OVERCOMING THE CHALLENGES OF BUILDING HERITAGE PROJECTS: IMPROVEMENTS TO TIME, SCOPE AND COST PERFORMANCE

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Abstract

The movement to protect the heritage of national buildings has grown enormously in many countries since the World Heritage Centre and the World Heritage list within UNECSO were both established in 1972. Many heritage organisations have since been founded with the aim to protect and manage cultural heritage, and numerous studies have supported the importance of preserving and protecting built heritage. Today, the idea of heritage building protection incorporates the protection of many cultural attributes globally.

Managing heritage-listed building projects has been seen as a sensitive issue, sometimes facing criticism due to such projects often running over time and, as a result of such delays, over budget. Various research studies have been conducted to identify solutions to improve the management of the restoration and refurbishment of heritage projects. Despite the development of principles, policies and guidance, many problems still exist that affect the management of heritage projects.

The aim of this research is to investigate the general and specific factors that affect the project performance and delivery of heritage building projects. The objective of the study is to determine and analyse the causes of project delays during the planning/design and execution/construction phases, while also analysing the management of multiple stakeholder relationships and the influence of technical factors during the construction phases of heritage projects. Further, the study investigates the current policies, procedures and practices and their constraints impact the project performance and delivery.

This research project attempts to address the omissions of certain critical elements in the current management of the planning/design phase of the project lifecycle of heritage buildings, which negatively impact on the subsequent execution/construction phase and causes, or significantly contribute to, project cost overruns and time delays. Better stakeholder management is particularly important to facilitate interaction by, and gain involvement and approbation from, or at least prevent the negative influence of, different stakeholders. Furthermore, technical issues/factors arising from interviewed respondents have been taken into account, which needed to be further acknowledged and examined.

The original research propositions were confirmed by the research study. In particular, the study determines that the ability to influence cost savings is substantially higher at the beginning of a project. Although not a new finding, it is proven in this study to be of very high significance to the ultimate success of heritage projects. Therefore, a heavier investment in the planning/design stage of heritage projects will ultimately cost the project owner less than advancing with unresolved critical issues still encapsulated in the project. Once the on-site operation starts, the inclusion of changes such as dealing with latent conditions would cost the owner considerably more than would have been envisaged in the budget that was used to gain approvals for works and as the basis to let contracts.

This research used both case studies and surveys for the data collection purposes. The data collection techniques consisted of a questionnaire, interviews, document analysis, observation and focus groups as a validation of the findings. Only Queensland heritage-listed building projects were used for the case study purposes and this might considered as a limitation. Despite that limitation, the cross-case study analysis provides an overview of the existing problems in managing heritage-listed projects within a specific region (Queensland) that appear to be transferable to other parts of Australia and outside. The survey questionnaire was widely distributed all over Australia. Therefore, data on the existing challenges in different states and territories was collected. The quantitative data was analysed using statistical analysis techniques SPSS Statistics 21 and Stata 2013 software packages, and NVivo 10 software was used to code and facilitate analysis of the qualitative data. Use of this mixed-methods approach resulted in good data triangulation of the results ensured that the research objectives were reached and the research questions answered.

The study proposes "call for action" guidance, which was developed on the basis of the research findings reported in this thesis and validated by experts with more than 20 years' experience each in heritage building projects in Australia. The proposed guidance is designed to ensure that realistic cost targets and delivery timeframes are set in future heritage projects. The evaluation of the results through an expert focus group discussion generated the final recommended actions to be included as part of the research recommendations. The need for urgent action related to the delivery of current and future heritage projects is clear, and significant improvements in current practices are needed to overcome the problems of cost and time overruns in future heritage projects. The conclusions in the thesis answer the following research questions:

RQ1. What are the main challenges that form the key reasons and make the decision on retaining existing heritage places?

RQ2. What are the challenges (and their causes) in complying with policies and procedures that affect the management and delivery of heritage projects?

RQ3. How can the project management process be improved for more effective management in the operation and delivery of heritage building projects?

This research project summarises the current status of practices related to the research problem area, as well as detailing implications for theory and practice and offering suggestions for the future improvement around the identified issues and problem area, as well as potential directions for further research.

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List of Abbreviations

ADF	Asymptotic distribution free
AGFI	Adjusted goodness-of-fit index
AMOS	Analysis of moment structures
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CMIN/DF	Chi-square/ Degree of freedom
CR	Critical ratio
EC	Execution/construction
EFA	Exploratory factor analysis
GFI	Goodness of fit index
HR	Heritage retention
ICOMOS	International Council on Monuments and Sites
KMO	Kaiser-Mayer-Olkin
KR	Key reasons
MC	Main challenges
ML	Maximum likelihood
MVML	Maximum likelihood with missing values
M_stake	Multiple stakeholders
NFI	Normed fit index
OGH	Old Government House
PD	Planning/design
PM	Project management
PP	Project performance
QML	Quasi maximum likelihood

R	Interviewed Respondent
RMSEA	Root mean square error of approximation
SEM	Structural equation modelling
Technical	Technical factors
TLI	Tucker-Lewis index
WLS	Weighted least squares

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

QUT Verified Signature

Signature:

Date: 15th December 2015

Acknowledgements

PSALM IX

I will give thanks unto thee,

O Lord, with my whole heart;

I will speak of all thy marvellous works.

PSALM CXVIII

Blessed be he that cometh in the name of the Lord.

PSALM CXLIV

Blessed be the Lord my strength :
who teacheth my hands to war,
and my fingers to fight;

My hope and my fortress,
my castle and deliverer,
my defender in whom I trust.

The Psalms of David from the
Book of Common Prayer (1841)

As your servant, dear God, you brought me here to serve this country with this work and other works according to your will.

Those who are coming in your name, blessed by you dear God, have made your will manifest. Grant all those who contributed in different ways to this work gifts that hardly could be imagined by human desire.

Strengthen me for the new battles to protect the future life of heritage places that have witnessed the past. We should never forget the past that has formed us; we should bring it to glory.

Chapter 1

BACKGROUND OF THE RESEARCH

Many of us will not visit any of the sites on the World Heritage List. But we would feel impoverished to know of the loss of such sites, and feel enriched by their continuing existence, even if we never visit them.

Ismail Serageldin (1999, p. 241)

1.1. Research Background

The movement to protect historical and old buildings that are regarded as forming part of a country's national heritage has grown enormously since the World Heritage Centre and the World Heritage list were both established in 1972 (UNESCO 1972). The significance of historic sites has been recognised globally and discussed by many researchers (Araoz 2011; Brand 1995; Forster and Kayan 2009; Orbagli 2008; Rypkema 2003). Many heritage organisations have since been founded with the aim of protecting and managing cultural heritage, and numerous studies have supported the importance of preserving and protecting heritage architecture. In his annual lecture to the Royal Institute of British Architects, His Royal Highness The Prince of Wales (2009) said 'Surely architects flock in such numbers to live in these lovely old houses – many from the 18th Century, often in the last remaining conservation areas of our towns and cities that haven't yet been destroyed – because, deep down, they do respond to the natural patterns and rhythms I have been talking about, and feel more comfortable in such harmonious surroundings.' The need to preserve the aesthetic quality of heritage buildings and their outstanding universal value is emerging as a task of high importance for governments and the professional disciplines that run heritage projects (i.e. heritage consultants, architects, engineers and project managers) (Mason 2005; Provins et al. 2008; Roders and Oers 2011).

Managing heritage-listed building projects has been seen as a sensitive issue, sometimes facing significant criticism (Reyers and Mansfield 2001). Today, there is growing acceptance that heritage conservation provides cultural, economic and social benefits to urban communities. Moreover, heritage buildings are seen as an important element of Australia's social capital (Bullen and Love 2011). The Australian State of the Environment Committee (2011) highlighted the importance of taking action to protect heritage places from further development pressure in order to retain their values.

Heritage projects are problematic in terms of meeting time and cost impositions; this underpins the need for investigation of current project management systems/processes to assure better outcomes in heritage projects (especially as a recognition that conventional project management frameworks are failing to deliver in other types of projects as well).

Better stakeholder management is also particularly important to facilitate interaction by, and gain involvement and approbation from, or at least prevent negative influence of, different stakeholders. This will greatly help and enhance the stakeholders' contribution and add value to the project outcomes of renewal projects, in which interested parties are many and varied. The complexity of the conservation process and the often large numbers of stakeholders engaged usually leads to there being several different objectives and requirements, which brings about conflicts (Alallafa and Torreb 2010).

The present research attempts to address the omissions of certain critical elements in the current management of the planning/design phase of the project lifecycle of heritage buildings, which currently negatively impacts on the subsequent execution/construction phase and causes, or significantly contributes to, project cost overruns and time delays. Although supporting principles, policies and guidance to improve heritage project outcomes have been developed, many problems still exist that seriously affect the management of heritage projects.

A fresh and current look at the project performance and delivery of heritage projects is needed, because few studies have been conducted to explore the specific project management and stakeholder issues that contribute to failed elements (time and cost) in heritage projects.

1.2. Research Problem

Despite the results from previous research that have been utilised to provide solutions to improve the delivery of heritage projects, many such projects are in fact still running over time and therefore over budget. Shenhar and Dvir (2007, p.6) explain that projects are thought to fail because of poor planning, lack of communication or inadequate resources; however, "as the evidence suggests, failure is often found even in well-managed projects that are run by experienced managers and supported by highly regarded organizations". After fifteen years of collecting data, Shenhar and Dvir (2007) came up with the astonishing result that 85 percent of all construction projects have failed to meet time and budget goals. If heritage projects are already problematic in terms of meeting time and cost impositions, then the fact that conventional project management frameworks are also failing to deliver successful time and cost outcomes in other types of projects underpins the need for a fresh look at current systems/procedures and for the development of specific recommendations/guidance to assure better outcomes in heritage projects. As a result of this, one of the major areas to be researched in relation to the successful delivery of heritage-listed building projects is the application of existing project management practices, especially as they relate to heritage projects. This research sits well within current interests as issues with existing project management methodologies are currently being addressed and criticised by the research community (Zwikael and Smyrk 2011, p. 11).

1.3. Research Aim and Objectives

The aim of this study is to investigate the general and specific factors that affect the project performance and delivery of heritage building projects. Therefore, this research focuses on the two phases in the project lifecycle where stakeholder engagement can play the most significant role in adding upstream value, namely, the planning/design and execution/construction phases. The research target was to identify factors that have the most effect on the integral processes in these stages. The essential objective of the research is to investigate 'how' different factors in each of targeted stages influence the overall project performance and delivery, and to determine their impact levels. Moreover, the research focuses attention on finding the causes of the recurrent challenges that influence the time and cost overruns that appear to be prevalent in many heritage-listed building projects and to conceptualise and develop a new "call for action" guidance to assist in reducing the future occurrence of such issues.

In summary, the aim of this research is to determine project performance challenges and analyse causes during the planning/design and execution/construction phases whilst also analysing the multiple stakeholder management factors that exist in the environment of heritage building projects and the influence that these have on the design and construction phases of those projects.

Based on the research problem and the stated aims, the objectives of this research are:

RO1. To document the values of a heritage-listed building and to address the main challenges in protecting and maintaining an existing building rather than constructing a new one.

RO2. To evaluate the current policy and procedures relevant to heritage projects and identify ongoing project challenges and causes.

RO3. To recognise the challenges in the management process, elaborate its causes and propose a set of actions to maximise the effectiveness of heritage project performance.

1.4. Research Propositions / Hypothesis

To answer the three research questions two models were developed and propositions for each model offered.

To answer the RQ1 the propositions are next:

Proposition 1 – Key reasons **(**KR) and Main Challenges (MC) are directly related.

"Within the statistical model, there is a significant covariance relationship between KR and MC. Therefore, a relationship between KR and MC exists."

Proposition 2 – Minimising MC will improve KR.

To answer the RQ2 and RQ3 the propositions are:

Proposition 1 – Project performance (PP) success measurement is composed of Time, Cost and Quality/scope.

Planning/Design (PD) and Execution/Construction (EC) are the two phases in the project management lifecycle examined in this study; by examining the observed challenges that characterised each construct, guidance could be developed to improve the effectiveness of each phase.

Proposition 2 – PD and EC measure project performance (PP).

There is a significant association between planning design, execution/construction and project performance as measured by the structural equation model.

Proposition 3 – Multiple stakeholders **(**M_stake) factors measure PP.

Proposition 4 – Technical factors measure PP.

By examining the observed factors that characterise each construct (M-stake and Technical), guidance could be developed to improve the effectiveness of examined constructs.

1.5. Research Limitations

Certain limitations are identified in this research as follows:

- In order to gain greater depth of investigation, this research is focused on heritage projects undertaken in Australia.
- Thus, only Queensland heritage-listed building projects were used to provide data. Similarly, only local project stakeholders were used as the survey population.

1.6. Research Significance and Contribution to Body of Knowledge

A key task of the research is to investigate how current processes and procedures can be improved, tailored or even re-developed to better fit the heritage project needs and ensure the successful project performance and delivery in future.

In addition, the part played by stakeholders, in terms of both engagement and management in the process, is identified and a determination is undertaken of where barriers to good management of projects exist and how these can be overcome for improvement of project outcomes. By superimposing these processes onto the processes of planning/design and execution/construction phases of projects, it will be possible to develop new high-level recommendations/guidance to improve the project performance and delivery of heritage type construction contracts.

To conclude, the major contribution of this research is in the guidance development, which is expected to help diminish or avoid delays and cost overruns in future heritage building projects.

1.7. Thesis Structure

The thesis began with an introduction that presents the background and preface to the research problem with justification for this research along with the research aims and objectives. The first chapter further discussed the research limitations and points out the significance of this research through its contribution to knowledge to the field of heritage management.

Chapter 2 presents a comprehensive overview and review of the extant literature that is relevant to the research area. Chapter 3 discusses the research methodologies that were utilised in the execution of the research. Chapter 4 discusses the operationalisation of the research methods. Chapter 5 presents the project management challenges analysed through the three case studies and cross-case analysis. Chapter 6 presents the project performance challenges identified through an analysis of the survey results. Chapter 7 presents the focus group discussion and validation of the results, and Chapter 8 presents the conclusion.

Chapter 2

LITERATURE REVIEW

Social value embraces the qualities for which a place becomes a focus of spiritual, political, national or other cultural sentiment to a majority or minority group.

Australia ICOMOS guidelines to the Burra Charter (in Johnston (1992, p. 1)

2.1. Introduction

This chapter builds the theoretical foundation upon which the research is based, by reviewing the accumulated knowledge about the research problem and the topics related to this issue. The literature review opens with an explanation of some global concepts about the aesthetic, historic, scientific, social and other special values of heritage places. Acknowledging the stated importance of retaining heritage places for future generations found in the literature, this review highlights the major issues in the area of heritage project management, such as extensive delays leading to exceeding of the allotted time and budget cost. The chapter continues by discussing the current thinking regarding: the benefits of and barriers to retaining heritage places; the different project management frameworks in use; the key indicators of project success; the factors affecting project success; and the stakeholder management. Following this, the review narrows down and focuses its examination to Australian, and specifically Queensland, heritage project issues/challenges. Premised on these discussions, the research identifies gaps in the field of heritage management research and literature.

2.2. The 'treasure' of heritage places

2.2.1. What is heritage?

According to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (2012a, p. 2), heritage includes:

> *"…stories, traditions, languages, events and experiences inherited from the past: it comprises both natural and cultural places with tangible and*

intangible values. More than a legacy from our past, heritage is also a living, integral part of life today that is constantly renewed and refreshed. Shaped by nature and history, it gives context to where we are now and where we are headed as a community."

2.2.2. What is the importance of preserving heritage places?

The story of a city is told almost always by preserving as many of the heritage buildings as possible, which contribute to that story. Once an old building has gone, the significance of a place is lost in the people's memory (Marquis-Kyle and Walker 1992a; Worthing and Counsell 1999). The duty of the local community and society is to protect its heritage and to preserve the buildings in their full richness of authenticity (Pearson and Sullivan 1995; Plevoets and Cleempoel 2011; Williamson 2010). There is a social purpose of retaining heritage buildings as well as tangible evidence of technical achievement and a chronicle of the development of style (Spennemann 2006). Nimrud and Ready (2002) revisited the question of the value and importance of heritage buildings to the communities which live within the environment in which these artefacts are sited, and noted that several authors were clearly supportive of the central theme of the value of conservation and preservation rather than destruction. Tyler et al. (2009), for example, expounded American society's appreciation for heritage places in the last few decades and gave a view that historical sites are irreplaceable. Heritage places have an irreplaceable value for every community: places tell the stories about who we are and our past that has formed us (Marquis-Kyle and Walker 1992b). Stemming from the awareness of the need to protect cultural heritage worldwide, heritage organisations and institutions have been forming to preserve origins in diverse settings.

Many discussions on the subject of the social and historical value of 'place' have suggested that sentimental attachment to the past is essential for any community. People seek physical reminders from the past as a social identification of place and their communities. In addition, aesthetic values, quality design, craftsmanship and historic materials all serve to indicate the significance of historic places and the diversity of the cultures in which they were built (Lawerance Douglas County Metropolitan Planning Office 2011). This view has been further supported by

Johnston (1992) who noted that places where people gather and act together as a community become the "private environment".

2.3. Heritage organisations and institutions

The preservation of historic buildings has important environmental, cultural, social, aesthetic/architectural and spiritual values (Johnston 1992), and heritage organisations and institutions have been established globally to protect and manage cultural resources. Many of these bodies have established policies and guidelines to protect and manage the heritage buildings and sites within their areas and spans of control. Some of the major instruments (listed and described chronologically) are:

1931 The Athens Charter, the Restoration of Historic Monuments

In 1931, at the IV International Congress of Modern Architecture, the Athens Charter introduced the concept of international heritage. The Charter has been accepted as a set of basic principles.

1964 The Venice Charter, the Conservation and Restoration of Monuments and Sites

In 1964, at the second Congress of Architects and Specialist of Historic Buildings meeting in Venice, the Venice Charter was approved: "It was agreed that the Charter should be laid down on an international basis, with each country responsible for applying the plan within the framework of its own culture and traditions" (cited in Heritage Perth (2014).

1965 The International Council on Monuments and Sites

The International Council on Monuments and Sites (ICOMOS) was established to protect and manage cultural resources. It was founded in 1965, in Warsaw, as a result of the Venice Charter.

In 1977, Australia ICOMOS reviewed the Venice Charter in regard to Australian practice and in 1979 the Charter was adopted as the guidelines for the Conservation of the Places of Cultural Significance. The Burra Charter (Australia ICOMOS 1979 cited in Dann et al. (1999, p.143)) defines conservation as being "all of the processes of looking after a place so as to retain cultural significance". This original publication was revised in 1981, 1988 and 1999(Australia ICOMOS 1999) and the latest revision in 2013 has been incorporated into a workbook developed by the Australian Heritage Commission and Commonwealth Department of the Environment and Heritage (Smith 2005, p.102).

1972 The United Nations Educational, Scientific and Cultural Organisation

In 1972, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) defined heritage based on three main elements: (i) monuments: architectural works, works of monumental sculpture and painting, including cave dwellings and inscriptions, and elements, groups of elements or structures of special value from the point of view of archaeology, history, art or science; (ii) groups of buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of special value from the point of view of history, art or science; and (iii) sites: topographical areas, the combined works of man and of nature, which are of special value by reason of their beauty or their interest from the archaeological, historical, ethnological or anthropological points of view (UNESCO 1972).

1972 The World Heritage Convention

In 1972, UNESCO adopted the 'Convention Concerning the Protection of the World Cultural and Natural Heritage', known as the World Heritage Convention (WHC). This was drafted to provide a procedural, legal and financial framework for enabling nations to protect and preserve their cultural and national sites of outstanding universal value (Slatyer 1983).

Australia became one of the first countries to ratify the WHC in 1974. This resulted in the adoption of general policy and integration of the protection of the cultural and natural heritage into comprehensive planning programs in this country (Department of Sustainability Environment Water Population and Communities 2012b).

1987 The Washington Charter 1987

The Charter for the Conservation of Historic Towns and Urban Areas was adopted by the ICOMOS General Assembly in Washington 1987. Planning for conservation of historic towns and sites in urban areas is to ensure the harmonious relationship between past and present (ICOMOS 1987).

1993 Organisation of World Heritage Cities

The Organisation of World Heritage Cities (OWHC) was established in 1993 and was founded on an aspiration from the 1991 'First International Symposium of World Heritage Cities', which instigated that a body be set up to assist cities to improve the existing management methods in relation to the particular needs of developing heritage sites (OWHC 2012).

Various countries have incorporated and modified these instruments into their own national and localised regulations and laws to provide better protection for places of significance in their locations of control. Commenting on the responsibilities of the government, Jokilehto (2011, p. 61) states that "the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of such heritage belongs, in the first place, to the state of whose territory it is located".

2.4. How are important 'heritage places' identified and protected in Australia?

Economic growth involves changes, which could contribute to the loss of the values of significant places through inappropriate change (Australian State of the Environment Committee 2011).

2.4.1. Identification

Not every place has heritage value. Figure 2.1 presents the Australian model criteria for recognising whether a heritage place or site has intrinsic value.

Model criteria for identifying heritage places

Criteria for identifying heritage significance taking into account aesthetic, historic, scientific, social or other special values to all generations.

- Importance to the course, or pattern, of our cultural or natural history.
- Possession of uncommon, rare or endangered aspects of our cultural or natural history.
- Potential to yield information that will contribute to an understanding of our cultural or natural history.
- Importance in demonstrating the principal characteristics of a class of cultural or natural places or environments.
- Importance in exhibiting particular aesthetic characteristics.
- Importance in demonstrating a high degree of creative or technical achievement at a particular period.
- Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons. This includes the significance of a place to Indigenous peoples as part of their continuing and developing cultural traditions.
- Special association with the life or works of a person, or group of persons, of importance in our history.

Figure 2.1: Model criteria for identifying heritage places in Australia (Department of Environment, Water, Heritage and the Arts (2008, p. 2)

A heritage place can be identified based on meeting one or more of these criteria. After identification, the appropriate level of listing would be applied.

2.4.2. Listing

In order to celebrate the building/place special history and architectural value, the listing helps to protect those building/places. In order to maintain heritage places in the most appropriate way, different levels of heritage listing have been determined in Australia—with responsibilities allocated to different levels of government accordingly—as follows (Strategy 2008):

- World heritage
- Australian/National heritage
- State/Territory heritage
- Local heritage.

The concept and context of heritage work varies at all levels. In addition, some places can be identified at more than one level; therefore, several levels of government will share responsibilities of that place. Figure 2.2 presents the different levels of government related to heritage listing, together with their responsibilities. Each of the different levels of heritage listing is discussed in more detail below.

LEVEL OF GOVERNMENT	HERITAGE RESPONSIBILITY	HERITAGE LIST	THRESHOLD FOR LISTING
AUSTRALIAN / NATIONAL	World Heritage These places have outstanding universal values above and beyond the values they hold for a particular nation. For example, the Great Barrier Reef.	World Heritage List Places in Australia are nominated by the Australian Government but the list is maintained by the World Heritage Centre of the United Nations Educational, Scientific and Cultural Organisation (UNESCO), based in Paris.	Outstanding universal value
	National Heritage Our most valued natural, Indigenous and historic heritage sites. They reflect the richness of our natural heritage and the story of our development, from our original inhabitants to present day, Australia's spirit and ingenuity, and our unique, living landscapes. For example, Old Parliament House in Canberra.	National Heritage List	Outstanding heritage value to the nation
	Commonwealth Heritage These are places owned or controlled by the Australian Government. For example, Geraldton Drill Hall Complex, WA.	Commonwealth Heritage List	Significant heritage value
STATE AND TERRITORY	State and territory heritage These are places of special interest in the broader context of the state or territory. They must have some important significance to the state or territory in its widest sense (rather than just a locally important place). For example, a colonial building.	ACT Heritage Register NSW State Heritage Register NT Heritage Register Queensland Heritage Register SA Heritage Register Tasmanian Heritage Register Victorian Heritage Register WA Register of Heritage Places Some of these lists deal with all types of heritage – natural, Indigenous and historic, and some also deal with heritage objects. Some states and territories also have a separate Indigenous site register.	Importance or significance to the state or territory
LOCAL GOVERNMENT	Local heritage These places are significant in the context of a local area. They contribute to the individuality and streetscape, townscape, landscape or natural character of an area and are matters controlled by local government. They often reflect the socio-economic or natural history of a local area. For example, a church or town hall.	ACT: incorporated in the territory register NSW: NSW State Heritage Inventory/Local Environment Plan Qld: local government heritage register SA: list in Council Development Plan Tas: list in planning scheme heritage schedules Vic: scheduling in Heritage Overlay or other mechanism in local government planning scheme WA: Municipal Inventory.	Importance or significance to the local community.

Figure 2.2: Levels of heritage listing (Department of Environment, Water, Heritage and the Arts (2008, p. 4)

International (world) heritage listing is given to a place that has outstanding universal value to a particular nation and could be maintained by the UNESCO World Heritage Centre. Such places are listed on Australia's World Heritage List. National heritage refers to indigenous and historic sites of outstanding heritage value to the nation. Such places are listed on the National and Commonwealth Heritage List.

Places listed as Commonwealth heritage are controlled by the Australian Government and have significant heritage value. Those places are listed on the National and Commonwealth Heritage List.

State and Territory heritage listing is given to places of special interest, importance and significance to the state or territory, and is inscribed to the relevant State and Territory Heritage Register. Local heritage listing is given to important and significant places to the local community. Those places reflect the socio-economical history of a local area. Each state has its own inventory and mechanisms in its planning scheme. Those places are listed on the Local Government List.

In addition, some of the professional organisations, such as the National Trust in the most states and territories, the Royal Australian Institute of Architects and Engineering Heritage Australia, maintain lists of special places which are recognised by their fields of expertise but without providing legal protection. Key heritage legislation and the establishment dates of the National Trust 1945–2011, prepared by Vines (2012), are attached in Appendix H as a more detailed summary of heritage legislation.

2.4.3. Protection - Heritage laws in Australia

The principal heritage legislation that guides Australian heritage projects in preserving cultural heritage is shown in Table 2.1.

Table 2.1: Principal heritage legislation (Australian Government Productivity Commission 2006, p.56-57)

State	Natural	Indigenous	Historic heritage	Movable	Shipwrecks	Heritage Council	State/ Territory National Trust
Cwth	Environment Protection and Biodiversity Conservation Act 1999	Environment Protection and Biodiversity Conservation Act 1999	Environment Protection and Biodiversity Conservation Act 1999	Protection of Movable Cultural Heritage Act 1986	Historic Shipwrecks Act 1976	Australian Heritage Council Act 2003	n/a
NSW	National Parks and Wildlife Act 1974	Heritage Act 1977	Heritage Act 1977 Historic Houses Act 1971	Heritage Act 1977	Heritage Act 1977	Heritage Act 1977	National Trust of Australia (NSW) Act 1990
Vic	National Parks Act 1975 Parks Victoria Act 1998	Archaeological and Aboriginal Relics Preservation Act 1972	Heritage Act 1995	Heritage Act 1995	Heritage Act 1995	Heritage Act 1995	n/a
Qld	Nature Conservation Act 1992	Aboriginal Cultural Heritage Act 2003	Queensland Heritage Act 1992	Queensland Heritage Act 1992	Queensland Heritage Act 1992	Queensland Heritage Act 1992	National Trust of Queensland Act 1963
WA	Conservation and Land Management Act 1984	Heritage of Western Australia Act 1990	Heritage of Western Australia Act 1990	Heritage of Western Australia Act 1990	Maritime Archaeology Act 1973	Heritage of Western Australia Act 1990	National trust of Australia (WA) Act 1964
SA	Native Vegetation Act 1991	The Aboriginal Heritage Act 1988	Heritage Act 1993	Heritage Act 1993	Historic Shipwrecks Act 1981	Heritage Act 1993	National trust of South Australia Act 1953
Tas	Nature Conservation Act 2002	Aboriginal Relics Act 1975	Historic Cultural Heritage Act 1995	Historic Cultural Heritage Act 1995	Historic Cultural Heritage Act 1995	Historic Cultural Heritage Act 1995	National trust of Australia (Tasmania) Act 1975
NT	Territory Parks and Wildlife Conservation Act	Northern Territory Aboriginal Sacred Sites Act 1989	Heritage Conservation Act 1991	Heritage Conservation Act 1991	Heritage Conservation Act 1991	Heritage Conservation Act 1991	National Trust (Northern Territory) Act 1976
ACT	Nature Conservation Act 1980	Heritage Act 2004	Heritage Act 2004	Heritage Act 2004	Heritage Act 2004	Heritage Act 2004	n/a

The most important set of guidelines_and the best standard for establishment of overriding policies and principles for good conservation in any Australian territory is the Burra Charter (Australia ICOMOS 1999), most recently revised in 2013.

2.5. Australian Strategy – public involvement

In 2011, the Australian Government called for public input to help develop a national heritage strategy for Australia's heritage for the next 10 years (Strategy 2011). The latest Australian 'State of the Environment' (SoE) report was released in December 2011 for public feedback and was specifically designed to inform and guide a wide range of stakeholders, including members of the public and policy-makers, on heritage issues and the value of heritage protection. Australian leadership in heritage management, particularly in taking action to protect heritage places, is recognised internationally (Australian State of the Environment Committee 2011). The latest call from government for 'A new vision for Australia's heritage' notes that "the Australian Government is calling on heritage practitioners and experts across Australia to come forward with their ideas and suggestions for the Australian Heritage Strategy" (The Hon. Greg Hunt MP 2013).

Any conservation work on heritage buildings has to meet the Burra Charter standards for guiding the making of decisions about, and undertaking the works to, places of cultural significance in the states, territories and Commonwealth of Australia (Australia ICOMOS 1999). A guide for owners and managers of National Heritage places has been developed for better understanding of the management requirements for these places. The guide has been aligned with the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and its regulations.

