | "It's the technical terms but it's easy to answer. It could be the question on concrete, the question on the dome, arches, could be questions on bolting, welding to steel frame. For instance, at the moment, we have to redesign the original one; there is an issue in regard to welding. So, sort of like that, all the critical aspects of the job, we get people to do the job. We have an expert in London; rather than trying to work out everything yourself, you ask around the place. Every means that we have. Probably one of the biggest strengths is the effect of having 10,000 people connected. No need for outside expertise." | "It was identified and the issues were broad, up through the university management, and saying that, "here is what we found; we cannot remove it and we could retain it and work on whatever is there. We could remove it but if we remove it, it would cost a lot or we could patch it up and the problem might occur again in another 50 years or 100 years because we would own it for so long. So, as the owner, we took a longer time on this problem ... It was hard to match a use to that" |
| **Architect** | "This is not so much the users who occupied of the building, it's more about the department, the security department and all those other section of RMIT that go into looking after the building. The people who look after the garden. So, there are other actions that have too many problems but there are certain criteria on which these groups come to us but which we are unaware of. So, I guess, that's a bit of a hole in the briefing because people come up and ask the question about why we have done this and this because nobody told us what you wanted to see so that we can do that. So, as much as the architect generally gets the brief, it is also a part of the client's responsibility to direct what needs to be done next and sometimes it quite difficult getting information. That is not an unusual situation in public sector work. It's very difficult because so many people were involved. It's hard to find the people who you need the information from. Sometimes it is harder: at least have a central person who directs all of this. You know, I go to one person and say "what about the security? what's happened here? who do I talk to?" and they say "OK, you talk to this department". Sometimes it doesn't happen that way until you find the person. You keep ringing to find that who does what. " | "So many unknown and unpredictable things, so, when you peel the fit-out away, to at least see the condition. There are the things that no one could have foreseen. You might say "look ... that I expected this but you don't know", so there was a lot of unknowns and so creating modern spaces in the old building, it's quite difficult because an old building has very small rooms like this, many small rooms. ... There were many sorts of things like that." |
| **Contractor** | "So many unknown and unpredictable things, so, when you peel the fit-out away, to at least see the condition. There are the things that no one could have foreseen. You might say "look ... that I expected this but you don't know", so there was a lot of unknowns and so creating modern spaces in the old building, it's quite difficult because an old building has very small rooms like this, many small rooms. ... There were many sorts of things like that." | "It was identified and the issues were broad, up through the university management, and saying that, "here is what we found; we cannot remove it and we could retain it and work on whatever is there. We could remove it but if we remove it, it would cost a lot or we could patch it up and the problem might occur again in another 50 years or 100 years because we would own it for so long. So, as the owner, we took a longer time on this problem ... It was hard to match a use to that" |
**Key Component 2: The Same Project Team**

The interview analysis revealed that the components of skills, communication, experience, collaboration, supportive attitude and trust were considered as helpful in the process of developing solutions in the AR1 and AR2 projects. The situation in case study 2 was considered to be a different approach to case study 1 in terms of having the same project team in two adaptive re-use projects. The constraint in this study was that it was difficult to get the same project team for both projects in case study 2. In this second case study, for two consultants, the project only managed to appoint the same company rather than the

<table>
<thead>
<tr>
<th>Role</th>
<th>Statements</th>
<th>Additional Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Project Manager</td>
<td>“It could be very slow particularly with the number of people that needed to approve. We were having input because, at this stage, most of the consultants, the architect worked for her company and the mechanical engineer worked for different companies: the hydraulic engineers had one issue which impacted on all of them. Each one took time to look at it or you could discuss it in the meeting. Someone ultimately had to go away and verify different checks and balances and it takes time for that correspondence to go to everyone and to come back and then to make sure that it can work within the time frame. For other constraints, was it affordable and the funny one, because of being contractual, depending on the contract, I think it’s a little bit vague on the time frame for responding to our advice and some of the updated finance and the reality when you find something on-site that’s a bit unusual. It can be absolutely urgent and needing a response right away. It’s difficult to manage that when you know that the other consultants all have other projects and you have other projects.”</td>
<td>Longer time taken in discussion and in decision verification by each of the consultants</td>
</tr>
<tr>
<td>Structural Engineer</td>
<td>“I think, the hardest thing with the old building and I have had to do in differently in parts of old buildings, is providing the materials for the buildings. The old building obviously had a good support for the floor, supporting the floors was good. If I had got a problem in terms of, you can take out enough walls and earthquake becomes an issue, that’s a hard one to solve. The main thing is introduce the structure and that might be a problem for the heritage; it certainly is a problem for the architect, so, you need to spend the time and it’s the hard part of the work, coming up with a low part, making sure everything is supported laterally not vertically. That is why cutting a hole is a problem with old buildings. You take out that part, if you take out the structure there, I will be honest that it is not hard to take out work: it is hard taking out both: it would really need support on all four sides and maybe would not be safe anymore and might need to be taken out. So, you do have to spend a lot of time, looking into the building, investigating and trying to work out what bit you must leave and what bit you must comply with. And making sure you always be enough left, so you can still look after the horizontal weight load. It’s a big problem.”</td>
<td>Spending a lot of time in solving one problem vs old building conditions</td>
</tr>
</tbody>
</table>
same person as had happened in case study 1. The architect and structural engineer were from the same firms but were different individuals. In this stage, this study managed to identify the reasons of appointing different firms and different people for the AR2 project.

The *architect* did not have any problems either working with different people or with the same people on any projects. However, the architect provided positive feedback on working with the same person. She mentioned working with the same person from the client’s organisation. The advantages of working with the same person related to being familiar with the person’s personality and knowledge, and not having to repeat the process of getting to know that person from the beginning. She also stated that familiarity made the project team members work better together particularly in problem solving.

The *client* described the importance of the quality of documentation prepared by the lead architect from previous projects. However, the client agreed with this study’s findings indicating that it was necessary to retain the same person, particularly the architect or whoever was the principal consultant leading the project. There is the value of learnt knowledge which is retained within the individual or having this very well captured in the documentation was also important. The client also indicated a negative perspective where, generally, other projects needed new consultants for new and fresh ideas to run the project. Nevertheless, the client agreed that it was important to stick with one consultant for any difficult project, depending on the project. Working with one consultant was related to successful collaboration for the client.

The *contractor* had experience with changes in project team members and subcontractors for the critical works. There were some disadvantages for the contractor’s progress due to the change of project superintendent. This became a challenge for the contractor because the project superintendent was new and a big player in the project but the change occurred half-way through the project. The job was then delayed and payment became a sensitive issue for the contractor. The contractor had lost the subcontractors for critical jobs including the plumber, roofer and structural steel worker. The contractor had difficulties in terms of time because he needed to tender for new roofer, plumber and structural steel subcontractors. Considering this situation, the contractor reported that it was essential to retain the same project members particularly those who were critical for project management.

The *project manager* mentioned that it was crucial to have the same project team members in case study 2. The project manager indicated that he knew what to expect and how to work with the same project team members. With the same project team members, the project
manager’s strategy involved the ability to control and to have clear lines of communication and responsibility for the projects.

Table 7.6 shows the evidence of the project team members’ perceptions about the reasons for having the same or different project team members in the AR1 and AR2 projects and how that helped them in the problem-solving process. There were two categories of perceptions; perceptions about having the same consultant and perceptions about having either different consultant firms or different individuals from the same firm.

Table 7.6: Evidence of having the same project teams in the problem-solving process in case study 2

<table>
<thead>
<tr>
<th>Project Team Member</th>
<th>The Same Team</th>
<th>Positive Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>“Sometimes, it is not with the same person but the same company and sometimes it is with the same person. The other person might be better and really you can work with the same people that you used previously or with RMIT (client) and there were a lot of consultants brought back again because I know the project, I guess. There was probably the system involved with RMIT. So, there was an advantage there in using the same consultant. The advantage was in terms of knowledge, getting along and probably all those things that generally familiarity makes better in the team because you don’t have to go through that process of starting to work with someone. Generally it is OK with new people and generally fine. But it’s always good to see the familiar face of a person and to work with him. It seems to, I guess, people have expectations and usually if you’ve worked with someone before, you are familiar with them. Understanding each other and expectations and being able to get on.”</td>
<td>Familiarity makes better as the team Knowledge familiarity Getting along and understand more No repeating for introduction process</td>
</tr>
<tr>
<td>Client</td>
<td>“It depends on the quality of documentation that was left behind and, yes, I think for the lead designer, I think so, but secondary consultant not so much. So, I don’t think services consultant was as important as the principal designer. I think it is easy to swap all the structural consultants or whoever. I think it is easy to swap them, then at least to swap the lead consultant. There is a value of learnt knowledge that is retained within the individual or having this very well captured in the documentation was also important … The architect drives it all…The principal consultant had guided them and it’s a little bit different, whether it can be done within the structure and looking at the consultant, the aesthetic appearance, what the the architect is trying to achieve.”</td>
<td></td>
</tr>
<tr>
<td>External Project Manager</td>
<td>“I think it helps that you generally know them, you have a report and know what to expect and you know how to work with them but it doesn’t say that you can’t work with someone new as well. Once you get to know each other, there is also the complacency in team that comes out as well … It is pretty varied I think. In this industry, it is an expectation that you are gonna work as a team because with projects like this, almost always the</td>
<td>Increased expecting level Knowing how they work Complacency in team</td>
</tr>
</tbody>
</table>
consultant is appointed by the client before we are involved or sometimes we get involved and appoint the consultant but always the architect appoints the other consultants. There are all different ways that we can come together. From our points of view, the strategy on how to appoint people is the best way, so, you have control and clear lines of communication and responsibility. But it’s a given that you are gonna work on it as a team 'cause from now on, you can't do everything for the building. That's impossible.”

Contractor "Generally, everybody was pretty good but I looked at that one thing that was quite severely delayed. So, there was a quite a change of staff in that time, the superintendent actually changed, which is unusual and generally they don’t change too much. The consultants have a lot of change, the architect might vary; the quantity surveyor might be one guy one day and another guy the next day. The superintendent actually changed: that was one point where it was RMIT and then the outsourcing. There were two client's representatives and that was a challenge because they were new and big players in the project and changed halfway through. Rather, that I should work with that but when the job was delayed, the budget tended to be a little bit sensitive for the contractor and for everybody. We lost three subcontractors during that time. They went broke and one subcontractor left the job.”

No delay in progress and payment process, because changes of people make progress slow and involved with changes in the process and design. Difficult for the contractor to get the work done.

Client "Sometimes, it is good that you have got continuity particularly if the building was similar. In another project, it might be a disadvantage because you don’t get any fresh ideas. So, in some respects, I think that trying to achieve the same with similar types of building, knitting the team together, you expect to have one consultant. If they are a part, then it is not necessarily only one consultant who has done the master planning and all the feasibility. It doesn’t necessarily mean that they give the best outcome when bringing somebody else in, they might come out with some fresh ideas. So, it is hard and it depends on the project. You are better working with one consultant. Some people or some other architects are very good with the teams' members and some are about design but not very good with the teams' members.”

Lack of new ideas

Key Component 3: Project Team's Actions

The architect’s actions were based on the cost implications for the projects. The problems which involved no changes in costs were solved on-site. However, for the problems with major changes in cost and specification, the architect had to apply a different approach. Any changes or problem-solving actions without cost did not need the architect’s instruction for the contractor to carry out the changes. Only the architect, other consultants and the contractor using email verified the decision and the action to solve the problems.
The actions taken by the client were demonstrated in different directions. The client's perspective was concerned about dealing with the historical significance of the buildings in case study 2. As the initial action, the client made an agreement when purchasing the building with respect to the culture and heritage when re-designing the two historical buildings. The client mentioned that to achieve this goal, the process was undertaken with the skills and expertise of consultants in the consultation process. All these processes were also part of the university standards in which they wanted to retain the cultural and richness of the past within the building.

Effective collaboration and communication with the architect were the actions taken by the contractor in solving problems in case study 2, and particularly for the AR2 project. These actions were involved with the preparation of many questions and information before any works were started by the contractor. The contractor encountered some historical features which had been hidden behind a wall and needed to install some protection and retain the historical feature. With the purpose of protection and retaining the historical components, the contractor undertook research with the architect, reporting that most of the contractor's works were in conjunction with the architect. Collaboration between the contractor and structural engineer also occurred in this project. However, the contractor explained that, because the structural engineer did not have a specific methodology in their work, the communication between them was more flexible when identifying and deciding the best way to solve structural problems. This study found that the component of the experience of the structural engineer had delivered successful collaboration with the contractor.

As the project manager managed the project, he described that there were a number of ways to develop the solution for project problems. In the normal process, the project manager always magnified the solution on-site with the other consultants. The normal process involved much communication between the project manager and architect. Once the problem had been identified, the allocation of the right consultants was important to avoid redundancy or clashes between works on-site. The key of a the successful problem-solving process was being organised, keeping track and keeping records of what was going on on-site by communicating with the project team members and being clear about the expectations from the other consultants. The project manager’s internal actions involved meetings among the project managers in the project manager’s organisation. They had internal meetings every week bringing up all the issues from their various projects including the projects in case study 2. The meetings came up with solutions for all the issues, with advice received from the other 11 project managers in the project manager’s organisation. However, the project manager also took other actions or initiatives to receive advice for any issues that he did not fully understand before the internal meeting day (Wednesday) in his
organisation. The project manager received advice from the other consultants including the architect and structural engineer so that he had input from the appropriate person in order to understand any situation. One situation that happened in the AR2 project related to water underneath Building 1. As the project manager said:

"In Building 1 we had an issue where we were concerned that water was coming up from the ground. There have been traps in Australia for 15 years, now issues of dampness were reported, so that we had built the building. One of the buildings was opened up for that: for weeks and weeks, there was water coming out from underneath the concrete. I actually remember specifically clearly talking to the builder, I was to send the landscaping project back to our builder to get recommendations as to who they knew to take on the concrete person's role. We talked to the architect and we worked out who was the best consultant to come and have a look at the dampness on the wall."

The project manager’s perspective demonstrated that the project team members were very collaborative in the problem-solving process. As an individual, the project manager had the confidence and courage to take initiatives and actions to find the solution for the project’s benefit.

The data analysis demonstrated the project team members’ actions in solving problems according to their own disciplines and skills. Some project team members referred to their own skills when describing their actions in response to any challenges that they were facing. However, some project team members described other team members’ actions in their perceptions about the problem-solving process. Table 7.7 shows the evidence of the project team members’ perceptions about the key component of action in the problem-solving process for case study 2.

Table 7.7: Evidence for key of component of action in problem-solving process in case study 2

<table>
<thead>
<tr>
<th>Project Team Member</th>
<th>Key Component of action</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>“It definitely might be something that would not incur costs. So, basically anything that doesn’t incur costs: it’s all within the documents which say that something that doesn’t have a cost; it needs to go through a different process. So, I think on-site, that if there was no cost involved generally, and there was no change to the specification then that would be an item that you probably resolved on-site. Then, usually things that were not quite covered in the documents but the intent was should be done but it was just discussing how you would want to get it done or the builder would come up and bring the problem to our attention and we would work out a solution. If it didn’t cost anything within the spirit of the documents, then we would just resolve it on-site and confirm it by email usually but perhaps it didn’t need to get</td>
<td>Immediate action for changes without costs</td>
</tr>
</tbody>
</table>

196
| Client | “From the heritage perspective, some of that was called up, let’s say, in the initial agreement to purchase and how we wanted to retain that. There were [heritage] overlays over Building 20 in recent years and a [heritage] overlay over Building 1, so, for Building 1 when we designed, we did the design without the heritage overlay. It was still respecting the culture and the heritage building. So, it wasn’t done without consultation with Heritage Victoria and other authorities. So, it was done with consultation, so we did have to do that. It was part of the university standard that wanted to retain the culture and richness of the past within the building.” | Respect the culture and heritage building |
| Contractor | “To appoint, we had a lot of questions, a lot of information we needed to get from the architect before we actually did our work, we needed it if we came across some historical feature which had been hidden behind a wall or behind the building. We needed to start protecting it and then researching with the architect to protect or retain or restore whatever it was. In fact, with these changes, a lot of things were done in conjunction with the architect. As contractor, you don’t care that much about the historical things …” “I think so, because the structural engineer didn’t have a methodology or anything for how we were to do that work. He just said, “you need to do it” and we said, “how about we do this way?” OK … it wasn’t a bad idea and was thought about because originally, he said that if we had a door, we set to it and knocked it down and he stuck on prop this and prop that and knocked it all out, which was difficult for the access problem and really hard. So, when we said through doing this, he said that it would be even better. Yes, people who have that prior experience like the director when I had say “why I can’t do this”, definitely helped usually like that. The team was very cooperative”. | Appoint with a lot of question Appoint with a lot of information Understanding historical features hidden behind building materials Protected and research with architectural guidance |
| External Project Manager | “It can be in a number of ways. The normal process undertaken on-site when something arises, the project manager always magnifies it, whether the consultant can do it our way. Particularly in a project like this, where they were so involved, there was a lot of communication with the architect and with the project managers. Once the problem was identified, there was already time constraints: it was identified and instructed to allocate the consultant who needed to work on it whether it was a clash between the mechanical system and the air conditioning or whether it was just architectural details such as the implications of the time needed for the materials…” “All the problems came up and it’s really got to be, the key is being organised, keeping track, keeping records on what is going on on-site but working by communicating with the project team and being clear about the expectations from the various consultants. The biggest point was to do all that while you were also trying to manage the cost and do it very quickly as well.” | Communication Kept track and records Allocated the problems to the appropriate person |
Key Component 4: Sources of Information

This section describes the sources of information that helped project team members to develop solutions. This study has identified the explicit documents that were used by the client and project team members in case study 2. Figure 7.17 shows the list of explicit documents that was found helpful from the client and project team members’ viewpoints. In some cases, project team members and client used the same documents.