2.5.1. Queensland's heritage strategy

Queensland's first formal heritage strategy was launched in 2009, as a framework for managing state heritage places for the next 10 years. The plan identified the following five key areas (Department of Environment and Heritage Protection and Queensland Heritage Council (2012):

1. Communicating values – improving the way Queenslanders understand and value their cultural heritage
2. Strengthening policy – embedding cultural heritage in mainstream policy and planning
3. Maximising sustainable investment – strengthening Queensland's investment in managing and conserving its cultural heritage

4. Building partnerships – leading and partnering with government, community and industry to conserve Queensland's cultural heritage
5. Developing capacity – building the capacity of government, community and industry to conserve Queensland's cultural heritage.

The two identified areas of "communicating value" and "strengthening policy" are targets that sit well with the aims of this research project.

How is heritage managed in Queensland?

Heritage in Queensland is maintained using a framework which includes legislation, policies and guidelines. Under Queensland legislation, the Queensland Heritage Act 1992 sets out a framework for protecting heritage places. Incorporating amendments subsequently made in 1995, 2003, 2004 and 2005, "this act is the principal legislative instrument through which places, archaeological objects and archaeological areas of historical cultural heritage significance are protected in Queensland" (Queensland Heritage Council (2006, p. 3). The Heritage Council was established by the same Act. As the state's peak body on heritage matters, the Heritage Council acts independently, impartially and in the public interest, with administrative support from the Department of Environment and Heritage Protection (Queensland Heritage Council 2014).

The state's conservation policy identifies what needs to be done to retain the significance of the place (Department of Environment and Heritage Protection 2014a). Figure 2.3 presents the guidelines when policies are required. Since December 2013, the state planning policy has been undergoing revision and reforms. The use of the policy and the constraints that affect project delivery are addressed in the second research question in the present study.

Policies are normally required for:

- routine maintenance, including how and when this will be done
- repairs, restoration and reconstruction—works that address problems revealed in the condition survey and works that return a place to a known earlier state
- uses, including how the use of the place will be managed and how any proposed new uses will be accommodated
- managing change, including how new uses, changes to existing buildings or features, and developing new buildings will be managed
- interpretation—how the cultural heritage significance of the place will be communicated, potentially on-site
- involving interested parties—how interested parties, including government agencies, neighbours and people with significant associations with the place, will be involved
- monitoring—how actions taken under the CMP will be documented and how outcomes will be monitored
- management and decision making—how management structures, resources and decision-making processes will be established or varied to ensure the CMP is effectively implemented.

Figure 2.3: Use of policies
(Department of Environment and Heritage Protection (2014a, p. 4)

The Burra Charter, according to many authors, has had a considerable influence on conservation practice (Marquis-Kyle and Walker 1992b). Local governments and their conservation bodies link their programs to the Burra Charter's preferred methodologies and use these as a measure to facilitate the provision of regulatory protection (Productivity Commission 2006; Sullivan 2006). Moreover, before any development can take place, it is required that planners and developers look for potential impacts of their projects on historical places (Brooks 1992). The Burra Charter has been recognised and adopted by the Queensland Heritage Council as the best practice for managing Queensland's heritage places (Department of Environment and Heritage Protection 2014b). The Queensland Heritage Council (2006, p. 12) states that the Burra Charter "provides guidance for management of places of cultural significance and cultural heritage significance, of a place or object, including its aesthetic, architectural, historical, scientific, social or technological significance to the present generation or past or future generations".

There have been a series of established principles to guide the planning of preservation, restoration, reconstruction and adaptation projects, for heritage-listed buildings. Heritage places can be retained in different ways as examined in the following section.

2.5.2. Different types of actions and projects for heritage buildings

It is necessary to understand the nature of the significance of the place to society so that appropriate management can occur. The process of determining the value of the place is known as "the assessment of cultural significance" (Pearson and Sullivan 1995). The concept of 'significance' is crucial as this probably has the greatest impact on whether a heritage building project goes ahead or not, or what form the project will take in terms of 'type' of project and degree of the works undertaken (time and cost impacting). For example, if the façade of a building is significant there might be a decision to remove everything else and just embed the façade in the ground floor elevation (e.g., Charlotte Towers, Charlotte Street, Brisbane) and this makes construction awkward. Likewise, if any internal parts of a project are significant then this makes work around the significant part extremely difficult by way of protecting the works. Therefore, it is the difficulty of retaining the 'significance' of a heritage building that has a major effect on the time and cost of project works.

There are different types of actions and conservation projects that can be undertaken to preserve those significant places for future generations. "Conservation" in this context means all the processes that are undertaken to care for the place and to retain its cultural significance, meaning the historic, scientific, aesthetic, social and spiritual values of the place.

According to the Burra Charter (1999, p. 2), the different types of processes that can be applied to preserve heritage places and buildings are:

- Maintenance – the continuous protective care of the fabric and setting of a place (to be distinguished from repair, which involves restoration or reconstruction)
- Preservation – maintaining the fabric of a place in its existing state and retarding deterioration
- Restoration – returning the existing fabric of a place to a known earlier state by removing accretions or by reassembling existing components without the introduction of new material

- Reconstruction – returning a place to a known earlier state (distinguished from restoration by the introduction of new material into the fabric)
- Adaptation – modifying a place to suit the existing use or a proposed use
- Compatible use – use which respects the cultural significance of a place; such a use involves no, or minimal, impact on cultural significance.

Of these various ways that heritage-listed buildings may be retained, the most currently accepted way to maintain a heritage-listed building is in adaptive reuse, as the finding of a new use for a place "brings new life" to the building and attracts investors.

In addition to those methods, heritage retrofitting is another technique for preserving and sustaining the future life of heritage-listed buildings. In the UK context, Grogan (2012, p.2) notes that "heritage says that anything is possible in retrofitting heritage buildings, as long as it doesn't leave a permanent scar". Based on the company's experience of more than 10,000 projects around the world repairing, reconstructing, refurbishing and restoring buildings, John Turzynski (2013), a director of Arup, stated that "getting more from existing buildings will benefit users, the community, the environment, business and the bottom line".

This research explores some of these major guidelines such as the *Conservation Principles, Policies and Guidance* (English Heritage 2008), which have helped to set out a logical approach to making decisions for the sustainable management of the historic environment and the *Local Development Framework* (English Heritage 2005) which introduced a new kind of planning system with more focus on involvement of the community and other stakeholders, flexibility and early decisions making in the preparation phase of a project. These guidelines were taken into consideration in establishing a deeper understanding of well-established principles and policies to facilitate more effective modelling of the "call for action" guidance.

2.5.3. Economic benefits of heritage sites

Maintaining historical places has become crucial (Smith 2005) and historic preservation has started to play an important role in the overall construction landscape. Positive global trends towards greater public awareness of, and support for, heritage-driven developments have been shown in many capital cities including recently in London. Since 1999, 68% of buildings at risk in London have been saved (English Heritage 2011).

The public interest in historic building preservation is now highly recognised. According to Tyler et al. (2009, p.189), ideas are changing; they claim that "there are currently more projects involving the adaptive use of older buildings than there are new construction projects". This supports the growing perception that the relative cost of preserving a heritage building as a multi-valuable resource is sometimes more economic and sustainable than engaging in new construction (Maeer and Fawcett 2011; Rypkema 2001; Wilkinson, James and Reed 2009).

Adaptive reuse is "the modification of a heritage place to a new use which conserves in heritage value" stated by Vine (2012, p.4). Kumarasuriyar and Nielsen (2012) state that adaptive reuse "allows a heritage property to be used for purposes other than original designed for". This view is supported by Bullen and Love (2010) who note that "adaptive reuse can enable buildings to accommodate the changes that revolve around shifting economic, environmental and social patterns". The decision-making process around adaptive reuse is based on the consideration of four criteria: environmental, economic, social and governance. The decision-making process is shown in Figure 2.4 (Bullen and Love 2010).

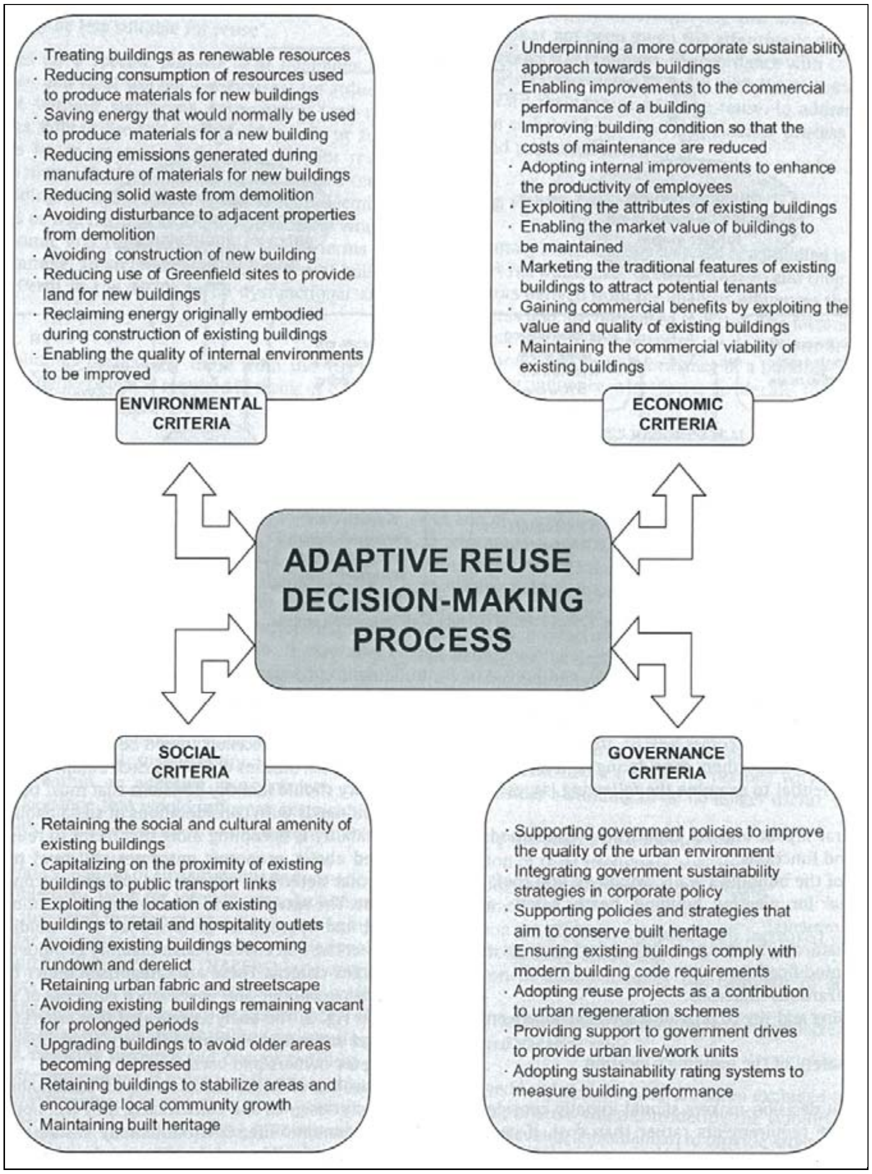


Figure 2.4: Model of decision making process in adaptive reuse (Bullen and Love (2010, p.222)

Guidelines for the adaptation/adaptive reuse of historic buildings and sites prepared by NSW Heritage Office and the Australian Institute of Architects (formerly the Royal Australian Institute of Architects) NSW branch demonstrate a vision of heritage places in a new context, meaning that now the appropriate use for a heritage place is recognised as a critical issue (Heritage Council of New South Wales and The Royal Australian Institute of Architects 2008).

Tourism plays an important role in the Australian economy. According to the Australian Bureau of Statistics (2015) “Of Australia's 2.8 million international cultural and heritage visitors in 2012, 58% reported visiting a museum or art gallery and 57% had visited historical/heritage buildings, sites or monuments.” Furthermore, the Australian Bureau of Statistics (2013b, p.5) states that “tourism grew faster than the total of the economy last financial year, contributing over $112 million dollars a day to the Australian economy”. Following extremely positive statistics in 2012, 2013 recorded further progress in strong tourism growth. Moreover, tourism outpaced the growth of industries such as agriculture, mining and manufacturing (Australian Bureau of Statistics 2013a).

In Australia, there is a close relationship between tourism and cultural heritage management (McKercher, Ho and Cros 2005) and gaining an understanding of tourist behaviour is an important element in the management of heritage sites (Poria, Butler and Airey 2003). This relationship is a good reason for utilising better stakeholder management to ensure that the views of all stakeholders, including tourists and tour agencies, are incorporated in making decisions on heritage projects.

2.6. Challenges to retaining heritage-listed buildings

Development and redevelopment are an unavoidable necessity within the world’s heritage cities, and on many occasions significant heritage sites have come under severe pressure from a number of directions (Rypkema 1990). The World Heritage Committee (Australia) in its *List of World Heritage in Danger* identifies development projects in the first place amongst the three most prevalent threats to heritage preservation (Department of Sustainability Environment Water Population and Communities 2012b). The problem is still current, and is seriously affecting the Australian refurbishment sector.

The Royal Institute of British Architects (RIBA) reported that “any conservation project over £10,000 was likely to require an extension of time” (cited in Reyes and Mansfield (2001, p.243). Plans even when developed to the pre-contract stage can often be re-arranged, particularly in terms of altering specifications, durations and cost. However, conservation projects have more technical and economic risks than new build projects and so some authors observe that generally it is poor leadership and lack of compliance with procedural systems that are amongst the major causes of unsuccessful building maintenance and refurbishment (Dann and Cantell 2007; Forster and Kayan 2009; University of the West of England 2003). The lack of conservation literature in the field of facilities and maintenance management has been identified as a problem (Dann and Wood 2004). This evidence indicates that another type of project management needs to be created to ensure successful achievement for future conservation projects.

Dan and Wood (2004) ascertained that in the maintenance management processes, there is insufficient recognition that maintenance management has to be organised differently accordingly to the situation. Zwikael and Smyrk (2011, p.88), commenting on project execution, observed that "because projects are not repeated, everyone who is involved faces uncharted territory".

In the Canadian province of Ontario, hundreds of historical buildings have been demolished over the past decade. The reason for the destruction of the traditional urban fabric as argued by owners, bankers and developers is that adapting and refurbishing the historical buildings would cost considerably more than developing new constructions (Shipley, Utz and Parsons 2006). Despite the preference for many members of the 26 to live in older traditional buildings, there are many physical and administrative complications involved with marketing, developing and implementing heritage construction projects.

2.7. Project management

The current concept of project management as a professional discipline and as an operational control system began in the early 1960s, instigated predominantly by businesses resulting from seeing the perceived advantages of organised work around projects. From 1960 till the present, there have been numerous modified frameworks developed to handle projects for various types of buildings. The major ones identified during the conduct of this research are as follows. *The Logical Framework* (LFA) was developed in 1969 for the US Agency for International Development by Leon J. Rosenberg. LFA methodology operates around several major principles (Sida Civil Society Center 2006) and one such principle relevant in this research is that many different stakeholders working together for common goals tend to be essential in an effective planning process. *Projects in a Controlled Environment* (PRINCE 2), now subtitled 'Towards Managing Successful Projects' (OGH 2011), is used extensively by the UK Government on a wide range of publically funded projects. The Commonwealth Government in Australia and most State Governments have adopted this system. In Queensland, the government adopted the PRINCE2 methodology to accomplish more effective governance and risk management of its capital projects (Crawford and Helm 2009). The Project Management Institute (PMI) published the *Project Management Body of Knowledge* (PMBOK) (2008) as a recognised standard for the project management profession, and widely recognised as good practice.

The construction industry in the UK uses the RIBA *Outline Plan of Work* as a model framework for managing projects and basic office procedures (RIBA 2000). In the UK, the outline plan is widely recognised as a model for managing heritage-listed projects (RIBA 2013).

2.7.1. Project success and project performance success measures

A popular indicator of the basic dimensions of project performance success measures is the simple model known as the "iron triangle" in which the criteria for project performance success are measured by achievements against the benchmarks of time, cost and quality (Haughey 2012). There are various views on the efficacy of the iron triangle in the literature. One of the emerging theories is that the triangle creates an unrealistic view of project performance success (Atkinson 1999; Lipovetsky et al. 2002; Toor and Ogunlana 2010). Authors have different views of what the most effective measures of success outcomes on projects should be; however, there is a common perception that to be seen as successful, any management framework must facilitate the delivery of projects on time, on budget and within specified quality requirements. Suggestions for the successful management of projects indicate that there is a need to manage projects in an adoptable, flexible and iterative way to account for changes to be made according to the project progress and taking into account the environment in which the project resides (Shenhar and Dvir 2007). Figure 2.5 presents a comprehensive theoretical model of project success measures.

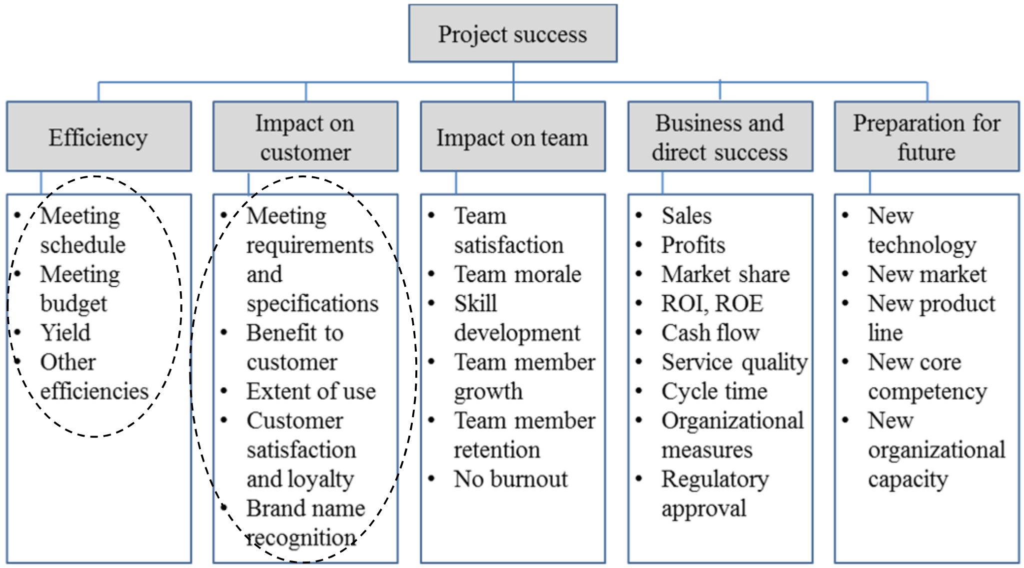


Figure 2.5: Specific project success measures (Shenhar and Dvir (2007, p.27)

Project success, according to Shenhar and Dvir (2007), is grouped under five dimensions including various sub-measures. The first dimension is project efficiency which represents the meeting of planned goals. As the present study investigates project success in meeting time and cost goals, the first project success dimension is relevant . The second dimension is impact on the customer, which can be viewed as representing the major stakeholders whose participation is critical to project success. These two dimensions are most applicable to heritage project.

The basic principles of cost planning are to set a realistic cost target for all parts of the project (Smith et al. 2004); however, in certain circumstances where accurate cost information is difficult to obtain this is often not the case, especially in heritage projects. Moreover, it is believed that a professionally cost managed project has to be organised not just based on the accuracy of costing but also on the application of sound project management principles.

Furthermore, it is interesting to note that quality criteria are usually well met in conservation projects. There may be several reasons for this including the scrutiny applied by planners and local and national heritage bodies to both the work processes and final outcomes of heritage buildings, before capital is released or grants finalised and paid. However, time and budget constraints are often exceeded sometimes by an astronomical margin.

The disparity in the points of view on project success is noted by Freeman and Beale (1992, p.8) who state that “an architect may consider success in terms of aesthetic appearance, an engineer in terms of technical competence, an accountant in terms of dollars spent under budget, a human resources manager in terms of employee satisfaction and chief executive officers rate their success in the stock market”. Because of this range of differing views, there appears to be considerable merit in utilising the traditional project management model of success measurement which uses a simple and objective rationale around what represents project success, and this research generally follows the more traditional iron triangle key factors as its units of measurement of project success. Professionally managed projects need to be measured by established project management principles, so that the stakeholders and project team members involved can make sense of measuring success or determining when projects are going wrong. Belassi and Tukel (1996) also share the view that to be successful, projects must be completed within cost, on time and to the desired level of quality; however, they also stress the critical importance of client satisfaction.

There are differences between project success measured by the achievement of basic project objectives and project management success, specifically gauged against compliance with time, cost, quality and customer satisfaction, that is, the ‘modified’ iron triangle. Another distinction of importance to be acknowledged is the difference between success criteria which means a set of measures by which success will be judged and success factors as project inputs which lead to final project success (Cooke-Davies 2002). Analysing the schedule delay and cost escalation caused by different factors and comparing these with the project inputs will create realistic measures for project success.

Because project performance success is not the same as project success—and because of the input and impact of multiple stakeholders who have an invested interest to achieve personal benefits through the project—it is difficult to establish exactly what success in a project actually looks like. Good front-end project planning and pre-determination of the project goals in the early stage of the project (project input) can therefore directly impact the project outcomes (Cooke-Davies 2002). In order to hold these established goals constant, stakeholder management is important.

The inherent quality of a project thus begins at the inception and planning stages of a project and can be measured through to execution and handover. It is this achievement through the whole lifecycle of a project that espouses real project success (Soetanto, Proverbs and Holt 2001).

2.7.2. Factors affecting project success

Project failures may be perceived differently by different stakeholders and each stakeholder group is likely to enforce their expectations of success on their view of the project achievements; thus, the determination of relative project failure may also be difficult. Zwikael and Smyrk (2011, p.249) state:

> “Although all of the parameters for a project are clearly stated in the business case and project plan, additional constraints on the agreed timeframe and budget can emerge for either of two reasons: 1. During execution, the dates on which milestones are achieved start to run late, or expenditures attached to each start to exceed the budget; 2. The funder has arbitrarily reduced the timeframe and/or budget. In either event, the project becomes infeasible.”

Cleland and Ireland (2010) have identified several failure factors for all types of infrastructure and construction projects and some of the same listed causes of project failure also are applicable to heritage building projects. The major failure factors according to these authors (ibid 2010) are the overruns of cost and schedule, which are also the major focus of this research project, Nine other factors identified in this research are specifically observed to impact on heritage listed building projects. Therefore the major project failure factors and sub-factors identified by Cleland and Ireland (2010) have been adopted and extended for the purposes of operationalising this research. Cleland and Ireland (2010, p.3) have described the factors contributing to project failure as shown in Figure 2.6.

Project Failure – Factors

- The project has overrun cost and schedule goals.
- The project does not have an appropriate fit with the customer's mission, objectives, and goals.
- The project has failed to meet its technical performance expectations.
- The project was permitted to run beyond the point where its results were needed to support the customer's expectations.
- Inadequate management processes were carried out on the project.
- A faulty design of the project's technical performance standards was conducted.
- The project stakeholders were unhappy with the progress on the project and/or the results that were obtained.
- Top management failed to periodically review and support the project.
- Unqualified people served on the project team.
- The project met the initial requirements, but did not solve the longer-range business need.

Figure 2.6: Causes of project failures (Cleland and Ireland (2010, p.3)

Time management is the major factor contributing to a large percentage of project failures, and many refurbishment and reconstruction projects run well over schedule. However, due to their interconnection, the two dimensions of time and cost are usually both highly prevalent in the failure of many heritage projects. Therefore, there is an urgent need for them to be investigated vigorously in the heritage project performance context as they continue to affect the decision-making around whether to actually undertake heritage projects or not.

It is widely accepted that poor scope management_is one of the leading causes of project failure (Dumont, Gibson and Fish (1997, p. 54). Moreover, the poor scope definition can lead to numerous causal relationships during the project. Managing the scope of heritage projects that contain so many' unknowns' is often difficult or even impossible and so focusing on strategies to ensure the right scope from the beginning of the project is the major target of this research.

2.8. Stakeholder management

The importance of stakeholders to the planning, developing and executing of successful projects is well identified by many authors (Bourne and Walker 2005; Freeman and McVea 2001; Frooman 2010; Newcombe 2003).

Since the emergence of the earliest project management theories and methodologies, the concept of the 'project stakeholder' arose out of the results of pioneering work undertaken at the Stanford Research Institute (today SRI International). Since then, the definition of stakeholders has been revised in both orientation and definition many times since it was first introduced (Freeman and McVea 2001). Currently, the process of stakeholder management is applied to the briefing and planning stages of most large-scale or complex building projects. An important part of stakeholder management is stakeholder analysis that, since its inception, has increased the project manager's ability to anticipate and properly identify problems emanating from the actions of, and that will impact on, involved stakeholders while it is still early enough to intervene, and review and change plans (Jepsen and Eskerod 2009). Bourne (2005) notes that effectively focused stakeholder management aims at improving the perception of project success and involves identifying the key stakeholders of the project and developing appropriate stakeholder communication through the vehicle of the project management team.

2.8.1. Stakeholder influence on project

The stakeholder involvement in, and impact on, a project can be of differing intensity, ranking from the informative level to the decision making level. The stakeholders of highest influence and highest interest on the project are most critical to the project success; however, the levels of influence and interest can change over time so managing the stakeholders is a constantly changing and dynamic process. This research adopts the model shown in figure 2.7 to address the levels of influence/power in relation to the stakeholder interest in heritage projects.

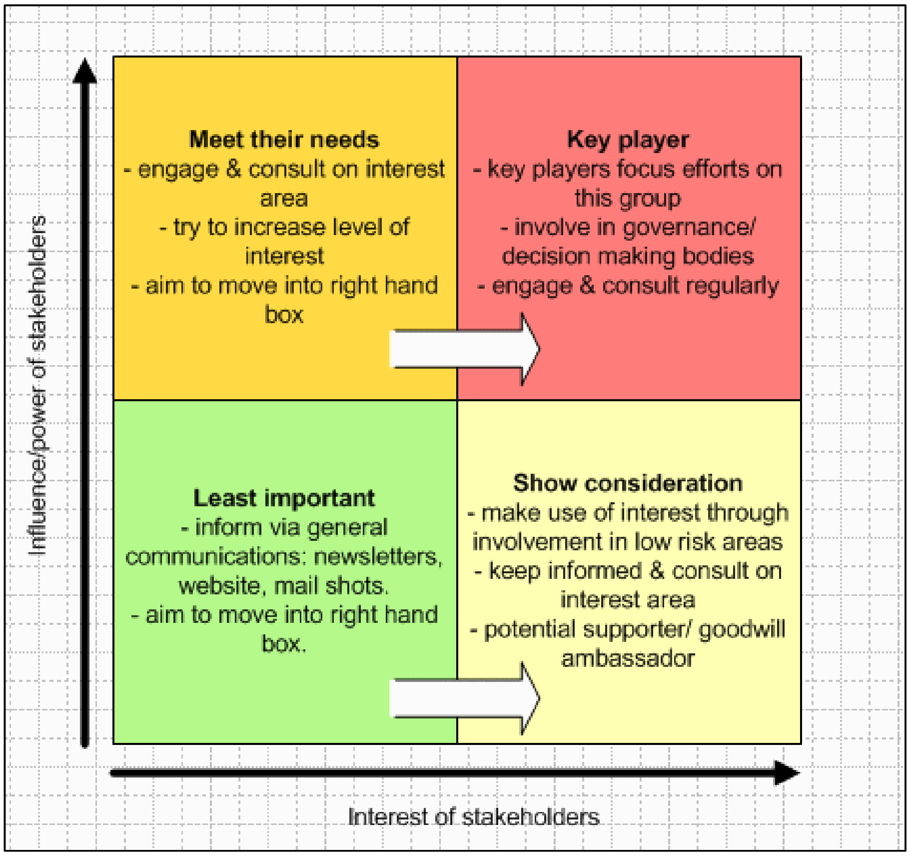


Figure 2.7: Stakeholder map (Eden and Ackermann 1998) (Source: http://stakeholdermap.com/stakeholder-analysis.html)

In addition to establishing the overall power or influence and interest of identified stakeholders, it is also necessary in the project performance context to ascertain the degree of stakeholder influence using a scale based on the use of possible tools, processes and instruments that are going to be used. The relationship between what to measure and how to measure it is shown in Table 2.2.

Table 2.2: Stakeholder degrees of influence
Source: Nagothu et al. (2009, p.7)

Degree of influence according to the scale	**Possible tools, processes and instruments to be used**
1. Stakeholders are informed – they remain passive	Folders, brochures, newsletters, advertisement, reports, exhibitions, internet
2. Stakeholders are consulted	Workshops, focus group meetings, internet questionnaires
3. Stakeholders give advice	Advisory panels consisting of stakeholders, interactive sessions, internet discussion
4. Stake holders become co-producers	Stakeholder panel meetings, internet discussions
	Organizing workshops, create a common ground for discussion, for example, joint scenario development
5. Stakeholders not only produce solutions but also decide about them	Joint working groups that decide about implementation for solutions

Different types of stakeholder classifications, as well as different definitions of stakeholder impact, exist in the stakeholder literature. Furthermore, various frameworks have been identified for accomplishing successful stakeholder relationship/management (Bourne and Walker 2005; Frooman 1999; Olander 2007; Yang et al. 2010).

The stakeholder management factor ranking for heritage building projects will contribute to better understanding of stakeholder management priorities and the impact of those factors to the project performance, and moreover the improvement of outcomes of overall projects.

2.8.2. Managing multiple stakeholders

It is important to interconnect all the stakeholders in order for them to work cohesively towards facilitating common and mutually satisfying goals in order to ensure a high degree of project success. The complexity of the conservation process and having a number of stakeholders engaged often leads to there being several different objectives and requirements, which brings about conflicts (Alallafa and Torreb 2010). Figure 2.8 presents the crucial problem inherent in conservation projects when multiple stakeholders are involved.

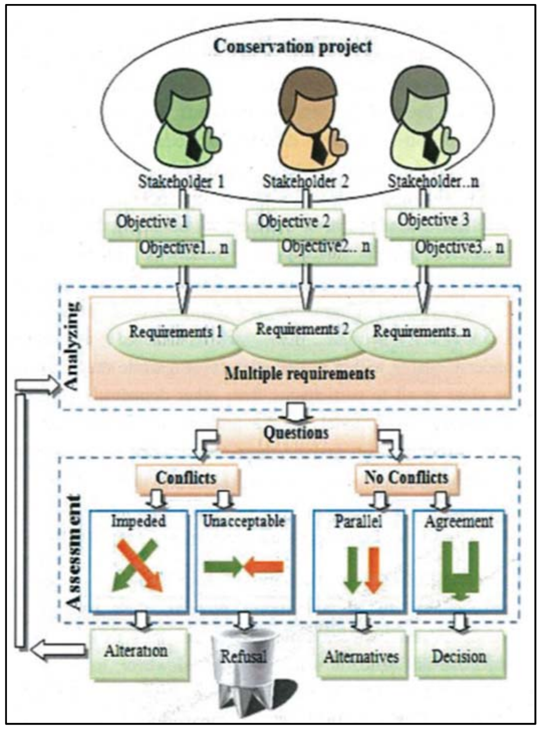


Figure 2.8: Multiple stakeholder models in conservation projects (Alallafa and Torreb (2010, p.6)

The fact of the different objectives and requirements raised by the various stakeholders and their different levels of involvement leads to a need to identify conflicts and often results in a need for restructuring of the requirements. Furthermore, as projects involve a wide array of stakeholders (Aaltonen 2011; Olander and Landin 2005) it must be emphasised that project management decisions made during the different phases of the project lifecycle are directly influenced by stakeholders (Aaltonen and Kujala 2010). As Aaltonen and Kujala (2010, p. 381) state, projects "are affected by multiple stakeholders with differing interests and demands". Moreover, it is noted that stakeholders "are the major source of uncertainty in projects" (Ward and Chapman (2008). Therefore, robust and meaningful stakeholder management is a crucial element of managing projects successfully.

Aligning with the views of Ward and Chapman (2008), in the area of stakeholder management in conservation projects, various aims and goals can negatively affect project delivery. Therefore, coordination among various stakeholders in the design and construction phases and in the supervision of these phases is significant in ensuring project success. However, this assumes that the stakeholders most closely involved with planning and delivery of the projects, have the specialised competencies to effectively undertake these duties and processes. The problem of the lack of skills among the various stakeholders in conservation projects has been noted by Alallaf and Toreb (2010, p. 2) who observe that:

> *"Recent studies confirm that capturing manageable documentation is especially important in large-complex activities because the framework in which key decisions are made will be misplaced when different actors are engaged indifferent aspects of the conservation process; critical mistakes are commonly made in formulation and resolution of decisions, but they are often unnoticed in the absence of comprehensive managed documentation; in the absence of reliable documentation, work groups engage in repetitive discussion and resolution of the same issues; and key decisions are often misunderstood and misinterpreted when stakeholders with conflicting skill, perspective and viewpoints are involved. Indecision-making process, most stakeholders have a misunderstanding of the technical problem of used tool type and what results from such restriction."*

2.8.3. Australian – Needs for Stakeholders' Expertise

The skill levels and specialist knowledge capabilities of those stakeholders engaged in planning, designing and building heritage projects, especially concerning the materials and procedures that need to be strictly followed has been identified in the literature as an issue. Many of the "old" skills have been lost and the emphasis is on the trades to be able to satisfy the appropriate level of preparation and execution work required on most unique heritage buildings and places. This problem of the lack of required skills and knowledge has been recognised and reported by the Australian State and Environmental Committee in 2011.

Figure 2.9 presents a summary of the perceived lack of skills and expertise of specialists in historic heritage conservation according to the Australian State of the Environment Committee (2011).

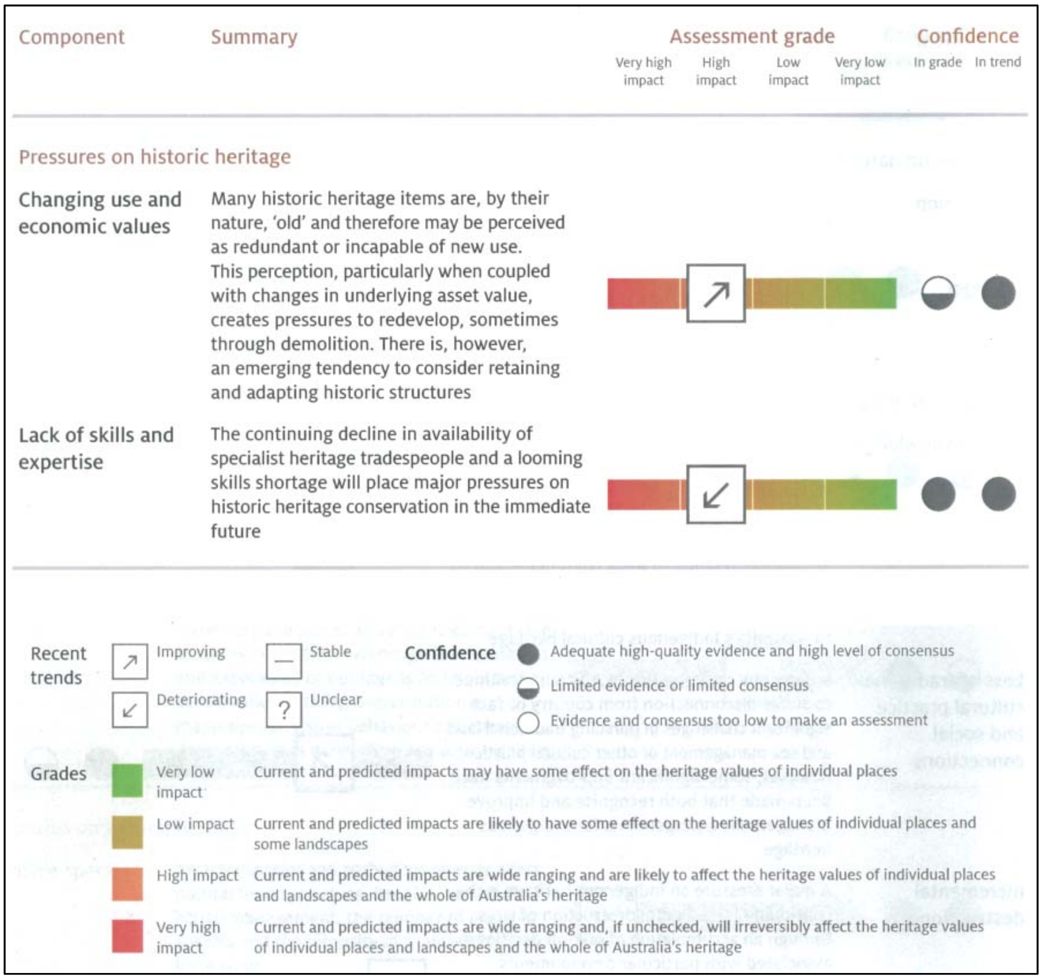


Figure 2.9: Historic heritage, lack of skills and expertise (Australian State of the Environment Committee (2011, p. 741)

There is a clear and urgent need to investigate this lack of skills and knowledge in the heritage buildings field. Therefore in order to ensure that the heritage projects will be able to procure the right skills there is a need for the correct skills set to be identified and introduced when planning heritage projects to facilitate the effective management procedures in executing such projects.

According to the Australian State of the Environment Committee (2011, p. 745), this lack of leadership comes about "partly through statutory limitations on the role of the

Australian Heritage Council, and partly through diminution of resources and responsibilities and, in a conceptual sense, from the absence of a national heritage strategy". Underlying the challenges facing the management of stakeholders in heritage projects is a lack of leadership at a national level. Therefore, better stakeholder management becomes the issue of interest.

2.9. Discussion

As shown, this research investigates the factors affecting project failures that are prevalent in the two project management stages planning/design and execution/construction of construction projects in general and heritage-listed projects in particular. The present study investigates the challenges in heritage projects with a view to validating these and developing set of recommendations/guidance for improving the project performance and delivery outcomes in heritage projects. Also of importance in the research is a need to identify and evaluate the contribution and importance of stakeholder roles in the planning/design and execution/construction stages of heritage projects, in order to ascertain if specific and specialised management is possible for achievement of better project performance outcomes.

Therefore based on the extensive literature review in the project challenges the present research seeks to address the following questions:

RQ1. What are the main challenges that form the key reasons and make the decision on retaining existing heritage places?

RQ2. What are the challenges (and causes of the challenges) in complying with policies and procedures that affect the management and delivery of heritage projects?

RQ3. How can the project management process be improved for more effective management in the operation and delivery of heritage building projects?

2.10. Summary

This chapter documented the instruments and approaches to maintaining heritage-listed buildings in recognition of the value of these buildings to local communities and their histories (Peacock and Rizzo 2008). However, like all construction projects, heritage projects are often affected by problems such as running over time and over budget.

Based on a review of the literature, the research objectives that form the research question can be summarised as follows: the current project management framework has been criticised by the research community and it is essential to develop new models and theories based on the dominant areas of concern and project management lifecycle model stages (Winter et al. 2006). Furthermore few, or indeed any, studies have previously been conducted to explore the specific project management and stakeholder issues that contribute to failed elements (time and cost) of heritage projects. It is also important to evaluate current maintenance procedures and current project management strategies (Carmichael 2004; Gambles 2009; Hill 2010; Meredith and Mantel 2011; Phelps, Ashworth and Johansson 2002; Sommer 2010) as well as identifying the challenges impacting on the management of design and execution.

The identified research gap further relates to the research problem, that is, despite the results from previous research studies that have been utilised to provide solutions to improve the management of projects, many such projects are in fact still running over time and therefore over budget. It has been estimated that 85% of projects fail to meet delivery goals (Shenhar and Dvir 2007).

Therefore the three research objectives have been drawn from the gap in the research and the stated problems. The research objectives are addressed by investigating the challenges in heritage projects while investigating the stakeholder management as a base for the development of guidance to improve the current policy and procedures and practices to make a contribution to the successful execution of future heritage projects. Having reviewed the literature and contextualised the research question, the next chapter analyses the applicability of the methodology to ensure that the research question is answered in the most appropriate way.

Chapter 3

RESEARCH DESIGN AND METHOD

Divide a problem into as many parts as necessary to attack it in the best way, and start an analysis by examining the simplest and most easily understood parts before ascending gradually to an understanding of the most complex.

Descartes in Kasi (2009, p.12)

3.1. Introduction

In Chapter 2, the main focus was on project challenges and the major gaps in the literature and thus the weaker or missing elements in heritage project management were identified. This chapter deals with the critical methodological foundation for achievement of a successful outcome in the research project. The research methodology consists of three basic elements (Crotty 1998; Sarantakos 2005). Firstly, positioning the study within an appropriate research paradigm is fundamental. Secondly, the choice of research paradigm governs the selection of a suitable research approach. Thirdly, the chosen research approach directs the selection of the research method, that is, the data collection and the analytical method.

The chapter begins with a restating of the research questions and provides an introduction to the phenomenon under study in this research project by locating it against the most relevant research paradigm and focusing on using the best and most relevant philosophical approach most likely to collect the required data for validation purposes. The research approach is described (Section 3.3) and the proposed research method is outlined (Section 3.4). The overall research strategy is defined according to the methodology. A summary of the estimated activity resources is presented (Section 3.5).

3.2. Research Paradigm and Philosophy

The undertaking of any research begins by describing a phenomenon (Groenewald 2004). Krauss (2005, p. 760) notes that "the phenomenon of multiple realities exist [so] conducting research without taking this into account violates their fundamental view of the individual". Hatch and Cunliffe (2006) highlight that observing the same phenomenon from different physiological perspectives may lead to different kinds of knowledge.

There are two major philosophical approaches to research, namely, subjective or objective approaches concerning ontology (reality), epistemology (knowledge), human nature and methodology. Figure 3.1 presents the scheme for analysing the assumptions reflected in the paradigms (Burrell and Morgan 1979).

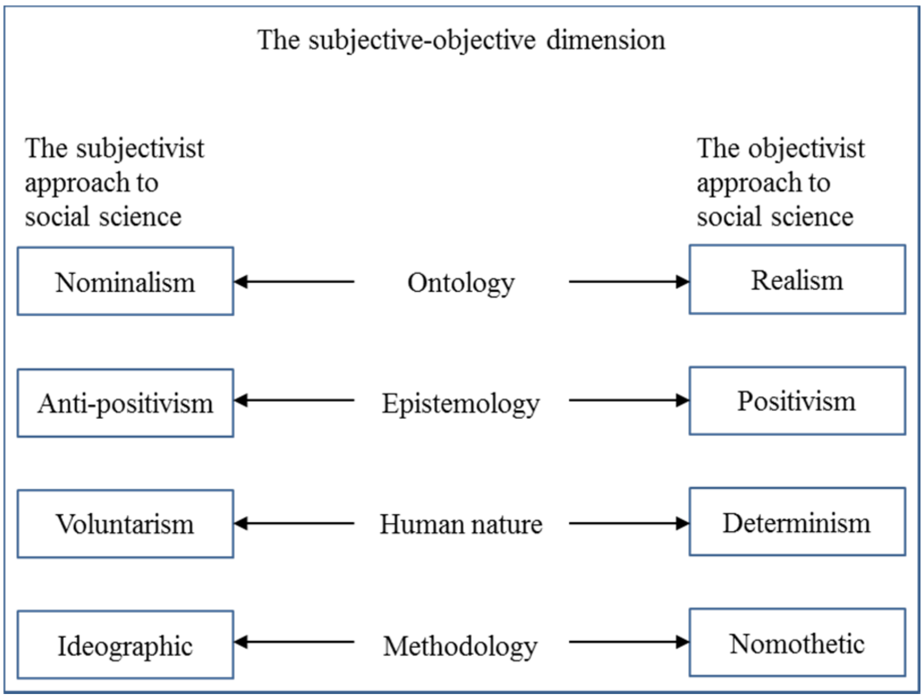


Figure 3.1: Scheme for analysing assumptions reflected in the paradigms (Burrell and Morgan 1979)

There are many perspectives surrounding reality (ontology) and knowledge (epistemology). Such debate is unlikely to end in any philosophical solution, as there is no right or wrong philosophical stance (Holden and Lynch 2004). There are many conflicting definitions and connotations that lead into "conceptual quicksand" rather than a sense of understanding (Nord and Connell 1993). Furthermore, Connell and Nord (1996, p. 12) argue that "if reality is external and unknown to humans, then how do we accumulate knowledge regarding it? and… if we are accumulating knowledge about it, how do we know that we are doing it?" Therefore, this way of understanding reality does not require any further philosophical debate because the nature of existence cannot be correctly or definitively positioned.

Table 3.1 presents a summary of the various paradigms identified by Sarantakos (1998), which are widely accepted by Australian and international scientists. The positivist, critical and interpretative paradigms are discussed in detail below.

Table 3.1: Research paradigms (Sarantakos 1998)

POSITIVISTIC	INTERPRETATIVE	CRITICAL
Positivism Neo-positivism Methodological positivism Logical positivism	Symbolic interactionism Phenomenology Ethnomethodology Hermeneutics Psychoanalysis Ethnology Ethnography Sociolinguistics	Critical sociology Conflict school of thought Marxism Feminism

Utilising the most appropriate philosophical approach presented in Figure 3.1 and the relevant research paradigm presented in a Table 3.1 facilitates the researcher to associate the correct relationship between the research questions and objectives (Cohen, Manion and Morrison 2011). Therefore the positivist quantitative paradigm and the qualitative interpretative research paradigm represent the core of the mixed methods approach applied to this research (Creswell 2009).

3.3. Research context – Literature Review

As established in the literature review in Chapter 2, the need to preserve the aesthetic quality of heritage buildings and their outstanding universal value is emerging as a task of high importance (Mason 2005; Provins et al. 2008; Roders and Oers 2011). Coupled with this is the evaluative notion that most projects fail to meet their goals (Shenhar and Dvir 2007) such as time, cost and quality. Figure 3.2 shows the estimate activity resources in the literature review step (involving the inputs, tools and techniques, and outputs) as set out in the PMBOK.

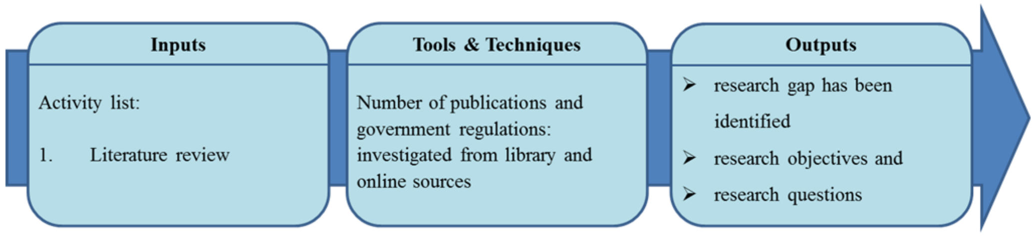


Figure 3.2: Estimate activity resources – Literature Review – Input, Tools & Techniques, and Outputs (adopted from PMBOK)

If heritage projects are already problematic in terms of meeting time and cost impositions, then the fact that conventional project management frameworks are failing to deliver in other types of projects underpins the need for a fresh look at current systems and for the development of specific systems/guidance to assure better outcomes in heritage projects. Issues with current project management methodologies are addressed and criticised by the research community (Zwikael and Smyrk 2011, p. 11).

The present study seeks to explore the following questions:

RQ1. What are the main challenges that form the key reasons and make the decision on retaining existing heritage places?

RQ2. What are the challenges (and their causes) in complying with policies and procedures that affect the management and delivery of heritage projects?

RQ3. How can the project management process be improved for more effective management in the operation and delivery of heritage building projects?

According to Yin (2009), selecting the appropriate research method requires three factors to be considered. The first and second research questions in this study are 'what' types of questions, which possess an exploratory purpose so the most appropriate matching methods are survey and archival analysis. The third question is a 'how' type and this has a descriptive purpose for which the appropriate method is a case study (Yin (2009). These factors and the matching methods are described in Figure 3.3.

METHOD	(1) Form of Research Question	(2) Requires Control of Behavioral Events?	(3) Focuses on Contemporary Events?
Experiment	how, why?	yes	yes
Survey	who, what, where, how many, how much?	no	yes
Archival Analysis	who, what, where, how many, how much?	no	yes/no
History	how, why?	no	no
Case Study	how, why?	no	yes

Figure 3.3: Form of research question matching the appropriate method (Yin (2009, p. 8)

Every research method has its strengths and weaknesses; therefore, a main priority in determining the most appropriate research method (Fellows and Liu 2003) is to ensure that the identified research questions operationalising the overriding research problem and aims are explored and the research objectives are significantly reached.

The methods utilised in this research were case studies (involving participant observation, document reviews and interviews) and a survey of the broad population of stakeholders involved in heritage projects or with knowledge of the field/discipline. This means that both qualitative and quantitative methods can be employed. The data and concept validation were provided by focus group discussion. Statistical techniques were used for analysis quantitative data and specialist data coding software was used for dealing with qualitative data. Using this mixed methodological approach, results were triangulated in order to validate the findings from the data collection. The benefits of using a mixed-methods approach is described in the following section.

3.4. The mixed-methods approach

Defining an appropriate research approach and research method to answer specific research questions has a base in the research philosophy and paradigm. Established research methods define the ways of collecting and analysing data. According to Yin

(2011), the validity of the collected evidence is summarised in three principles: triangulation, maintaining the chain of evidence, and creating a database.

Research approaches are commonly categorised into either a qualitative (explanatory) or quantitative (verifying) approach (Creswell 2009; Neuman 2006). This research project used a combination of qualitative and quantitative methodologies to ensure multiple sources of evidence and therefore the results are likely to be more accurate, valid and reliable. A qualitative research approach such as an interpretative enquiry methodology has verification as categorised by Creswell (2009). Figure 3.4 indicates in a parallel alignment the qualitative and quantitative research characteristics.

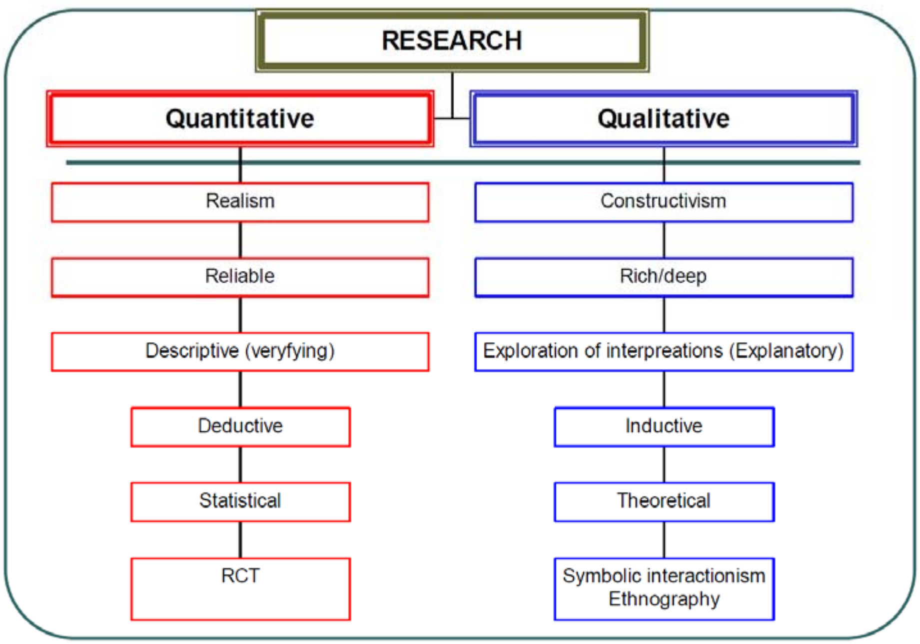


Figure 3.4: Research approaches (ECDC and University of Chester (2009, p.15)

While the qualitative methods will generate subjective hypotheses, the quantitative methods will test the hypotheses objectively. To produce a high quality guidance, this research required both measures. The rationale for both measures is further elaborated upon below.

3.4.1. Benefits of applying qualitative research approach

The primary approaches to qualitative research are classified by Hesse-Biber and Leavy (2010) under three categories: post-positivist, interpretative, and critical. The interpretative approaches that focus on the interpretations and understandings of social meaning are found to be appropriate for this research. Lythcott and Duschl Krauss (2005, p. 760) acknowledged that:

> In general, qualitative research is based on a relativistic, constructivist ontology that posits that there is no objective reality. Rather, there are multiple realities constructed by human beings who experience a phenomenon of interest. People impose order on the world perceived in an effort to construct meaning; meaning lies in cognition not in elements external to us; information impinging on our cognitive systems is screened, translated, altered, perhaps rejected by the knowledge that already exists in that system; the resulting knowledge is idiosyncratic and is purposefully constructed.

However, qualitative research involves the evaluation of people's experiences, feelings, social interactions, and the data gathered from this type of methodology will be varied and needs filtering and sorting, so that the required information can be prepared for analyses (Fellows and Liu 2003). Table 3.2 sets out the strengths and weaknesses of qualitative research.

Table 3.2: Strengths and weaknesses of qualitative research (Johnson and Onwuegbuzie (2004, p. 20)

Strengths

- The data are based on the participants' own categories of meaning.
- It is useful for studying a limited number of cases in depth.
- It is useful for describing complex phenomena.
- Provides individual case information.
- Can conduct cross-case comparisons and analysis.
- Provides understanding and description of people's personal experiences of phenomena (i.e., the "emic" or insider's viewpoint).
- Can describe, in rich detail, phenomena as they are situated and embedded in local contexts.
- The researcher identifies contextual and setting factors as they relate to the phenomenon of interest.
- The researcher can study dynamic processes (i.e., documenting sequential patterns and change).
- The researcher can use the primarily qualitative method of "grounded theory" to generate inductively a tentative but explanatory theory about a phenomenon.
- Can determine how participants interpret "constructs" (e.g., self-esteem, IQ).
- Data are usually collected in naturalistic settings in qualitative research.
- Qualitative approaches are responsive to local situations, conditions, and stakeholders' needs.
- Qualitative researchers are responsive to changes that occur during the conduct of a study (especially during extended fieldwork) and may shift the focus of their studies as a result.
- Qualitative data in the words and categories of participants lend themselves to exploring how and why phenomena occur.
- One can use an important case to demonstrate vividly a phenomenon to the readers of a report.
- Determine *idiographic* causation (i.e., determination of causes of a particular event).

Weaknesses

- Knowledge produced may not generalize to other people or other settings (i.e., findings may be unique to the relatively few people included in the research study).
- It is difficult to make quantitative predictions.
- It is more difficult to test hypotheses and theories.
- It may have lower credibility with some administrators and commissioners of programs.
- It generally takes more time to collect the data when compared to quantitative research.
- Data analysis is often time consuming.
- The results are more easily influenced by the researcher's personal biases and idiosyncrasies.

Assessing the appropriateness of this method by fully considering all the advantages and disadvantages listed in the table above is discussed in more detail in the case study Chapter 3 and additionally supports the usefulness of the employed method for this research project within document analysis, interviews and observations.

3.4.2. Benefits of applying a quantitative research approach

Applying a quantitative research approach will help measure the patterns with numbers (Rudestam and Newton 2007), as the quantitative approach seeks to gather factual data and to scrutinise or explore relationships between facts and how those relationships concur with the theories (Fellows and Liu 2003).

The quantitative research approach is a realist view of science. For realism, knowledge is a social and historical product. 'Facts' are theory-laden (Robson 2011) and realism is particularly appropriate for practice-based research. In the realist view, the task of science is to invent theories to explain the real world. The real world is stratified into different layers (individual, group and institutional, and societal levels). As heritage architectural management involves many stakeholders (some aligned and some in conflict), and as the methodology of identifying, evaluating and managing stakeholders is often based on a more qualitative approach, the use of some quantitative assessment is appropriate to balance the realism of the research.

The advantages and disadvantages of qualitative research are listed in Table 3.3. The appropriateness of quantitative research to be employed in this research project is discussed in more detail in Chapter 3.

Table 3.3: Strengths and weaknesses of quantitative research (Johnson and Onwuegbuzie (2004)

Strengths

- Testing and validating already constructed theories about how (and to a lesser degree, why) phenomena occur.
- Testing hypotheses that are constructed before the data are collected. Can generalize research findings when the data are based on random samples of sufficient size.
- Can generalize a research finding when it has been replicated on many different populations and subpopulations.
- Useful for obtaining data that allow quantitative predictions to be made.
- The researcher may construct a situation that eliminates the confounding influence of many variables, allowing one to more credibly assess *cause-and-effect* relationships.
- Data collection using some quantitative methods is relatively quick (e.g., telephone interviews).
- Provides precise, quantitative, numerical data.
- Data analysis is relatively less time consuming (using statistical software).
- The research results are relatively independent of the researcher (e.g., effect size, statistical significance).
- It may have higher credibility with many people in power (e.g., administrators, politicians, people who fund programs).
- It is useful for studying large numbers of people.

Weaknesses

- The researcher's categories that are used may not reflect local constituencies' understandings.
- The researcher's theories that are used may not reflect local constituencies' understandings.
- The researcher may miss out on phenomena occurring because of the focus on theory or hypothesis *testing* rather than on theory or hypothesis *generation* (called the *confirmation bias*).
- Knowledge produced may be too abstract and general for direct application to specific local situations, contexts, and individuals.

The applicability of this method by considering the advantages and disadvantages listed in a table above is discussed in more detail in relation to the survey (Chapter 3) which additionally supports the usefulness of the employed method for this research project.

3.5. The mixed-method approach and how this is enriched by use of an architectural research sense

The basic methodology for this research as stated above is based on a combined qualitative and quantitative approach and enriched with a specific architectural research sense. In the architectural research process, as shown in Figure 3.5 (Groat and Wang 2002) the researcher looks in two directions. On one side is a research question and the other side is an audience in expectation of receiving the research results. Two bodies of literature are also depicted and it is obvious that the research literature contributes to every phase of the research process.

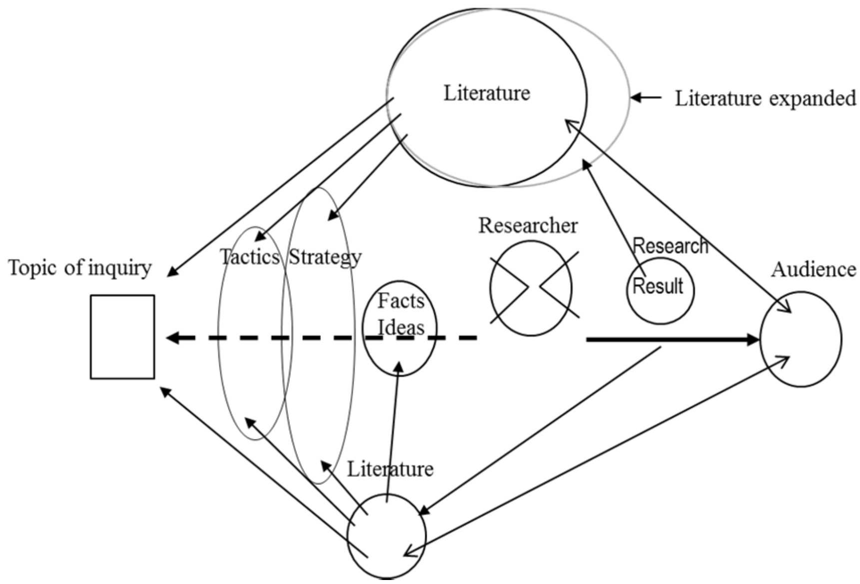


Figure 3.5: Overall diagrammatic of an architectural research project (Groat and Wang (2002, p.48)

On one side, the present study focuses on the real-world problem in construction projects running over time and over budget (not just heritage projects as previously stated), and from the other side the study looks for the gaps in the literature and aims to fill the gaps and make a contribution for the future heritage projects which is expected by the audience (general public and professionals). With the employment of the mixed-method approach to investigate project failure and produce guidance, the research has been led by experienced project practitioners to produce a useful outcome of this investigation.