![Figure 7.17: List of explicit documents used by client and project team in case study 2](image)

According to the list of explicit documents, this study has identified five main sources of information related to adaptive re-use projects to which the client and project team members referred in case study 2. The five main sources were contract information, heritage information; design information, regulation information and additional information (see figure 7.18).
The architect dealt with lack of information from the client briefing about her responsibility. A situation had occurred in which the architect needed information about the building to solve a problem, but it was difficult to find the right person with this information in the client’s organisation. The reason for this situation was that so many people were involved. From a communication point of view, the architect’s experience of difficulty in getting the information to answer a question meant that she needed to keep ringing until she found the right person with the responsibility and answer for her questions. A longer time was required to find the information needed to solve the project’s problems. Therefore, the architect’s viewpoint demonstrated that the client briefing had deficiencies when it came to describing the responsibilities of people involved in case study 2. The architect usually used drawings, specifications and bills of quantities to help her group to find the solution and to clarify the problems that occurred in the projects. The heritage requirement was already stated in specifications. The architect also ensured that their design for the adaptive re-use (AR1 and AR2) projects followed the client’s, heritage and environmentally sustainable development (ESD) requirements.

The client explained in his interview that they had prepared a design brief for the architect’s team to guide them in designing the AR1 and AR2 projects. The design brief consisted of the standards and expectations of what the client wanted including the colours, fittings, the spaces, the sizes and purposes of areas such as meeting rooms, and the number of people to be accommodated within the building. The architect was required to implement all of the client requirements. However, if the architect wanted to deviate in order to do something different, she needed to prepare a structural report document. The design brief guided the
architect in how she needed to design the building. Furthermore, the client indicated that the design brief “doesn’t tell them everything, they still need to get their artistic skill and their planning skill on their own but it does guide”. Meanwhile, in the related explicit documents such as drawings, specifications and monthly progress reports, the brief also included the guidelines for the reporting structure. The reporting structure guided consultants on how they were required to report including the content and number of reports, when to prepare them and their reporting responsibilities. In terms of safety issues, the client referred to the strict regulations around occupational health and safety regulations which were relevant in dealing with the lead paint problems in Building 1 and this caused to the project to run behind schedule. In relation to disability access and other occupational health issues, the client had prepared this design brief in line with the building codes. From the client’s perspective, this study found that knowledge transfer occurred in case study 2. The previous design document by the architect from the same firm had been used and reviewed in designing the AR2 project. As the client said “So, [architect]’s original design back in the early 90s has now been often looked at again, and became and began to be captured in the infrastructure plan”.

In terms of the intellectual property for case study 2 projects, all hard copies of project drawings and original drawings had been converted to soft copy around the early 2000s. This study’s findings demonstrated that the client had to take actions to protect their intellectual capital in the electronic database. In addition, all project team members, and especially the architect, could easily acquire the project information such as the original drawings of the building as design references. The original drawings which were mostly almost 100 years old were scanned. This showed that most of the information in the client’s organisation had been updated and was of benefit to the consultants in learning from past information about the buildings. Furthermore, it saved time and provided a better outcome because the client and project team members knew the history and were able to transform the building to its new uses. In terms of public documents, the client used the infrastructure plan (a public document) as a guide for the whole adaptation process.

The contractor’s perception about sources of information demonstrated that documentation was good preparation. The contractor had obtained and was satisfied with all the heritage information in terms of what they needed to protect, retain and restore. However, the situation changed when the contractor started to do the work on-site. As the contractor said, “but other parts of it were terrible because you couldn’t follow what you had got on-site and what you had got had nothing to do with the drawings, the specifications, the bills of quantities or anything like that; the bills of quantities were a guaranteed bill for the job. So, the bills said it needed new doors to be created but how do you know how to count them? It
could cost $2,000 for a new doorway but, in fact when you get on-site, the wall is that thick and for that part and you needed it to be much bigger or the door came in where it was, the small one or the short one, so you can’t do it and it’s difficult to document that”.

Table 7.8 shows the evidence of the sources of information that were used and applied by the project team members in case study 2 for both AR1 and AR2 projects. This study found one source of information that obviously did not apply in the AR1 project which was the fire engineering requirements. The rationale of this situation was because the AR1 and AR2 projects had different approaches in relation to fire safety. However, the data findings demonstrated the sources of information used in case study 1 as the entire information that was appropriate for the within-case analysis.

Table 7.8: Evidence of sources of information that referred to by project team member in the problem-solving process for case study 2

<table>
<thead>
<tr>
<th>Project Teams Member</th>
<th>Sources of information</th>
<th>Types of Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>“So, much as the architect generally gets the brief, it is also that part of the client’s responsibility to direct what next needs to be done and sometimes it was quite difficult getting information. That was not an unusual situation in public sector work. It was very difficult because so many people were involved. It was hard to find the people when you needed the information … You keep on ringing to find that who does what …”</td>
<td>Knowledge on preparing Drawings and Specification related with heritage buildings Knowledge on Environmental Sustainable Design (ESD)</td>
</tr>
<tr>
<td></td>
<td>“It’s usually the drawings and the specification. That would be two documents and the specification is in the written part and sometimes the bill of quantities as well and sometimes that can help you out: it would have a piece on that part and would sometimes clarify. All the requirements related to the heritage requirements were already in the specs and that’s what is documented and that’s what is usually going to be built. Usually, we don’t do that. Generally, if we need to change anything to do with the authority then, yes, it takes you on quite a different path. You’re trying to work within what you have documented because you need time to go back to the office authority and confirm with him that it is OK to change it and whether it is allowable. Often we called the building surveyor, and said that we had a problem on-site and got them to help us to resolve it within the boundaries which were different to what was documented. So, outside of the drawings and the specification, we needed to alert the authorities if any changes were involved. Definitely, the building surveyor and Heritage Victoria knew and possibly about the ESD (environmentally sustainable design) [guidelines].”</td>
<td></td>
</tr>
<tr>
<td>Client</td>
<td>“We used to have a hard copy but, in about early 2000, we scanned everything. Part of the specifications and all drawings are in electronic form. If we didn’t have it, at least we get them in PDF. So, we update everything now as we need to”</td>
<td>Knowledge on original drawings of historical buildings Knowledge related to the design brief for heritage buildings</td>
</tr>
</tbody>
</table>
and they are fast and licensed to use that file for our purpose for that building. But earlier, we got the original drawings of Building 1, for example: we had those in paper form and then we had the opportunity to scan them: some of them were almost 100 years old and all were in the archives but now they were accessible. Anyone of us can go to the electronic database and pull out that drawing and we give our architect access to the building and to the network to draw on this past information. They might learn from the past information, what was done in the past, what changes were made. So, it then saves time and gives a better outcome because at least we know the history about what has been added to, what has been changed all the time.”

**Contractor**

“As far as possible, yes, the documentation was good in terms of what we needed to protect and retain and what needed to be restored, quite good in that regard, very good. but other parts of it were terrible because you couldn’t follow what you had got on-site and what you had got had nothing to do with the drawings, the specifications, the bills of quantities or anything like that; the bills of quantities were a guaranteed bill for the job. So, the bills said it needed new doors to be created but how do you know how to count them? It could cost $2,000 for a new doorway but, in fact when you get on-site, the wall is that thick and for that part and you needed it to be much bigger or the door came in where it was, the small one or the short one, so you couldn’t do it and it's difficult to document that …”

**Knowledge on the relationship to bills of quantities for adaptive re-use projects**

7.4.2 Research Findings 3: Key Components of Problem Solving- Knowledge Creation Context

Following is a detailed discussion of the findings which supported and explained the key components of success in problem solving in the knowledge creation context. The two key components involved were generating new skills and developing new solutions.

**Key Component 1: Generating New Skills**

The *architect* generated new skills through her experience with uncooperative project team members. She experienced the expansion of her knowledge as she ensured that every member of the project team had collaborated in solving the problem. Within this situation, the architect developed new skills through learning about the problem and developing the way to solve it: she also expanded her skills by undertaking analysis to find the best solutions to resolve problems.
The client demonstrated two ways in which they generated or developed new skills in their organisation. The viewpoint from the client was not in terms of the individual generating new skills but of this occurring in the whole organisation. One new skill that was developed by the client was in the area of post-occupancy evaluation. This was in the form of a survey of building occupants which was conducted six months after occupancy particularly to identify that the building was fit for its purpose. The client applied the findings of the survey for planning future building or refurbishment projects. The client named this survey as one tool in terms of learning from the previous project results with the findings transferred to future projects.

The contractor's experience in relation to generating new skills was through directly engaging with subcontractors rather than depending on information (documentation), including specifications and drawings, provided by the consultants. This helped the contractor to learn how to identify the solution for issues in two ways, namely, through documentation and site visits. The contractor in this project also reported that new skills were generated in the area of communication. Data findings from the contractor's perceptions demonstrated that he was generating new communication skills with the client. This was important for the contractor so that he could take the client's information and deliver the job in accordance with the client's needs.

Working through different problems delivered an understanding of the project's complexity in terms of the project manager's skills. The project manager mentioned that he came across similar issues in different projects and that they were relatively easy to solve. Experience and knowledge were thus considered to be components of success in generating new skills among the project team members.

Previous project results were documented for future reference and this happened in the structural engineer’s organisation. The documentation of previous projects led to solving problems in future projects. The structural engineer demonstrated that they shared their knowledge within their organisation, particularly through skills networks. As the structural engineer said “So, again, if somebody else asks me a question on the skills network about working on old buildings, I respond, so, straight away that knowledge goes around the world, that sort of thing. There are three ways that we do this. But I might not transfer that knowledge to anyone who is competitive around that. So, I want to write down the entire lesson, how you can learn about that is natural in this industry …” In terms of getting collaboration, the structural engineer used the knowledge that had been learnt from previous situations and activities.
The evidence of the new skills generated by the project team members in the problem-solving process in the AR1 and AR2 projects is provided in table 7.9.

Table 7.9: Evidence of new skills that generated by project team members in the problem-solving process for case study 2

<table>
<thead>
<tr>
<th>Project Teams Member</th>
<th>Generating New Skills</th>
<th>New Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>I think primarily your role thus remains the same but you find probably that your knowledge, your in-depth knowledge into other areas extends, so you have extended yourself a bit further and that is sometimes to do with perhaps the consultant, they are not speaking, not cooperative so that one puts in extra work there, so you end up probably putting in some extra work there. Or just because of the situation, it becomes, I guess, for example, in ways such as this material coming crisis that sort of pops up quite a bit and so you end up learning more about that sort of thing and then become more, it is also part of your roles but it does expand your roles, I guess, as you end up dealing with analysing to work out the best way to resolve the problem.</td>
<td></td>
</tr>
<tr>
<td>Client</td>
<td>“What we can do is what we call post-occupancy evaluation which means that we survey the building occupants after six months or a year after they move in to see if the building fits the purpose, what works and what doesn’t work for them and, in summary, we would use their findings in terms of our plans for future building or refurbishment projects. Also, in terms of the materials we use, a lot of the work, the air conditioning and anything to do with the functionality of the building. So, that was one tool in terms of learning”</td>
<td></td>
</tr>
<tr>
<td>Contractor</td>
<td>“It’s helped in my role, it’s helped me to improve my skills in engaging subcontractors .... rather than using information given to me by the consultants, specifications and drawings, to scope work from subcontractors. It’s helped me to learn about it but it doesn’t tell me much: that’s where I need to go into the building and actually need to look at it myself. So, rather than create 40 doors, you need to create an opening … so it’s helped me, in improving scope writing for subcontractors. It certainly taught me more about dealing with the client because rather than just taking their information, delivering them the job, we constantly needed to talk about what they wanted, how they wanted it done, how they wanted it to look, so, this helped my people skills, certainly helped my managing skills because every little bit of the job had to be managed rather than just learning and trying to manage the work and coordinate. Yes, the management of the job and scope writing to suit the client, I guess these helped the project team relationships.”</td>
<td></td>
</tr>
<tr>
<td>External Project Manager</td>
<td>“I think you have lot of experience particularly at working through different problems because issues also arrive, anything from the flushing to the air conditioning system and you start to get an appreciation of how they work and you start to understand the complexity. When you come...”</td>
<td></td>
</tr>
</tbody>
</table>

Skills to deal with crises by getting collaboration with other consultants

Skills to fit the building for its new purpose for future adaptive re-use projects

Skills in engaging with the multiple skills of subcontractors and the client’s needs. Special skills and the client’s needs were different from conventional projects. For example, how to deal with the existing openings (closing or replacing them) to suit the new functions.

Skills in understanding and handling the different contract negotiations, the settlement of different variations (involved with various variations from time to time which were not stated in the contract document)
across similar issues you can gauge what it’s going to be, unless it’s some important thing for me to get into and to know that you have similar problems, that this is relatively easy to fix and I can get a couple of consultants. Or I see something and I think that it happened on the project that I’ve worked on before and it took week after week to sort it out or better yet, to really get the consultant for the meeting tomorrow and we need to know the process for it. It’s from that sort of thing that you also learn, I think, quite a bit about different contract negotiation, about settlement invariably, it’s about a lot variations that came up along the way because there was so many integration issues and junctions (choices) and documentations, coordination issues and you learn quite a bit about that, the process and how important it is to stay on top of the correspondence that is going through.”

Structural Engineer

“"The other things we do, when we finish the job and we work out what we have learned, we share it in here and it is documented. So, the next project comes along, some other things for that one e.g. leadership problems. What’s left on that and it is a lot, so the biggest reason why we share knowledge is for the end result, which is appraisal, reviews that you go through the whole network, and skills networks. So, again, if somebody else asks me a question on the skills network about working on old buildings, I respond, so, straight away that knowledge goes around the world, that sort of thing. There are three ways that we do this. But I might not transfer that knowledge to anyone who is competitive around that. So, I want to write down the entire lesson, how you can learn about that is natural in this industry …”

Skills on how to share the knowledge among his organisation’s skills networks in relation to the involvement with old buildings. Responds to questions asked by other members of the skills networks

Key Component 2: Developing New Solutions

This section discusses project team members’ approaches in developing new solutions in relation to the components of project success for case study 2. The architect used meetings as the mechanism in which to develop new solutions for each of the problems. With good communication with the consultants and the builder, the architect was easily able to deliver solutions for the problems. This data finding demonstrated that teamwork went well in this project. Furthermore, the architect had consulted very well with the different disciplines of consultants and with the builder and ensured that all of the project team members were comfortable with her solution. The architect’s perception was that it was important that the members of the project team got along and worked well together in developing any solution for the projects.

The client’s action in developing new solutions at the design stage was by involving their representative with the design team (the architect’s team) at the weekly design meeting. The client representatives were the building surveyor and quantity surveyor. Every fortnight, the
client was represented by people (from the Properties Department) who attended the meeting to give some guidance and to resolve the problems at design level. These decisions involved the cost of the projects. The client gave the architect the results of their analysis of the occupants’ requirements from their last project as a reference for the next project as it related to the design solution. As the client said “… we give some surveys to the designers if applicable, so they aware of what the community or the students are thinking which would inform how they might be designed in the future.” The results provided the new learning which went into the new addition’s design brief. Every two or three years, the client updated the design brief.

The contractor’s perceptions about developing new solutions from previous projects referred to the way in which he communicated and cooperated with the structural engineer (consultant). The contractor already knew that the works for which he was engaged involved very old structures. The engagement of the ideas, experiences and skills of the structural engineer helped him in solving problems related to structural issues. A lot of structural issues that occurred during construction were not stated in the documentation, including how to construct new doors and windows through the two- to four-foot thickness of the wall. The new solution developed to construct these aspects came about through the good communication and collaboration between the contractor and the consultants.

The project manager’s view was demonstrated in two ways: firstly, through his individual self-interest in the job which offered the best way for developing new solutions. Secondly, he gained understanding of the individual’s needs in providing solutions for the problems. The data finding demonstrated that everybody was involved in these projects because they were interested and had the self-confidence to sit down together and start throwing ideas around to solve the problems. “In terms of solutions, it is always different because at the end of the day, it was all affected by personality: that is the human effect on all of this”, as stated by the project manager.

Communication through discussion with internal and external experts in the structural engineer’s organisation demonstrated the way to develop new solutions as perceived by the structural engineer. This started with ideas for possible solutions, then reviewing the solutions and discussing them with external experts to provide better ideas for the first solution. After that, the structural engineer prepared their modelling (the real model) for the solution from real materials and made the calculations to prove its strength before undertaking the real work for that problem. In the other words, the structural engineer was really particular about evidence for their process and their calculations in developing the new solution before its delivery to the real works.
Table 7.10 provides the evidence from the interview data that described the new solutions developed by project team members in case study 2. The new solutions were focused on the intellectual and social factors such as working together, communication, the same team, trust and collaboration.

Table 7.10: Evidence of new solutions that developed by project team members in the problem-solving process for case study 2

<table>
<thead>
<tr>
<th>Project Team Members</th>
<th>Developing new solutions</th>
<th>The New Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>“The meeting was often with the group. You really need to have good communication with the consultants and the builder and really it becomes a solution developed just by you. I mean some of them are simple things but rarely; it's often the way that you consult with different people; usually, you have to consult with different consultants to make sure they are comfortable with your solution and often you do that and maybe I come up with something and I should put in an email about what is reckoned to be fine and all these keep going. But this is definitely teamwork. That's why it's important the people get along and work well together which is often and good too. And often we call out to a consultant if we have a problem or need any ideas to help us…”</td>
<td>The method of communication was upgraded to be more efficient and to make sure everybody was comfortable with the solutions. Email systems were improved in the AR2 project.</td>
</tr>
<tr>
<td>Client</td>
<td>“Yes, it happened and we have weekly design meetings which would be just with design team itself and including our representatives, the quantity surveyor and building surveyor. So, they were a part of the design team. Every fortnight, the client would come and sit through that meeting as well and give some guidance, see what the problems were and resolve all this at the design level. And  (architect) himself as a member of the project control group which was more to look after the university teams’ members and about moving into the building. So, it would be senior directors or managers of the group who were going into that building. They would make the decisions about the price and the project and all the delegations which might be moved around. Not so much design, more about user issues within the building. Should we have another team group somewhere else? Those sorts of decision and planning decisions which the steering committee could resolve and setting up the group committee. Usually the Head of School and usually the chair was from the major teams’ members, some senior person. In the case of Building 1, it included the university secretary on behalf of the Vice Chancellor…”</td>
<td>The new steering committee was developed in the AR2 project to sort out decisions including planning decisions for future adaptive reuse projects since RMIT still had many historical buildings to be adapted. This did not happen in the AR1 project.</td>
</tr>
</tbody>
</table>

“… and we gave some surveys to the designers as applicable, so they were aware of what the community or the students were thinking which would inform how they might be designed in the future … These new learnings were included in the new addition in the design brief. So, every two or
three years we update the design brief. We gather that new information as new learning and keep putting it in there."