3.6. Research Methods

This section justifies the research methods to be employed to answer the three research questions. Furthermore, the research design guides the researcher to use the specific methods of collecting and analysing data (Too 2009). Using the mixed-method technique, this research attempts to overcome some of the main weaknesses of single methodologies (outlined in Tables 3.2 and 3.3) of both the qualitative and quantitative research methods. The mixed methodology and research paradigm (positivist quantitative and qualitative interpretative) allow the researcher to use and evaluate a smaller sample (focus group and case studies), in order to understand the view of a larger group of people (survey).

Figure 3.6 presents the research design including the research background and research paradigms, the methodologies, methods, data collection, data analysis, and the results and validation.

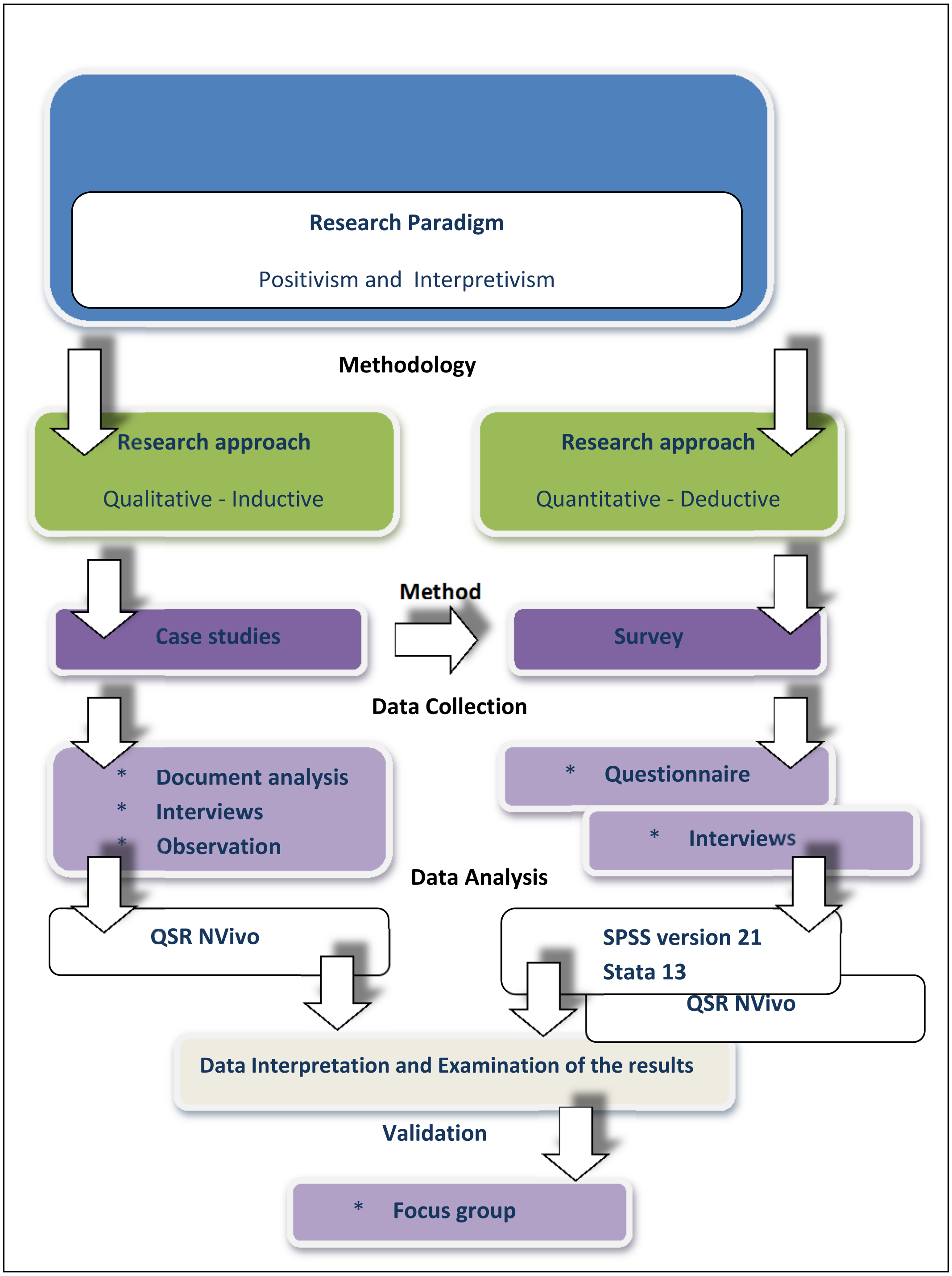


Figure 3.6: Research design

3.6.1. Rationale and design of the survey

As noted by Fellows and Liu (2008), the main objective of the survey as a quantitative research method is to collect valid and consistent data from representative patterns and respondents. Kasi defines a survey (2009, p.301) as "an observation study that generally has a cross-sectional design or a commonly used design to collect opinions". The survey questionnaire (Fairfax County Department of Neighborhood and Community Services 2012) is designed for the population to be sampled, maximising responses and minimising errors. The advantages and limitations of web questionnaires are (Kalantari, Kalantari and Maleki (2011, p.938):

- The possibility of checking the answers with warnings and prevention of illogical and out-of-framework results
- Simplicity, visual attraction, and homogeneity in answering and speed
- Suitable for large and various groups and for long-term surveys such as rate of a website users' satisfaction.

Figure 3.7 shows the estimate activity resources in the survey (involving the inputs, tools and techniques, and outputs).

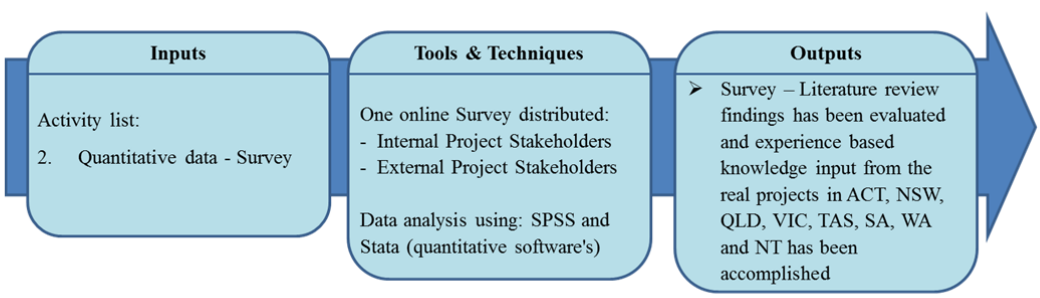


Figure 3.7: Estimate activity resources – Survey – Input, Tools & Techniques, and Outputs (adopted from PMBOK)

<u>Applicability of chosen data collection method to this research project</u>

Collecting data for this research project using a questionnaire (online survey) allowed the researcher to gather information about the challenges facing heritage projects all over Australia. The online pilot survey was distributed for validation of the findings (from the literature review and one of the case studies) to 13 respondents selected one from each of the stakeholder representatives and the accepted comments from the representative of each targeted stakeholder (internal and external) made a valid and reliable survey to be broadly distributed and to canvas a broad range of responses, and therefore to get a more complete picture of existing problems related to delays in heritage building projects.

Piloting the survey with 13 respondents narrowed the challenges and extended the questionnaire in order to facilitate discovery of the real-time project problems that had not been identified through the literature review and preliminary case study. Furthermore, the online survey enabled more than one user to answer the survey questions. It was very important to enable the owners of heritage buildings (mostly external project stakeholders) with no access to a personal computer to be able to participate in the online survey to share experienced challenges. This ability was recognised as an important factor especially for smaller places and towns where a large proportion of the population shares a public computer in their heritage organisation and/or libraries.

To collect data of interest, the online survey was divided between two identified project stakeholder sample groups: external and internal. The sampled groups are listed in detail in Section 4.2. The data collected from external and internal project stakeholders across Australia enabled the researcher to evaluate the findings within each state and to make relations to the existing challenges across the country.

3.6.2. Rationale and design of the case study

Case study approaches "facilitate in-depth investigation of particular instance of a phenomenon" (Fellows and Liu (2003, p.110). According to Yin (2008), case studies can be single or multiple case studies, and mapped with exploratory, explanatory and descriptive studies. Figure 3.8 summarises the inputs, tools and techniques and outputs of a case study.

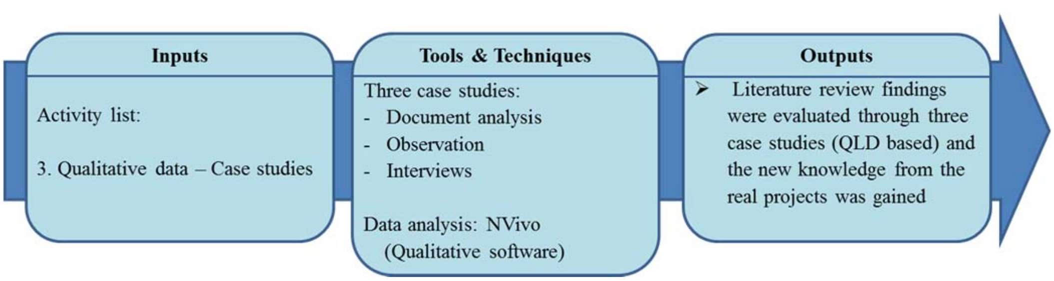


Figure 3.8: Estimate activity resources – Case Study – Inputs, Tools & Techniques, and Outputs (adopted from PMBOK)

Six sources of evidence are used in a case study: documentation, archival records, direct observation, participant observation, physical artefacts and interviews. Figure 3.9 (Yin 2008) illustrates the convergence and non-convergence of multiple sources of evidence.

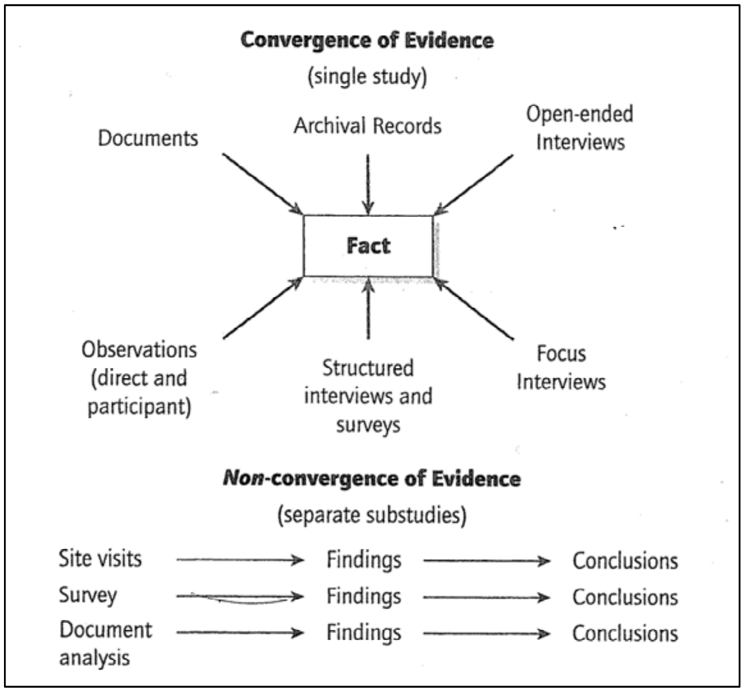


Figure 3.9: Convergence and no convergence of multiple sources of evidence (Yin (2008, p.117)

As shown in Figure 3.10, the scheme of the convergence of evidence has been applied for this research. Furthermore, the results have been analysed through the cross-case study table and the interview highlights have been combined in a survey model to achieve the maximum convergence of evidence. Figure 3.10 describes the strengths and weaknesses of each source of evidence.

SOURCE OF EVIDENCE	Strengths	Weaknesses
Documentation	◆ Stable–can be reviewed repeatedly ◆ Unobtrusive–not created as a result of the case study ◆ Exact–contains exact names, references, and details of an event ◆ Broad coverage–long span of time, many events, and many settings	◆ Retrievability–can be difficult to find ◆ Biased selectivity, if collection is incomplete ◆ Reporting bias–reflects (unknown) bias of author ◆ Access–may be deliberately withheld
Archival records	◆ *[Same as those for documentation]* ◆ Precise and usually quantitative	◆ *[Same as those for documentation]* ◆ Accessibility due to privacy reasons
Interviews	◆ Targeted–focuses directly on case study topics ◆ Insightful–provides perceived causal inferences and explanations	◆ Bias due to poorly articulated questions ◆ Response bias ◆ Inaccuracies due to poor recall ◆ Reflexivity–interviewee gives what interviewer wants to hear
Direct observations	◆ Reality–covers events in real time ◆ Contextual–covers context of "case"	◆ Time-consuming ◆ Selectivity–broad coverage difficult without a team of observers ◆ Reflexivity–event may proceed differently because it is being observed ◆ Cost–hours needed by human observers
Participant-observation	◆ *[Same as above for direct observations]* ◆ Insightful into interpersonal behavior and motives	◆ *[Same as above for direct observations]* ◆ Bias due to participant-observer's manipulation of events
Physical artifacts	◆ Insightful into cultural features ◆ Insightful into technical operations	◆ Selectivity ◆ Availability

Figure 3.10: Strengths and weaknesses of six sources of evidence (Yin (2008, p. 102)

The weaknesses of the case study method have been discussed by many researchers. Abercrombie, Hill and Turner (1984, p. 34) define a case study as a "detailed examination of the single example of a class of phenomena" and state that a case study "cannot provide reliable information about the broader class, but it may be useful in the preliminary stages of an investigation since it provides hypotheses, which may be tested systematically with a larger number of cases". To overcome this weakness, this research first investigated the documentation of the project and enriched the data obtained by following up with the interview questions. Furthermore, through use of a further two ongoing cases, this research was able to closely investigate the challenges and the causes of the project time and budget overruns.

Johnson and Onwuegbuzie (2004) noted that the weaknesses of the case study include: difficulties in testing the hypotheses and theory; the findings are unique to relatively few people; the conduct of case studies is time consuming; and the results are likely to be influenced by the researcher. However, they (ibid 2004) also pointed out the following strengths of the case study method: useful to study complex phenomena; provides individual case information; and deep case study analysis allows the researcher to describe the phenomena in rich detail, and enables the researcher to determine and describe in rich detail the causes of the particular event.

The case study as a chosen method for this research employed the following data collection methods:

(a) Document analysis

A document analysis is used in combination with the other qualitative methods as a combined methodology to study same phenomenon (Bowen 2009). A document contains text such as: minutes of meetings, agendas, letters, emails, newspapers, tender documentation, and DVD format containing pictures that have been recorded. As an analytical qualitative method, according to Bowen (2009, p.27), document analysis is "a systematic procedure for reviewing or evaluating documents – both printed and electronic material". Document analysis is commonly used for the systematic evaluation of a study, usually in combination with other qualitative methods in triangulation. One of the two key objectives of the document review is to identify documents relevant to the subject matter and to ensure that valuable information to support the case is not missed.

Applicability of chosen data collection method to this research project

Document analysis is a systematic procedure to identify, analyse and derive useful information from project documents. This research used document analysis as a method to identify the actual scenario of the case study. In this research, the document analysis took on the following form:

- First, to verify the findings from the literature review and corroborate the evidence to compare within the case study and cross-case analysis.

- Second, information gathered from documents regarding the projects to be observed (e.g. project schedule notice of likely delay, followed by the new schedule)
- Third, following the project within the context in which the stakeholders operate (e.g. examining the information flow and stakeholder relationship such as changes of duty).

The resourced that has been used as a documentation analysis were predominantly from the organizational files achieves enriched with online sites (government) and library files such as photo documentation. Also, the documentation was found in historical society offices and its online sites. In analysing the documents, extracting the targeted information of the project failures enabled the researcher to make a relation between happenings and causes.

(b) Interview

The interview is another important source of information and is used "widely to supplement and extend our knowledge about individual thoughts, interpretations, feelings and behaviour" And there are three types of case study interviews (Yin (2008): in-depth interviews, focused interviews, and structured questions. Overall, interviews are an essential source of data collection. In the research cycle, the questions have been asked, the answers have been given and at the end the answer is going to be questioned (ECDC and University of Chester 2009).

Applicability of chosen data collection method to this research project

The semi-structured mode of interviews was used for this project to provide the opportunity to ask follow-up questions to the participants, allowing them to express themselves. The involvement of key informants is critical to successful research. The project stakeholders (discussed in detail in Chapter 5) were carefully selected for interviews. Asking the same questions of each of the stakeholders to get the view of an issue and/or project requirements from different perspectives was the target. It enables the researcher to analyse the stakeholder's perspective on the identified challenge.

This research project opened the opportunity to the survey respondents to further discuss their experience either as external or internal project stakeholders. Therefore, two different sets of interview questions were designed.

(c) Observation

As an ethnographic research method, the observation method is used to study people in their environment to understand issues from their perspective (Baker 2006). Observation is categorised differently as a research method or as a data collection method. Research fields that use the observation method are anthropology and sociology, with sociology being described as the scientific study of human social behaviour. According to Giddens (1989) and Livesey (2005), sociology is a study of human social life, groups and societies.

The changes in an environment (e.g. urban development) have a reflection in social beings and social life. Serageldin (1999, p.241) points out that "many of us will not visit any of the sites on the World Heritage List. But we would feel impoverished to know of the loss of such sites and feel enriched by their continuing existence, even if we never visit them". The Australian Heritage Commission defines the methods for heritage professionals for understanding a social value of the place as "ask, listen and observe". The observation method is defined by Johnston (Johnston 1992) as "the ways in which people use a place to provide a basis for identifying places that may have special meaning". The most appropriate method for this research to follow is the role of the observer as participant. Adler and Adler (1994, p. 380) advocate this role which allows the researcher to remain "strongly research oriented" and "not to cross into a friendship domain" with the insiders of the case study.

Bade (2011, p.73) states that participant observation "provides a context for research and allows the researcher to experience the place which is being studied". It means that the information generated from observation can be used to translate the actual event from the researcher lens. Furthermore, the findings can be used to validate information from document analysis and interviews.

Applicability of chosen data collection method to this research project

The validity of the place is often a sensitive subject to be touched on by others, but is highly prevalent in the heritage context. Assessing a place in terms of to whom and how important it is needs to be explored within the social purpose of conserving heritage places.

Participant observation data collection techniques allow a researcher to observe intimately the everyday life and the world view of participants who are involved to varying degrees in heritage work and heritage projects. Baker (2006) states that the observation roles of researchers include: complete observer, observer as participant, participant as observer, non-participation, moderate membership and complete membership.

3.6.3. Rationale and design of the focus group

Focus groups are an accepted method among sociologists for gathering qualitative data and are used in a wide range of applied research areas. Focus groups are usually used as a self-contained method (as applied for this research) but also in combination with surveys and in-depth interviews (Morgan 1996). Powell and Single (1996, p.499) define a focus group as "a group of individuals selected and assembled by researchers to discuss and comment on, from personal experience, the topic that is the subject of the research". Figure 3.11 summarises the inputs, tools and techniques and outputs of the focus group.

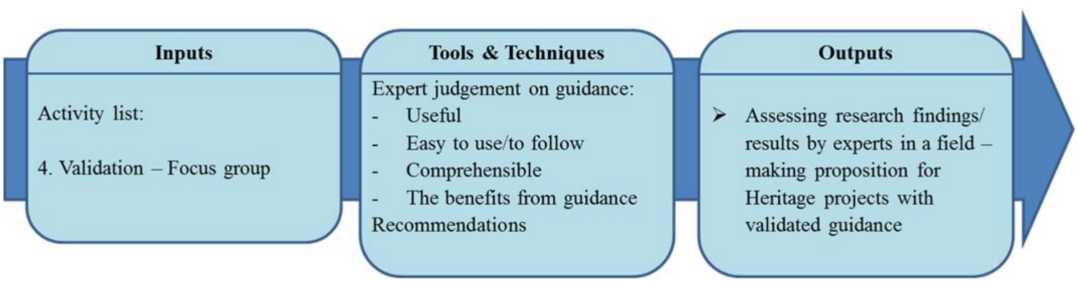


Figure 3.11: Estimate activity resources – Focus Group – Inputs, Tools & Techniques, and Outputs (adopted from PMBOK)

<u>Applicability of chosen data collection method to this research project</u>

The focus group as a qualitative method for this research was used to enhance the validity of the research findings. The main purpose of the focus group technique is to "draw up respondents' attitudes, feelings, beliefs, experience and reactions in the way in which will not be feasible using other methods, for example observation, one-to-one interviewing and questionnaire survey" noted byGibbs (1997, p.1). A focus group has validated the proposed guidance and confirmed that it benefits heritage management via the "call for action" recommendations prior to implementation. Furthermore, Krueger and Casey (2009, p.12) note that "by using focus group to pilot test the policies or procedures, the public organisations can determine which options are easy for the public to follow". In this research, the focus group consisted of five panel members with over 20 years' experience each as heritage practitioners. The criteria for selection of the focus group members are shown in Chapter 7 (Table 7.1).

3.7. Summary of Chapter

As discussed in this chapter, applying both qualitative and quantitative analysis techniques helps to secure the quality of the collected data. Moreover, data triangulation was conducted by combining the interview highlights with the top survey results to form the top four results to be finally examined by using appropriate software.

This chapter began with introducing the paradigms and research approaches to research methods from a philosophical perspective. An overview of the advantages and disadvantages of the quantitative and qualitative methods was also presented, and the rationale and specific fit of the selected research methods to this research study were discussed. Figure 3.12 presents a summary of the activity resource proposed for this research project. The next chapter explains the operationalisation of the research methods.

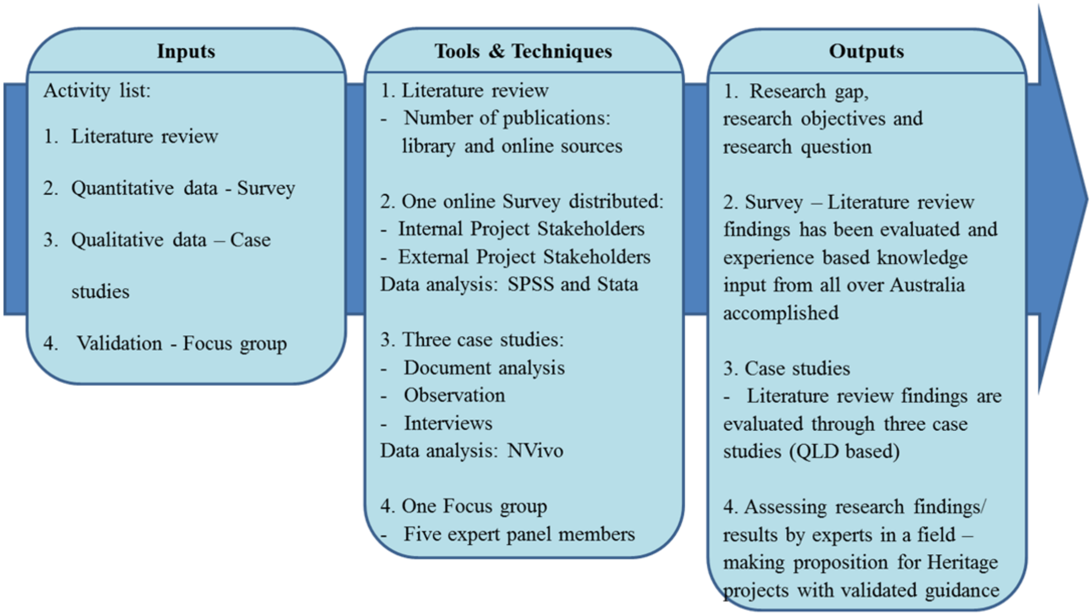


Figure 3.12: Summary of estimated activity resources – Research Project – Inputs, Tools & Techniques, and Outputs (adopted from PMBOK)

Chapter 4

OPERATIONALISING THE RESEARCH

4.1. Introduction

Chapter 3 identified the fundamental approaches that were selected as applicable for this research project in order to ensure that the research questions would be answered and the research objectives would be accomplished. This chapter demonstrates the concept of the research project divided into phases. Each phase emphasises the various stages of the research project. Although the stages are linked together, each of the various types of methods forms a separate entity in its own right. Advocates of the mixed-method research approach such as Creswell (2009), Johnson and Onwuegbuzie (2004), Tashakkori and Teddlie (2012) and Terrell (2012) recommend a graphical representation of the mixed methodology as the visual model presentation enables the reader to comprehend the multi-phase sequences.

Figure 4.1 is an illustrative model of the research design divided into phases to show what strategy was adopted to answer the research questions and satisfy the objectives of the research project. The six phases in operationalising this research were: (I) literature review and preparation, (II) qualitative data collection,(III) quantitative data collection and qualitative data collection, (IV) qualitative data collection, (V) data analysis, and (VI) focus group validation of the final guidance and theory building.

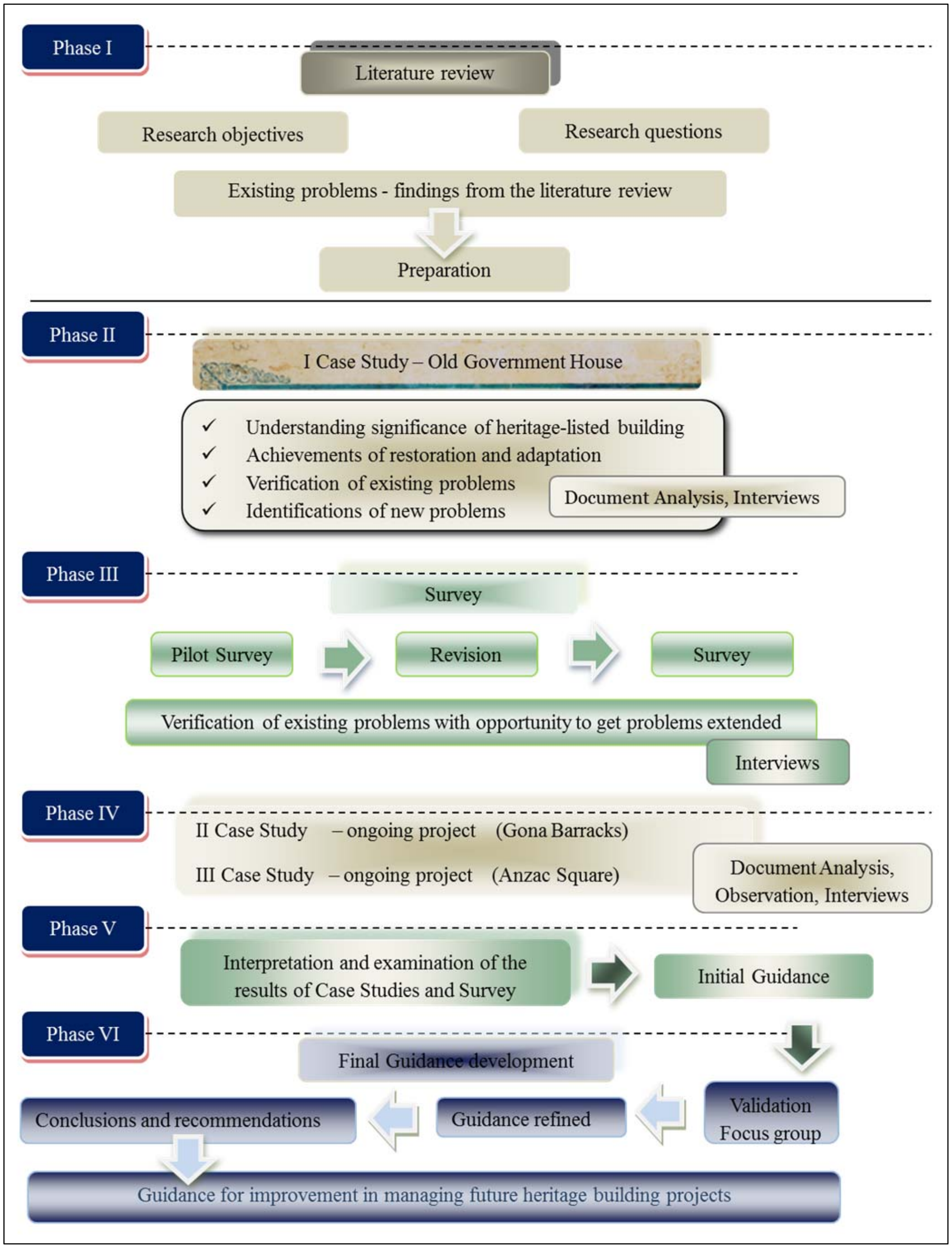


Figure 4.1: Research outline

4.2. Phase I – Literature review and preparation

(a) Literature review

The purpose of the literature review phase was to conduct a comprehensive search of existing research and texts present in the relevant field, as well as examining the existing theories in order to define the research objectives, research questions and preliminary conceptual framework for this research project. Therefore, the gaps in the existing literature were identified and three literature-based research questions were developed. To be able to answer the research questions, the researcher investigated the applicability of each research method and data collection technique so the project moved to the process of preparation.

(b) Preparation

After the comprehensive literature review and before the actual data collection begins, a detailed preparation of how the data will be collected is essential. Linking the research questions with the research strategy provides a plan regarding what kind of data needs to be collected.

(c) Ethics Approval

Before collection of any data that involves human participants, the ethical approval from QUT Ethics Committee has to be granted. This research project was granted QUT research ethics approval number 1400000542.