Contractor

"There was about 41 or 42 new doors way through up 2 to 4 foot thick brickwork, and we need in-situ concrete to support all of them. So, basically you have the wall like this, and you put the door here, what we do in, before we put the door in, we take it out that brickwork like that, and then we had about 80 original steel prop to made up and we have to stuck in there, like that, took a lot of above and we blind pump up concrete right into the building and need to fill it up, so it was there and lay and knock that door. Obviously we don't know what was in wall. Whether in there solid or hollow right through, we often accounted pre-poor condition cause everything so old, we were taking and render off wall, so structurally, we were taking the roof often rising some areas and remove the whole floor, like a that removing the whole floors here, to make double high for it. So, there was considerable structure issue, we had some a big wall top to the stairways, that the whole raise and keep, which wall actually fall in. So, that is the part that 15m up in the air, so this actually we had to braise to back to walls, so, wireless and braise it back…" (technical views)

"I think so, because for this, the structural engineer didn’t have a methodology or anything for how we were going to do that work. He just said, “you need to do it” and we said, “how about we do it this way”. OK … it wasn’t a bad idea and was thought about because originally, he said that if we had a door, we set to it and knocked it down and he stuck on prop this and prop that and knocked it all out, which was difficult for the access problem and really hard. So, when we said through doing this, he said that it would be even better. Yes, people who have that prior experience like the director when I had say “why I can’t do this”, definitely helped usually like that. The team was very cooperative”

External Project Manager

"I mean I can say yes, but again, from my perspective, the new thing I wanted to learn was my approach with various people rather than the result. I did come up with and I barely remember the solution for the air conditioning unit which had to be moved because we weren’t aware of the wall but certainly I did find specific people that, you know, I developed ways of managing people, ways of keeping track of what people were doing where I had a different approach for different people. In terms of solutions, it was always different because, at the end of the day, it is all affected by personality: that is the human effect on all of this.
The architect had personality and they had an investment in the project; they put all the work into it but their aspect was not like my aspect. How you approach issues and how you approach contractual obligations and that sort of thing ‘cause you can just email someone an instruction which is what you are supposed to do or you can actually gauge the situation, you can go down there, you can call them, work together on it but you need to give and take while still sending an
instruction to meet any obligations. This is the approach that I think I have developed. I’m trying on and on to make projects work together. That is just from my point of view on how the collaboration happened in this project.”

Developed their own methodology according to the experience (of the structural engineer) in handling the structural problems by increasing their knowledge on calculations and modelling of heritage projects in order to propose the appropriate solution.

7.4.3 Summary

The key findings in case study 2 are summarised in table 7.11.

Table 7.11: The summary of key findings in case study 2

<table>
<thead>
<tr>
<th>Project Teams’ Involvement</th>
<th>Components of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>According to project teams’ involvement within a time series scenario</td>
<td>Five participants indicated that they had balanced involvement in conventional projects and heritage projects within the intervening period (scenario 2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Three Major Research Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Finding 1</td>
</tr>
</tbody>
</table>
| Critical (80%-100%) | - Collaboration (100%)  
- Communication (100%)  
- Skills (100%)  
- Past Experience (80%)  
- Trust (80%)  
- Supportive Attitude (60%) – eliminated: percentage below 80% |

<table>
<thead>
<tr>
<th>Research Finding 2</th>
<th>Key Components of Problem Solving in Relation to Knowledge Transfer</th>
</tr>
</thead>
</table>
| Key Component 1: Efficiency and Effectiveness Mode  
Key Component 2: Same Project Teams  
Key Component 3: Project Team’s Actions  
Key Component 4: Sources of Information |

<table>
<thead>
<tr>
<th>Research Finding 3</th>
<th>Key Components of Problem Solving in Relation to Knowledge Creation</th>
</tr>
</thead>
</table>
| Key Component 1: Generating New Skills  
Key Component 2: Developing New Solutions |

Source: Case study 2
This chapter presented the three major research findings revealed by this research in case study 2. As is typical of qualitative research, extensive evidence is included in this thesis using quotations from project team members’ perceptions. In terms of the involvement of project team members, the external project manager, contractor and architect were not involved in the AR1 project; however, the architect came from the same architectural firm. The architect’s perspective on the AR1 project provided deep value in the data analysis. The information about the AR1 project was recorded (explicitly) in her architectural firm. All five project team members were involved in the AR2 project.

The primary research finding of case study 2 was that five critical components of success helped project team members in the problem-solving process. These five components, namely, collaboration, communication, skills, past experience and trust, had 80% to 100% frequencies in project team members’ views. The supportive attitude was eliminated as it only recorded 60% of frequencies. In discussing the types of knowledge that contributed to the adaptive re-use problem-solving process, the majority of the project team members indicated that communication, collaboration, past experience, skills and trust were the components that needed some specific knowledge in relation to heritage matters. The understanding of project team members’ multidisciplinary backgrounds and the integration of their heritage knowledge was critical in the problem-solving process. Discussion about their past experience on heritage buildings contributed to their increased level of sensitivity about the buildings and about retaining their historical value. This knowledge including how to deal with historical buildings in relation to workmanship and materials was expressed by the majority of the project team members. In addition, extra knowledge was needed about the techniques and to analyse the approach to use with these methods of construction and materials characteristics in order to integrate the new and old components. The majority of the project team members cited that their skills were related to the knowledge and ability to handle unexpected problems in heritage buildings. Unexpected problems during the construction process contributed to situations that were dangerous for the project team members and these problems needed appropriate solutions. Knowledge and skills about hazards and handling hazardous situations were significant in the success of these adaptive re-use projects. The majority of participants indicated that trust between individuals related to professional trust. The professional trust between the architect and structural engineer led to the design decision which successfully adapted the complicated heritage building space to suit its new use as new university space. The advice changed between the architect and structural engineer based on trust. Mutual trust helped the project team members to provide satisfactory solutions particularly from the client viewpoint. One of the project team members mentioned that human factors contributed to mutual trust in heritage project situations.
The second research finding in case study 2 was that the majority of project team members indicated that it was not easy to solve the problems in adaptive re-use projects. This contributed to the effectiveness and efficiency of project team members in the problem-solving process. The architect highlighted that she had difficulty in getting information as information was lacking in the client’s brief. This lack of information was mentioned as there should be a responsible individual in the client’s organisation to whom the architect could bring problems so they could be addressed by the right person. This was a cost in terms of the extra time that it took for the architect to make decisions solving problems that had arisen from other project team members. The majority of the project team members cited positive responses with regard to having the same project team members in the AR2 project as in the AR1 project. The familiarity of project team members with heritage requirements and their knowledge of conventional construction, as well as their personal backgrounds, were valued. With regard to this, they were easy to get along with and they understood their fellow project team members’ needs. In addition, the process of adaptive re-use was more efficient because by not changing the members of the entire project team, delays in progress and payment were avoided. The same project team members corroborated similar methodology. A few project team members stated that the actions to solve problems were referred to the cost as stated in the bills of quantities. If the cost was not affected by the problems’ solutions, the problems were solved immediately on a day-by-day basis. However, if the problems’ solutions involved changes in total cost, these actions took more time in which the solution was defined with agreement of all project team members: this involved many stages. In addition to investigating the types of knowledge, the sources of documents used by the project team members to define solutions were identified. There were 11 main sources including contractual information, heritage information, design information, building regulations information and AR1 project information.

The third research finding in case study 2 was that new skills and new solutions were created within the time series scenario. In the generation of new skills, knowing how to deal with collaboration crises and understanding the different contractual negotiations in adaptive re-use projects were considered important in knowledge creation activities. Also, skills in how to share knowledge and in networking internally and externally with project team members’ organisations helped them to identify solutions to solve problems. The majority of project team members mentioned that their past experience in the AR1 project and other heritage projects provided them with the ability to develop their methodology so they could effectively solve the specific problems that happened in the AR2 project.
7.5 Summary

The research findings presented in chapter 7 indicated that five components of success, four key components in the knowledge transfer context and two key components in the knowledge creation contest were important in the problem-solving process particularly in a “time series” scenario in which the same project team members were involved in both projects.

The next chapter comprises the cross-case analysis and discussion which compares the data findings from case study 1 and case study 2. The results of this cross-case analysis will prepare this study for the detailed discussion in chapter 9 in which the framework is refined.
CHAPTER 8
CROSS-CASE ANALYSIS AND DATA FINDINGS

The presentation of this chapter is structured in accordance with the data analyses and discussions in chapters 6 and 7. The discussions on the similarities and differences of the data findings between case studies 1 and 2 have been structured in order to shape the refinement of the framework in chapter 9.

This chapter is structured to correspond with the research questions (described in Chapter 10, Section 10.1). The results of this analysis will answer these two research questions which were on the components of success and the key components for problem solving and what and how they contribute to the process of problem solving in adaptive re-use projects. The answers to how these components contribute and are linked in relationship to knowledge transfer and creation activities are also described in this chapter. This chapter comparing the backgrounds of the two case studies, comparing research finding 1: five components of success, comparing research finding 2: four key components in the knowledge transfer context, comparing research finding 3: two key components in the knowledge creation context; and summary of research findings in the two case studies.

8.1 Comparing Backgrounds of the Two Case Studies

A comparison of the backgrounds of the case studies was undertaken to identify the differences and similarities in terms of the history and characteristics of the buildings. It was believed in this study that a better understanding of the characteristics and history of these heritage buildings would provide other practitioners with preliminary knowledge in dealing with historical buildings. As shown in Table 8.1, four main findings were identified and are discussed in the following section:
Table 8.1: Comparison of the Case Studies’ Backgrounds

<table>
<thead>
<tr>
<th>Four Main Findings from Comparison of Case Studies’ Backgrounds</th>
<th>Case Study 1</th>
<th>Case Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The location of historical buildings</strong></td>
<td>Urban in large Regional City (the Greater City of Geelong)</td>
<td>Urban in Capital City (Melbourne City Centre)</td>
</tr>
<tr>
<td><strong>The types of historical buildings vs their new functions</strong></td>
<td>Formerly woolstores AR1 (1891-1954) AR2 (1934)</td>
<td>Formerly Magistrates Court Building (AR1) Formerly Francis Ormond Old College (AR2) AR1 (1911 1913) AR2 (1887)</td>
</tr>
<tr>
<td><strong>The project-to-project time series scenario approach</strong></td>
<td>13 years of time series scenario period (1996-2009)</td>
<td>8 years of time series scenario period (2002-2010)</td>
</tr>
<tr>
<td><strong>The project team members’ involvement in the AR1 and AR2 projects</strong></td>
<td>8 project team members were fully involved and 1 was partly involved (early stage) in AR2 2 project team members were not involved in AR1 Architect had the most experience in projects related heritage buildings</td>
<td>5 project team members were fully involved in AR2 3 project team members were not involved in AR1</td>
</tr>
</tbody>
</table>

Source: Case Studies

8.1.1 The Location of the Historical Buildings

Both case studies were located in urban areas which represented city areas that incorporated components of social and economic factors typical to the built environment. Case study 1 was located in the Greater City of Geelong which represented the urban area in a large regional city. Case study 2 was also located in an urban area but in the capital city of Melbourne. Regarding the area in which the buildings were located, this study found that the building space was limited. Therefore, the client and the project team members found difficulties in ensuring that all of the space was fully functional and useful. The impact of the location of these historical buildings had a major impact on the workload of the client and project team members. This study found that the project team members in case study 1 were more flexible and more focused on the AR1 and AR2 projects compared to those in case study 2. This was due to the lack of other projects in regional city areas. Case study 2 faced a different situation in which project team members were involved with other projects.
while doing the AR1 and AR2 projects. The capital city was experiencing significant pressure to achieve capital development.

8.1.2 The Types of Historical Buildings vs Their New Functions

Historical buildings can be categorised according to many types of characteristics and functions. In this study, each case study had different characteristics and original functions. The historical buildings for case study 1 were built in seven different stages from 1891 to 1954. Case study 2 involved two historical buildings that were built between 1887 and 1911. The comparison showed that the buildings in both case studies were built around the same era. Both projects encountered similar problems related to lead paint and very thick walls and floors. However, these differences were identified in terms of the buildings’ original functions. The buildings (AR1 and AR2 projects) in case study 1 were formerly used as woolstores (industrial buildings). The buildings in case study 2 had different original functions: the AR1 project involved the former Magistrates Court Building (an administration building) and the AR2 project was undertaken on the building formerly known as Francis Ormond Building (an education building). These differences provided various levels of understanding about the original functions from the client and project team members’ perspectives. Although these buildings all had different original functions, this study identified that they were similar in terms of their new functions. In both case studies, the buildings were adapted into university buildings for teaching and administration purposes. In addition, in the AR2 projects in both case study 1 and case study 2, the buildings were transformed into chancellery buildings.

8.1.3 The Project-to-project Time Series Scenario Approach

The AR1 project in case study 1 started the adaptation process in 1993 and was completed in 1996 whereas the AR2 project involved refurbishment undertaken between 2006 and 2009. In the adaptive re-use projects for case study 2, the AR1 project was completed in 2002 although the information did not state the year in which it started. Meanwhile, the AR2 project in case study 2 commenced the refurbishment process in 2008 with this completed in 2010. All of the projects in case studies 1 and 2 had a similar adaptation period of between two to three years. In discussing the time series scenario approach, this study used the completion dates of the AR1 and AR2 projects as the time frame for the time calculation. The range of the time taken to complete the AR1 and AR2 projects was significant with the activities of knowledge transfer and knowledge creation occurring in three scenarios. The time series scenario in case study 1 comprised a 13-year period (1996–2009). In case study 2, an eight-year period was involved in the time series scenarios approach (2002–2010). This study found that the time series scenarios of both cases were significant in showing the
relevance of the involvement of the same project team members in the AR1 and AR2 projects.

8.1.4 The Project Team Members’ Involvement in AR1 and AR2 Projects

Comparing the involvement and the experience levels of project team members in the adaptive re-use projects showed that all 14 participants were involved in the AR2 projects for both cases between 2006 and 2010. Project team members’ knowledge on the AR2 projects showed a very deep understanding about these types of projects. The architect and the building surveyor in case study 1 were the team members with the most knowledge about the history of the buildings. The architect and building surveyor were both able to explain in detail about each building component and the functions of existing components (which had been retained until the present) showing the richness of their knowledge about the woolstores. As the architect said:

“… just around the corner is the elevator; it’s the steam driven by the boiler which is over here, to push them up. And then to get them down, you just drop it down the hole so one is a drop, what you see in the School of Architecture. You will see the glass lid that we put on the drop ‘cause at the top floor you don’t need the rest of it because you just tip them in the hole, but at the other levels, there were openings, a chute, little doors. They bring the bail over and slide it in and then it will drop from there, from this other floor level so they slide in, whereas for this one, they just had this hole, just dropped it here … we kept some of them, reinstated them before we polished the floor, so if you go down there, you may never notice them but if you look at the timber floor around the open streets into the building, you will see some little squares with numbers, that’s how it used to be over the entire floor …”

The most experienced project team member across the two cases in projects related to heritage buildings was the architect (in case study 1). This finding was based on an in-depth interview, from which emerged the richness of the architect’s perceptions and his total number of years involved in this industry. The knowledge about heritage projects was not just about the buildings but also how he managed difficulties in any kind of heritage project with the authorities. From his 30 to 40 years of experience in heritage projects, the architect indicated that his accumulated knowledge had emerged from experience, as he said:

“Deciding what material to use, deciding the cost, the specification and knowing the sort of contractors who were appropriate for the job, who knew the materials that might be appropriate, their judgment about whether it matched the material used and the contrast with the new material used while certain protocols like the Burra Charter dictated how you should approach dealing with old buildings. What you keep, what you introduce, what you do when you introduce new materials. So the heritage characteristics are diminished on what you do and what you add to keep some of the building’s qualities. You don’t do all parts as new again. But there were elements of how to insert services into buildings and how to integrate new services and
The architect also cited that involvement and experience in heritage projects needed to consider various aspects not just the building regulations. This kind of project needed to consider the sensitivity of other factors such as Aboriginal issues. When the project involved Aboriginal sensitivity, he needed to deal with Aboriginal Affairs Victoria. It was considered critical that all practitioners in adaptive re-use projects were aware that they needed to have an understanding of this sensitivity and its unique situation. The building that was being adapted potentially had sensitive issues that related to Aboriginal people. As the architect said:

"Every project is involved with solving problems that are unique in their own way. The Geelong Art Gallery that we worked on had a lot of different things. We do a lot of work refurbishing buildings and not always heritage buildings but are involved with re-working with existing school, re-working existing commercial buildings like Mercedes. It wasn't heritage, but it was Aboriginal sensitive, it had Aboriginal sites so we had to get special permission from Aboriginal Affairs Victoria to do what we were doing there and I had to deal with the Wathaurong people. So, it's not heritage but, on the other hand, it is geological because it has significance as an Aboriginal site. So, there are elements of dealing with authorities, the experience indeed, and the confidence increased through the project. It's just building your knowledge. It's like life; you get more experience, hopefully become wiser when you get older and things become easier because you have more confidence and are comfortable in doing this. When you start out as an architect, you are hesitant about something, then you get more experience and it becomes easier for you because you've done that before and you know how to approach the problem in that particular way because you've done it before."