(d) Selection of an appropriate sampling method

The mixed-method approach was applied to increase the perceived quality of the research, as discussed in Chapter 3. Once the data collection method is known, the next step is identifying the sample that needs to be targeted to be an accurate representation of the population. Targeted populations are people, events, documents and records that contain the desired information that can answer research questions (Cooper and Schindler 2008). Therefore, the sampling design and execution can affect the validity and/or total error of the research. The validity of the sample depends on: (1) accuracy – a balance among the members of the sample, and (2) precision of estimate – no sample may fully represent its population in all respects (Cooper and Schindler 1998; Henry 1990).

There are two basic choices: a probability and non-probability sample. Probability sampling is based on the concept of random selection, whereby each population element is given a chance of selection. In contrast, non-probability is not random and samples are chosen 'at random' which suggests that they are chosen 'by wish' or 'wherever they could be found' (Cooper and Schindler 1998). Figure 4.2 presents the types of sampling design and their grouping.

	Representation Basis	
Element Selection	**Probability**	**Nonprobability**
Unrestricted	Simple random	Convenience
Restricted	Complex random Systematic Cluster Stratified Double	Purposive Judgment Quota Snowball

Figure 4.2: Types of sampling design (Cooper and Schindler (2008, p. 379)

Furthermore, Table 4.1 compares the advantages and disadvantages of the probability sampling design types.

Table 4.1: Advantages and disadvantages of the probability sampling designs (Cooper and Schindler (2008, p. 395)

Type	Description	Advantages	Disadvantages
Simple Random *Cost: High* Use: Moderate	Each population element has an equal chance of being selected into the sample. Sample drawn using random number table/generator.	Easy to implement with automatic dialing (random-digit dialing) and with computerized voice response systems.	Requires a listing of population elements. Takes more time to implement. Uses larger sample sizes. Produces larger errors.
Systematic *Cost: Moderate* Use: Moderate	Selects an element of the population at the beginning with a random start, and following the sampling skip interval selects every *k*th element.	Simple to design. Easier to use than the simple random. Easy to determine sampling distribution of mean or proportion.	Periodicity within the population may skew the sample and results. If the population list has a monotonic trend, a biased estimate will result based on the start point.
Stratified *Cost: High* Use: Moderate	Divides population into subpopulations or strata and uses simple random on each stratum. Results may be weighted and combined.	Researcher controls sample size in strata. Increased statistical efficiency. Provides data to represent and analyze subgroups. Enables use of different methods in strata.	Increased error will result if subgroups are selected at different rates. Especially expensive if strata on the population have to be created.
Cluster *Cost: Moderate* Use: High	Population is divided into internally heterogeneous subgroups. Some are randomly selected for further study.	Provides an unbiased estimate of population parameters if properly done. Economically more efficient than simple random. Lowest cost per sample, especially with geographic clusters. Easy to do without a population list.	Often lower statistical efficiency (more error) due to subgroups being homogeneous rather than heterogeneous.
Double (sequential or multiphase) *Cost: Moderate* Use: Moderate	Process includes collecting data from a sample using a previously defined technique. Based on the information found, a subsample is selected for further study.	May reduce costs if first stage results in enough data to stratify or cluster the population.	Increased costs if indiscriminately used.

For this research it was adequate for the sampling to be based on the probability of selection. According to the different types of probability sampling, a number of sampling techniques were employed to achieve the most relevant outcomes for the case study, survey and focus group.

(e) Sampling process

For the case study, the complex random sampling method called double sampling (also called sequential sampling or multi-phase sampling) was chosen. The principles of the multi-stage sampling are straightforward. Henry (1990, p.110) notes that "a more tractable use of multi-stage sampling, the nested units sampling involves the selection of nested units to obtain a sample of special population". Figure 4.3 shows the visual steps of sampling at multiple stages.

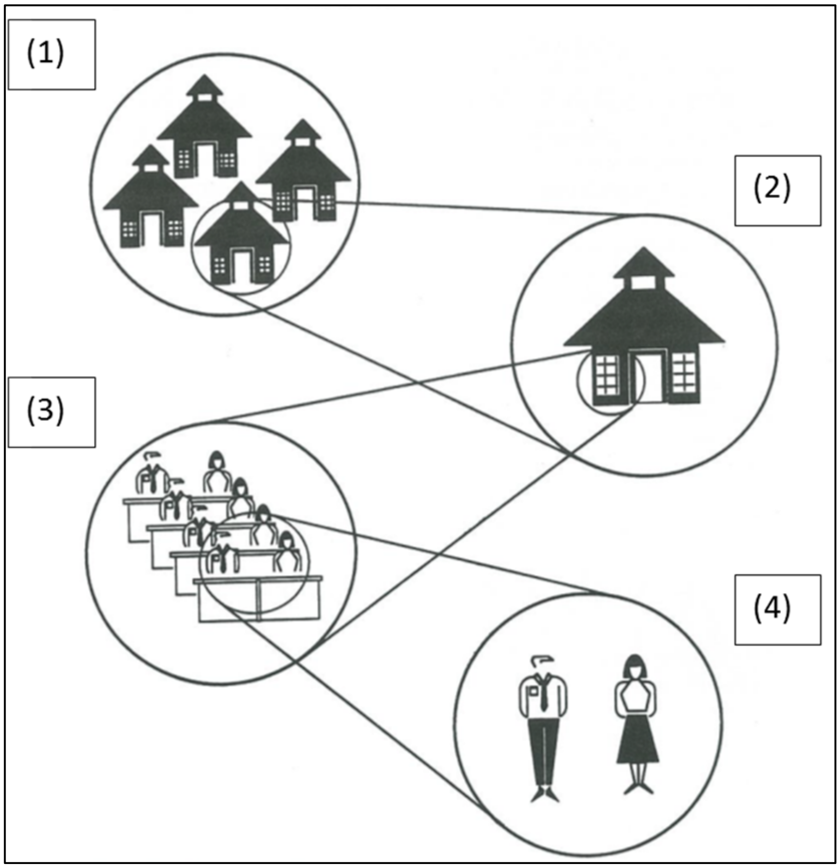


Figure 4.3: Sampling in the multiple stages (Henry (1990, p.111)

According to the schematic visual example shown above in Figure 4.3, the following steps were taken in the present research: (1) the most appropriate case studies relevant to the research objectives were identified, (2) each case study (3) has multiple stakeholders involved in the project; therefore, (4) selecting the most relevant targeted stakeholders to be interviewed was the final step in good sampling.

For the survey, the simple random sampling was selected whereby "each member of the study population has an equal probability of selection" noted by Henry (1990, p. 27). The first step was identifying the pool eligible for selection which in this case meant:

(1) External project stakeholders
   - Users/occupiers of heritage building (bookshop, café, museum, bank, etc.), tourism and related organisations, and members of the public that have an interest in heritage buildings/places.

(2) Internal project stakeholders

- A group of experts in the field located within government and non-government organisations and private firms in the relevant sectors.

An online survey was distributed to the identified sampled population. The option for further discussion regarding the survey answers was offered to the participants in both groups if they expressed willingness to be interviewed.

The importance of randomisation for a focus group has been argued by many researchers (Krueger and Casey 2009). Krueger and Casey (2009, p.73) state that "randomization is an effective strategy to minimize section bias. Randomization is rarely done of the entire population, but rather on those passing the selection screens." In the present study, the recruiting process for the focus group was carefully designed to ensure the selection of a sample with the relevant knowledge.

(f) What sample size is adequate?

The sample size needs to produce reliable results (Henry 1990; Cooper and Schindler 2008). The size of a sample that is needed for the chosen probability sampling can vary. According to Cooper and Schindler (2008, p. 385), "How large a sample should be is a function of the variation in the population parameters under study and estimating precision needed by the researcher". Cooper and Schindler (1998, p. 222) also state that "one false belief is that a sample must be large or it is not representative" and advise (2008, p. 385) that "a sample should bear some proportional relationship to the size of the population from which is drawn". Therefore, this research targeted the most representative sample of the population, rather than focusing on the quantity in order to get the most value from the data collection.

4.3. Phase II, IV– Qualitative data collection (case study)

Case studies emphasise the real-world context in which certain phenomena occur. Cooper and Schindler (2008, p. 184) refer to a case study as a "powerful research methodology that combines individual and (sometimes) group interviews with record analysis and observation".

The approach depicted in Figure 4.4 was adopted by the researcher to guide the definition and design of the selected cases, the preparation, collection and analysis of the data, and at the end the drawing of the cross-case study conclusions.

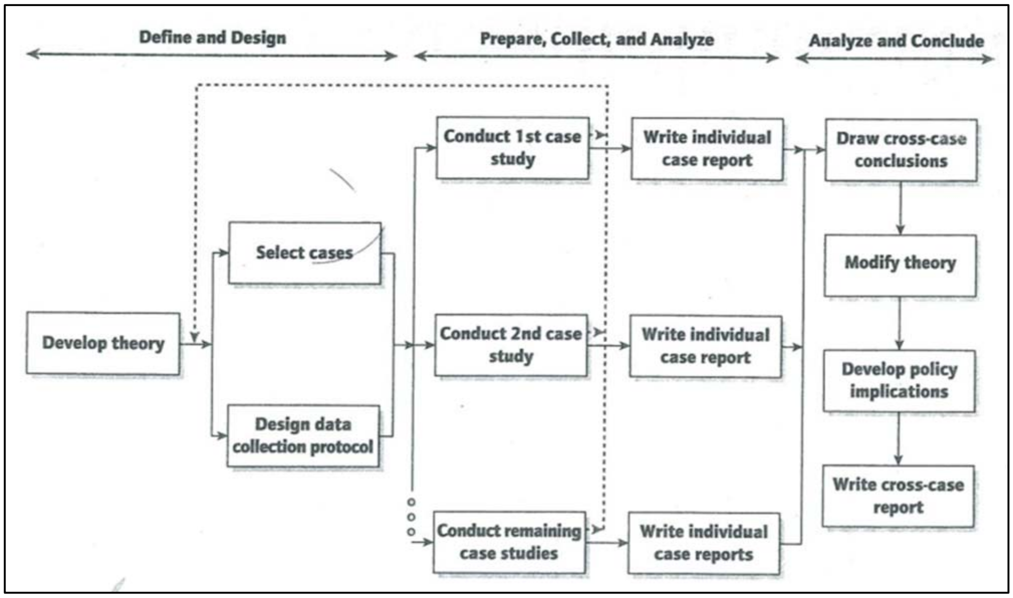


Figure 4.4: Case study method (Yin (2008, p. 57)

The selection of appropriate cases, defining the units of analysis, the case study protocol, and within-case study analysis are elaborated upon below:

(a) Selection of appropriate case studies

Selection of the cases is the most important aspect of the qualitative data collection strategy. Multiple case studies provide a good and strong base for theory building (Yin 2009). Furthermore, Too (2009, p. 105) agrees with Eisenhardt (1989) that multiple cases “enable comparison that clarify whether an emergent finding is simply idiosyncratic to a single case or consistently replicated by several cases”.

In the context of this research project, all of the heritage building projects considered are unique in regard to the techniques and materials that were used and reflect the time it was built. One aspect they all have in common is that heritage building projects face challenges that result in variations which lead the project to run over time and go over budget. The selection of appropriate cases for this research project was led by certain factors. Every case study had faced both specific and common issues and had run over time and over budget, which is the core of the investigation in this research project. Moreover, particular selection criteria were applied to ensure the applicability of the chosen case studies for this research (as discussed in detail in Chapter 5, Table 0.0).

(b) Definition of the units of analysis

In this study, the primary unit analysis is the project management level, that is, the design phase and execution phase of the project management lifecycle. As noted in the discussion in Chapter 1, 85 percent of projects have failed to meet time and budget goals (Shenhar and Dvir 2007). Furthermore, the evidence suggests that failure is often found even in well-managed projects that are run by experienced managers and supported by highly regarded organisations. The present research sits well with current interests as issues with the existing project management methodologies are currently being addressed and criticised by the research community. This study focuses on the two stages in the project management lifecycle: the design phase and the execution phase. The research focuses attention on finding the causes of the recurrent problems of the time and cost overruns that appear to be prevalent in many heritage building projects and the causes of which can be traced back to work within these two stages.

(c) Establishment of the case study protocol

The goal of the case study protocol is to remove bias and errors in this research activity. This can be achieved by following the procedures of the case study protocol. This research project adopted Yin's (2011, p. 81) case study protocol:

- An overview of the case study project – Includes the objectives of the research, relevant reading about the topic that is being investigated, significance and relevance of the selected case, all case study issues analysed in depth, diagrams that can visually present the specific issue, the standard confidentiality statements, the recorded interviews and the subsequent storage of data.
- Field procedures – Includes the presentation of credentials, access to the case study sites, language pertaining to the protection of human subjects, source of data, and procedural reminders.

- Case study questions – Includes the specific question that the case study investigator must keep in mind when collecting data, “table shells” for specific arrays of data, and the potential sources of information for answering each question.
- A guide for the case study report – Includes the outline format for the data, use and presentation of other documentation, and bibliographical information.

(d) Performance of the within-case study analysis

A case study allows a researcher to generate theories from practice. The proposed data collection technique and applicability to this research project were discussed in Chapter 3. The data collected from the document analysis, interviews and observation were generated through the following processes. Firstly, analysing project documents in depth guided the researcher to get a better understanding of different issues and causes in the project. Information on how they interfere with each other within the phase of happening and what affect each phase can produce to other phases in the project management lifecycle was extracted (Chapter 5, Table 5.9). Further to that stage, the generic semi-structured interview questions were formulated to ensure that the answers will be focused on the research target of identification of ongoing project challenges and its causes. Therefore, during the interview process the researcher prompted the interviewee to go deeper in explaining the important challenges that the researcher marked as significant during the document analysis and observation. Asking the same questions to the different stakeholders in a project enabled the researcher to observe the same challenge from different perspectives and draw the conclusions. ‘Entering’ into a project from inside gives the researcher a certain level of intensity in observing the issues that are happening. As stated by Baker (2006, p. 172), observation is “a complex research method because often requires the researcher to play a number of roles and to use a number of techniques, including her/his five senses, to collect data”. Choosing the role of ‘observer as participant’ allowed the researcher to remain personally detached from the people under study while gaining knowledge of the total situation (Baker 2006). Seven semi-structured interviews were undertaken for each case study. The following seven stakeholders were identified as key stakeholders in the projects: project owner, project manager, architect/heritage architect, engineer, quantity surveyor, constructor, and consultant. All the proposed techniques (document analysis, interviews and observation) conducted in each case study provided considerable empirical evidence to support the argument in the study's conclusion.

4.4. Phase III – Quantitative Data Collection

A survey is widely considered as one of the most reliable research methods in many different fields (Kalantari, Kalantari and Maleki 2011) including construction and project management. The main objective of the survey was to achieve statistical validity. The survey was conducted by means of a questionnaire that was divided into two main stakeholder groups to enhance the validity, consistency and impartiality of data from representative samples of respondents. There are certain advantages of this data collection method such as: it is inexpensive to conduct (or less expensive that other data collection methods); it can be distributed widely; it has the ability to accommodate a huge research population; it is common for respondents to answer; and it can be interpreted both qualitatively and quantitatively (Fellows and Liu 2008). Therefore, the questionnaire survey was identified as the most appropriate method for accessing a large number of respondents. In this study, an online survey was distributed nationally to targeted government and non-government organisations, agencies, private firms, professional organisations, and industry.

Before the survey was widely distributed, the pilot survey was sent out to each of the stakeholder group representatives (13) to validate the applicability of the questions that had been formulated. The stakeholder representatives provided feedback by returning the emails with the points that needed to be changed added and better explained in order to avoid misunderstanding. The comments were accepted and the survey was sent for ethical approval before final distribution.

4.5. Phase V – Data analysis tools

Many researchers provide a detailed description of the data analysis process. In the process of data analysis, sorting and qualifying is given a key role (Creswell 2009; Fellows and Liu 2003; Green et al. 2007; Yin 2008). A critical part of data analyses, according to Green et al. (2007, p.20), is "in the process of examining the information collected and transforming it into a coherent account of what was found". For the purpose of this research, data gathered from both qualitative and quantitative methods were analysed using the appropriate software as explained.

The quantitative analysis that was carried out is explained in a detail as follows: The research topic on heritage project challenges encompasses the three research questions presented in Chapter 1 (Section 1.2). For analytical purposes, these questions were conceptualised in two models.

4.5.1. Relationship propositions – Model 1

The relationship model presented in Figure 4.5 was conceived to answer the first research question (RQ1): the relationship between the concepts of the constructs key reasons (KR) and main challenges (MC) for heritage retention (HR).

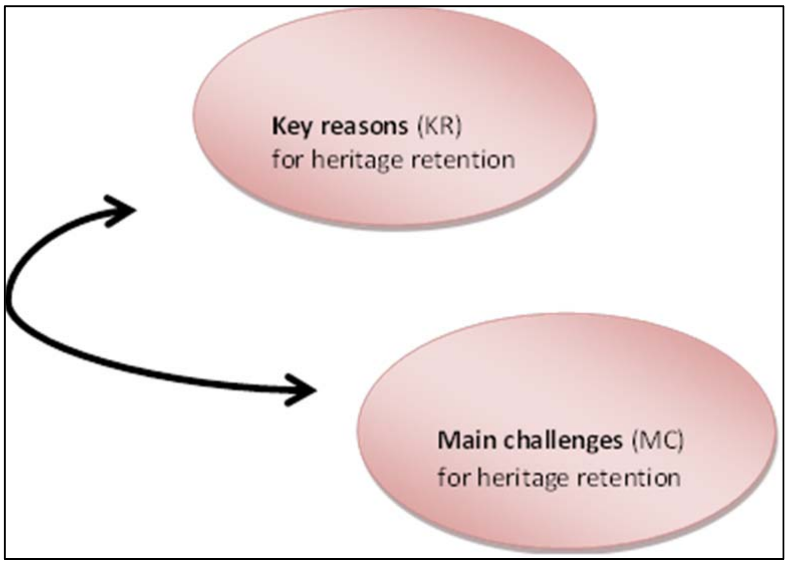


Figure 4.5: Model 1 – Heritage retention model

Figure 4.5 indicates that there is a covariant relationship between two latent constructs. Based on the conceptual model shown in Figure 4.5, two propositions were assigned as follows:

Proposition 1 – KR and MC are directly related.

"Within the statistical model, there is a significant covariate relationship between KR and MC. Therefore, a relationship between KR and MC exists."

Proposition 2 – Minimising MC will improve KR.

4.5.2. Relationship propositions – Model 2

A conceptual model presented in Figure 4.6 is grounded in the PMBOK (2008), which formulates standards for the project management profession and is widely recognised as a good practice guide. Based on the assimilation of real project challenges, PMBOK aims to establish the causal relationships between or among the various processes and knowledge areas that appear in every project. The main focus of this research is on the highlighted areas shown on the generic project management cycle (Planning stage, Execution stage and Stakeholder management strategy) in Figure 4.6.

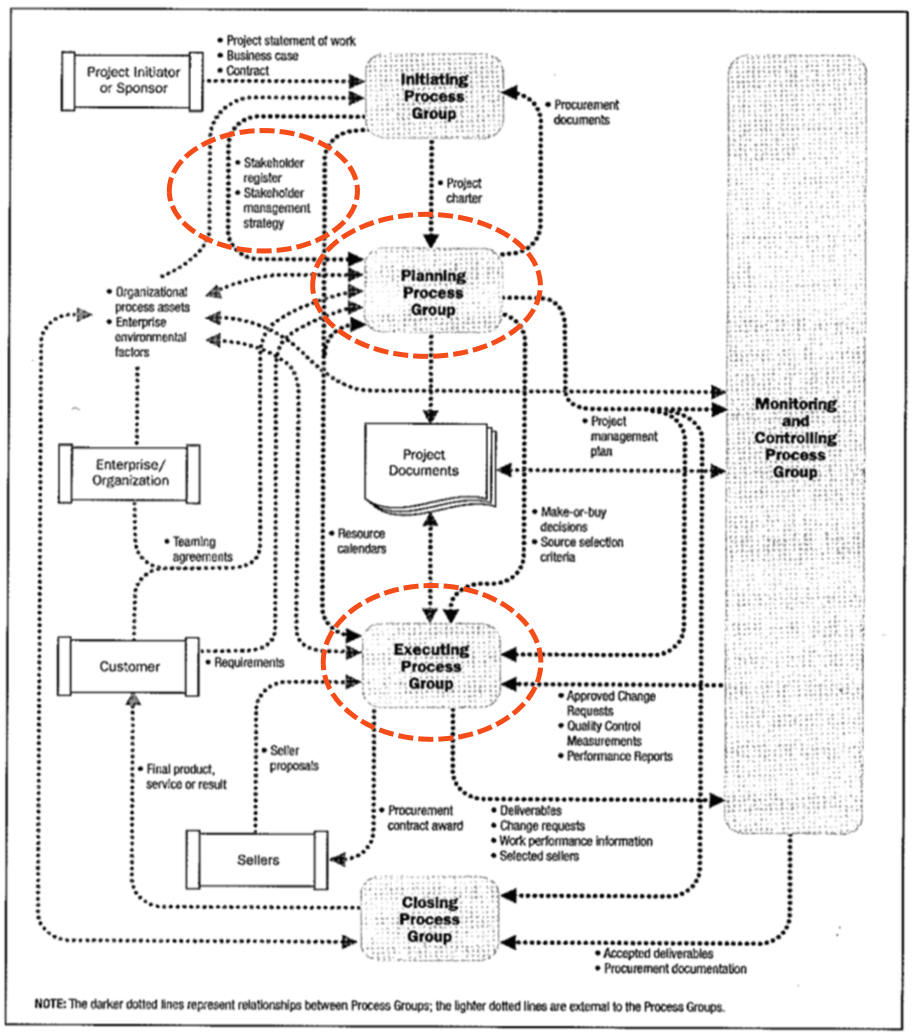


Figure 4.6: Targeted project management process indicators (Project Management Institute 2008, p.44)

The model presented in Figure 4.7 was conceived to answer the second (RQ2) and the third (RQ3) research questions and the relationship between the concepts of the proposed constructs.

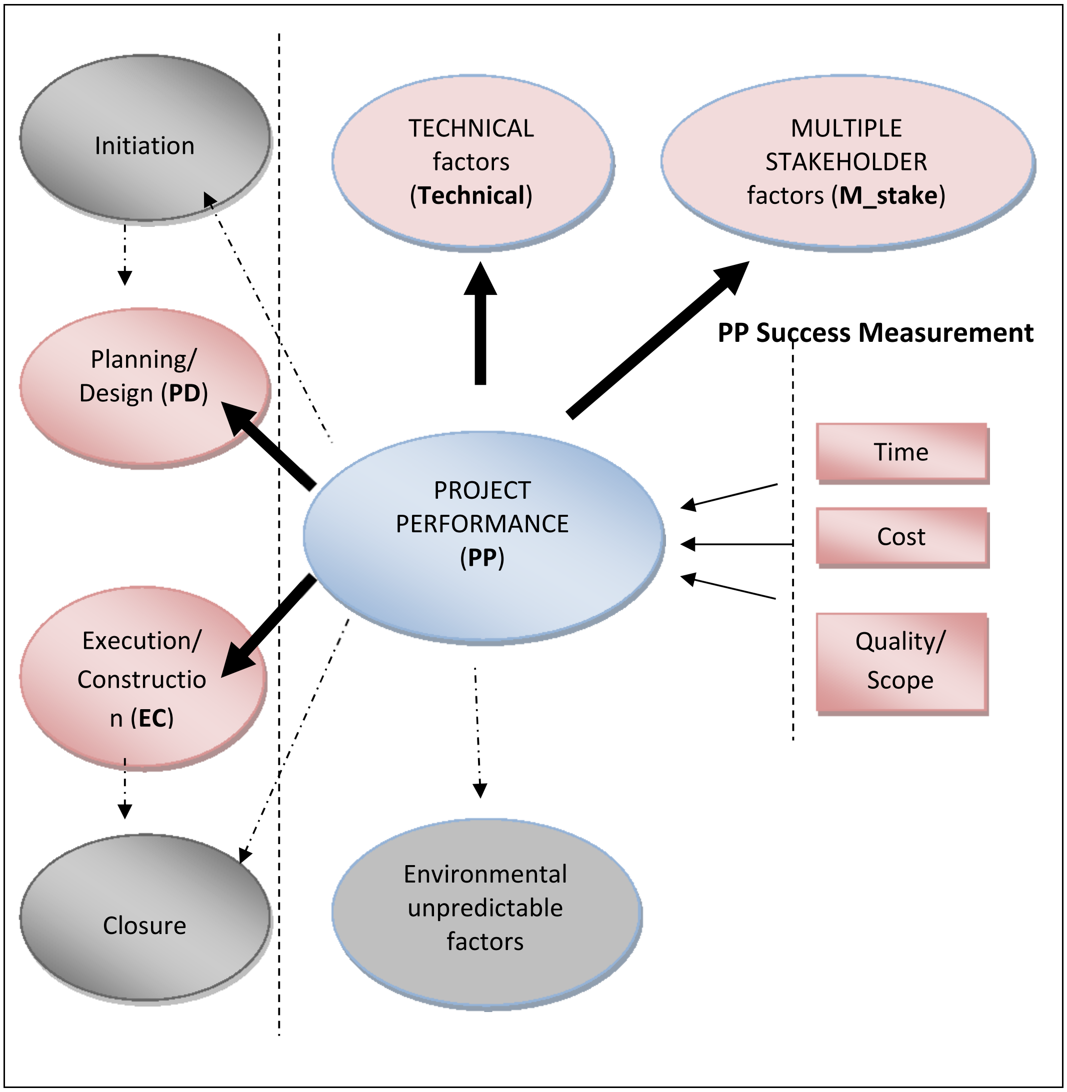


Figure 4.7: Model 2 – Conceptual project performance model

Based on the conceptual model shown in Figure 4.7, several propositions were assigned as follows:

Proposition 1 – Project performance success measurement is composed of Time, Cost and Quality/scope.

PD and EC are the two phases in the project management lifecycle examined in this study; by examining the observed challenges that characterised each construct, guidance could be developed to improve the effectiveness of each phase.

Proposition 2 – PD and EC measure project performance (PP).

There is a significant association between planning design, execution/construction and project performance as measured by the structural equation model.

Proposition 3 – M_stake factors measure PP.

Proposition 4 – Technical factors measure PP.

By examining the observed factors that characterised each construct (M-stake and Technical), guidance could be developed to improve the effectiveness of examined constructs.

4.5.3. Development of the Survey Questionnaire

The questionnaire was developed from the results of the literature review and incorporated the preliminary case study results (based on real heritage project management experience) to ensure that the survey questions being asked were suitable in nature for drawing information from either professional or non-professional stakeholders. Therefore, the survey questions were directed at internal (INTS) and external project stakeholders (EXTS) in order to provide an appropriate range of responses to answer the relevant research questions. The survey consisted of a general opening section of questions that gather demographic information. This was followed by sections of targeted questions designed to determine the key reasons and challenges in retaining heritage structures/buildings, and to validate the causal relationship between planning/design (PD) and execution/construction (EC) in a project management context. The survey was also designed to examine how multiple stakeholder factors (M_stake) and technical factors (Technical) influence project management. The proposed theoretical/structural model was developed using a structural equation modelling (SEM) approach to examine the relationship that exists between unobserved latent variables that cannot be measured directly but only through the use of indicators/observed variables.

The unobserved variables from the external stakeholders (HR, KR and MC) and internal stakeholders (PP, PD, EC, M_stake and Technical) and the observed variables related to each unobserved variable in the proposed models. In each of the models (Model 1 and Model 2), the relationships between unobserved variables and related composite items are used to answer the research questions as follows:

Part 1 of the EXTS survey questionnaire consisted of general background questions and questions that target the first research question (see the survey in Appendix A). By identifying and improving, the main causal challenge can maximise the success of heritage retention that can further affect the decision making on heritage retention.

Part 2 of the INTS survey questionnaire examined the project management challenges that occur through the planning design and execution/construction phases and impact on the eventual success of heritage projects and was designed to answer the second and third research questions. By examining directly observed variables, the questions aimed to identify and quantify the main challenges and causal relationships that exist between PD, EC to PP; M_stake to PP; Technical to PP; M-Stake to PD and EC through MP.

Each part of the survey questionnaire concluded with a series of open-ended questions to enable the participants to provide knowledgeable input based on their in-depth understanding of the critical issues in the delivery of heritage projects beyond those raised in the survey questions. This section was highly important to gain new knowledge from participants with different backgrounds (such as technical and legislative) and heritage experience practitioners (such as architects, engineers, quantity surveyors and builders). Each of the salient comments drawn from these open-ended questions is presented in Appendix F and when analysed, they provided rich insights into the depth of respondents' heritage-related experiences and included suggestions for the better management of heritage building projects in the future.

The literature clearly indicates that heritage projects, like many other types of construction projects, not only have a tendency to run over time and go over budget, but with such projects, this becomes a norm rather than an exception (Zwikael and Smyrk 2011). Why projects are not able to meet the criteria of even basic project success models such as the modified iron triangle (time, cost and quality/scope) presents a major question that needs to be further investigated as in this research. In order to determine the main challenges that have a significant impact on the project delivery, the two models (see Figure 4.5 and Figure 4.7) were developed. To enable the examination of each construct and unobserved variable, the measuring elements for each were developed based on the literature as discussed in Chapter 3 and the preliminary case study validated through extensive interviews to ensure that they reflect specifically the Australian perspective (presented in detail in Chapter 5). These elements are:

- The need to take action to protect heritage places from further development pressure
  - ✓ Historical importance
  - ✓ Social value
  - ✓ Tourism
- Problematic factors that affect project delivery through the project management phases
  - ✓ Scope definition
  - ✓ Accuracy in tender documentation
  - ✓ Meeting the Building Code of Australia (BCA)
  - ✓ Meeting the Disability Discrimination Act (DDA)
- Multiple stakeholder involvement
  - ✓ Identification
  - ✓ Requirements and needs
  - ✓ Communication and engagement.