8.2 Comparing Research Finding 1 in Case Studies 1 and 2 on Five Components of Success in the Problem-solving Process

The analysis of the interview data in case studies 1 and 2 identified five critical components of success in the problem-solving process within a time series scenario. These five components of success, namely, collaboration, communication, past experience, skills and trust, contributed to research finding 1 in both case studies. A comparison between the two case studies on the critical components of success revealed their similarities and differences.
Table 8.2: Comparison of components of success in Case Study 1 and in Case Study 2

<table>
<thead>
<tr>
<th>Critical Component of Success</th>
<th>Case Study 1</th>
<th>Case Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration</td>
<td>Social Routine</td>
<td>Social Routine</td>
</tr>
<tr>
<td>Types of Intellectual Capital</td>
<td>Related Knowledge</td>
<td>Types of Intellectual capital</td>
</tr>
<tr>
<td></td>
<td>building background</td>
<td>related knowledge</td>
</tr>
<tr>
<td></td>
<td>costing and pricing</td>
<td>(Project Planning)</td>
</tr>
<tr>
<td></td>
<td>Estimate the heritage buildings</td>
<td>heritage (CMP, heritage requirements, recycling guideline, heritage citations, heritage policy)</td>
</tr>
<tr>
<td></td>
<td>fire protection for heritage buildings</td>
<td>fire protection for heritage buildings</td>
</tr>
<tr>
<td></td>
<td>building regulations to suit with heritage buildings</td>
<td>building regulations to suit with heritage buildings</td>
</tr>
<tr>
<td></td>
<td>previous project records (AR1 and other adaptive re-use projects)</td>
<td>previous project records (AR1 and other adaptive re-use projects)</td>
</tr>
<tr>
<td>Communication</td>
<td>Documentation</td>
<td>Documentation</td>
</tr>
<tr>
<td>Types of Intellectual Capital</td>
<td>Integrating the new and old building components for new functions</td>
<td>Related Knowledge</td>
</tr>
<tr>
<td></td>
<td>Preparing the complex fire engineering solution for fire protection in heritage buildings for their new functions</td>
<td>defined the internal (project team's organisation) solution for project</td>
</tr>
<tr>
<td></td>
<td>Ability to handle unexpected problems that happened in projects involving heritage buildings</td>
<td>Conceptual Skills</td>
</tr>
<tr>
<td></td>
<td>Conceptual Skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Experiential</td>
<td>Experiential</td>
</tr>
<tr>
<td>Types of Intellectual Capital</td>
<td>Dealing with authorities with the building permit and planning permit applications from local authorities including fire department.</td>
<td>Experiential</td>
</tr>
<tr>
<td></td>
<td>Experiential</td>
<td></td>
</tr>
</tbody>
</table>
Trust Conceptual Skills Experiential Social Routines Documentation
Trust on project team members’ skills (professionalisme) Trust in the individual
Conceptual Skills Experiential Social Routines Documentation
Professional trust between the architect and structural engineer led to the successful design decision to adapt complicated heritage buildings’ space to suit new university space.
Mutual trust helped project team members to provide satisfactory solutions particularly from the client’s viewpoint.

Note: CMP = conservation management plan

8.2.1 Comparing the Component of Collaboration

In comparing the component of collaboration, both case studies identified having similar types of intellectual capital. In engaging collaboration among project team members, the activity where the sharing and transferring of knowledge among project team members happened was called ‘social routines’. This study noted that the types of knowledge most often cited by project team members in case study 1 were to do with heritage buildings and heritage requirements. The majority of the project team members in case study 1 mentioned that good collaboration was affected by the intellectual richness on heritage which contributed to the social routines during project implementation. The types of knowledge which worked in conjunction with heritage in case study 1 included knowledge on costing and estimating in preparing adaptive re-use project planning. Project team members also referred to the CMP, heritage requirements, recycling guidelines, records of previous adaptive re-use projects, heritage citations and policy when gaining the knowledge that was critical in defining the solution process. The main difference identified in case study 2 in terms of good collaboration was through corroboration of the knowledge through understanding the project team members’ discipline or responsibilities. An understanding of the other team members’ responsibilities when undertaking an adaptive re-use project certainly helped them to work together in harmony. As the external project manager in case study 2 said:
“It depends on who you work with … a lot of personalities and some consultants are very willing to go a little bit outside their scope and others perhaps they keep to the minimum … you know when you are working with 15 or 20 people, there are people who are really excited about the project and some people are bored and don’t want to be there because they’re too busy on other projects … your role tends to rather be chasing people a lot to get solutions, get organised and get information, the flow information or you end up picking it up by yourself.”

8.2.2 Comparing the Component of Communication

The types of intellectual capital in relation to communication consisted of objective knowledge which was obtained from documentation related to the heritage requirements. There were some points of difference in communication activities between case studies 1 and 2. Case study 1 was focused on the knowledge of how to integrate new and old components in existing buildings with communication used to identify the solution for that problem. The project team members in case study 1 undertook critical communication about the fire safety in the building because timber and steel were the main materials in the existing buildings. Knowledge transfer occurred in the process of finding the solution for fire protection of these historic buildings. The knowledge about the fire engineering approach was learned from a previous project which had used a traditional approach. This situation produced difficulties in obtaining building permits for projects that were carried out in 1993 when the fire engineering approach had not yet been implemented. Therefore, the communication activity in project AR2 was focused on fire safety solutions for historic buildings by using the technology that was required in order to prepare the fire protection model.

However, the majority of project team members in case study 2 indicated that their experience of communication process was because they needed knowledge related to understanding other team members’ responsibilities. Communication activity in the problem-solving process was essential in order to understand project team members’ responsibilities thus ensuring that the problem was directed to the right person. The client mentioned that the problems were cumulative but that action to solve the problem must be directed to the right individual with the right discipline, due to the different and unique problems in adaptive re-use projects, and that this was particularly important with unpredictable problems. As the client said:
8.2.3 Comparing the Component of Skills

A similar type of knowledge in relation to the skills of project team members was knowledge about how they handled unexpected problems in both cases. The difference was the way in which they solved unexpected problems. For instance, in case study 2, the presence of lead paint and asbestos, and the structural conditions of the buildings were the unpredictable problems which occurred during the adaptive re-use process. As the contractor in case study 2 mentioned:

“So many unknown and unpredictable [problems] … probably the largest challenge was the presence of contamination; lead paint and asbestos were present. … The second largest was the structural condition of the building. There were a lot of unknown conditions. … So, structurally there was a bit that was unknown, we had the structural engineer on-site quite a lot to inspect: there were a lot of quite big things … we had to protect what was painted 100 years ago and we restored it. It’s quite hard, you need a lot of workmen and tools, mess, dust, dirt and everything to protect that, maintaining and protecting heritage features …”

The condition of the existing structure was inspected using the high skill level of the structural engineer which helped the contractor to solve problems in terms of construction. The knowledge of how to handle and how to be ready for unpredictable problems in future projects developed certain skills through working on adaptive re-use projects.

8.2.4 Comparing the Component of Past Experience

In discussing the planning and building permit applications, the increased level of confidence and comfort when dealing again with the authorities in the AR2 project were factors which used past experience. Past experience was categorised as experiential knowledge that accumulated during the time series scenario in case study 1. Dealing with the authorities including the local council, the fire brigade department and the Heritage Council of Victoria for planning and building permits, etc. was critical. Without the authorities’ approval, the adaptive re-use project which would refurbish the woolstores could not proceed. The
architect expressed the view in the next quote that transferring knowledge from past experience happened within the time series scenario in case study 1: as he said:

"... the original Dalgetys (AR1) project was handled by a series of modifications to the building regulations. The building doesn't comply with the building regulations because it is not a new construction construction. You can't build a timber-framed building with four floors of that size because it would modify the model of the building regulations by introducing the fire services, and sprinklers, and the compartmentation, and fire stairs to get a result that was acceptable to the building surveyor and the Building Referees because we started from scratch on the greenfield site ... the existing building had heritage value and Deakin wanted to keep that building's character, we were able to get around the building regulations by choosing different devices like the fire ... In Dennys (AR2), we had a fire engineer come in and do the fire engineering strategy ... We identified the engineering solution so that we modelled the building in the fire scenario. The report came up with strategies to allow us to keep that steel and timber frame building without collapse."

The experience of project team members in case study 2 was different in terms of the increased level of sensitivity about retaining the historical value of the buildings. There was more sensitivity regarding materials and workmanship applied to the project by project team members in the refurbishment process (the construction stage) compared to case study 1 where it was more focused on the early stage before the refurbishment activity.

### 8.2.5 Comparing the Component of Trust

In discussing the component of trust between project team members within the time series scenario, beliefs in professional (skills and knowledge) and individual (mutual) trust were expressed by the majority of project team members in both case studies. This study found that similar perceptions about the trust components in their relationships delivered a successful problem-solving process. With regard to the trust components, all types of intellectual capital including conceptual knowledge (skills), experiential knowledge (past experience), social routine knowledge (collaboration) and documentation knowledge (communication) went around the circle of relationships that were based on trust and honesty to successfully complete the project. The trust factor provided a clear view of the project team members’ satisfaction with actions undertaken by other members in the problem-solving process. As the architect from case study 1 said:

"... the teams were the same, very loyal: we have good quality consultants that we keep going back to, building up relationships with them. They understand how to use things and you understand how they operate and understand what’s good and not good, and vice versa. Definitely the relationship is very important ... with the consultant, we keep giving work to or finding work for because it helps out our teams, there is LOYALTY built up and TRUST and RELIANCE so we could rely on them ..."
8.3 Comparing Research Finding 2 in Case Studies 1 and 2 on Four Key Components of the Problem-solving Process in the Knowledge Transfer Context

The research findings on key components in relationship to knowledge transfer activities in case studies 1 and 2 were categorised in a similar pattern of responses and actions. The four key components identified in data analysis (chapters 6 and 7) that were experienced by the 14 project team members during the problem-solving process were efficiency and effectiveness mode (quicker or slower), same project teams, project team’s actions and sources of information.

8.3.1 Comparing the Key Component 1: Efficiency and Effectiveness Mode in the Problem-solving Process

Answers to the question in the interview instrument which asked “Given that you had worked on Project 1, were you able to solve problems quicker and easier?” contributed to identifying the key components in problem solving in relation to how efficient and effective the project team members were in solving the problems. Table 8.3 shows the negative responses from project team members who indicated that the problems were not easy and they needed more time to solve all the problems.

Table 8.3: Summary of negative responses from case studies 1 and 2

<table>
<thead>
<tr>
<th>Project Team Members’ Responses</th>
<th>Case Study 1</th>
<th>Case Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Responses</td>
<td>Difficulty in measurement and estimating</td>
<td>Difficulty in getting project information because lacking information in the client brief particularly the path that questions needed to go through within the client’s organisation (architect’s view)</td>
</tr>
<tr>
<td></td>
<td>Complexity in permit applications (building, planning and fire)</td>
<td>Complexity because the situation or problems were unknown and unpredictable (not stated in specifications) (contractor’s view)</td>
</tr>
<tr>
<td></td>
<td>Complexity in construction (refurbishment) process: needed to keep the existing building structure and fabric</td>
<td>Difficulty in suitting the existing buildings to the new functions (client’s view)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Complexity in terms of discussion and verification of decisions: every decision from each consultant took a longer time for each team member.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difficult to get agreement between the architect’s decision and structural decision to suit the new functions</td>
</tr>
</tbody>
</table>

A long time period was required for the measurement and estimation of the adaptive re-use works in order to complete the adaptive re-use cost planning and costing. The factors that
contributed to this difficulty was that the process needed many ideas about appropriate prices for the special workmanship and materials needed to integrate the old and new building components. The quantity surveyor in case study 1 mentioned that doing the measurements and estimates for adaptive re-use work, and particularly for the AR2 project, was more difficult than measurement for new buildings and general refurbishment. As he said:

“Obviously, it probably takes a longer time to measure and estimate a project like that because it needed a lot of ideas, increasing above what was normal. So, it was more difficult than a new building and more difficult than general refurbishment … It’s not easy to gain what we required … the process was going back … to the consultant meetings where a lot of issues surrounding the design and the construction were discussed.”

In case study 2, the project team members expressed negative responses about problem solving and that the problems were not easy to solve and needed longer times in order to produce the solution. This factor contributed to the difficulty because the process of gaining agreement and verification from each of the project team members caused time constraints. The reason for this difficulty was corroborated by each of the project team members working in large cities who were responsible for other projects as well. As the external project manager in case study 2 said:

“… take time to look at it or you can discuss it in the meeting … it takes time for that correspondence to go to everyone and to come back and then to make sure that it can work within the time frame … I think it’s little bit vague on the time frame for responding to our advice, and some of the finance updates and the reality is that when you find something on-site that’s a bit unusual, it can be absolutely urgent and need to be responded to right away. It’s difficult to manage that when you know that the other consultants all have other projects and you have other projects.”

8.3.2 Comparing the Key Component 2: Same Project Teams in the Problem-solving Process

In discussing the differences and similarities in responses about working in the same (or similar) project teams in a time series scenario, this study found that the majority of participants in both cases were similar in expressing a positive response. Table 8.4 describes the positive responses on working with the same (or similar) project team members during problem-solving activities.
The main positive responses related to the communication and collaboration benefits for project team members when they were back working together in sequential projects (e.g. AR2). Understanding of and familiarity with the problems, the process and fellow team members’ needs led to smooth communication and they collaborated well to identify solutions. The knowledge transfer activity happened when the project team members in both case studies transferred their experience from the AR1 project to the AR2 project. The knowledge accumulated in the AR1 project related to issues of fire safety, services and fittings: heritage issues in the AR2 project were where a lot of the same kinds of difficulties occurred. As the quantity surveyor in case study 1 said:

"Experience with the Dalgetys’ job (AR1) where experience with the same architect and builder certainly helped them to understand some of the problems that occurred in the Dennys’ job (AR2). So, that was how cooperation was done, with documentation of any information, and discussion from the early days rather than discovering it down the track."

8.3.3 Comparing the Key Component 3: Project Team’s Actions in the Problem-solving Process

The feedback from the majority of project team members in case studies 1 and 2 regarding taking actions was corroborated with the specific problems that occurred during project implementation.
Table 8.5: Actions taken by project teams in both case studies

<table>
<thead>
<tr>
<th>Project Team Members’ Actions</th>
<th>Case Study 1</th>
<th>Case Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actions taken</td>
<td>Modified the building regulations to suit heritage requirements in the building permit application.</td>
<td>Action for changes referred to the cost impact</td>
</tr>
<tr>
<td></td>
<td>Architect took immediate action to sort out the problems on-site (day-to-day actions) with other consultants and the contractor</td>
<td>Learning about the importance and being respectful of the culture and heritage buildings. Actions from client to make sure every project team member was aware about the significance of retaining culture and heritage.</td>
</tr>
<tr>
<td></td>
<td>Knowledge on how to deal with local authorities was transferred to AR2 in relation to retaining the building’s integrity in terms of heritage</td>
<td>Contractor was always prepared with questions to gain more information from consultants and the client in understanding the historical features hidden behind building materials</td>
</tr>
<tr>
<td></td>
<td>Always keeping track and keeping records and allocating the problems to the appropriate discipline for solving those problems.</td>
<td></td>
</tr>
</tbody>
</table>

The immediate actions taken by the principal consultants (the architects) demonstrated the main similarity in terms of actions taken to transfer knowledge while solving problems. The architect in case study 1 worked on the AR1 and AR2 projects on a day-to-day basis where he worked more on-site rather than from his firm’s offices. Hands-on working on-site provided initiative to respond with immediate actions when problems occurred. However, the only difference in case study 2 was that the architect worked more in her firm’s offices rather than on-site. The different way of working for both architects was due to their workloads with other projects. This study identified that the architect in case study 1 was a local architect in a regional urban area who had a minimum workload and gave his full concentration and focus to the AR1 and AR2 projects compared to the architect in case study 2 who was working in a large city area. This study found that the more experience and knowledge in adaptive re-use projects that project team members had, the faster the decisions were made and actions taken. The architect in case study 2 had less experience: therefore, the decisions were made and actions taken depending more on explicit documentation rather than on immediate day-to-day actions.

8.3.4 Comparing the Key Component 4: Sources of Information

The main difference in the key component of sources of information related to the volume of documentations to which project team members referred during the AR1 and AR2 projects to solve problems. This study identified that case study 2 referred to a lower volume of information sources compared to what had been referred to in case study 1. Table 8.6
shows the link between the sources of documentation and the types of knowledge used to help project teams to identify the solutions for problems in the AR1 and AR2 projects.