The factors that measure the stakeholder influence on the project were derived from the review of previous research into stakeholder management (Yang 2010) The stakeholder factors were mostly adopted from the survey questionnaire by Yang (2010, p. 256 - 257), but some of the factors were omitted as they were not relevant to this research.

The CFA model was run for each of the four main latent constructs. The items that were most heavily loaded (0.6 and higher) were chosen between all items.

The constructs were analysed separately with CFA prior to assembling all factors (with the factor loading 0.6 and higher) to be selected priory to further analyses by using SEM.

Figure 4.8 presents the two project management phases (PD and EC) with two sets of factors (Technical and M_stake) and all of their component elements used to measure those unobserved variables and how they influence the overall project performance and delivery. Successful heritage project performance in this research is represented by the modified iron triangle theory described in the literature review (Chapter 2), where project success is measured by time, cost and quality/scope. The other two unobserved variables (M_stake and Technical) and their likeliness to influence the project delivery were analysed separately. The elements of PD, MC, M_stake and Technical that were identified in the interview results as the factors that were most likely to impact the overall project success were examined as a statistical model as shown in Figure 4.8. Data triangulation of the qualitative and quantitative results takes a place prior to using the final test of the top four rankings under SEM. The combined top four scores have been tested in SEM. Figure 4.8 present the initial proposed SEM model that was proposed to be run for final analysis and the four boxes represent the four top results that were chosen to sit within the detailed SEM after the data was triangulated.

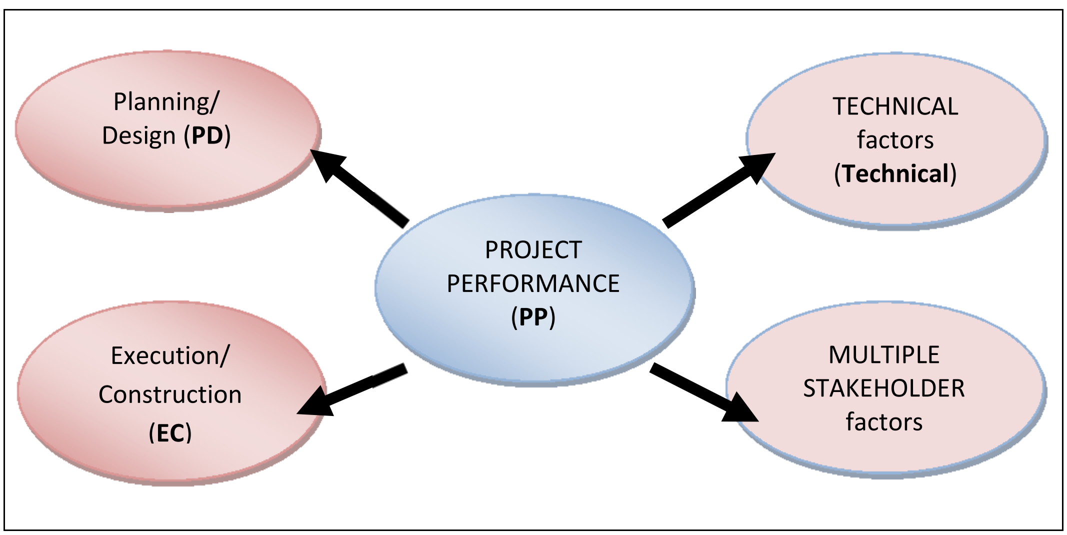


Figure 4.8: Project performance structural equation model

Each of the observed variables in the CFA is an indicator variable that reflects the associated latent variable as in this case the four of them will be further analysed.

In the final section of the survey, the respondents were asked to indicate whether they were willing to be further contacted or interviewed. This option provided the researcher with the opportunity to further discuss any of respondents' answers and extend the investigation of challenges of significance.

4.5.4. Questionnaire scales

The survey questionnaire used a Likert scale measure as an independent rating type, as is common practice in the field of education and social sciences (Brill 2008; Spector 2004)The aim of the scale is to measure the extent of respondents' agreement with a critical statement and/or perceptions of a particular issue (Barnette 2010). According to Spector (2004), there are two different ranges, namely, unipolar and bipolar ranges. The unipolar range is from low to high, and the bipolar range is from extreme negative to extreme positive. Furthermore, Spector (2004) classifies a number of agreements linked to the use of bipolar scales, such as using the structure of an odd number of response choices including/excluding the neutral response in the middle. Including the neutral number in the middle means the respondents are not forced to make a choice in one direction or the other, but it may influence respondents to be noncommittal. The response format used in the survey questionnaire was from 1–5, but varied with the agreement measurement from 'Strongly disagree' (1) to 'Strongly agree' (5) including the neutral response to 'Not at all influential' (1) to 'Highest influence' (5) and 'Not needed' (1) to 'Already provided' (5), both excluding the neutral response. A Likert type format was used for all of the closed-ended questions in Part 2 of the questionnaire.

Brill (2008) indicates that many researchers are likely to treat the data in the Likert response format as interval data (using parametric statistics to analyse it), whereas it is technically characterised as ordinal data. The retrieved Likert format response data in this project was treated as interval data so as to be able to ensure the requirements for parametric statistics, outliers, normality distribution and data refined from missing values were met.

4.5.5. Sample size

The views in the literature on the sample size for statistical modelling (CFA and SEM) differ greatly. The ideal sample size agreed by Comrey and Lee (1992) and Tabachnick and Fidell (2007) is at least 300 cases. Commonly followed in practice is the advice by Boomsma (1983) that the sample size of around 200 for so-called "small to medium models" should be adequate. Furthermore, Hair at al. (2010) specified the sample size for a SEM depends on the model complexity: a minimum sample size of 100 is recommended for the model that contains five or less constructs.

4.5.6. Preliminary data analysis

The Statistical Package for Social Sciences (SPSS) Version 22 and Stata Version 13 was used to analyse the data from the survey questionnaire. Data obtained from the questionnaire survey underwent several processes, namely, coding of the data, screening the outliers and testing of the normality distribution, validity and reliability. These processes are described in detail below.

4.5.7. Coding data

The variables extracted from the key survey results were labelled as shown in Appendix C. The data exported from the key survey results was given numerical values that were aligned with the text values to enable the reader to understand the results obtained from the different tests applied to both (Zikmund et al. 2012).

4.5.8. Screening the missing values/data

Missing data can cause problems regarding the reliability and validity of the research outcome (Hair et al. 2010). There are two methods to overcome the problem of missing data. Firstly, the amount of missing data needs to be assessed; and secondly, the pattern of missing data needs to be evaluated (Hair et al. 2010 ; Tabachnick and Fidell 2007). If missing data is less than ten percent for an individual case, it can be ignored (Hair et al. 2010), as a usual procedure for handling the incomplete cases.

The amount of missing data across all module variables was less than ten percent. Because of this low frequency, the data was left intact. Moreover, the parameters of the CFA and SEM were obtained using both the maximum likelihood (ML) algorithm and the maximum likelihood with missing values (MLMV) algorithm, and in this case, the missing data did not have an impact on the module results.

4.5.9. Screening the outliers

In statistics, an outlier is an observation point that appears to be distant from other observations taken (Uhde 2008). It is important to identify outliers and assess their impact on the statistical tests. Identifying and treating them may improve the replicability of results in other research (Aguinis, Gottfredson and Joo 2013; Sheskin 2010).

The approach to treating an outlier depends on the cause such as retention, exclusion, non-normal distribution, set-membership uncertainties and alternative mode. Outliers, while being the most extreme observations, can include the 'sample maximum' and 'sample minimum' or both depending on how extremely high or low are they. However, if survey Likert scale is used, it would be in appropriate to delete the highest and lowest scale items as outliers.

Hubert and Vandervieren (2008) describe the boxplot as a popular graphical tool "for visualising the distribution of continuous unimodal data". The boxplot tool was employed in the present study for the fast and automatic detection of possible outliers. According to the inbuilt validation rules that this research project set for the online key survey, whereby the responses could only take on allowable values from 1 to 5, any outliers from the boxplot were not treated as an outlier as they took a value from 1 to 5.

4.5.10. Normality distribution

The critical assumption in conducting SEM analysis is that the data is normal. The statistical procedure to test the normality of the data distribution was conducted in the present study by using the Shapiro–Francia test (Royston 1982; Royston 1991). The test result for the INTS indicated high values of the normality of data distribution (Appendix D6) and the result for the EXTS showed normal distribution of the observed variables (Appendix D7). Within the CFA and structural equation models, the asymptotically distribution-free estimation method was used as an added check (Acock 2013).

While graphical methods are more visual and easy to interpret, the statistical test by Shapiro–Francia was employed to test the normality of data distribution for this research project. The different numerical methods and programs that support this analysis are presented in Table 4.2. The Stata was employed in this research and from the table could be seen that the Stata results supported the Shapiro–Francia test.

Table 4.2: Numerical methods of testing normality (Park 2008, p.8)

Test	Statistic	N Range	Dist.	SAS	Stata	SPSS
Jarque-Bera	χ^2		$\chi^2(2)$	-	-	-
Skewness-Kurtosis	χ^2	9≤N	$\chi^2(2)$	-	.sktest	-
Shapiro-Wilk	W	7≤N≤ 2,000	-	YES	.swilk	YES
Shapiro-Francia	W'	5≤N≤ 5,000	-	-	.sfrancia	-
Kolmogorov-Smirnov	D		EDF	YES	*	YES
Cramer-vol Mises	W^2		EDF	YES	-	-
Anderson-Darling	A^2		EDF	YES	-	-

* Stata .ksmirnov command is not used for testing normality.

4.5.11. Reliability of the established measures

Reliability is an essential characteristic for a good measurement tool. In order to ensure the quality of the data, preliminary tests were undertaken to examine the reliability of the established measures. A pilot survey was conducted prior to the main survey as a common practice to ensure that the content validity could be assumed.

Reliability is a major concern when a psychological test is used to measure an attribute. The data should be reliable before further statistical tests are applied (DeVellis 2012). Cronbach's alpha is the most widely used metrics to test reliability (Gliem and Gliem 2003). Cronbach's alpha values and their interpretations by George and Mallery (2003) and compared to Multon and Coleman (2010) are described in Table 4.3 with the reliability level considerations.

Table 4.3: Reliability level considerations (George and Mallery 2003; Multon and Coleman 2010)

Cronbach's Alphas Values	Reliability level considered		
	George and Mallery (2003, p.203)	Multon and Coleman (2010)	Adopted for this study
> 0.9	Excellent	High	High
> 0.8	Good	Very good	Very good
> 0.7	Acceptable	Good	Good
> 0.6	Questionable	Unacceptable	Unacceptable
> 0.5	Poor	Unacceptable	Unacceptable
< 0.5	Unacceptable	Unacceptable	Unacceptable

In this project, the Cronbach alpha was employed to measure reliability. The reliability tests of each of the analysed constructs are described in the following chapter. The reliability examination involved the Cronbach's alpha test for each construct as the first verification after obtaining the data and before the CFA and SEM analysis. The reliability tests for each construct are shown in Appendix D8 – D13.

4.5.12. Descriptive analysis

SPSS Version 21 was used for the descriptive analysis, and the individual mean, median and standard deviation values. The mean value was used in this research as the data set took the values between 1 and 5. The median is determined by sorting the data from the lowest to the highest value, and taking the numerical value from the middle of the observation (Kwok 2008). The value of the standard deviation is used to indicate the distance of the separate measurements from the mean score (Richard 2010). A lower standard deviation value indicates that the data points are gathered closely to the mean value, while a higher value indicates that the data is less accurate (Richard 2010).

4.5.13. Correlation

For this research, the Pearson correlation coefficients were run with Bonferroni adjustment to correct for an enhanced probability of making Type I errors across the multiple pairwise comparisons between items variables. The correlation coefficient indicates the strength of the correlation between the examined variables.

4.5.14. Confirmatory factor analysis

There are two basic disciplines of factor analysis: exploratory factor analysis (EFA) and CFA. These two disciplines of factor analysis implement two different concepts (Thompson 2004). Both techniques are based on linear statistical models, assume a normal distribution, and incorporate measured variables and latent constructs. The validity is ensured if certain assumptions are met (Suhr 2006).

EFA is useful to determine how and to what extent the observed variables are related to their underlying factors when the link between the observed variables is uncertain or unknown (Byrne 2013). CFA is appropriately used when the investigator has knowledge to postulate the relationship between the observed variables and the underlying factors and then uses the CFA to test this hypothesised model statistically (Byrne 2013). Therefore, the CFA was used in this research as the link between the observed variables and hypothesised model. CFA, as described by Hair et al. (2006, p.773), "is a way of testing how well measured variables represent a smaller number of constructs". Suhr (2006, p.1) notes that CFA "allows the researcher to test the hypothesis that a relationship between the observed variables and their underlying latent construct(s) exists". This research used a two-step CFA procedure: one step was to examine if each of the relevant items loaded on the appropriate latent construct and the other step was to test if that was supported for the combined model for the data. In the present study, both the HR and PP models were shown to be significant as discussed in the following chapter.

4.5.15. Structural Equation Modelling

The CFA model "focuses solely on the link between factors and their measurement variables, but when used within the framework of SEM, it represents what has been termed a measurement model" noted by Byrne (2001, p.6). SEM is a mathematical and graphical way to represent a serious of linked regression equations. SEM has been used widely in econometrics, epidemiology and in many areas of the social sciences to determine the relationship between latent constructs and observed variables.

The advantage of the technique lies in the ability of SEM to analyse the observed (measured) variables and unobserved (latent or construct) variables and the dependent and independent variables (Suhr 2006). Furthermore, those complex relationships and related estimated parameters can be presented in a visual way. However, having multiple indicators for each latent variable allows the effect of measurement error to be isolated and removed from the latent variable measures. In addition, SEM allows researchers to evaluate the proposed model-fit through multiple tests such as the Chi-square, comparative fit index (CFI) and root mean squared error of approximation (RMSEA) (Byrne 2013; Hair et al. 2010; Suhr 2006).

In this research, SEM was performed using Stata Version 13. According to Hair et al. (2006), SEM is divided into two basic parts: a measurement model that deals with the relationship between the measured variables and latent variables, and a structural model that deals with the latent variables and their relationships. The measurement model specifies the indicators for each construct and also enables the assessment of construct validity, and the structural model represents the interrelationship of the variables and constructs. A structural model is a "set of one or more dependent relationships linking the hypothesized model's construct" noted by Hair et al. (2006, p.710). Table 4.4 presents the assessment of the measurement model adopted by Hair et al. (2010, p.713) that includes standardised loading, standardised residuals and modification indices.

Table 4.4: Assessment of measurement model (Hair et al. 2010, p.713)

- Loading estimates can be statistically significant but still be too low to qualify as a good item (standardized loadings below |.5|); in CFA, items with low loadings become candidates for deletion
- Completely standardized loadings above 1.0 or below −1.0 are out of the feasible range and can be an important indicator of some problem with the data
- Typically, standardized residuals less than |2.5| do not suggest a problem:
  - Standardized residuals greater than |4.0| suggest a potentially unacceptable degree of error that may call for the deletion of an offending item
  - Standardized residuals for any pair of items between |2.5| and |4.0| deserve some attention, but may not suggest any changes to the model if no other problems are associated with those two items
- The researcher should use the modification indices only as a guideline for model improvements of those relationships that can theoretically be justified
- Specification searches based on purely empirical grounds are discouraged because they are inconsistent with the theoretical basis of CFA and SEM
- CFA results suggesting more than minor modification should be reevaluated with a new data set (e.g., if more than 20% of the measured variables are deleted, then the modifications cannot be considered minor)

If dropped from the model, the items with low factor loadings (0.5 and lover) would not affect the model as long as the construct retains an adequate number of indicators. As an optimal check, it is preferable to measure each construct by three indicators (Hair et al. 2010).

Hair et al. (2010, p.678) identified five groups of goodness of fit indicators as follows:

1) The x^2 value and associated degree of freedom (DF): CMIN/DF
2) Absolute fit indices: GFI, RMSA or SRMR
3) Incremental fit indices: CFI or TLI
4) Goodness of fit indices: GFI, CFI, TLI
5) Badness of fit indices: RMSEA, SRMR.

By using one index from each group, the overall model fit can be assessed accurately (Hair et al. 2010) . The goodness of fit statistics used as recommended to check the CFA and SEM model fit for this research project were CMIN/DF, CFI, RMSEA and TLI.

SEM requires a measure of model fit or 'predictive' accuracy (Hooper, Coughlan and Mullen 2008), in determining whether or not the overall model is acceptable prior to examining the separate relationships (Hair et al. 2006). According to (Barrett 2007), there is no "single" statistical test that indicates a correct model fit; moreover, evaluation of the model fit is based on multiple fit indices. Table 4.5 summarises the criteria for the multi-fit indices for defining the structural model fit.

Table 4.5: Criteria for multi-fit indices for defining the structural model fit (Hair et al. 2010; Hooper, Coughlan and Mullen 2008; Schermelleh-Engel, Moosbrugger and Müller 2003)

Fit Indices	Level Range	Level Fit
CMIN/DF	CMIN/DF < 2 (Hair et al., 2010; Schermelleh et al., 2003)	Excellent fit
	3 < CMIN/DF < 5 (Hair et al., 2010)	Acceptable fit
	CMIN/DF > 5 (Hair et al., 2010)	Poor fit
GFI	0.90 < GFI < 0.95 (Hair et al., 2010; Schermelleh et al., 2003)	Acceptable fit
	0.95 < GFI < 1.00 (Hair et al., 2010; Hooper et al., 2008; Schermelleh et al., 2003)	Perfect fit
RMSEA	RMSEA < 0.03 (Hair et al., 2010; Hooper et al., 2008; Schermelleh et al., 2003)	Excellent fit
	0.03 < RMSEA < 0.07 (Hooper et al., 2008)	Acceptable fit
	0.03 < RMSEA < 0.08 (Hair et al., 2010; Schermelleh et al., 2003)	Acceptable fit
NFI	0.90 < NFI < 0.95 (Schermelleh et al., 2003)	Acceptable fit
	0.95 < GFI <1.00 (Hooper et al., 2008; Schermelleh et al., 2003)	Perfect fit
TLI	0.90 < TLI < 0.95 (Hair et al., 2010)	Acceptable fit
	0.95 < TLI < 1.00 (Hair et al., 2010)	Perfect fit
CFI	0.90 < CFI < 0.95 (Hair et al., 2010)	Acceptable fit
	0.95 < CFI < 1.00 (Hair et al., 2010; Hooper et al., 2008; Schermelleh et al., 2003)	Perfect fit
RNI	CFI > 0.90 (Hair et al., 2010)	Acceptable fit

Where:

CMIN/DF = (CMIN=Chi Square or X^2 & DF=Degree of freedom);
GFI = Goodness-of-Fit Index;
RMSEA = Root Mean Square Error of Approximation; **NFI** = Normed Fit Index;
TLI = Tucker-Lewis Index; **RNI** = Relative Noncentrality Index.

4.5.16. Unpredictable environmental factors

Unpredictable environmental factors such as flood, fire, wind, earthquake, humidity and temperature (extreme high or low) also influence the overall project delivery and may cause a project to run beyond schedule. Such unpredictable factors are acknowledged but were not further observed.

4.5.17. Qualitative tool

A number of steps were undertaken for the qualitative data analysis. Interviews with a variety of stakeholders such as project owner, project manager, architect/heritage architect, engineer, quantity surveyor, constructor and consultant were conducted at their offices or at the relevant sites. The 19 interviews were then transcribed verbatim. The text derived from the interviews was analysed using QSR International's Nvivo 10 (International 2012). This qualitative analysis software was used because, according to Bullen and Love (2010, p.217-218) in agreement with Kale (1996) it enables "the researcher to develop an organic approach to coding as it enables triggers or categories of interest in the text to be coded and used to keep track of emerging and developing ideas". Rigorous analyses of the qualitative data form the foundation of the production of high-quality research. Software is used to maximise efficiency in interpreting the data and data coding (Bringer, Johnston and Brackenridge 2006).

4.5.18. Data triangulation

Merging qualitative and quantitative methodologies involves triangulation in order to avoid the potential controversy related to the paradigms as described in Chapter 3. According to Collis and Hussey (2003), triangulation is classified as follows: methodological triangulation (different methods); data triangulation (data sources); and investigator triangulation (different evaluators). Patton (2002) added a fourth type of triangulation, namely, theory triangulation or perspective to the same data set. According to Easterby-Smith et al. (Easterby-Smith et al. 2008), data triangulation increases the reliability of the results. Data triangulation for this research involved the methodological triangulation using the mixed-method research (i.e. qualitative and quantitative methods). Furthermore, the data triangulation in this research was achieved by encompassing the highlights from the interviews (case studies) and the survey results in the conclusion while answering the three research questions. The interpretation and examination of the results of the case studies and the survey were the basis for developing the set of propositions that formed the proposed guidance. The guidance (referred to as a "call for action") was then validated by the focus group. The "call for action" emphasises the two project management phases examined in this study together with the stakeholder management and technical factors.

4.6. Phase VI – Theoretical propositions (validation of guidance by the focus group)

It is necessary to develop a guidance or model because, according to Moore (1981), "research involves the systematic analyses of phenomena under conditions allowing facts, laws, and theories to emerge and be tested". The proposition was set and tested, so that "the theory was right from the first go" in this research. Model 1 and Model 2 were strongly supported by the data.

The production of good quality research has to be evaluated. With the use of the mixed-method concepts and chosen data collection techniques in this research project, it was necessary to ensure that the undertaken processes were based on a critical investigation which was validated. Quantitative methodology excludes context from scientific practice, subjectivity and interpretation, because the theory has to be universally applicable and based on objectivity. Auerbach and Silverstein (2003, p. 78) give a straightforward definition that "objectivity simply means the absence of subjectivity". The criteria for evaluating quantitative research are statistical tools of reliability, validity and generalisability. However, researchers need to be aware that these tools can work only in so-called 'ideal' situations and indeed cannot be obtained in practice. The qualitative methodology is based on the strong belief that context, subjectivity and interpretation are inevitably interwoven into a research project. Moreover, these elements are seen as essential and should not be disregarded or eliminated. The criterion for evaluating qualitative research is the concept of justifiability of interpretation and transferability of theoretical constructs. Figure 4.9 presents the tests for judging the quality of the research established by Cooper and Schindler (2008). As shown in the figure, research has to aspire to high validity and high reliability in order to be good quality research.

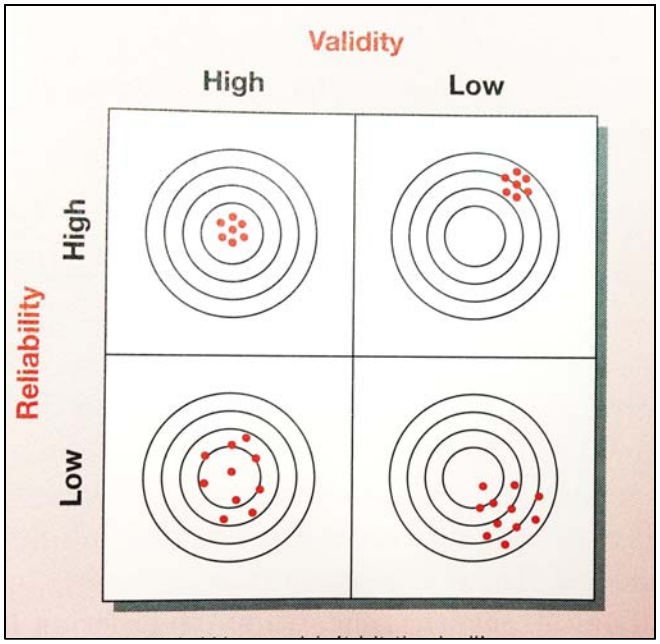


Figure 4.9: Test for judging the research quality (Cooper and Schindler 2008, p. 292)

Reliability, or a reliable method, occurs when a method is applied by other researchers and gives basically the same results. Research must be "systematic, organized and disciplined so that those who re-test or re-examine your source of data will arrive at similar findings" according to the definition of reliability by Kellehear (1993, p. 9).

Validity refers to the scale that has been defined as a measurement of 'what it claims to measure'. If the scale measures what it claims, then the scale is valid and it proves objectiveness. There are many definitions of validity such as face validity, construct validity and predictive validity. Generalisability is an important criterion that intends to ensure that research provides a universally applicable theory.

To ensure the reliability, validity and generalisability of the quantitative data, this research project conducted a pilot study. The pilot study respondents were selected from each group of sample representatives of the sample population of the main survey as previously discussed.

Justifiability refers to the use of subjectivity in analysing and interpreting data (Auerbach and Silverstein 2003), but it is not justifiable to impose subjectivity that has not been grounded in the data. Therefore, there needs to be a clear distinction between justifiable and unjustifiable uses of subjectivity in interpretation. This research has a subject that 'goes into' the historic sense of place which is indivisible from the emotions that form the connection between people and places/buildings. That requires the researcher to be neutral and emotionally inexpressive in relation to any findings in order to ensure justifiability of the qualitative data. The criteria that researchers use for distinguishing justifiable and unjustifiable interpretations of the data are: transparency, communicability and coherence (Rubin and Rubin 2011).

Transferability refers to the development of theory extended beyond a specific sample. As stated by Auerbach and Silverstein (2003, p. 87), "as you include more samples you refine theory". The theoretical construct that has been developed in one study, as truly transferable, helps to gain a better understanding of the subjective experience of the participants in the next sample.

4.7. Summary

The purpose of this chapter was to discuss the operationalisation of the research methods. This chapter summarises the whole process with the data collection purpose that was undertaken. The next chapter will present the proposed case studies and its findings.

Chapter 5

PROJECT MANAGEMENT CHALLENGES – CASE STUDY

5.1. Introduction

Chapter 4 introduced the operationalisation of the various research phases designed to ensure that the most appropriate data collection procedures would be undertaken. This chapter presents the findings from the data collection accomplished by conducting a series of qualitative case studies.

The first case study (Old Government House Restoration, QUT, Brisbane, Queensland) was undertaken as a pilot case to provide the both qualitative and quantitative information needed to develop a strong questionnaire survey and to validate literature review findings through a real completed case. The second (Gona Barracks) and third (Anzac Square) case studies were conducted after the quantitative data was collected from an extensive survey questionnaire conducted amongst public and professional stakeholders. The analysis of the quantitative data, followed by two case studies, builds a deeper understanding of the challenges facing heritage building projects and investigates whether these challenges were similar across different parts of Australia.

5.2. Selection of the case studies

The aim of this research is to investigate the reasons why heritage-listed projects often fail to meet the delivery goals of time, budget and scope/quality. This aim was adopted as a major focus for selecting the case studies. Therefore, a set of selection criteria was established to find the most appropriate cases for analytical purposes that would achieve this aim. Firstly, this research sought to investigate heritage-listed building projects in Queensland that were running over time and over budget. Three projects were identified that met this selection criterion. Secondly, in order to get an overview of the diverse issues that affect heritage projects during their lifecycle, the case studies were to include projects with different sources of funding or mixed funding. Thirdly, in order to get a better perspective of how heritage projects are affected at different stages of their lifecycle, it was decided to select at least one completed and two ongoing projects. Choosing an ongoing project enabled the researcher to attend weekly and monthly site meetings as an observer. This enabled the researcher to make site visits and discuss project issues with the stakeholders on a day-to-day informal basis in addition to the semi-structured feedback from formal interviews. The three case study projects chosen were: Old Government House (OGH) at 2 George Street, Brisbane City; Gona Barracks on Gona Parade, Kevin Grove; and Anzac Square at 228 Adelaide Street, Brisbane City. The application of the criteria to select the three case studies for this research is presented in Table 5.1.

Table 5.1: Application of criteria to selected projects for case studies in this research

Case Study	**Selection Criteria 1**				**Applicability for this Research**
	Heritage-listed (national/state/local)	Time issues	Budget issues	Scope revisions	
OGH	√	√	√	√	Yes
Anzac Square	√	√	√	√	Yes
Gona Barracks	√	√	√	√	Yes
Case Study	**Selection Criteria 2**				**Applicability for this Research**
	Privately funded	Funded by government	Completed project	Ongoing project	
OGH	√	√	√	0	Yes
Anzac Square	0	√	0	√	Yes
Gona Barracks	√	√	0	√	Yes

√ =satisfied the criteria, 0 = did not satisfy the criteria

As seen in the table, the chosen case studies satisfied the established criteria. Therefore, it was believed that all three case studies would be able to accomplish the research objectives, namely:

- To identify the causes of the project time overrun
- To identify the causes of the project budget overrun

- To identify the influence of multiple stakeholders on the project and their inner relationships that have a positive or/and negative effect on the overall project delivery.

5.3. Stakeholder Interviews Identification

Based on the case study objectives (a group of stakeholders was identified as representing the relevant sources of data to pinpoint and evaluate the specific challenges experienced by certain projects at different lifecycle stages. The identified stakeholders (Table 5.2) were asked the same set of semi-structured questions via interviews to enable the researcher to gather data from different stakeholders that was based on the same research rationale. The Anzac Square case study involved an extra stakeholder, namely, the project programmer, who was also interviewed.

Table 5.2: Stakeholder interview identification

Case Study	**Interviewees**							**Total**
	Project Owner	Project Manager	Super-intendant	Heritage/ Architect	Engineer	Quantity Surveyor	Builder	

5.4. Data Coding for Interviews

NVivo software has many advantages for research projects (Creswell 2009, 2007) and was chosen to assist the researcher in data-handling tasks such as organising files and easily locating the main phrase or idea after identifying the themes in a case study. In addition, the mapping features of the software can be used to draw a visual model. For the purposes of the present study, not all of the features of the software were utilised. In the within-case and cross-case analysis, an employed program identified similar themes. Each case study highlighted emerging points that were drawn from the interviews and grouped together as tree nodes as seen in Figure 5.1.