Table 8.6: Related knowledge from sources of information in problem-solving process

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Sources of Information</th>
<th>Related Knowledge from Sources of Information in Problem-solving Process</th>
</tr>
</thead>
</table>
| Case Study 1 (21 types of documentation) | Cost information  
Heritage information  
Fire engineering information  
Building regulation information  
Additional information | Knowledge on costing and pricing (estimating and cost planning of heritage building)  
Knowledge on adaptive re-use regulations  
Knowledge on other supportive information  
Knowledge on fire engineering  
Knowledge on heritage policy and regulations |
| Case Study 2 (11 types of documentation) | Contract information  
Heritage information  
Design information  
Building regulation information  
Additional information | Knowledge on contractual arrangements (procurement method for heritage buildings)  
Knowledge on adaptive re-use regulations  
Knowledge on other supportive information (bills of quantities for adaptive re-use)  
Knowledge on design in relation to heritage buildings including ESD  
Knowledge on heritage policy and regulations including occupational health and safety |

The main types of documentation identified in cross-case analysis as being different were fire engineering information and design information. The majority of project team members in case study 1 considered the fire engineering approach in the AR2 project as a new approach which had a major impact on the adaptation process. Their comments about the transfer of knowledge from this learning experience were based on how difficult the application process for the building permit was back in 1993 without the fire engineering approach. As the building surveyor said:

“So they were the challenges. I mean basically new regulations in a very old building was very hard, very hard because you’re basically dealing with a different construction time, so, and because of the type of building it was going to become, the fire safety had to be greater. In a building like that … most of the area in this building was unprotected steel or timber columns, unprotected timber floors.”
Also, the fire engineer provided documentation to show how the fire engineering strategy flows was helping project team members in case study 1 to solve the puzzle in relation to the fire safety strategy. Meanwhile, in Case Study 2, the majority of project team members indicated that the design information including the client brief was the documentation to which they referred most often during the adaptive re-use process. The design factors were considered critical in the implementation of the AR1 and AR2 projects in case study 2. The project team members most often referred to the design brief from the architect and client for the purpose of achieving ESD in relation to these heritage building projects. As the client in case study 2 said:

“When sustainability is affected … it was the biggest challenge in this sort of building and you know that adaptive re-use is sustainability that focuses to buildings or ancient official buildings … we have the design brief: there are the standards and expectations of what we want the design team to do, like colours, fittings, the spaces, how big an office should be, where the meeting rooms should be, the density of people within the building. The design brief that we have, the designers must use it and deviate from the brief, deviate and want to try something different. I have to know through the reporting structure. That is our guidance in how to design.”

The documentation to which the project team members referred obviously provided the knowledge that helped them in identifying specific solutions to specific problems.

8.4 Comparing Research Finding 3 in Case Studies 1 and 2 on Two Key Components of the Problem-solving Process in the Knowledge Creation Context

Two key components of problem solving in relation to knowledge creation were identified and discussed in chapters 6 and 7. The comparison of these two key components in case studies 1 and 2 is described next. The two key components in knowledge creation activities for problem solving, namely, generating new skills and developing new solutions, especially applied in the AR2 projects (in both case studies). The creation of new skills and new solutions for problems were dependent on project team members’ experience within the time series scenario. The accumulative experience, knowledge and skills were transferred from scenario 1, through scenario 2 and were used in the creation of new solutions for problems that occurred in scenario 3 (AR2). At the same time, project team members were creating new skills that provided the richness of intellectual capital related to adaptive re-use projects in their discipline.
8.4.1 Comparing the Key Component 1: Generating New Skills

In comparing this key component, the types of skills developed in the AR2 projects for both case studies are summarised in table 8.7. There were differences in the new skills generated during the process in the two case studies.

Table 8.7: Knowledge related to generating new skills

<table>
<thead>
<tr>
<th>Generating New Skills in Knowledge Creation</th>
<th>Case Study 1</th>
<th>Case Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills and knowledge</td>
<td>Research on the building materials</td>
<td>Knowing how to deal with crises by getting collaboration with other consultants</td>
</tr>
<tr>
<td></td>
<td>Tackling the building heritage situation</td>
<td>Skills to fit the building to its new purpose for future adaptive re-use projects</td>
</tr>
<tr>
<td></td>
<td>Knowing how to deal with local authorities when this related to heritage regulations</td>
<td>Skills in engaging with the multiple skills of subcontractors and the client's needs</td>
</tr>
<tr>
<td></td>
<td>Integrating and suiting the new services and finishes to heritage buildings</td>
<td>Skill in understanding and handling the different contract negotiations, settlement of the different variations (involved with various variations from time-to-time which were not stated in the contract document)</td>
</tr>
<tr>
<td></td>
<td>Pricing requirements for heritage building with special kind of materials and the current price</td>
<td>Skills on how to share the knowledge with skills networks in relation to involvement with old buildings. Responding to questions from other members of skills networks.</td>
</tr>
<tr>
<td></td>
<td>Fire engineering systems that suited heritage building requirements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Understanding the client's requirements in relation to heritage buildings such as the building characteristics, fire safety strength and steps for the next project</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thinking about fire safety based on technology (building model preparations)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skills related to heritage buildings with commercial purposes</td>
<td></td>
</tr>
</tbody>
</table>

The perceptions of project team members about the new skills that had been generated in the AR2 project demonstrated the similarity of their points of view which were still under the scope of the heritage field. The main evidence of new skills development among project team members in case study 1 was the approach using “know-how” skills within the process of adaptive re-use, but the methods of adaptive re-use were different. In the AR1 project in case study 1, most of the work was done by “trial and error” using social routines (collaboration) to find the solution for any issues that occurred during the planning, monitoring and control of the projects. The biggest issue was around fire safety in the AR1 project. As mentioned by the building surveyor in his interview:

“Pretty much so, again in Dalgetys (AR1), because of the new type of project it was, we supported each other. It was a very strong collaborative approach. So, a lot of people actually developed skills as I think, “trial and error” on the first one. The second one probably again, people like the fire engineer were involved, they had been involved in building control about 10 years before we started the Dennys’ (AR2) buildings. There was a lot more...”
In case study 2, the structural engineer mentioned that the new skills and knowledge generated depended on technology to solve the problems. As he said:

> “On that old property, we certainly had to look at the only way that we could build: that structure worked when it was completed. I think completed. It’s stood up at least in a certain way … the more complex the structure gets; the more you have to rely on technology. What I mean is that to prove to the builder that the building had to been done in a certain way, you had to do a lot of graphics work for him, to do the analysis and show the plot.”

The “know-how” to deal with the adaptive re-use process was the new skill that was generated from the learning experience in the AR1 project and other adaptive re-use projects in the intervening period. These skills and knowledge provided benefits to the project team members in making decisions to solve problems and potential problems for future adaptive re-use projects, with these decisions also reliant on technology.

### 8.4.2 Comparing the Key Component 2: Developing New Solutions

In discussing the development of new solutions in the AR2 projects in both case studies, the social routines (collaboration) and the documentation (communication) were the similar factors that affected these projects’ success. The development of good explicit reports and project documentation in the AR2 projects proposed new ways for finding the solution and prevented the loss of the intellectual capital of project team members after the completion of these adaptive re-use projects. The project team members in both case studies expressed the same perceptions about the way in which the solutions continued to use the heritage knowledge for future benefit. Having the same (or similar) project team members and relying on technology were the factors which helped project team members to solve new problems. The next factor identified which was similar in both case studies was the level of experience on related heritage projects which also supported this finding. Table 8.8 shows the summary of new knowledge related to the development of new solutions.
Table 8.8 Summary of comparison of developing new solutions between case studies 1 and 2

<table>
<thead>
<tr>
<th>The Development of New Solutions</th>
<th>Case Study 1</th>
<th>Case Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and solutions</td>
<td>Developing good explicit reports about project solutions</td>
<td>The methods of communication were upgraded to be more efficient and to make sure that everyone was comfortable with the solutions. Email systems were improved in AR2.</td>
</tr>
<tr>
<td></td>
<td>Synchronising ideas in good collaboration</td>
<td></td>
</tr>
<tr>
<td>Fire strategy based on the fire engineering approach to suit existing buildings’ structures and elements (timber and steel)</td>
<td>The new steering committee was developed in AR2 to sort out decisions including planning decisions for future adaptive reuse projects since RMIT still had a lot of historical buildings to be adapted. This did not happen in AR1.</td>
<td></td>
</tr>
<tr>
<td>Having the same (or similar) teams helped to develop solutions – knowledge about the previous project was never lost.</td>
<td>Developed their own methodology in accordance with the experience (of the contractor) in handling construction problems for heritage buildings since the existing structure and material were unpredictable.</td>
<td></td>
</tr>
<tr>
<td>Knowledge of the old building, how they put it together and how the building had actually been built originally</td>
<td>Developed an understanding of the human factors in solving problems. Developed the relationships and put out the sparks and found out how interesting it was working with people who had knowledge about historical buildings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Developed their own methodology in accordance with the experience (of the structural engineer) in handling the structural problems by increasing their knowledge on calculation and modelling in heritage projects to propose appropriate solutions.</td>
<td></td>
</tr>
</tbody>
</table>

8.5 Summary of Research Findings in the Two Case Studies

The purpose of this section is to summarise the research findings for both case studies (case study 1 and case study 2). The section begins by presenting the findings from the documentation analysis. Next, the discussion summarises the findings from the interview analysis.

8.5.1 Findings from the Documentation Analysis

To facilitate the adaptive re-use process, the client much preferred to employ consultants who were operating in the same area as the adaptive re-use site. However, this study found the critical impact that occurred where the consultants operating in a large city had a high workload compared to those who operated in a smaller regional city area. In the latter case, the focus on the adaptive re-use project was lacking as it was affected by project team
members’ workloads on other projects. This affected the problem-solving process as it would slow down the rate at which feedback and verification of the solution from each the consultants was received. However, the time-series scenario approach with the same (or similar) project teams could help this problem. Having the client and consultants understand and explore the history of the old building was critical before proceeding to the adaptation process. This situation was important for the architect (as principal consultant) in making decisions related to heritage. In making the design decision to adapt the original space to new and appropriate functions, the architect in the adaptive re-use process knew parts of the original that needed to be retained and preserved. The architect must study in detail why it should be preserved and how to integrate the old components and new components to achieve adaptive re-use success in compliant heritage work.

8.5.2 Findings from the Interview Analysis: The Relationship between Findings 1, 2 and 3

The relationship between project team members contributed to better collaboration and smooth communication. The reason identified was that they were working with the same (or similar) project team members on other projects. They understood the way that the other project team members were working with heritage buildings and this facilitated the smooth communication process in every single process in the adaptive re-use projects. Next, trust had already been established throughout their work history along the time series scenario. This study in summarising the data findings showed that there were two types of trust; trust of a person and trust of the skills and knowledge that were both established along the time series scenario. This supported them in making better decisions because they understood the project requirement with regard to heritage matters.

In relation to intellectual capital, this study found that four types of knowledge essentially occurred in the data from interviews conducted with 14 project team members, namely, conceptual knowledge, experiential knowledge, objective knowledge and collective knowledge. Relying on components of success, intellectual capital in the adaptive re-use project is very important in affecting the knowledge transfer activity and creating knowledge.

Firstly, it appeared that each action taken to solve problems was dependent on the individual’s level of skills in relation to the heritage concept. Secondly, how efficient and effective the project team members were in problem solving was dependent on their level of practical orientation. The project team members that had more experience in projects related to historic buildings were more effective in decision making and in identifying the appropriate ideas and solutions to solve problems. The experience factor also provided benefits to
project team members when they were confronted with unexpected problems during the implementation of adaptive re-use projects.

Thirdly, communication was dependent on the adequacy and completeness of the references or sources of information which were prepared by the client, consultants and authorities (Heritage Council of Victoria, and local and state authorities) including the design brief, drawings, bills of quantities and others. The more complete the documents, the easier the process of communication between project team members in seeking a solution for problems. There were two types of communication activities used in seeking solutions to problems, namely, internal communication (project team member’s organisations) and project communication. The communication process also relied on technology.

Fourthly, collaboration in these adaptive re-use projects was more effective because it depended on the appointment of the same (or similar) project teams in time series scenarios. By using the same (or similar) project teams, collaboration avoided misunderstandings and the use of different methodology in managing adaptive re-use projects as they related to problem solving. The study also found that changing the project team members brought about changes in the work, and the project time was extended because it was difficult to get collaboration with new project team members in project teams working on sequential projects.

8.6 Summary

This chapter presented the research findings and description of the comparison of the documentation data and interview data. Three research findings in relation to the interview data and findings from the documentation were also presented in this chapter. Section 8.1 showed the comparison of the documentation data which consisted of the similarities and differences in locations of the case studies, types of historical buildings versus their new functions, the time series scenario approach and the level of project team members' involvement in the AR1 and AR2 projects for both case studies. Section 8.2 described the comparison of research findings between the case studies as this related to the five components of success that contributed to the success factors (SFs) in adaptive re-use projects. Section 8.3 compared the four key components in problem-solving activities in both case studies in the context of knowledge transfer. Section 8.4 compared two key components of problem solving in the knowledge creation context. Section 8.5 summarised the research findings of the two case studies.
The next chapter discusses the links between the five components of success, the four key components in the knowledge transfer context and two key components in the knowledge creation context. These are addressed along with the previous literature review in answering the research questions and refining the model for the intellectual capital framework for adaptive re-use project success.
CHAPTER 9
DISCUSSION, SYNTHESIS AND REFINEMENT OF INTELLECTUAL CAPITAL FRAMEWORK FOR SUCCESSFUL ADAPTIVE RE-USE PROJECTS

Chapters 6 and 7 presented the findings for this study from case study 1 and case study 2 by organising the data from the documentation and interview process. Chapter 8 presented the findings from the cross-case analysis derived from the research findings in chapters 6 and 7. The purpose of this chapter is to discuss the research findings and to synthesise the findings into a diagram. This chapter will also discuss the refinement of the framework. This discussion and the refinement of the framework will take into consideration the literature on adaptive re-use, project management and knowledge management as discussed in chapters 2, 3 and 4, with both the discussion and the refinement guided by the two research questions:

1. What are the components of success and the key components of knowledge creation and transfer that contribute to problems solving on adaptive re-use projects within the time series scenario?

2. How do the components of success and the key components of solving problems rely on each other to help the development of intellectual capital framework for successful adaptive re-use projects?

9.1 Discussion on Research Findings

This study has investigated the component of success and key components in the problem-solving process in relation to knowledge creation and knowledge transfer. It has also examined how the components of success and key components rely on each other in transferring and creating the intellectual capital of project teams within a time series scenario in adaptive re-use projects. The research findings have indicated that in the problem-solving process, the contributing factors to adaptive re-use success were communication, collaboration, skills, past experience and trust. The project teams transferred their intellectual capital within the time series scenario using four key components that relied on the components of success to solve problems. These components were: (1) the effectiveness and efficiency mode in problem solving; (2) the sources of information on
which they relied to enhance their knowledge and which helped in identifying the solution; (3) the project teams’ actions to solve the problem; and (4) similar project teams working on AR1 and AR2 thus providing an intellectual capital benefit to the problem-solving process. In creating new skills and solutions in AR2, project teams relied on component of success and the four key components in the knowledge transfer process within the time series scenario. A framework which related intellectual capital to the problem-solving process for successful adaptive re-use projects was developed in this study.

There are three areas in which this study can contribute to a better understanding of the intellectual capital of project teams in developing solutions for problem solving in successful adaptive re-use projects.

The first contribution is that this study has discovered the component of success that are critical for adaptive re-use projects. This has been achieved by undertaking an in-depth analysis of the content of the documentation and interview data based on the richness of experience in two successful adaptive re-use projects. In the adaptive re-use literature, the identification of success factors in adaptive re-use projects was lacking the application of empirical research in exploring and analysing the content of the problem-solving process. This contributed to the difficulty of linking this finding to previous adaptive re-use literature. Even though the skills and knowledge of project teams have been mentioned continuously since 1980 by McGraw (1980) and Egbu (1997); Kincaid (2000); Latham (2000); Ball (2002); Shipley, Utz and Parsons (2006); Kurul (2007); Cys and Lawrence (2008); Zawawi and Abdullah (2008); and Watson (2009a, 2009b), they do not explicitly provide any in-depth research on how skills and knowledge are critically important to problem solving within a time series scenario.

This study has indicated that five components of success are relied upon in the knowledge transfer and knowledge creation process in order to successfully manage the richness of the intellectual capital of adaptive re-use practitioners. The success of adaptive re-use projects does not rely only on skills and knowledge but also upon the experience of project members working within similar project teams, the knowledge developed in the longitudinal process between two related projects and the development of professional and personal trust, all of which critically affected the process of transforming historical buildings into new useful functions. Shipley, Utz and Parsons (2006) along with Latham (2000) have mentioned that project teams need a catalyst (richness of experience) to encourage a spirit of teamwork, collaboration and communication in refurbishment work. Moreover, the evidence from this
current study has indicated that trust between team members was a core component contributing to success in adaptive re-use processes, particularly in a time series scenario.

The second contribution that this study has demonstrated is its three contributions to the knowledge within the success factors literature: this was in the process of developing the understanding of the role played by intellectual capital in adaptive re-use success which this study explored when developing a conceptual framework (chapter 4).

Firstly, this study has contributed to a deeper understanding of the importance of success factors and has revealed the lack of research on success factors in adaptive re-use. Secondly, this study has demonstrated that no empirical research has been conducted on the CSFs in adaptive re-use projects. The previous literature on success factors has empirically proven the importance of these factors in contributing to the success of the project, but has only focused on conventional projects, rather than on adaptive re-use projects. This study has synthesised, from the success factors in conventional projects, six components of success which apply within an adaptive re-use conceptual framework, namely, transparency and trust; supportive attitude; communication; appreciation and recognition; collaboration; and skills and knowledge. Pinto and Covin (1989), Iyer and Jha (2006) and Khang and Moe (2008) indicated that a supportive attitude on the part of top management proved to be critical in providing the project’s resources. However, this study has revealed that a supportive attitude, and appreciation and recognition are not critical in adaptive re-use projects, and more specifically, in the problem-solving process of these projects. Strong cooperation between the client and all project team members has been found in this study because the reliance on trust and longitudinal relationships within the process of adaptation. However, this study has also revealed that past experience, particularly in similar circumstances, has influenced success in adaptive re-use projects within a time series scenario, which was not at all explicitly described in project management literature on success factors. Thirdly, this study has proven that in conjunction with hands-on experience, qualitative research can contribute to an in-depth understanding in comparison to existing literature on CSFs which has used quantitative analysis and has not appropriately considered the management of the transferral and creation of the intellectual capital in complex projects.