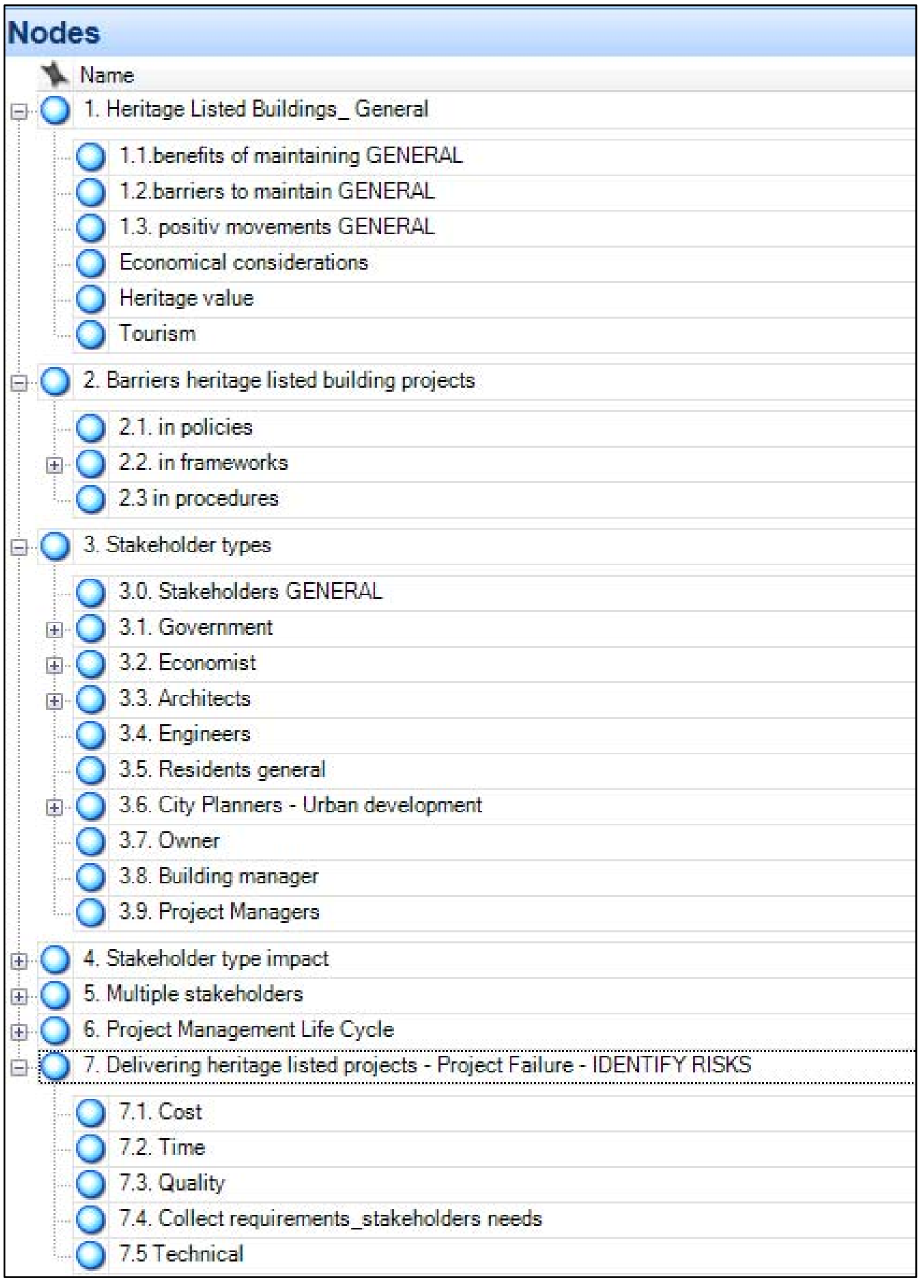


Figure 5.1: Tree nodes in case study data

All the interviews were transcribed, coded, transferred, categorised and grouped in the QSR NVivo Version 10 software for analytical purposes. The data codes enabled the researcher to easily analyse and compare the existing data with, and between, the other case studies. Passive participant observations were carried out as part of the qualitative approach methodology. These allowed the researcher to closely examine the issues and behaviours prevalent within the projects, make photo-documentation and informally discuss project issues with the involved stakeholders on the site. The ongoing projects, namely, Gona Barracks and Anzac Square, provided working real examples and allowed for rich discussions and observation of working solutions being applied to the latent condition issues. The observation of the ongoing projects through site visits involved informal discussions which enriched the interviews already conducted with each of the project stakeholders. The following sections provide a detailed overview of the three case studies.

5.5. Case Study 1: Old Government House

5.5.1. Introduction

The history of the place

In 1859, Queensland became a separate colony with 30,000 settlers and a site was chosen for the state's first government house. The first Queensland Government House was designed by colonial architect Charles Tiffin. The house was built with the purpose to serve the various governors of Queensland until 1910. OGH has been used as a government office, public reception and governor's accommodation which included family members and servants. With changes in the role of governor around 1910, OGH was allocated to the new university that was established on the same site (Queensland Government 2015c).

Building Characteristics

OGH is situated adjacent to the Botanical Gardens and was built from sandstone. The building was designed to be naturally ventilated. It is a symmetrically planned, two storeyed building with an entrance facing the river emphasised by two storeyed semicircular colonnades. Figure 5.2 shows a photograph of OGH (1863) from the Queensland University of Technology (QUT) archives.

Figure 5.2: Old Government House (Source: QUT Archives)

The building was designed in a way that connects and simultaneously separates the private (family members and servants) and public aspects of the building's use. The verandas continue around both sides on both elevations. The interior of the house has timber floors, and the walls and ceilings are plastered. The interior joinery is made of the highest quality cedar. Influenced by the classical revival style assembled in a tropical environment, the building is a fine example of a well-appointed nineteenth century house. Figure 5.3 shows the design symmetry in the ground floor plan and main entrance of the building.

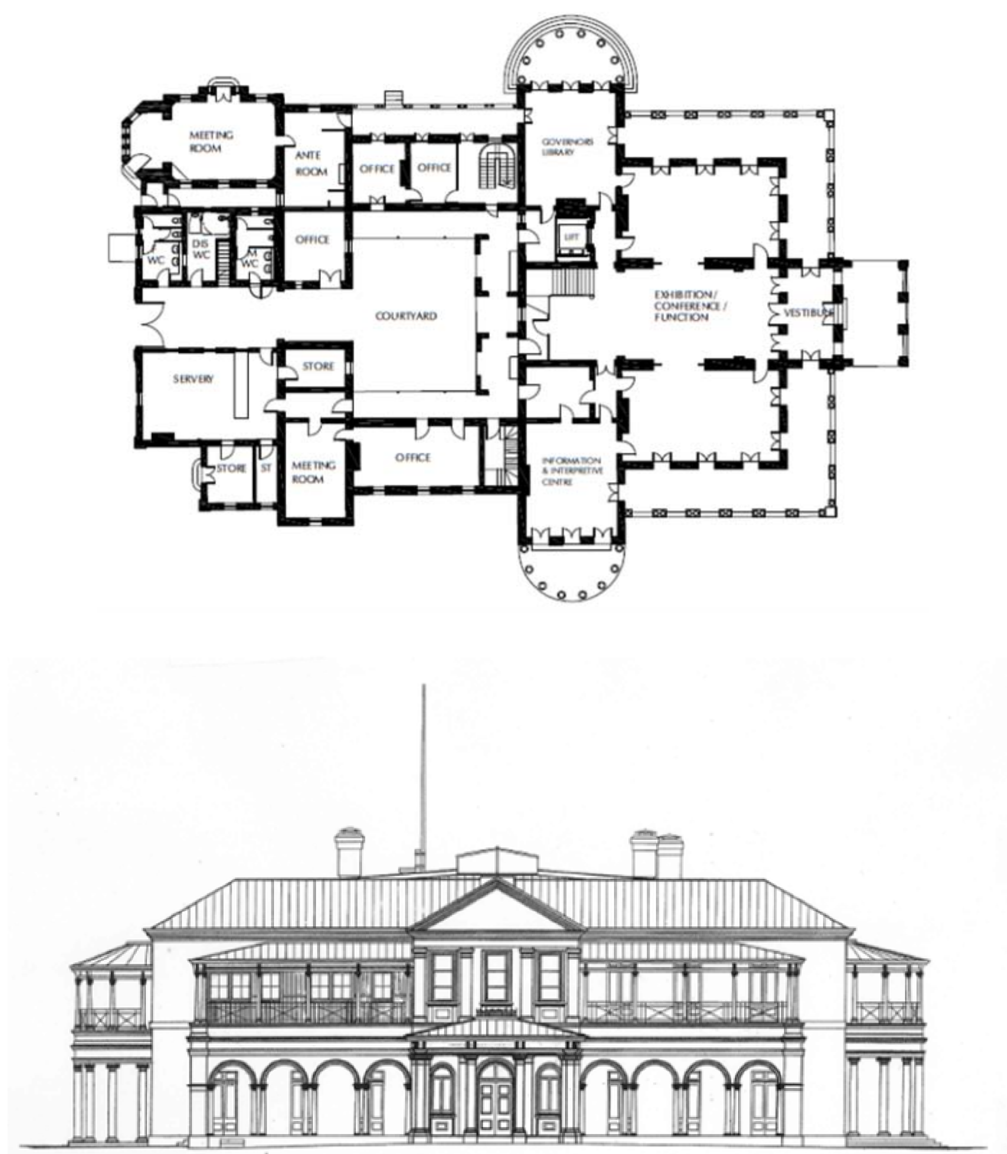


Figure 5.3: Design symmetry in the ground floor plan and main entrance of the building (Source: QUT Archives)

Cultural Heritage Significance

The principal period of the historical significance of OGH was from 1860 to 1945, a period of history when Queensland was undergoing extensive industrial and agricultural development. OGH is also unique as a rare surviving example of the work of colonial architect Charles Tiffin. Moreover, the picturesque quality of the villa was enhanced by the garden surrounding the house which has also been heritage listed (Figure 5.4, 1870).

Figure 5.4: The Old Government House garden (Source: QUT Archives)

The garden is significant as the work of botanist and Botanic Garden curator, Walter Hill, with planting schemes and large established trees that perfectly shape the building. The building evinces a perfect design that fuses separate functional spaces in one cohesive unit. OGH was heritage listed in 1978 and was the first building in the state to be heritage listed. Table 5.3 presents a summary of the characteristics of OGH.

Table 5.3: Characteristics of OGH (Source: Registers and Inventories EPH QLD Government (2015c)

Name:	**Old Government House**
Place ID:	600118
Registration type:	State Heritage
Architect:	Charles Tiffin
Design Period:	1840s – 1860s (Mid-19th century)
Constructed between:	1860-1862/1899
Style:	Victorian - Composite
Place Classification:	Built Landscape
Place Category:	Government Administration
Place Type:	Government House
Cultural significance:	First QLD Government Building
Present use of the building:	Cafe, museum, art gallery, different functions
Heritage listed:	Listed on the Queensland Heritage Register
Location:	2 George Street Brisbane City, 4000

5.5.2. OGH Restoration Project 2007–2009

Project Budget

The original project budget was approximately $8,500,000. The final project cost was approximately $13,500,000.

Project Timeframe

The original proposed timeline was 2007 to 2008. The final project duration was extended to 2009.

5.5.3. Stakeholder Interviews

Most heritage projects experience some kind of difficulty in regard to meeting financial and time targets. In the interviews with the OGH stakeholders, questions were asked to target these issues and the interview objectives were discussed with each of the identified stakeholders to get their views on these problems. Table 5.4

shows the stakeholders interviewed in the OGH case study. The remainder of this section presents the OGH stakeholders' views on the topics investigated in the interviews.

Table 5.4: OGH case study stakeholder interviews

Case Study	**Interviews**							**Total**
	Project Owner	Project Manager	Super-intendant	Heritage/ Architect	Engineer	Quantity Surveyor	Builder	
OGH	√	√	**0**	**√/0**	**0**	**0**	√	**4**
Gona Barracks	√	√	√	0/√	√	0	√	6
Anzac Square	√	√	√	0/√	√	√	√	7+1

Differences in managing/designing heritage building projects and conventional building projects

It is not only heritage building projects that run over time and over budget: most conventional building projects also experience these difficulties. Managing a project to run within its scope is challenging in most construction-based projects (Zwikael and Smyrk 2011).

The following comments made by the OGH stakeholder [R4] revealed the view on the differences between heritage building projects and conventional building projects:

a) Pre-planning – *"Heritage projects require considerably greater level of pre-planning and consultation. Sufficient timeframe should be allocated during this period"*.

b) Stakeholder management – *"There are a greater number of stakeholders in heritage projects. In fact stakeholder management is one of the key requirements"*.

c) Community consultation – *"Owned by the public, community consultation is also one of the key aspects in delivering these projects. Programming this activity into the program is critical"*.

d) Risks – *"Due to age of these building, it is very difficult to assess what one comes across the building during the construction stage. The construction risks are considerably higher. It is not uncommon to have a contingency of 20–40%"*.

e) Media and political interest – Heritage projects *"attract considerable interest from media as well as from political arenas"*.

Conventional building projects are mostly run in line with *"what the client wants"* [R1], while heritage building projects have to follow the Burra Charter outlining good practice for heritage places.

Conventional building projects are also believed to take *"the short term view"* [R1] while heritage projects consider the *"long term community interest"* [R1, R3 and R4]. One main difference between conventional building projects and heritage projects is that *"you can make mistakes"* [R1] in conventional building projects but in heritage projects there is no place for mistakes and the stakeholders must be *"prudent, careful, responsible and very proper"* [R1].

Furthermore, different trades are involved in conventional and heritage projects, and sourcing materials is different [R2]. Meeting the BCA requirements for conventional projects and heritage projects is also different [R2].

Limitations of current policies and procedures for heritage building projects

Meeting the requirements of heritage legislation can sometimes be time consuming, but when dealing with heritage projects the concept of time can be considered differently: *"what is two months in two hundred years?"* [R1]. Due to the limitations, *"there are more about people to think in conservation way, to have more general understanding of procedures and it is about too many people who carry out this processes do not understand very well"* [R1]. Moreover, *"a heritage classification of the building whether it is local, state or national listed limits the design"* [R2].

"It is very hard to determine the scope" [R4], as the amount of investigation of the building is not adequate and *"non-destructive investigation prior to tender documentation is desirable"* [R2 and R3]. Visual inspection of the building

especially in relation to termite infestation could be insufficient. Differences in meeting the requirements of the BCA were noted, highlighting the need for adjustments to the BCA or a *"separate code is needed"* [R2]. Also "*finding strategies to meet Disability Discrimination Act 1992* (*DDA) is a challenge*" [R2] for heritage building projects.

Causes of project delays

In relation to project delays, common problems emerge from project to project. One of the OGH stakeholders [R1] highlighted: "*Bad process of planning as significance of place is not well understood*" (usually the approval of the proposed project is revised two to five times or more); "*doing work in a wrong order as work that has been completed has been damaged because of the late work*" (further causing new rework); "*having unsuitable deadline*" (e.g. political interests); and "*building investigation challenges*" (only visual inspection was allowed prior to the scope definition). At the end, "*It is all about the latent condition"* [R2].

Different stakeholders and the project delivery

When multiple stakeholders are involved in the project, it is ideal to have a "*team environment where everyone heading towards the same outcome regardless of the political, financial and other goals*" [R2]. The stakeholders can be grouped as: *"owners – passionate and have understanding; consultants – clear thinking, technical and historical knowledge experience; community – looking after the place to keep it significant – individuals and organisations such as the National Trust; regulators – ultimate protection; trades – knowledge that needs to be passed along"* [R1]. Understanding the role of the different groups enables the project to be led and maintained in a desirable way. However, managing different stakeholders with different interest/influence on the project is difficult especially when project attracts considerable interest from media as well as political arenas.

Specialists and subcontractors on the project

The subcontractor could be already allocated by the heritage consultant, or *"the builder has to ensure the subcontractor for the specific work"* [R3]; "*there are specific trades that are now difficult to find. In OGH, it was difficult to find a tradesperson for the re-roofing component. Stone mason is another trade difficult to procure"* [R4]. Therefore, sourcing of traditional trades to do the specific work can sometimes be difficult as "*knowledge has not been passed along*" [R3 and R4]. Moreover, "*very few understand to do it in a proper way*" [R1].

Heritage project components

Among the policies and procedures, scope definition, tender documentation, decision making, managing within time, lack of information on the building and managing the multiple stakeholders as the various heritage project components, the OGH stakeholders identified the scope definition as the most difficult component [R1, R2, R3 and R4], followed by the media for the tender documentation, and the lack of information on the building. "*The request for the information on the project has become an almost daily procedure*" [R2]; because the project documentation is not detailed enough, the requests for information "*take the considerable time of the project*" [R3]. Furthermore, one of the stakeholders [R4] stated that:

- "*I would consider defining the scope would be the most difficult component of the project. Having the right team of heritage architects, experienced engineers in this area would be critical in delivering the project successfully*."
- "*Managing the time is another major risk item and needs to be appropriately programmed into the timeframe incorporating consultation, stakeholder management, risks etc*."

Project contingency

Based on their experience, the respondents stated that the project contingency *"should be a minimum 30%*" [R1 and R2]: "*It is quite normal to have 20 to 40% contingency on projects of this nature*" [R4]. The discovery of latent conditions is likely to happen: "*The contingency should be based on the areas of risk and the unknowns and estimated by a quantity surveyor with experience in this area*" [R4]. An appropriate amount of contingency would ensure that any further work could be covered to ensure the project quality. Owners have an "*influence in getting a good result*" [R1] by allocating the suitable amount for the contingency fund: "*It is not difficult convince the project owner as long as it has been assessed properly*" [R4].

Dilapidation survey - October 2007

A survey was conducted in 2007 "to capture the existing conditions and defects prior to removal of fabric"; it was intended that the survey would be "a reference point to match existing fabric where required once removed" Kane Construction (2007, p.2). The archived photo-documentation from the dilapidation survey, including external elevations, courtyard and external landscaping, showed the condition of the building before adaptation.

Building Exterior/ Interior

Figures 5.5 and 5.6 show photo-documentation of the building condition (exterior and interior).

Figure 5.5: Photo-documentation of the building condition- exterior 1

Figure 5.6: Photo-documentation of the building condition - interior 2

5.5.4. Archived documentation

The conservation and adaptation process on the building and the landscaping project was photo-documented using photos from QUT archives for the purpose of addressing and photo-documenting the main project delays. Two items were highlighted by the stakeholders and classified as service reticulation (Item 1) and termite infestation (Item 2). Each item is briefly summarised below; however, the specific time and budget implications could not be determined from the final cost.

Item 1: Service Reticulation

Example:

New service reticulation in the heritage-listed garden – one of the details

All the reticulations that came into the building needed to be new. The heritage-listed garden contained large and mature trees with widespread roots. The trees had to be treated as heritage, which meant "*any damages to the roots are not allowed*" [R2]. This limitation affected the directions of the reticulation infrastructure for the services upgrade. The specific details on the time and budget implications of that work were not possible to be extracted from the final sum.

Item 2: Termite Infestation

Before:

After:

Summary of OGH delays: The structural investigation was part of the original contract work as it was designed to be undertaken as the post-contract award due to heritage constraints of any structural investigation prior to approval. Following the structural investigation, a high level of termite infestation was discovered. Dealing with the termite infestation required:

1) Rectification of roof and finishes in the ceilings
2) Rectification of first floor joists including the flooring
3) Rectification of ground floor joists including flooring.

Time and budget implications: It was not possible to extract the specific details on the time and budget implications of that work from the final sum due to the achieved missing documents.

5.5.5. Summary of Case Study 1

Based on the points discussed and highlighted by the OGH project stakeholders, the main issues that affect the project performance and delivery can be summarised as follows:

a) Pre-planning – a sufficient timeframe should be allocated during the planning/design stage
b) Stakeholder management – a large number of stakeholders with different interest are involved in the project
c) Community consultation – it is critical to programme this activity into the project
d) Project risk – allocate up to 40% for contingency
e) Media and political interest is strong in this type of project
f) Heritage classification of the building limits the design
g) Scope – hard to determine
h) Getting approval from heritage bodies involves multiple redesign resulting in additional cost and time delays
i) Latent conditions cause:

- Redesign and re-documentation involving the architect, engineer and contractor
- New approvals from heritage authorities to get the design approved
- Pricing issues
- Difficulties in sourcing additional materials due to the limited sources
- Difficulties in finding new subcontractors and trade specialists

j) Specifications should be written clearly and concisely to avoid requests for information

k) Requests for information take up considerable time in the project

l) Adjustments to the BCA are needed in regard to heritage projects

m) Challenges to satisfy DDA

n) Non-destructive investigation prior to tender is needed.

5.6. Case Study 2: QUT Precinct 2, "Gona Barracks"

5.6.1. Introduction

The History of the place

The Gona Barracks at Kelvin Grove, Brisbane, is a rare surviving precinct that demonstrates the pattern of Queensland military activities in history. From 1879 to 1911, the site was used by the Brisbane Grammar School under an endowment by the then British colonial government. No buildings were constructed on the site at that time. In 1911, the site was renamed as the Kevin Grove Defence Reserve and was used for compulsory military training. Buildings including an infantry drill hall began to be constructed on the site. In the 1920s, the use of the site began to diversify as part of a gradual expansion on the site in the inter-war period including a riding school and memorial hall. During the Second World War, a garage and workshops were added. In 1960, the name was changed and the site became "Gona Barracks" with the name derived from the battle of Gona on the north coast of Papua New Guinea in 1942. The site was mostly used as base of voluntary military forces until 1998 when the barracks officially closed (Queensland Government 2015b). In 2000, the Queensland Department of Housing purchased the site and subsequently formed a partnership with the Brisbane City Council and the Queensland University of Technology to develop a mixed-use urban village precinct using the Gona Barracks site and adjacent land.

Building Characteristics

The military complex 'Gona Barracks' comprises approximately 70 buildings which are located in two areas, namely, the upper barracks and the lower barracks. The buildings that are being renovated in the Gona Barracks project are situated in the upper barracks area. The main characteristics of the buildings are a timber structure and a concrete base (some of the concrete bases are not original). Some of the buildings have a gabled roof sheeted in corrugated iron and some are sheeted in corrugated steel. Most of the buildings have the original timber linings and doors, but some of the original doors and windows have not survived and were replaced with steel doors. Figure 5.7 shows the Australian Army Service Corps drill hall and wagon shed, with the plans and elevations dated from 1915.

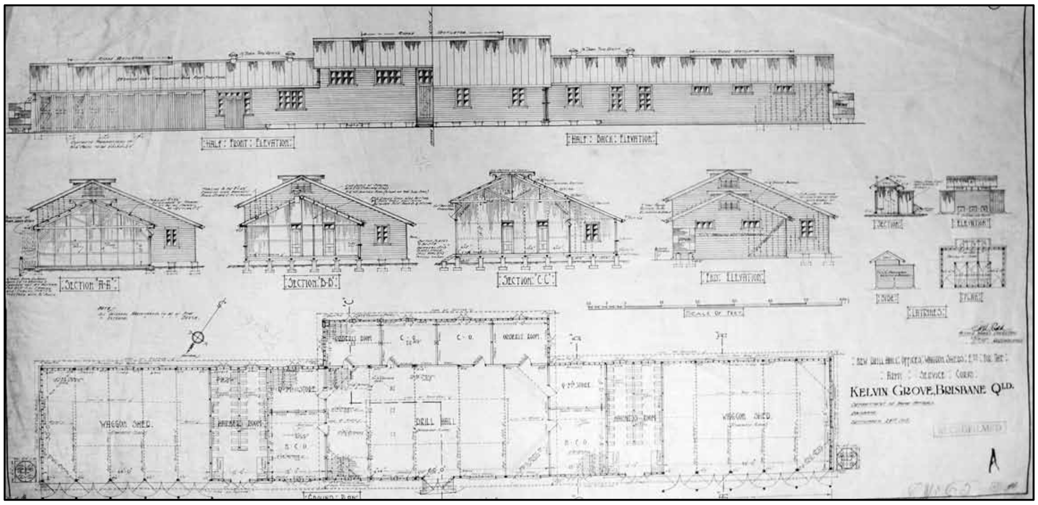


Figure 5.7: Australian Army Services Corps drill hall and wagon shed, plans and elevations, 1915 (Source: QUT Archives)

Infantry drill hall – a large single-storey building with the gabled roof sheeted in corrugated iron. The concrete floor is not original.

Australian Army Service Corps (AASC) drill hall – a long single-storey building set on an original concrete base with the centrally located double storey height section. The gabled roof is sheeted in corrugated steel.

Frank Moran Hall – a single storey building with a gabled roof sheeted in corrugated steel. The building sits on low concrete stumps.

Infill building (at the rear of the AASC drill hall and infantry drill hall) – a single structure building with a simple gable skillion roof.

Workshop – a large single storey building with a corrugated iron roof that has a saw tooth profile. The building has been demolished and will be rebuilt in the same place.

Former Toowong drill hall – this building was not of cultural heritage significance.

More detailed information about the history of the buildings is presented in Appendix G-2. Table 5.5 presents a summary of the characteristics of Gona Barracks.

Table 5.5: Characteristics of Gona Barracks (Source: Registers and Inventories EPH QLD Government (2015b)

Name:	Gona Barracks
Place ID:	601966
Registration type:	State Heritage (QLD) The Local Authority (BCC)
Architect:	
Design Period:	1914–1919 World War I
Constructed between:	1914–1960s
Style:	Early military building
Place Classification:	Built
Place Category:	Defence
Place Type:	Military barracks
Cultural significance:	Defence heritage
Present use of the building:	Different educational purposes such as workshops
Heritage listed:	Listed on the Queensland Heritage Register
Location:	3, 7, 12, 25 & 26 Gona Parade Kevin Grove, 4059

Cultural Heritage Significance

The principal period of historical significance was during the First World War and Second World War. Thousands of men and women who served in the defence forces had an association with the site.

The Gona Barracks site with its buildings and other elements was identified as culturally significant because of its aesthetic significance and the buildings' illustration of the military use of the site. The site has strong connections to the military community as the operations carried out on this site played an active role during the First and Second World Wars. The landscape significance could be identified, with the Ficus platypoda along the Kevin Grove alignment as the only remnant vegetation on the site.

5.6.2. QUT Precinct 2 Project 2013–2015

Project Budget

The original project budget was approximately $6,085,000. The final project cost is unknown from this stage as the project was still in progress at the time of writing The expenditure up to the point cannot be estimated against the scheduled expenditure as project scope has its revisions.

Project Timeframe

The original proposed timeline for project completion was August 2014. The final project duration is unknown as the project was still in progress at the time of writing.

5.6.3. Stakeholder Interviews

As discussed previously, heritage projects—like most building projects—experience difficulties that result in delays. To explore the experience of difficulties and challenges in the Gona Barracks project as part of the QUT Precinct 2 project, targeted interview questions were asked and the interview objectives were discussed with the each of the identified stakeholders to get their views. Table 5.6 summarises the six QUT Precinct 2 stakeholders who were interviewed.

Table 5.6: QUT Precinct 2, Gona Barracks case study stakeholder interviews

Case Study	**Interviews**							**Total**
	Project Owner	Project Manager	Super-intendant	Heritage/ Architect	Engineer	Quantity Surveyor	Builder	
OGH	√	√	0	√/0	0	0	√	4
Gona Barracks	√	√	√	**0**/√	√	**0**	√	**6**
Anzac Square	√	√	√	0/√	√	√	√	7+1

Differences in managing/designing heritage building projects and conventional building projects

In preserving our heritage for the future generation, the stakeholders believed that we have to be aware of the *"duty of care to preserve the architectural fabric and make changes in a sensitive manner"* [R7]. Further, it is necessary in heritage projects to assess the *"importance of the building"* [R7] in order to recognise the significant fabric and *"the real intent in terms of heritage listing and how the heritage project should be approached"*; this is one of the ways in which a heritage project is different to the conventional building project [R7].

From the technical point of view, the main differences are in the *"level of detailing in particular design, as for heritage, a higher level of detail is required"* [R6]. Heritage projects are *"never, 100% documented"* and understanding *"the building design and how the structure was built"* [R8] could be a challenge. Further, "*sourcing of original style of material is an issue"* [R8] such as *"having to match all materials"* [R5] and *"procuring the right people, the skilled people to do the work"* [R8] due to the *"reduced pool of subcontractors to do the work"* [R5]. Therefore, the importance of trades for heritage projects is crucial.

Unlike the conventional building projects where scope could be easily determined, it is difficult in heritage projects *"to determine the scope"* [R5 and R10] as there is a lack of ability to fully ascertain the condition of the building prior to obtaining the approval.

The approval time is another difference between heritage and conventional building projects. This is because the design itself is usually inadequate as the *"footprint"* [R5] of the heritage building is fixed. The use of the space has to be reconsidered, and *"defining a use of the space"* [R5] is sometimes demanding. Once *"you know where you stand"* [R7], the next step is handling the technical difficulties, and the challenge to *"bring it up to the code"* [R5 and R10] requires *"a lot of additional activities in the construction process to achieve code compliance"*. In contrast, the BCA could be easily applied to conventional projects.

Limitations of current policies and procedures for heritage building projects

From the structural point of view, *"how much intervention is allowed in the building against how much heritage you keep"* and *"replacing small parts… rather than the whole thing"* are challenges that mean *"you cannot comply with the current building code"* [R9]. Sometimes there is a need *"to rebuild the building to make it safe"* [R9] which goes against the heritage practice to change *"as little as possible"* [R9], as *"heritage people don't want to change anything"* [R9].