For its third contribution, this study has confirmed the intellectual capital model that presented the types of knowledge which support the problem-solving process in adaptive re-use projects. The types of intellectual capital as numerated by Spender’s (1996) model and supported by the Nonaka and Krogh (2009) models framed conscious knowledge, automatic
knowledge, objective knowledge and collective knowledge as distinctly important. This study extended their findings by showing how the knowledge transfer and knowledge creation process and success factors in problem solving rely on each other to contribute to the success of adaptive re-use. The main finding in this study showed that mutual trust in the skills and knowledge of the project team is a core component in intellectual capital in relation to heritage knowledge. Heritage requirements and related regulations including recycling guidelines, fire regulations and local council requirements were collectively the most critical types of knowledge in the project teams’ intellectual capital along the time series scenario. This study has extended the finding by Wasan and Chotchai (2006) that there is a practice whereby the project teams are re-appointed to other conventional construction projects subsequent to the adaptive re-use projects.

In answering research question 1, this study suggests that intellectual capital in successful adaptive re-use projects within a time series scenario is built based on a strong knowledge core with the component of trust. The trust component that was developed within a time series scenario from AR1 to AR2 (long-term relationship) provided good collaboration and communication while identifying the solutions for heritage distractions and the technical challenges involved in integrating new and old material. For example, long-term relationships would be developed through a time series scenario in which the client employed the similar consultant (individual or organisation) in order to develop an understanding between the project team members through either personal beliefs or professional beliefs. Trust development within this scenario could provide for better communication and collaboration based on project team members’ experience not only of the process but also of the knowledge that has accumulated about heritage requirements and regulations, and the situation regarding heritage buildings. In terms of the understanding and ‘know-how’, the history of the early development of heritage buildings is critical for all practitioners when implementing the stage of transforming heritage buildings to provide new functions.

In relation to research question 2, this study suggests the key components required to achieve a smooth flow in the problem-solving process when identifying the solution for particular problems. These key components are what action could be taken and how effective and efficient the problem-solving process is when it comes to relying on the skills and past experience of project team members (relying on their intellectual ability and practical abilities) in relation to their heritage knowledge. How smooth the communication flow and how strong the collaboration of project teams in the problem-solving process in adaptive re-use could rely on the types of the sources of knowledge to which they refer and the appointment of similar project teams (either similar individuals or organisations). This
reliance on communication and collaboration could be known as objective knowledge as all professional knowledge on heritage has been documented as well as the social routine used in the process. Therefore, the study findings have indicated that the intellectual capital framework within the time series scenario was relying on success factors and key components in developing a new solution in sequential adaptive re-use projects.

9.2 Summary of the Main Research Findings

In this study, chapter 2 reviewed the non-empirical success factors in previous adaptive re-use literature. Chapter 3 reviewed previous empirical studies in the project management and knowledge management literature on SFs in relation to the construction industry. Chapter 4 of this study has developed a synthesised intellectual capital framework for successful adaptive re-use which has responded to the gaps in the adaptive re-use literature and to success factors gaps in the knowledge management literature (see figure 4.2). This conceptual framework identified six component of success that were critical in the problem-solving process in adaptive re-use projects, namely, trust, supportive attitude, communication, appreciation, collaboration, and skills and expertise. With these six success factors, the contribution of knowledge creation and knowledge transfer activities helped the project team members to identify the solution. The knowledge of project team members was continuously collected thus increasing their knowledge and experience in undertaking projects related to heritage buildings.

Chapters 6 and 7 described three findings from case study 1 and case study 2. The approach used to analyse the content within-case of the data from the interviews and the documentation was repeated in both chapters. The three findings were a reflection of the study’s research questions. Within qualitative research, the content analysis of data from interviews provides the frequencies of perceptions based on extensive quotations from the interviews in the report. Finding 1 referred to the five components of success that contributed to the problem-solving process. The five components of success that were critical in adaptive re-use were collaboration, communication, skills, past experience and trust. Trust was strongly developed within the time series scenario wherein the client engaged similar project teams (both individuals and organisations) in AR1 and AR2. These within-case analysis chapters also identified four key components in the problem-solving process that applied to the project team members in the time series scenario in relation to how the related adaptive re-use knowledge was transferred during the process. These key components were: similar project teams, the efficiency and effectiveness mode, the project team’s actions to solve the problems and the sources of information providing the relevant knowledge to the
project team members' intellectual capital. Furthermore, this study found two key components related to the creation of new skills and solutions for AR2 were experienced by the project team members thus helping them to solve the problems. This study also found that each of the three findings relied on each component. As an example, collaboration was good between the project team members in AR1 and AR2 because they knew each other personally and knew the ways in which project team members worked. This indicated that each member respected every action that they performed together since they were familiar with how the individual had worked on AR1.

Chapter 8 described the similarity and differences of the research findings by comparing case study 1 and case study 2. This cross-case analysis helped this study to describe the similarity and difference of the research findings. The analysis in chapter 8 described the three main findings which were five critical success factors, four key components in knowledge transfer and two key components in knowledge creation. The data findings showed that knowledge related to heritage including the understanding about and knowledge of the building’s history, and heritage requirements and regulations were critical in intellectual capital development in the problem-solving process.

9.3 Synthesis of the Research Findings

Figure 9.1 combines the findings of the three previous chapters into a diagram to show the process of problem solving in adaptive re-use projects within a time series scenario relying on components of success and some key components related to knowledge transfer and knowledge creation activities. The relationships of three loops of activity in the problem-solving process within a time series scenario (scenarios 1, 2 and 3) are demonstrated. The first loops demonstrate the factors that contributed to a successful process and which were critical in identifying the solutions. The second loop after the success factors (SFs) loop represents the circle of knowledge transfer activity, with the two small loops on the right and left demonstrating the knowledge creation process in AR2.
Figure 9.1: A Diagram Synthesising the Research Findings

Notes: SFs = Success Factors; KT= Knowledge Transfer; KC= Knowledge Creation

= First Loop
= Second Loop
= Third Loop

The long arrows (at the top and bottom) in the diagram show the period of the time series scenario presented as three scenarios. Scenario 1 is the period of Adaptive Re-use 1 (AR1) project from its start to completion. The duration of scenario 1 depends on how long it took to complete the project which was approximately three years for the two case studies which formed the project’s background. Scenario 2 shows the intervening period, that is, the time between scenario 1 and scenario 2. The intervening time period was approximately 10 to 13 years. In this intervening period, the intellectual capital of project team members could be
demonstrated by their skills and knowledge in their experience or involvement whether it was more on projects whether related to heritage or in conventional new-build projects. This scenario showed that the majority of project team members had sharpened their knowledge and understanding on heritage. Within this scenario, the study found that the involvement in conventional projects did not affect the problem solving in AR2. Most project team members only used their knowledge from conventional projects with their heritage knowledge to help identify the problems for management purposes but not for solving technical problems. Scenario 3 shows a similar explanation to scenario 1. This presents new sequential projects that relate to scenario 1 where the client has employed similar key individuals in scenario 1 and scenario 2. This situation indicates that the client was satisfied with the project team members from the previous adaptive re-use project (AR1) (scenario 1) and ensured that the knowledge and understanding from the AR1 project could be transferred to AR2 (scenario 3).

The middle diagram between the time series scenario arrows (top and bottom) shows the three loops of the relationships between SFs, knowledge transfer (KF) and knowledge creation (KC) in relation to the three main research findings from the interview analysis. These three main research findings are indirect response to the research questions:

1. **What are the components of success and the key components of knowledge creation and transfer that contribute to problems solving on adaptive re-use projects within the time series scenario?**

2. **How do the components of success and the key components of solving problems rely on each other to help the development of intellectual capital framework for successful adaptive re-use projects?**

**First Loop**

The first loop in the diagram is the SFs in adaptive re-use. Through the case studies' in-depth analysis of the data interview content, it was found that the success factors, namely, trust, collaboration, communication, past experience and skills were critical in their contribution to the problem-solving process. The line in the diagram between the factors shows the strong relationships between the types of knowledge that create intellectual capital. Collaboration explained the *collective knowledge* activity in the social routine within the adaptive re-use work. Communication related to *objective knowledge* where it represented the shared body of knowledge which was explicitly documented. In the study, this communication stage was smooth flowing due to frequent meetings in which the client and consultants prepared well-documented information, especially design and historical
information, to which they referred when problems occurred, particularly when these were unpredictable problems. Past experience considered the *experiential knowledge* based on the practical orientation of project teams in AR1 (scenario 1) and on other adaptive re-use projects or projects related to heritage buildings in the intervening period (scenario 2). This study found the project team member with the most experience in adaptive re-use relevant to their responsibility was the principal consultant (architect) in case study 1. The more involved that project team members were in adaptive re-use projects, the more experience that they accumulated and the higher the quality of the decision making and the solutions provided. Knowledge and understanding about the building’s history before any design work was done was most critical in the adaptive re-use process and this was developed from experience in related projects.

The skills of the project team members that were identified from the interview data related to *conceptual knowledge* which focused on individual skills and intellectual abilities in the problem-solving process. The data findings showed that the skills and intellectual abilities of project team members in adaptive re-use projects showed an understanding of the previous project’s situation and the historical background of the buildings. The skills that were developed from scenario 1 (AR1) and from other projects that related to heritage buildings in scenario 2 helped the project teams to identify the problems before the same problems could occur in AR2. In the diagram of the SFs’ stage, trust among project team members was identified as the core of the problem-solving process. Trust being both individual and social was blended between *professional and personal beliefs*. This study found that trust developed among project team members within the time series scenario. Trust was strengthened by retaining similar project teams, either in terms of individuals or organisations, in sequential projects (AR2) in scenario 3. The development of trust enabled collaboration and communication to flow smoothly and to work well as the social routine within the adaptive re-use projects. Trust in individual skills and respect for the experience of every member of the project teams was also found in the problem-solving process used in transforming heritage buildings so they could be used for university purposes. Trust as a SF was newly recognised as contributing to the problem-solving process within the knowledge transfer and creation dimensions in adaptive re-use projects.

**Second Loop**

The second loop represents the activity of knowledge transfer in project problem solving. The four key components in problem solving in relation to knowledge transfer were the implementation of similar project teams in AR1 and AR2; the sources of information; the effectiveness and efficiency mode of problem solving; and the project teams’ actions that
were taken during AR1 and AR2. This study found that there was a strong relationship between each of key components and that the CSFs relied on each component in the problem-solving process. The first key component, similar project teams, relied on the effectiveness of and success in collaboration in the adaptive re-use projects. The project team members had known each other when they returned to work on AR2 after having completed AR1 approximately 10 years before. This study found that, even if the project team members had gone back to their own organisation and been involved in other projects during scenario 2, the relationships still continued between the project team members. Another factor that contributed to the application of a similar team in AR2 was that some of the project team members were still doing a small amount of sequential work in scenario 2 in similar client organisations. The satisfaction of the client with the project teams in previous projects and their improved understanding of the process and background of AR1 projects were the reasons for this first key component.

The sources of information were the second key component in the problem-solving process that helped project team members during the time series scenario. The communication process relied on the completeness of the documentation to which project team members referred when identifying solutions during meetings and in basic communication through email and telephone. The sources of information in adaptive re-use projects provided relevant knowledge to the project team members. This study identified at least five main types of information that were critical in solving problems which were: knowledge related to heritage policy and requirements, fire engineering, history of the buildings, the procurement method in heritage buildings, costing and estimating, and building regulations that were applicable to heritage buildings. This is one activity in which the project team members transferred their knowledge through their social routine.

The third key component in the knowledge transfer loop was the effectiveness and efficiency mode in the problem-solving process. This study identified that project team members required a long period in which to solve the technical problems in the adaptive re-use process. Solving technical problems needed a longer time to get the decision and verification from all project team members because each technical problem related to the existing material and workmanship affected the total construction cost. However, the level of effectiveness in providing the right solutions with heritage, fire strategy, safety and health and other requirements was good because this relied on the past experience of project team members. The greater the project team members’ experience in historic buildings, the more effective they were in producing and proposing the solution but the process of verification of
each proposed solution still required a long time. This knowledge transfer happened between individuals in the social routine of problem solving.

The last key component in the knowledge transfer loop was with regard to the actions that were taken by project team members. In the social routine of problem solving, each of the actions was dependent on the individual skills and intellectual abilities of each of the project team members in scenarios 1, 2 and 3. The synchronisation of ideas and actions from each of the members when solving problems was the knowledge transfer criterion between them. The knowledge transfer activity in the second loop shows that each of the key components and the SFs were relying on each other to deliver a successful problem-solving process in the adaptive re-use projects. The loops represented what was revealed in data interviews which was that knowledge transfer content occurred in the time series scenario from AR1 (scenario 1) and AR2 (scenario 2) to the problem solving in AR2 (scenario 3).

Third Loop
The third loop in the diagram represents the activity of knowledge creation which happened in relation to developing new solutions and new skills in AR2. The small loop on the right represents AR2 (scenario 3) and demonstrates the new skills generated during the development of new solutions for problems that were never experienced by project teams in scenarios 1 and 2. This study found that generating new skills during problem solving in AR2 happened individually rather than collectively. Each individual generated their new skills in identifying the best solution for fire safety, managing the authorities’ requirements in planning and building permit applications, or meeting the heritage requirements through their past experience in involvement in scenarios 1 and 2. The small loop of knowledge creation at the left demonstrates the development of new solutions, the process which happened in the social routine with great collaboration and a great communication process because this relied on detailed documentation (the source of information) and respected the value of the long-term relationships which had contributed to the process of new solutions for AR2’s new problems.

In summary, this diagram presents a complete picture of what occurs with the SFs and key components for the problem-solving process in relation to knowledge transfer and knowledge creation (which was in response to research question 1). Also, it demonstrates how the SFs and six key components relied on each other during the process of problem solving when unique solutions were required for unique problems particularly for technical and safety problems which were related to the existing material conditions (which was in response to research question 2). Knowledge creation in adaptive re-use problem solving
within a time series scenario was identified as happening after knowledge transfer. This situation was the reverse to what happened in new building or conventional projects because the process of knowledge management there starts from zero knowledge about the building, and then creates knowledge, transferring it to other projects. However, adaptive re-use projects within a time series scenario readily demonstrated that the knowledge related to heritage projects in project team members’ intellectual capital was accumulated from scenario 1 and scenario 2 and was considered to exist before the creation of knowledge in scenario 2.

9.4 A Refinement of the Intellectual Capital Framework for Successful Adaptive Re-use Projects

The synthesised diagram (see figure 9.1) identified five critical component of success that reflected four key components of problem solving in knowledge transfer and two key components of problem solving in knowledge creation in adaptive re-use projects within a time series scenario. Through representation on the diagram that was synthesised from the findings, the researcher has increased the understanding of the success factors and key components in the problem-solving process within knowledge transfer and knowledge creation activity. The proposed conceptual frameworks (in chapter 4) will be refined in this section to provide a framework that is more pragmatic and practical in order for it to be compatible with the real world situation. The development of the intellectual capital framework illustrates the link between four types of intellectual capital, the critical success factors and the six key components for solving problems through practical processes. Figure 9.2 shows three stages of the components that contribute to the problem-solving process in adaptive re-use projects.
In this framework, the problem-solving process that contributed to success in adaptive re-use projects occurred in three stages as follows:

- **Stage 1: The core success dimension**
- **Stage 2: The knowledge transfer dimension**
- **Stage 3: The knowledge creation dimension**

**Stage 1: The core success dimension**
To achieve success in solving problems in adaptive re-use projects, five components of success critically drive project team members pointing out their responsibilities for successful project completion. In this stage, the project team members’ skills relate to the four types of intellectual capital that have been defined as: conceptual knowledge relying on skills; experiential knowledge relying on past experience; collective knowledge relying on collaboration; and objective knowledge relying on communication. Trust relying on the components of skills, past experience, collaboration and communication is the core...
component in the problem-solving process in adaptive re-use projects. Trust develops from the time series scenario and needs long-term relationships among the project team members for this to occur. The trust component impacts at the level of both professional trust and personal trust. If both levels of trust are well developed, the mutual trust among project team members makes smooth and successful processes of communication and synchronisation of knowledge for problem solving. All of this relies on the level of skills and past experience of project team members that has accumulated within a time series scenario. The professional trust between the architect and structural engineer led to the design decision which successfully adapted the complicated heritage building space to suit the new university space. This mutual trust helped the project team members to provide a solution which was particularly satisfactory from the client viewpoint.

Project team members’ skills related to the knowledge and ability to handle unexpected problems that particularly happened in projects involved with heritage buildings. The project of transforming unused historical buildings attracted unexpected problems during the construction process. The situation was possibly dangerous to the project team members with the whole project team needing specific protection during the practical problem-solving process on site. Knowledge and skills related the hazards were also significant to the success of adaptive re-use projects and included knowing about the health and safety regulations, fire regulations, heritage regulations and building regulations that would be amended to suit the building’s functionality.

Past experience is the practically-oriented knowledge that accumulates from past projects and the intervening period in a time series scenario. Gaining knowledge on how to deal with the local authorities including the fire department in the applications for building and planning permits has a critical impact on the problems at the planning stage. Most important here is that this framework shows that past experience on projects with similar characteristics (involved with heritage buildings) contributes to increasing the level of sensitivity about the building and retaining the historical and architectural value of the building. Other related knowledge affecting intellectual capital is on how to deal with the historic building situation in relation to workmanship and materials to achieve the successful integration of the new components with the existing old components. This needs specialised knowledge, either conceptual or practical, on the work methods for refurbishment.

Collaboration is the tool in the process for gaining full cooperation and understanding in knowledge transfer through sharing the individual’s knowledge. This includes information about the building’s background, costing and pricing, knowledge about heritage and fire
protection for heritage buildings, building regulations to suit heritage buildings, and the potential problems and complexities of the process according to previous experience. Within this knowledge lies the mechanism of the intellectual capital of project team members who establish good collaboration because they work in harmony and easily synchronise the multidisciplinary ideas. This achieves time, cost and quality benefits in a successful project but the critical achievement in the adaptive re-use project must result in the retention of the historical and architectural value in the new look university building. Collaboration is also related to the practice of collective problems but the direction for the solution pointed to the appropriate project team members in accordance with their individual roles and technical responsibilities.

Communication in successful adaptive re-use projects occurs in open discussion and frequent meetings. The consistency of the communication process lies in identifying the solution’s effects and depends on the skills, knowledge and experience in adaptive re-use projects. Each of the project team members stood by their intellectual ability in relation to how to derive the best solution for integrating the new and old building components for new functions, for example, preparing the fire engineering solution for fire protection in heritage buildings for new functions through the use of technology tools. This also involved the avoidance of clashes in responsibilities with the consultants thus ensuring that the problem was solved by the right discipline in the area of heritage buildings. The communication levels were identified as internal communication and project communication. When problems occurred in the project; the first stage identified the solution within the project team member’s organisation through the internal communication channel and, in the next stage, the communication among the project team members in the project organisation was confirmed, verified and agreed upon by other disciplines.

**Stage 2: Knowledge Transfer Dimension**

The project teams members’ actions are carried out step by step to undertake adaptive re-use problem solving. The major actions are critical in and rely on individual and social skills related to how to modify the building to suit heritage requirements for the building permit application and the need to track the industrialisation status and to understand the client’s requirements in heritage situations. The project team members can take immediate action to solve the problems on site (day-to-day actions) when the solution does not affect the major costs or heritage regulations. This knowledge can be transferred among the project team members individually and becomes the social routine within the time series scenario. This framework also can show the knowledge gained on how to be respectful of the culture and of the heritage buildings. With this framework, the project team members can always keep on
track and record and allocate the problems to the appropriate discipline for them to be solved.

This framework can also show the necessity of knowing how to effectively and efficiently problem solving in adaptive re-use projects when relying on the past experience of project team members. The problem solving process is not as easy or as fast as in conventional projects. It requires a significant amount of time to study and analyse the situation when it involves old materials and old workmanship and the integration of new and old components. Historical buildings incorporate hazardous materials such lead paint and asbestos that require time, effort and knowledge for the analysis and identification of the best solution for this particular problem. Other situations which are affected by the problem solving mode on which this framework contributes an understanding include the difficulties in doing measurements and estimates for adaptive re-use project cost planning, in applications for planning and building permits, and the technical complexity involved in retaining some of the existing building structure and fabric. Difficulty in getting project information because of information lacking in the client brief particularly on the path through which questions need to go in the client’s organisation and unpredictable problems are impediments of which project team members need to be aware if they were involved with adaptive re-use projects. This framework provides an in-depth understanding and awareness so that practitioners can achieve success in adaptive re-use projects.

The appointment of the same project team is the appropriate method for transferring knowledge from project to project in a time series scenario. The positive response from the appointment of similar project teams either of individuals or of organisations offers effectiveness in communication and collaboration because understanding occurs in the process of identifying the solutions. This framework also demonstrates how the level of understanding on building regulations suited to heritage buildings relies on collaboration and past experience with previous projects to develop a better result for future projects within the time series scenario. This framework also demonstrates familiarity with the knowledge on how to manage the heritage situation and how to manage and collaborate with multidisciplinary teams in adaptive re-use projects.

Sources of information are explicit knowledge that can help project teams in managing to identify the solutions for adaptive re-use project problems. Communication relies on the degree to which the documentation prepared for the project is complete and rich. This framework also shows the knowledge transfer from explicit to tacit within project teams and documentation during communication. There are five main types of sources of information.
which can be delivered throughout the process of adaptive re-use. The information of which all practitioners should be aware when they are involved with adaptive re-use includes cost information, heritage information, fire engineering information, building regulation information and additional information (drawings, contract documents and records of previous projects). This contributes to and helps the project teams to enhance their knowledge before and during the adaptive re-use process in the knowledge-related contractual arrangement (the procurement method in heritage buildings). This includes knowledge about adaptive re-use regulations and other supportive information (e.g. bills of quantities for adaptive re-use); knowledge about design in relation to heritage buildings including ESD, and knowledge about heritage policy and regulations including occupational health and safety. When each member of the project team in adaptive re-use projects has this knowledge, the transferral of their knowledge through communication happens more effectively.

**Stage 3 Knowledge Creation Dimension**

This framework divides the knowledge creation dimension into two activities: generating new skills and developing new solutions for sequential projects. The activities of generating and developing new skills and solutions rely on the core of critical success factors and the knowledge transfer components. If the project teams have trust and skills, their reflections from previous actions in previous projects, and complete and accessible sources of information during communication, the new skills that potentially are generated include the skills in conducting analysis using appropriate methods on the building materials. The skills involved in knowing how to manage unpredictable situations and deal with local authorities are related to the heritage regulations thus gaining good feedback and achieving understanding during the application process. This dimension also demonstrates the new skills in knowing how to integrate and tailor the new services and finishes within heritage buildings with the right heritage quality and requirements. This framework provides an understanding of the dimension of knowledge creation in achieving project success particularly for adaptive re-use projects.

In creating new knowledge that relates to the development of new solutions, this framework suggests that past experience (individual) and collaboration (social) are the key components in the problem-solving process. The new solutions are created by the project team members if similar teams are involved in sequential projects where the knowledge about the previous project is both useful and never lost. This framework also demonstrates that the way to create more efficient communication is by ensuring every project team member is comfortable and confident with the solutions. The new steering committee in the project organisation is helped with all kinds of decisions including planning decisions for future
adaptive re-use projects. Project teams can have their own problem-solving methodology according to their experience in internally managing the construction problems (the project team’s organisation) but still be within the scope of heritage matters. Developing an understanding of the human factors involved in solving problems is also demonstrated in this framework. This involves improving relationships and interest in the people working on the project who have knowledge about the historical buildings.

This study has demonstrated that knowledge and understanding of the process of problem solving in important in achieving adaptive re-use success and confirms the findings of Kurul’s (2007) and Kincaid’s (2000) studies that had limited knowledge and understanding of how the process of adaptive re-use contributed to difficulties in managing the complex process.

This finding expands the point that the client and consultants have full responsibilities in their tasks related to the problem-solving process, a point that was covered by Kurul (2007) who explained that the competent client and consultants wisely managed the overall process which contributed to the success of the heritage project. The responsibilities of the client and consultants were achieved through close collaboration and effective communication in every problem-solving process. Each problem was directed to the most appropriate project team member especially the problems for which the solutions required historical and technical knowledge.

This framework suggests that SFs are components of success that contribute to the problem-solving process and are core components in achieving adaptive re-use success. This finding extends Spenders’ (1996) model of intellectual capital and knowledge types as components of success that are critical in problem solving. The conceptual knowledge related to individual skills and intellectual abilities is considered as ‘individual explicit’. ‘Individual tacit’ in experiential knowledge is dependent on the practical orientation of project team members from previous sequential projects and other adaptive re-use projects.

Kincaid (2000) found that to achieve success in adaptive re-use projects, the process and the end of the project must not only meet the client’s requirements on time, cost and quality but also in maintaining the historical significance and architectural value of historical buildings. This finding was consistent with Kincaid’s (2000) finding in which the activities of problem solving in the adaptive re-use process showed the knowledge and understanding of the process, the building’s history and heritage requirements occurred in the individual’s intellectual abilities. The end-product of the buildings provides the evidence of whether the
historical significance and architectural value of historical buildings have been maintained. However, this framework extends Kincaid’s (2000) theories by showing how the knowledge and understanding of the process, the building’s history and the heritage requirements are reliant on the intellectual capital management within a time series scenario. Furthermore, this framework also shows that the knowledge and understanding of the project when applied by similar project teams in future adaptive re-use projects is stronger than when different project teams have been involved in each project. This is difficult to link with the literature because little research has been published on this matter.

This framework suggests that creating new knowledge related to the development of new solutions and the generation of new skills in adaptive re-use depends on all types of knowledge including individual explicit and tacit knowledge, and social explicit and tacit knowledge. Nonaka and Krogh (2009) synthesised the knowledge creation model as tacit and explicit individual knowledge and tacit and explicit social knowledge. This study confirmed Nonaka and Krogh’s (2009) model in which stage 3 of the problem-solving process was related to generating new skills and knowledge and to developing new solutions for new problems that could occur in future projects. In this stage, they suggested that, in generating new skills, project team members needed to rely on the knowledge transfer activity which was involved with the previous project team members’ actions and the previous sources of information which had solved any problems that had occurred in the heritage situation. This stage in the framework confirms Farshchi and Brown’s (2011) point that the creation of new knowledge could lead to new solutions for problem solving and to other processes in the built environment sector.

Moreover, this framework integrates the individual and social skills, experience, communication, collaboration and trust components as the core of success. The individual tacit and explicit knowledge attached to the history and the technical and management aspects accumulate to consolidate social tacit and explicit knowledge in the social routine to support the activities of knowledge transfer and knowledge creation in adaptive re-use projects. This framework confirms London and Chen’s (2004) theory that the component of intellectual capital is the accumulation of skills, experiences, competencies and knowledge of project teams.

The present framework identifies the relationship and the reliance between the SFs, knowledge transfer and knowledge creation in the problem-solving process. It is difficult to link this finding to the previous literature, because little research has been published in this field. The lack of empirical research on adaptive re-use success, the lack of research on
project management success related to adaptive re-use projects and the lack of research on using knowledge management to support a whole series of research studies lead to this present framework’s contribution being a new approach in the area of SFs and adaptive re-use research. Watson (2009a) had identified that implementation project management tools and concepts were success factors in heritage projects, but the research was not empirically based. The complexity of adaptive re-use was mentioned by Kurul’s (2007) and Latham’s (2000) studies which involved the entire adaptive re-use process. This current study has expanded the meaning of complexity as involving the whole process but has contributed to the detail of the complexity in terms of problem solving where was not covered by Kurul (2007); Kincaid (2000) or Latham (2000).

9.5 Summary

This chapter has discussed the main findings in this research which relate to the previous literature. The three main findings from the contents analysis of case study 1, case study 2 and the comparison case were synthesised into a diagram. Based on the discussion and this synthesised diagram of the main findings of this research, section 9.4 has refined the conceptual framework to develop the pragmatic framework for the use of adaptive re-use practitioners in achieving a successful problem-solving process and project success.

The next chapter describes the conclusion of this research with a summary of the research findings, limitations, suggestions for future research and the contributions of this research.
CHAPTER 10
CONCLUSION

This research has investigated the components of success that are critical in the problem-solving process, and the key components of the problem-solving process that have contributed to knowledge transfer and the knowledge creation dimension in successful adaptive re-use projects. This research has also explored the reliance between these components during the problem-solving process that has contributed to the management of the project teams’ intellectual capital within the time series scenario. The research findings in this study are relevant to answering the two research questions. Section 10.1 will describe the summary of the three research findings. Section 10.2 will discuss the limitations of the research design. Section 10.3 will suggest potential areas of future research that have been identified from this research. This thesis concludes by identifying the research contributions for both academics and adaptive re-use practitioners.

10.1 Summary of Research Findings

This research has investigated the components of success that critically contributed to the process of problem solving in four adaptive re-use projects from two case studies. This research has also identified four key components in relation to knowledge transfer activities and two key components in relation to knowledge creation and how the components relied on each other and contributed to the management of the project teams’ intellectual capital within the time series scenario. This section is based on the research findings which related to the two research questions proposed in chapter 1.

10.1.1 Research Findings for Research Question 1

Research question 1 related to success factors, and knowledge transfer and knowledge creation components that in turn contributed to the process of problem solving which
involved project teams’ intellectual capital within a time series scenario. Three main areas that relate to research question 1 will be addressed in this summary.

**What are the components of success and the key components of knowledge creation and transfer that contribute to problems solving on adaptive re-use projects within the time series scenario?**

This research question is mainly answered in two stages for the three main areas, namely, component of success, knowledge transfer key components and knowledge creation key components.

*Literature stage:* a thorough interdisciplinary literature review of both adaptive re-use and project management literature that focused on critical success factors as presented in chapters 2 and 3.

*Case study stage:* identified hands-on experience to support the conceptual model that was developed based on the thorough literature review, and informed by the concept of knowledge management. This was discussed in detail in chapters 4, 6, 7, 8 and 9.

**Literature Stage**

Success factors in adaptive re-use were related to the factors of the responsibilities of client and project teams which were concerned with the adaptive re-use requirements related to historical buildings (as reviewed in section 2.1). All of the requirements, including heritage regulations, building regulations, fire regulations and all other related regulations must be matched to the skills of the project teams to ensure the integration of the new and old components in successful adaptive re-use projects. Project teams need to have a better understanding of the whole process of transforming abandoned historical buildings to meet new functions, because this process provides an opportunity to enlighten a new generation about the evidence of history. It also provides a historical phenomenon united with modern development.

This study identified from the literature that there were different disciplines, skills and knowledge among the project teams and that these were affected the processes of communication, collaboration and trust, synchronising the ideas in solving the problems and achieving project success in the process of adaptive re-use. The skills and knowledge were stimulated by the understanding of their own roles and that of other project team members in relation to problem solving (Egbru 1997; Latham 2000; Shipley, Utz and Parsons 2006; Watson 2009a, 2009b; Zawawi and Abdullah 2008). In developing good relationships and
the success of the project, communication, collaboration and trust must be developed by an efficient catalyst to encourage a spirit of teamwork in the process of surveying, briefing, conceiving, designing, costing, engineering, approving, funding, detailing, specifying, pricing, implementing, commissioning and occupying (Latham 2000). This study also found that the source of complexity in the process of adaptation is often a lack of skills and knowledge (Shiptley, Utz and Parson 2006). This is related to previous studies that indicated that skills and knowledge are important in adaptive re-use. However, although all of the skills and knowledge were mentioned as being common skills and knowledge, this study found, for the purposes of a case study, that the skills and knowledge of project teams in adaptive re-use must be relevant and rich with historical knowledge.

In addressing the gap within adaptive re-use literature, this study reviewed the project management literature which focused on critical success factors. Based on an empirical study by a previous researcher, this study has synthesised the components of success in relation to adaptive re-use into the following six critical components: skills and knowledge, collaboration, appreciation and recognition, communication, supportive attitude, and transparency and trust (section 3.2). However, the empirical study was focused on common projects and not qualitatively on the purpose of specific adaptive re-use projects. As described in chapter 3, Chen and Chen (2007) stated that a mutually satisfactory solution can be achieved by cooperation when seeking an alternative solution to a problematic situation. For such a resolution, a collaborative relationship and enthusiasm for working in groups are very critical in order to maintain an understanding of the integration of the project’s mission with heritage requirements. Such a finding is similar to that of Baccarini and Collins (2003) who found that all project team members must be compatible and work in harmony.

The investigation of success factors in adaptive re-use led to the development of a conceptual framework, as presented in section 4.3 and figure 4.3, based mainly on a review of the adaptive re-use and project management literature. This shows that, in regards to intellectual capital and in the context of a time series scenario, project teams need to be supported by the knowledge management literature in order to link the adaptive re-use and critical success factors in the process of problem solving. The theoretical framework (chapter 4) that was developed based on a highly synthesised literature review (chapters 2 and 3) in relation to the knowledge management approach can be summarised as follows:

1) The correlation of trust in the activity of sharing project teams’ intellectual capital is critical in construction projects (Ma, Qi and Wang 2008). The process of gaining trust among the project teams is so crucial that all of the project team members must clearly understand the projects in which they are involved (Bacarrini 1999).
2) Martensson (2000) stated that the success of knowledge management as a strategic management tool is comprised of critical components such as top management support, communication, incentives, knowledge sharing, and the idea of collaboration and cooperation.

3) A construction project is unique and requires collaboration among multidisciplinary project teams’ members at each stage of involvement, regardless of whether they might or might not work together again (Dave and Koskela 2009). Collaboration makes sure that a clear target is set for the project teams and ensures that they are travelling in the same direction (Baccarini 1999). Significantly, this research has chosen unique case studies where the client has appointed the same architect and contractor to manage projects in different eras.

4) A construction project involves skills in the preparation of project schedules, in the technical tasks for which the teams have the availability of required expertise and the aid of technological tools to accomplish the action steps, in monitoring and feedback in which the information flow is comprehensively controlled at every stage in the design and construction process and the ability to handle unexpected crises and deviations from what has been planned (Slevin and Pinto 1987). The intellectual capital in relation to skills and expertise needs to be developed and accumulated without any interference from project to project to ensure that the creation and transferring process has occurred (Westerveld 2003). The skills component will aid in handling the complexity of the design and construction process in adaptive re-use projects (Kurul 2007).

5) Slevin and Pinto (1989) highlighted that communication was critical in providing an appropriate network and necessary data to all key actors in project implementation. Communication in construction was linked to the understanding of project teams with projects whose criticalness had been approved in the DeWit studies in 1988.

The investigation of the first research question aimed to demonstrate the components of success that are critical in adaptive re-use processes, including solving those problems in relation to the components of knowledge transfer and knowledge creation in project teams’ intellectual capital within a time series scenario. This led to the development of the methodology described in chapter 5. A case study research method was used to investigate the experience of project teams in two sequences of adaptive re-use projects in different eras. The result was an understanding of the link between the success factors and the key components of knowledge transfer and knowledge creation in the problem-solving process within a time series scenario. This led to the second stage of the conclusion for research
question 1, relating to the critical success factors and key components of knowledge transfer and creation.

Through the two case studies, this study has found that the success factors were not as set out in the conceptual framework. The real experiences of project teams in the two case studies showed that trust, collaboration, communication, past experience and skills were the critical components that contributed to solving the project teams’ challenges along the process of adaptive re-use. A supportive attitude and appreciation were eliminated from the refinement framework but were addressed with past experience in the real-world data analysis (as explained in section 9.4.). The categorisation of the findings in relation to research question 1 as reported in chapter 9 are summarised on figure 10.1 which also shows the link with the knowledge transfer and knowledge creation key components in the case studies and the link with research question 2.

Figure 10.1: Research Findings in Relation to Research Question 1
10.1.2 Research Findings for Research Question 2

Research question 2 was related to the case study findings after the completion of research question 1. Research question 2 aimed to provide an understanding of how the process of problem solving happened in the case studies.

**How do the components of success and the key components of solving problems rely on each other to help the development of intellectual capital framework for successful adaptive re-use projects?**

The investigation of how each of the components in the framework relied on each other in the problem-solving process within a time series scenario has also been explained in detail in section 9.4, figure 9.2. This investigation provided an understanding of how the project teams intellectually managed problem solving with the components of success and key components that were critical in the whole process. The findings for the second research question can be compiled into three dimensions of how the components relied on each other as reflected by the experiences of the project teams during the problem-solving process in successful adaptive re-use projects. These main dimensions can be understood as the dimension of core success, the knowledge transfer dimension and the knowledge creation dimension. The conclusion for these findings is as follows.

**Success Components and Key Components of Knowledge Transfer**

- **Trust in individual skills** relates to the actions that project teams take to solve problems
- **Trust in social communication** provides the smoothness of communication but relies on the completeness of the sources of information to identify the right solution within the right place and with the right person made responsible for solving it
- **Trust in individual past experience** that relates to the effectiveness and efficiency of the problem-solving process
- **Trust in social collaboration** that was affected by using similar project teams for both projects providing benefits through having good collaboration due to having an understanding of the previous problems and an understanding of how the teams and disciplines worked.
**Success Components, Key Components of Knowledge Transfer and Knowledge Creation**

In generating new skills and knowledge, project teams relied on their previous skills and the current skills developed during their involvement in previous projects or on other adaptive re-use projects in the intervening period. Knowledge related to the heritage requirements and heritage regulations was relevant to the project teams' skills. Most of the project team members with skills and knowledge about adaptive re-use were matched to these projects because they had been involved on more heritage projects including the refurbishment of heritage buildings.

Maintaining similar project teams can provide, for individual members, a better understanding of how their work from a previous project can be applied to the new project. Understanding and familiarity with other team members, either personally or professionally, contributed to these benefits in the way that the problem-solving process became more effective and efficient even when the process took longer because of the project's complexity. This also affected how the project team members developed new solutions for new or future projects. Familiarity with the way of working, the disciplines, and the previous problems and potential problems significantly helped the project teams to develop new solutions through good collaboration. This finding shows how critical it was to have similar project teams with similar past experience on previous adaptive re-use projects in order to achieve successful adaptive re-use projects and how this was related to the problem solving process.

**10.2 Limitations of This Research**

This study has three limitations which may have affected this research in instances where the generalisations might contain potential bias.

Firstly, two universities in Victoria were chosen as the case studies for real-world practices for this study and for conducting in-depth research. Even though the two universities used best practice in adapting historical buildings and their senior management used best practice for the new uses of the buildings, the results obtained from 14 project team members might not be able to be generalised with respect to all practices. This was because not all of the 14 project team members were involved in both projects (AR1 and AR2) for the duration of these time series scenarios. The most important members of the project teams, such as the client and the same principal consultant (the architect) for both cases could be generalised across the whole study.
Secondly, the results and subsequent discussion about them in case study 1 (chapter 6), case study 2 (chapter 7) and the cross-case analysis (chapter 8) are based on the researcher’s interpretations and there exists the possibility that the results could reflect this. However, the interview results were consistent because the interview process was individually conducted by a single researcher who was face to face with each participant. This was also important because the same researcher conducted the in-depth analysis of the interview contents using two approaches, within-case (chapter 6 and chapter 7) and cross case analysis (chapter 8), and this analysis provided the richness of this study’s data findings.

Thirdly, the first case study (Deakin University) provided very in-depth interpretations of the project team members’ experiences. The researcher was also more familiar with Deakin University because this case had been identified when the researcher started in the first year of their research. On the other hand, the second case study (RMIT University) was identified as a potential case for this study when the researcher had entered their second year of study. Furthermore, it was difficult to gain cooperation from potential participants in the second case study due to the time constraints for this study. However, clients for the second case study were particularly helpful, providing support for the researcher to conduct further interviews with other consultants and provided assistance with data processing. In addition, the researcher understood the interviewees’ perceptions and their rich experiences enable correct interpretations of the interviews during the content analysis of both cases. In addition, this study used a similar approach to data gathering and data analysis for both cases.

### 10.3 Contribution of the Research

The relationship of success factors and knowledge management research in adaptive re-use projects provides a new contribution to the knowledge in relation to the intellectual capital of project teams. This research provides a major research contribution for both practitioners and academics through its development of an intellectual capital framework for successful adaptive re-use projects. This framework contributes significantly to the existing body of knowledge and to academic literature in the area of adaptive re-use.

The first contribution is that the five component of success have been identified and discussed in this study supported by evidence from the empirical study of two significant case studies of adaptive re-use projects. The five components of success have also been analysed qualitatively, where previously the adaptive re-use literature has had no empirical studies on success factors or qualitative analysis of the factors. The five different and unique
success factors, namely, collaboration, communication, trust, past experience and skills must be integrated with the heritage and adaptive re-use knowledge, including relevant requirements and regulations. Rather than the usual documentation, a great deal of different documentation was identified that showed that the project team members were matched to unique and complicated situations. This study found that the documentation referred to during the process of adaptive re-use included heritage citations, the conservation management plan, ESD requirements, the history of early development of the historical buildings and the original drawings of the buildings. The intellectual capital of project team members, especially of the architect and building surveyor, must have an understanding and knowledge of the building’s history as it relates to the original functions of each section of the historical building. This was important so that the design process would also suit the new uses to which the buildings would be put. Furthermore, the building surveyor also requires knowledge about how to integrate with and conform to the usual building regulations and make the appropriate amendments for adaptive re-use of those historical buildings.

The second contribution is that this study recognised the relationships and reliance among the component of success and the key components of knowledge transfer and knowledge creation. Collaboration and communication in an adaptive re-use project relies on the maintenance of similar project teams in a time series scenario. Even though collaboration and communication factors look similar when working on a common project, these components when working in adaptive re-use must develop based on trust and an understanding of the other team members’ disciplines. Dave and Koskela (2009) noted that collaboration among multidisciplinary project teams can be developed regardless of whether or not they worked together again. This study contributes by identifying that the benefits of collaboration are developed through working together from one project to another. This contributes to the literature as it indicates which significant practitioners in adaptive re-use must maintain relationships to ensure the success of the project. This study confirmed Bacarrini’s (1999) study that the process of gaining trust among project teams is critical and that all the members must clearly understand the requirements of the project in which they are involved. So, in adaptive re-use, this study found that trust is the core of the critical success factors in project teams’ intellectual capital.

The third contribution is that the three stages of intellectual capital in the context of successful adaptive re-use projects have been identified and discussed in this study; stage 1: core success dimension; stage 2: the knowledge transfer dimension and stage 3: the knowledge creation dimension. It is difficult to link this finding to previous literature, because no research has been previously published on adaptive re-use projects within a time series scenario context. Even though Spender (1996) identified four types of intellectual
capital, he did not mention the link to and reliance on intellectual capital in construction projects. This model also suggests that each type of intellectual capital, including conceptual knowledge (skills), experiential knowledge (past experience), collective knowledge (collaboration) and objective knowledge (communication) must be developed upon the basis of the trust of each project team member during the transfer and creation of knowledge for future sequential projects. In addition, this framework demonstrated a new contribution to knowledge management in relation to adaptive re-use projects. Nonaka (1994) originally noted that knowledge management starts with knowledge creation, followed by knowledge transfer activity in common construction projects. However, this framework has also contributed to the concept by identifying that, in adaptive re-use projects within a time series scenario, there is a reversal in the structure of knowledge management. The project teams in adaptive re-use projects in a time series scenario start with a richness in their knowledge about heritage requirements and regulations. The activity of knowledge transfer from the first project to the second project happens first, after which the project teams would create new skills and knowledge along with the development of new solutions for problems in future projects.

This model has important practical implications for practitioners when they are involved in adaptive re-use projects within a time series scenario and shows the importance of the integration of the practical with knowledge activities and quantities. This framework also provides systematic stages for practitioners to manage their intellectual capital from project to project without losing their heritage knowledge and, at the same time, maintaining their skills and knowledge on common projects. This framework provides new insight into the practitioners' project management measured against the importance of collaboration, communication, skills, past experience, and the transfer and creation of knowledge in managing their rich intellectual capital.

Finally, the contribution of this study has also been generated according to the publishing standard. Within two and half years, the researcher has published four conference papers that have been presented nationally and internationally. All of these papers have been peer reviewed for presentation and publication in conference proceedings.
10.4 Recommendations for Future Research

This section recommends the directions for future research that might develop from this research.

1. The first recommendation is to continuously examine and test the intellectual capital framework of successful adaptive re-use projects. The investigation of this study was exploratory and descriptive in quality. This can be continued with more exploratory cases around the world that are related to successful adaptive re-use projects.

2. This study also only focused on the problem-solving process: there may well be room for the development of further study with other processes before and after adaptation which are related to knowledge transfer and creation within a time series scenario.

3. The framework can be extended to other types of historical buildings in terms of original functions and new uses. This will ensure that the framework is valid and fully functional for any kind of historical buildings and not just for industrial and education buildings which were developed most strongly through this research.

4. The regulations and the requirements that could help practitioners to understand them and how to integrate them with the new regulations and policies according to Heritage Victoria or other heritage organisations in the world provide grounds for further study for other researchers who display an interest in areas of adaptive re-use.

5. In light of the lack of research on adaptive re-use in the researcher’s country (Malaysia), the methodology of this study and the proposed framework could give guidance to other Malaysian researchers who have interest in adaptive re-use. The significance of this framework could introduce to relevant Malaysian practitioners one major strategy for conservation works which is not focused on passive uses such as that of a museum. This study would give direction to practitioners and researchers in investigating adaptive re-use issues and the processes used in successful adaptive re-use projects.
10.5 Summary

This final chapter has provided a summary of the research findings which answered the two research questions identified in chapter 1. There are three findings which related to the literature and interview analysis. This chapter also discussed the limitations of this research and its contribution to knowledge in research and industry. Finally, section 10.4 recommended the direction and content that might prove fruitful for further research for both academics and practitioners who have an interest in conducting research.
REFERENCES


Bernard, HR and Ryan, GW 2010, Analyzing Qualitative Data SAGE Publications, Inc, United States of America


Bullen, P 2007, 'Adaptive reuse and sustainability of commercial buildings', Facilities, vol. 25, no. 1/2, pp. 20 – 31


Egbru, CO 1997, 'Refurbishment management: challenges and opportunities', Building Research and Information, vol. 25, no. 6, pp. 338 – 47

http://www.eurekacouncil.com.au


Latham, D 2000, Creative re-use of buildings, 2 vols., Donhead, Dorset


Miles, MB and Huberman, AM 1994, 'Qualitative Data Analysis', Second edn, An Expended Sourcebook, SAGE Publications, Inc, United States of America


Rockart, J 1977, 'Chief executives define their own data needs', MIS Quarterly


University document, Department of Planning and Community Development, RMIT University, Heritage Victoria 2008, http://www.rmit.edu.au/

University document, Deakin University Website, https://www.deakin.edu.au/


Walker, M 2000, 'Adaptive Reuse: Continuity and Creativity', National Trust of Australia, New South Wales, 9 - 10 November 2000, Research paper


Wood, B 2006, 'The role of existing buildings in the sustainability agenda', Facilities, vol. 24, no. 1/2, pp. 61-7


Appendix A

The Development of an Intellectual Capital Framework for Successful Adaptive Re-use

Interview Details

DATE:
LOCATION:
TIME:

PARTICIPANT’S INFORMATION

Name:
Position:
Centre:
Area:
Campus:
Tel:
Mobile:
Email:
The Development of an Intellectual Capital Framework for Successful Adaptive Re-use

Interview Schedule:

- Client: ________________________________________________________
- Architect: ____________________________________________________
- Contractor: __________________________________________________
- Others Team Members: _______________________________________

PART 1 GENERAL VIEWS

<table>
<thead>
<tr>
<th>Questions</th>
<th>Researcher’s Notes</th>
<th>Triggers Questions</th>
<th>Researcher’s Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>What was your role on the project?</td>
<td></td>
<td>How many years have you been involved in historical building type’s projects?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>What other roles have you undertaken on these types of building projects?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can you tell me a little about any other historical projects that you have worked on since the adaptive re-use 1 project finished?</td>
<td></td>
</tr>
</tbody>
</table>
### PART 2 EXPERIENCES ON ADAPTIVE RE-USE

<table>
<thead>
<tr>
<th>Questions</th>
<th>Researcher’s Notes</th>
<th>Triggers Questions</th>
<th>Researcher’s Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you tell me a little about your experiences on those projects in terms of new ideas or skills created?</td>
<td></td>
<td>Do you think the team helped each other in developing new solutions?</td>
<td></td>
</tr>
<tr>
<td>Questions</td>
<td>Researcher's Notes</td>
<td>Triggers Questions</td>
<td>Researcher's Notes</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Can you tell me about the challenges or problems you experienced on the project?</td>
<td></td>
<td>Given that you had worked on the adaptive re-use 1 and 2 project were you able to solve problems quicker and easier?</td>
<td></td>
</tr>
<tr>
<td>How did this differ from the previous project?</td>
<td></td>
<td>Did having the same teams help/hinder?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>What actions did you take to solve the problems?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>What information helped you to develop solutions? Did you find this within your organization?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Did you find expertise outside of your organization? Did you find it within the consultant team?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Was the consultant team similar or different to the previous one?</td>
<td></td>
</tr>
</tbody>
</table>
### Questions

<table>
<thead>
<tr>
<th>Questions</th>
<th>Researcher’s Notes</th>
<th>Triggers Questions</th>
<th>Researcher’s Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Did other adaptive re-use projects which you were involved with between adaptive re-use 1 and adaptive re-use 2 help you to solve problems on the adaptive re-use 2?</strong></td>
<td>How? What actions did you take to solve unfamiliar problems?</td>
<td>Did you try out new things on the project? Did you have to come up with new solutions on the project in relation to the problems you described previously?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Do you think working on these helped when you came to the adaptive re-use 2? If so How?</td>
<td></td>
</tr>
</tbody>
</table>

---

280
<table>
<thead>
<tr>
<th>Consent: Agree to have my name or identity used</th>
<th>Name</th>
<th>Case Study</th>
<th>Position</th>
<th>Address</th>
<th>Date of Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>Julee Scott</td>
<td>CS1</td>
<td>Manager, Project Delivery</td>
<td>FMS Project Delivery (Major Works), Melbourne Bunwood Campus, Deakin University</td>
<td>18 August 2011</td>
</tr>
<tr>
<td>YES</td>
<td>Brian Sherwell</td>
<td>CS1</td>
<td>Building Surveyor</td>
<td>Brian Sherwell &amp; Associates, Grove Plaza Offices, Suites 2, 156 Torquay Rd, Grovedale 3216</td>
<td>28 August 2011</td>
</tr>
<tr>
<td>YES</td>
<td>Bruce Hogan</td>
<td>CS1</td>
<td>Senior Project Manager – Construction</td>
<td>FMS Project Delivery (Major Works), Geelong Waurn Ponds Campus, Deakin University</td>
<td>29 August 2011</td>
</tr>
<tr>
<td>YES</td>
<td>Geoff Saunders</td>
<td>CS1</td>
<td>Architect</td>
<td>2 Downes Pl, Geelong Vic 3220</td>
<td>17 &amp; 18 October 2011</td>
</tr>
<tr>
<td>YES</td>
<td>Stephen Kipp</td>
<td>CS1</td>
<td>Fire Engineer</td>
<td>Exova Warrington Unit 2, 409-411 Hammond Road, Dandenong 3175</td>
<td>20 October 2011</td>
</tr>
<tr>
<td>YES</td>
<td>Gary Connor</td>
<td>CS1</td>
<td>Contractor</td>
<td>190A, Noble Street, New Town 3220 Vic</td>
<td>25 October 2011</td>
</tr>
<tr>
<td>YES</td>
<td>Murray Campbell</td>
<td>CS1</td>
<td>Quantity Surveyor</td>
<td>Wilde &amp; Woolard Quantity Surveyor, 37/41 Prospect Street, Box Hill</td>
<td>27 October 2011</td>
</tr>
<tr>
<td>NO</td>
<td>NA</td>
<td>CS2</td>
<td>External Project Manager: Property Services</td>
<td>NA</td>
<td>2 March 2012</td>
</tr>
<tr>
<td>YES</td>
<td>Jude Doyle</td>
<td>CS2</td>
<td>Senior Architect</td>
<td>Peter Elliott Architecture + Urban Design Office, Level 11180, Russell St</td>
<td>15 March 2012</td>
</tr>
<tr>
<td>YES</td>
<td>David Rowe</td>
<td>CS1</td>
<td>Heritage Advisor</td>
<td>Authentic Heritage Services Pty Ltd, Heritage Advisor, St Alban Park, Geelong</td>
<td>20 March 2012</td>
</tr>
<tr>
<td>YES</td>
<td>Jacinta Rivette</td>
<td>CS1</td>
<td>Senior Strategic Planner</td>
<td>Economic Development and Planning, 131</td>
<td>26 March 2012</td>
</tr>
<tr>
<td>YES</td>
<td>Samuel Trumble</td>
<td>CS2</td>
<td>Contract Manager, Contractor</td>
<td>Kane Construction Pty Ltd, 658 Church Street, Richmond, 3121 Vic</td>
<td>29 March 2012</td>
</tr>
<tr>
<td>YES</td>
<td>Frank Gargano</td>
<td>CS2</td>
<td>Senior Associate, Engineer</td>
<td>ARUP Level 17, Nicholson St</td>
<td>2 May 2012</td>
</tr>
<tr>
<td>YES</td>
<td>Terry King &amp; David Howard</td>
<td>CS2</td>
<td>Project Manager, Client</td>
<td>Property Services, RMIT University, Melbourne</td>
<td>9 May 2012</td>
</tr>
</tbody>
</table>