"The current policies and procedures are convoluted" [R6] as *"there is not one particular policy and procedure that defines what you need to do"* [R6]. As a result, the policy and procedures framework *"needs to be streamlined"* [R6] especially if the *"department keeps changing"* [R7]. Furthermore, the stakeholders *"prefer the government to have [its] own resources and expertise"*, rather than relying on the external services. The stakeholders were concerned about "*how to streamline this process*" and "*make administration more efficient*" [R5 and R10].

The stakeholders also advised that *"ensuring the specifications are written very clearly and concisely"* would be desirable [R8] with "*higher detail resolution*" on the site in order to avoid unnecessary requests for more information.

Project delay causes

According to the stakeholders, in relation to the cause of delays, *"predominantly, it is unknown latent conditions"* [R9] as *"the biggest one"* [R6], as you have to *"design and document without knowing enough about the building"* [R7]. This problem is attributed to "*the scope that is not clearly defined and all documented, because you physically cannot document everything*" [R6].

The lack of prior knowledge about the building then causes *"too much work to redesign and re-document after construction starts"* [R7] with *"not knowing how long to wait the decision"* [R7] and you almost always have to do a *"lot more to get the design approved"* [R9]. In addition, there is not always the "*time for approvals before*" [R10] the construction starts, so it takes place "*during the construction*" [R10].

Discovering the latent conditions is the so-called "*big exercise*" [R5]. When you *"uncover something"* [R5] you have to *"design, price and agree on the methodology"* [R5] again, and get it approved again. The same process has to be repeated each time the project team uncovers something new [R5].

The reality is that stakeholders are starting the project knowing that "*you do know the full extent of [what is] required"* [R5]: *"if you can identify [the requirements] before construction starts"* [R5], it will lead to enormous savings in the time and project cost.

One of the stakeholders pointed out that, when a project is documented, *"a lot of detail needs to be changed as it must not fit each scenario"* [R8]. Therefore, an *"early works package"* [R7] needs to be considered in heritage building projects as a *"separate contract"* [R7]. This would consist of *"the demolition work"* [R7] which means detailed investigation work and *"the removal of asbestos"* [R7] if any as *"the decision on design"* [R7] will help clarify the tender documentation. That kind of the pre-tender *"early works package"* will require *"all design approval – what to demolish"* and with the possibility of the *"extent of demolition"* [R7].

Sometimes the heritage authorities do not quite understand the problem of *"sourcing the materials"* [R6] and the *"limitation of sources"*. This problem occurs because the materials that are available today often cannot match the materials that were available at the time the object was built.

Another cause of project delays is change introduced by the client during the construction phase. Therefore, *"the project client needs the clear image of the design brief of what they want"* [R5] to avoid the situation where the client expresses the view that *"it is not what I had in my mind"* [R5].

Different stakeholders and the project delivery

Every building project involves a range of different stakeholders who have a different interest in the project, guided by different motivations and focused on different goals. Dealing with the multiple stakeholders and their influence is "*critical in terms of the client*" [R7]. The project delivery is mostly *"stakeholder driven"* [R6]: *"[the] client wants to keep cost down and the architect often forgets about the cost, while heritage authorities want to maintain the heritage components of the* *building"* ensuring that the heritage components "*would not be compromised"* [R6]. The heritage authorities, as an external stakeholder, play an important role: *"they determine what has to be kept"* [R5] and *"they have a final say [about] what you are allowed to do"* [R10]. Early involvement of heritage bodies during the design even conceptual phase is desirable.

Among the internal stakeholders, it is important that the engineers *"do not overdesign what is required"* [R6]. Another internal stakeholder is the superintendent who is driven *"to ensure that what the client is paying for they are getting"*, to guarantee that the *"quality will be maintained"* [R6] and moreover to verify *"the design team [architect, engineer and services] give a realistic view"* [R6] and are "*aware of the importance and what the approaches are*" [R7]. The quantity surveyor has a hard task: *"because of not standard materials, details, as there is no set standard market rate that you can apply"* [R6]. The builder's responsibility is to "*appraise, construct and maintain the program*" which might be very difficult due to the numerous "*latent conditions*" on the project.

Other external project stakeholders are "*the members of the public that are really passionate about the heritage buildings*" [R9] and taking into account the public opinion of the heritage projects is highly recommended. This is especially so with heritage projects that contain a military element or in projects where there is a much deeper relationship to the community.

Specialists and subcontractors on the project

Finding the appropriate contractor and specialist consultancy staff could be difficult as *"expertise is a challenge"* [R6]. Many times, *"the realistic timeframe"* is unknown *"until they start doing it"* [R6]. This could be explained by *"the lack of experience"* [R6], as *"the subcontractors that do have the skills"* are few in number.

Heritage project components

Among the various heritage project components including the policies and procedures, scope definition, tender documentation, decision making, managing within time, lack of information on the building, and managing the multiple stakeholders, the project stakeholders identified the following components as the most significant challenges: *"Everything that happens on the project relies on the design"* [R6], but *"during the design [there] is just a limited amount of investigation"* [R9]; therefore, the project is designed with a *"lack of information"*[R9], *"the scope cannot be clearly outlined"* which results in *"tender documentation omissions when items are not included"* [R8]. Overall, therefore, *"the biggest risk is the scope definition"* [R5].

If a project has *"over 2000 requests for information"* [R8], then something needs to be improved for the good of future heritage projects. For example, one solution is for the *"architect to be situated on the site"* [R8]. This would enable any latent conditions and requests for more information to be addressed immediately.

Heritage projects cannot be looked at in purely economic terms during reconstruction when certain procedures and requirements must be undertaken to satisfy the *"various categories of significance"* [R5]; nevertheless, *"most of the decisions are budget focused"* [R5]. The project stakeholders stated that it was important for the client *"to know how the value of the heritage can produce some extra cost"* [R9] because a *"lack of appreciation of the costs that are incurred in heritage buildings"* [R10] can be a *"nightmare"* [R10]. The challenge for the project team is that they still have to *"create the level of satisfaction of the client"* [R10] without "*compromising the end result*" [R5].

Sourcing the materials in a heritage project is "*deliverable versus perception requirements*" [R10]. In the case of the Gona Barracks project, the timber was sourced as reconstituted material from another site. Sources of the material were extremely limited, as timber of the required size could not be found today.

The lack of information about the building such as termite infestation should be addressed as early as possible. Many heritage buildings are termite infested, so the stakeholders recommend *"more clarity about the pest control system"* such as *"termite management as the termite system gets broken"*. Some of the systems such as the *"pipe system"* or *"elevate all timber, etc."*[R8] should be listed and the use of each system should be specified.

Project contingency

In terms of the adequate project contingency, one of the stakeholders believed that if more of *"the testing/sampling of existing building such as: asbestos, lead paint, contamination (in ground), rotted timber and white art damage was completed prior to design phase, documentation could be more accurate"* [R8] and less contingency would be required to cover the risk.

5.6.4. Observation

As an observer, the researcher followed the conservation and adaptation process on the following buildings involved in the Gona Barracks renovation project: the infantry drill hall (A25), the AASC drill hall (A16), the Frank Moran Hall (A21), the infill building at the rear of A16, and A21 and the Workshop (A26). The former Toowong drill hall was not recognised as having cultural heritage significance and was demolished.

For the purpose of addressing and documenting the issue of project delays, three items are described in detail as follows:

- Item 1: Infantry drill hall – Condition of existing roof
- Item 2: AASC drill hall, Frank Moran Hall and infantry drill hall – Termite infestation, and
- Item 3: Infantry drill hall – Condition of existing slab and foundations.

A summary of each item was made including the time and budget implications to describe an issue. Further, every item was photo-documented. For some of the items it was possible to show the condition before and after renovation as the work was completed. For the other items, it was only possible to document the conditions before and during the adaptation as the work was still in progress at the time of writing.

Plan – map of items

Figure 5.8 shows a map of the items and their locations.

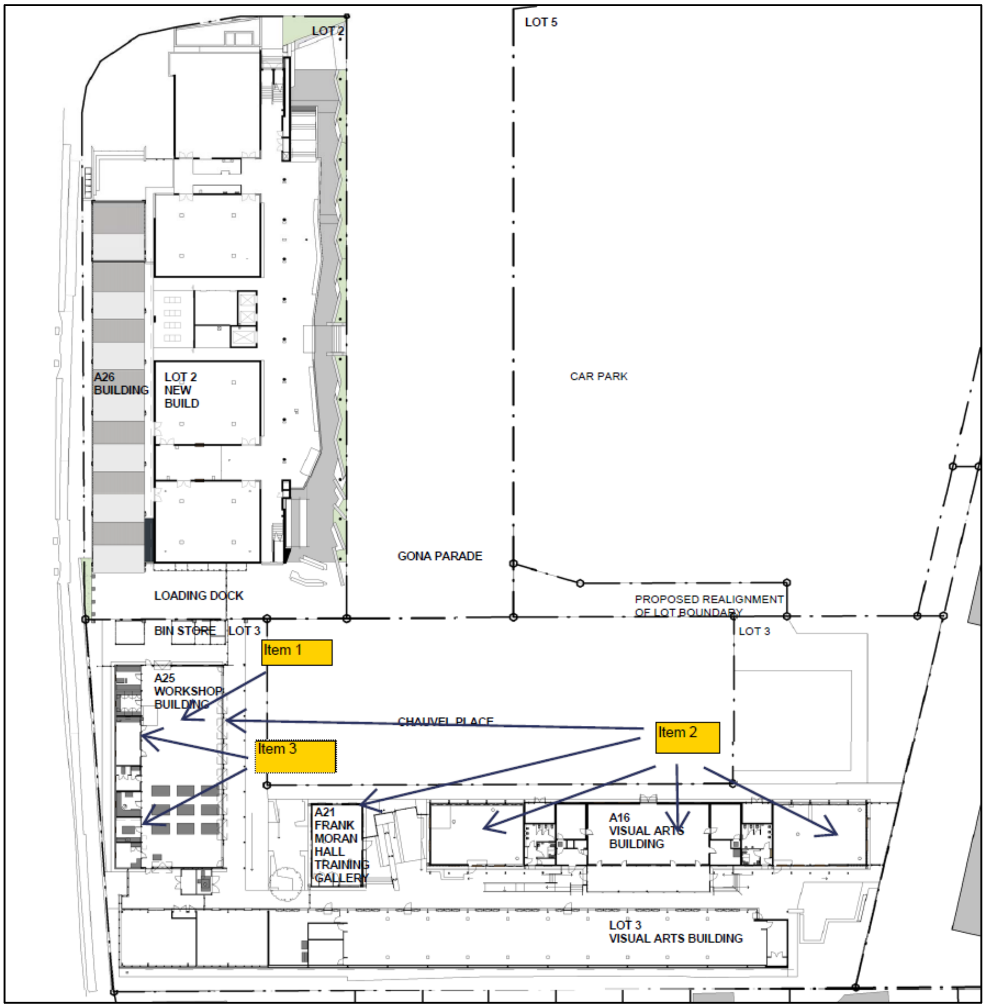
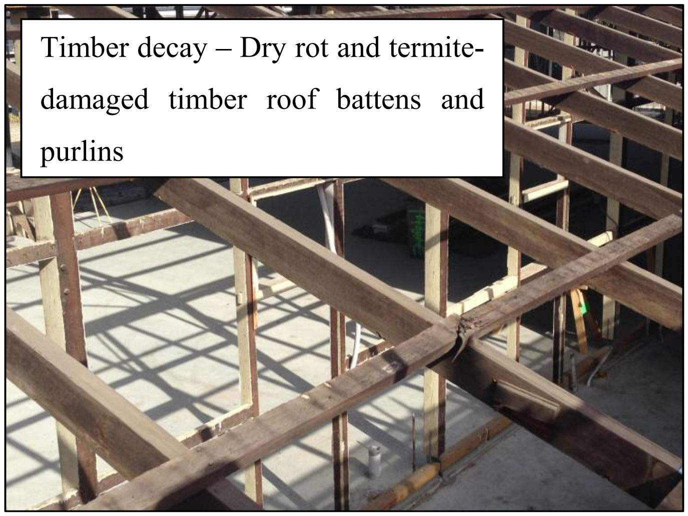


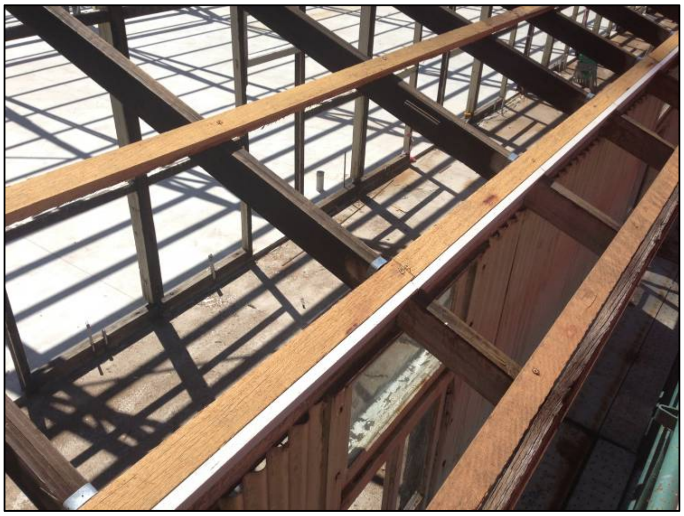
Figure 5.8: Map of items and its locations

Item 1: Infantry Drill Hall – Condition of Existing Roof

Before:



After:



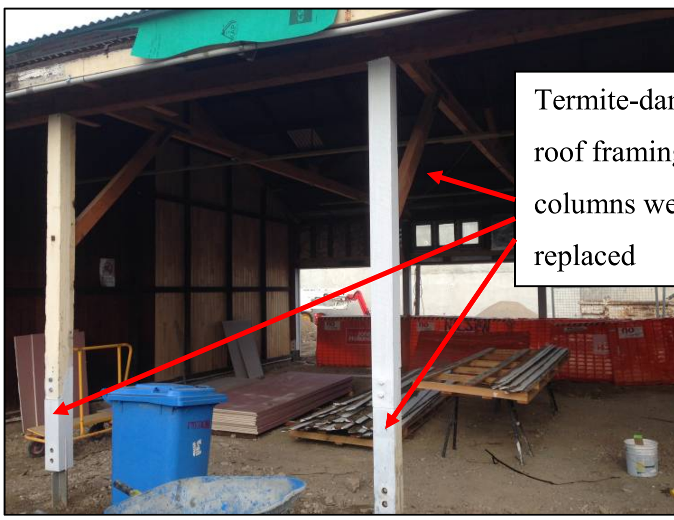
Summary of Gona Barracks – Item 1 delay: Following the inspection of the existing tin roof and the decision to remove and replace the roof sheets, it was also discovered the existing roof battens and purlins (and other key timber structural members) were in very poor condition due to timber rot and termite infestation. Owing to the structural and safety concerns, it was decided to replace approximately 75% of the timber battens and purlins.

Time Implications: Approximately 3–4 weeks delay was caused. Non-standard timber sizes had to be sourced to replace the timber battens and purlins. New connection details (i.e. splicing detail of new timber into existing timber) had to be designed and approved by the engineers.

Budget Implications: The budget implications were unknown at the time of writing; however, an estimate would be an additional 10–15% cost

Item 2: AASC Building, Frank Moran Building & Infantry Drill Hall – Termite Infestation

Termite-damaged joists – The extent was discovered when replacing the floor boards



Termite-damaged columns & timber roof framing – Sections of timber columns were required to be replaced

Termite prevention measures such as 'termimesh' installed to vulnerable/key entry points

Summary of Gona Barracks – Item 2 delay: During the design phase, a condition report including termite assessment of the heritage buildings was undertaken. The condition report identified areas within the heritage buildings requiring repair work and/or complete removal and reinstatement works, particularly to the timber structure. This document was included in the tender documentation for pricing by the main contractor.

When the work was undertaken, it was discovered the extent of the termite infestation was much greater than anticipated and as documented in the condition report. As a result, additional structural timber members were required to be replaced and additional termite prevention measures were introduced.

Time Implications: It is difficult to determine the exact time implication given that the works were spread out over a long period. In total, the time implications could be approximately 5 weeks. Non-standard timber sizes had to be sourced to replace the timber columns and trusses, and the lead times to source these members added to the delay.

Budget Implications: The budget implications were unknown at the time of writing; however, an estimate would be an additional 30% cost.

Item 3: Infantry Drill Hall – Condition of Existing Slab and Foundations

The base of the main timber columns – timber rot/termite damage

The existing concrete footings and slab were in very poor condition. The engineer could not certify the integrity of the existing footing and slab, and the decision was made to remove and replace.

Damaged timber columns cut and new sections/splicing detail introduced as well as new footing

Damaged timber columns cut and new sections/splicing detail introduced as well as new footing

New footing and slab

Time Implications of Gona Barracks – Item 3 delay: Approximately 6 weeks delay was caused. This included the time to redesign the footing and slab, including the splicing details.

Budget Implications: The budget implications were unknown at the time of writing; however, an estimate would be an additional 30% cost.

5.6.5. Summary of Case Study 2

Based on the points discussed and highlighted by the QUT Precinct 2 project stakeholders, the main issues that affect the project performance and delivery can be summarised as follows:

o) Visual inspection of the object without the ability to fully ascertain the building directly causes inaccurate scope definition.

p) Inaccurate scope definition leads to the problem of unknown latent conditions

q) The discovery of unknown latent conditions causes:

- Redesign and re-documentation involving the architect, engineer and contractor
- The need to obtain new approvals from heritage authorities to get designs approved
- Problems with pricing
- The need to source additional materials, which is difficult due to limited sources
- The need to identify new subcontractors and trade specialists

r) Specifications need to be written clearly and concisely to avoid requests for information

s) Requests for information slow down the construction phase

t) Compliance with the BCA is an issue

u) There is a need for an early works package in the form of a separate contract which includes demolition work

v) Taking into account the public opinion on the heritage projects is highly recommended.

5.7. Case Study 3: Anzac Square

5.7.1. Introduction

The history of the place

The First World War took many lives: from an Australian population of around five million people at the time, 60,000 soldiers were killed and 152,000 returned wounded. Land was granted in 1928 for a memorial park in Anzac Square in Brisbane to acknowledge those who participated and died in the First World War. Anzac Square commemorates all Queenslanders who participated in armed service and has become a repository for memorials of other wars (Queensland Government 2015a).

Building Characteristics

The site was designed to enhance the dominant feature of the square, namely, the Shrine of Remembrance. The design of the shrine was inspired by the classical Greek *temenos* (sacred enclosure) and *tholos* (circular shrine) comprising a circular colonnade with eighteen Doric columns that support a circular entablature internally inscribed with the names of battlefields. Figure 5.9 shows picture part of the Sidues series of postcards, no. 819 of Anzac Square.

Figure 5.9: Anzac Square, 1930 (Source: John Oxley Library, State Library Queensland)

The Queensland Women's War Memorial was unveiled in 1932 and is located on the western wall of Anzac Square. The relief panel was carved in sandstone from Helidon in Queensland's Lockyer Valley and depicts the military procession. This panel is the work of Queensland sculptor Daphne Mayo. The symbolism of tranquillity and renewed life is marked with the shallow tide reflecting pools situated on either side of the staircase which leads to the shrine. Table 5.7 presents a summary of the characteristics of Anzac Square.

Table 5.7: Characteristics of Anzac Square (Source: Registers and Inventories EPH QLD Government (2015a))

Name:	**Anzac Square**
Place ID:	600062
Registration type:	State Heritage (QLD)
Architect:	Buchanan and Cowper
Design Period:	1919–1930s (Interwar period)
Constructed between:	1928–1988
Style:	Greek style
Place Classification:	Built
Place Category:	Monuments and Memorials
Place Type:	Memorial/Monument
Cultural significance:	Defence heritage
Themes:	Creating social and cultural institutions/ Commemorating significant events
Heritage listed:	Listed on the Queensland Heritage Register
Location:	228 Adelaide Street Brisbane City, 4000

Cultural Heritage Significance

The principal periods of cultural significance of Anzac Square were: 1928–1988 (historical), 1928–1939 (park and memorials), and 1988 (Korean & Vietnam War memorials). The memorial is a rare example of formal urban design on a large scale for the purpose of commemorative services. Anzac Square is an example of Australian war iconography which glorifies the service of men and women in armed conflicts. The memorial is located in the central city area with built elements in a green space as a large open park. More details about the cultural significance of the site are presented in Appendix G-3. Figure 5.10 shows another early picture of Anzac Square.

Figure 5.10: Anzac Square (Source: John Oxley Library, State Library Queensland)

5.7.2. Anzac Square Restoration Project Phase One (2013–2015) and Phase 2 (2016)

Project Budget

The original project budget was approximately $3,400,000. The final project cost was unknown at the time of writing as the project was in progress. The figures given in the observation section present the current cost overrun by items and cannot be estimated in more detail.

Project Timeframe

In the original proposed timeline, Phase 1 was to be completed in 2015 and Phase 2 was to be completed in 2016. In the observation section, the current project overrun is overall five weeks as presented under the items.

5.7.3. Stakeholder Interviews

Interviews were held with each of the identified stakeholders in the Anzac Square project to get their views on the problems faced by heritage projects in meeting financial and timeline targets. As this project employed a project programmer to monitor the project performance, this stakeholder was added to the group of interviewees. Table 5.8 shows the roles of the eight stakeholders interviewed in relation to the Anzac Square project.

Table 5.8: Anzac Square case study stakeholder interviews

Case Study	**Interviews**							**Total**
	Project Owner	Project Manager	Super-intendant	Heritage/ Architect	Engineer	Quantity Surveyor	Builder	
OGH	√	√	0	√/0	0	0	√	4
Gona Barracks	√	√	√	√	√	0	√	6
Anzac Square	√	√	√	√	√	√	√	**7+1**

Differences in managing/designing heritage building projects and conventional projects

There is a perception that heritage projects run over time and over budget, but conventional projects experience the same issues. The usual amount of contingency to deal with latent difficulties in conventional projects is "*10% and for heritage projects it is 25%*" [R16]. Heritage building projects are different as they have an "*extra layer of constraints and opportunity*" [R14]. The difficulties arise when "*people do not have experience*" [Q18] such as "*practical experience and understanding building techniques*" [R13] which is crucial for heritage projects.

Design is based on "*the information of the building [which] is in archives*" [R13] and this information is often not the latest record. Therefore, heritage projects face the unique problem of "*managing unknown factors, constantly dealing with design and changing detail*" [R17]. This leads to heritage projects "*stopping – starting*"

[R17] every time a new unknown factor arises. When a new factor arises, "*you have to redesign*" [R17] again and it takes the project team back to the beginning.

Cost management for heritage projects is always difficult because there is no "*benchmark data available and to create budget estimates we need to adapt*" [R16]. In addition, there are "*no similar buildings*" [R16] so every heritage project is different.

At the time a building such as Anzac Square was constructed "*no one thought about the people with disability*" [R15]. Therefore, with heritage projects "*the biggest thing is to incorporate modern standards in building under DDA [Disability Discrimination Act 1992] compliance*" [R13]. According to one of the project stakeholders, the most difficult challenge "*is to find an engineer to understand that you cannot apply modern design and technical modern standards*" [R13]; rather, the main issue for engineers is that "*the design has to be covered by code*" [R13]. A further difference between heritage projects and conventional projects is that in the "*normal building market, suppliers and subcontractors tend to be more different*" [R18]. The heritage project requirements reduce the pool, which is already small.

Limitations of current policies and procedures for heritage building projects

The lack of a building investigation (other than a visual investigation) prior to approval causes numerous issues as it is only possible to "*make the best guess estimate*" [R18]. The difficulty arises in having to define a scope "*with the lack of information about the structure – nature of the structure*" [R18] together "*with the lack of information on the existing drawings*" [R13] and "*lack of preliminary investigation*" [R13]. This compounds the problem of already facing a "*lack of heritage experts – project managers*" [R13] and trades. Therefore, there will usually be "*hidden layers*" [R16] to be uncovered during the construction phase.

The usual procedure is "*tracking [down] the subcontractors*" using "*the database [of] who you already used or who you know*" [R17]. Specialist trades "*are unique with not much competition on the market*" [R17]. Efforts are made to find the subcontractors who suit the project based on "*their references, past experience, trade qualification and samples of work*"; however, "*at the end of the day it comes down to the budget, and what fits in the budget*" [R17].

A further limitation in heritage projects arises when "*you try to replicate heritage work*" [R13]. Sourcing the materials is not an easy task: for example, when "*getting the right stone to replace*" [R13] you have to "*to consider how the heritage building will be impacted*" [R12].

Causes of project delays

"*Allowing the sufficient time*" for investigation work in the design stage and having access to appropriate "*cost contingency*" [R18] will reduce the likelihood of project delays. When "*the records are not kept*" [R11] or "*the archived records are not the latest version*" [R11], the documentation can be misleading. This is compounded by problems related to *"investigative works such as soil investigation, X-rays and visual inspection on hidden elements"* [R14]. Limitations in the equipment are a problem. For example, the use of non-destructive techniques (such as X-rays) for structural investigations is not reliable: in some cases, what was anticipated (solid concrete beams under the slab) and what was found (brick webbing) are totally different.

"*Latent conditions*" [R14] and "*client brief changes*" [R14] are the most common causes of project delays. Managing projects on time when "*the time is based on the current program*" [R16] but "*the whole sequence of events has been changed*" [R13] is the typical scenario.

Sometimes "*the competitive type of arrangement and trying to win the project tend to [lead to] underestimating the work*" [R18] and this has further consequences in terms of delays. Furthermore, when the construction phase starts "*the RFI [requests for more information] slow the process down*" [R17].

In order to manage delays it is necessary "*to mitigate delays as they arise not to try and mitigate accumulated delays at the end of the project*" [R18]. The construction progress has to be strictly monitored in order "*to stay on track*" [R18]. However, having the "*project team and construction team working to the same goal with everyone on the same page with quick decision making*" [R17] can ensure the project's success.

Sourcing of the materials for the heritage projects is difficult most of the time. It is "*more challenging to get heritage stuff products as predominantly all of it was from the UK, and we have to source from the UK*" [R17]. This is because the project team must follow the rule of "*like to like*" [R17], so the making of timely decisions in procurement is critical. The "*lead time for material*" [R17] has to be considered and "*ordering material early on in the project*" [R17] will avoid "*procurement delays – materials*" [R14]. If a delay still happens, "*the realistic timeframe to start with dealing delay with procurement*" [R14] has to be thoroughly considered if "*there is no more room to change*" [R12].

Different stakeholders and the project delivery

Through the decades, war memorial sites have been of broad interest to the community. Today, the "*community are more interested in theoretical outcomes, purity of restoration and integrity of building*" [R14]. Further, any intervention to a memorial site can result in "*losing the essence of community*" [R14]. War memorials have "*extremely personal attachment*" [R14] to the families who lost loved ones in a war and have to be dealt with sensitively as "*people get very emotional*" [R14]. Managing the project in line with the "*political agenda*" [R16] puts an added pressure on all project stakeholders.

Different project stakeholders have different goals: "*Getting all the team to recognise opportunities and constraints is a challenge*" [R14]. Every stakeholder "*has a different perception which leads to a different set of objective in their mind and from the objective and design*" and "*if some of their objectives cannot be met, animosity between different stakeholders can be [present]*" [R18]. Therefore, "*managing expectations in the initial phase*" [R18] is desirable.

War memorial projects must be "*dealt with very carefully and thoughtfully*" [R16] especially due to the community expectations. Managing stakeholders, either external or internal, is about "*managing expectations – what they expect and what they receive*" [R17] and sometimes "*changing the mind*" will require "*more work which will impact to extend [i.e. delay]*" [R17]. Not every stakeholder can visualise the space from the design and sometimes it can cause the additional changes. Sometimes the stakeholder "*does not have visibility of cost*" [R18] and this can give rise to issues as every post-design intervention is always more costly.

Specialists and subcontractors in the project

The Anzac Square project was affected by the availability of "*only two stone masons in Queensland*" [R13]. The "*NSW heritage advisory network*" [R14] helped the project team and contractors to find "*recommendations for suppliers*" [R14].

Heritage project components

The Anzac Square project stakeholders were asked to identify the most significant challenges among the various heritage project components including the policies and procedures, scope definition, tender documentation, decision making, managing within time, lack of information on the building, and managing the multiple stakeholders. They reported that the quality procedure is "*the rigorous procedure*" [R17], and "*the difficulties arrived with not having documentation*" [R17] and adequate "*access to the site*" [R14]. Most of the time, "*assessing the condition of the building can be difficult*" [R14]. Therefore, an "*incomplete tender set*" results in "*latent conditions – that leads to variations, council requests, etc.*"[R17]. The worst thing is when "*the amount of investigation is related to money*" [R17].

Further, "*how much to take out and to put back is the biggest issue*" [R15] in relation to the scope. For example "*the demolition and investigation package [should specify] all fabric to be removed to enable accurate assessment of the building*" [R14]. It will enable the project team "*to fully address the scope*" so we will get a "*more accurate tender*" and "*unknown factors then could be eliminated*" [R17]. The project will be able to "*save time and money on construction process*" if the "*limitation to investigation*" [R17] is addressed and "*to demolish*" [R17] is allowed prior to scope definition. Without this, the project team is forced "*to design without knowing*" [R17]. It is important that the "*project roles are clearly defined*" [R14] from the beginning of the project, as a "*change of command*" [R14] during the project can influence multiple stakeholder relationships.

Project contingency

"*Allowing sufficient contingency*" [R18] helped the project to get back on the track.

5.7.4. Observation

As an observer, the researcher followed the adaptation process of the heritage memorial for the purpose of addressing and documenting the project delay causes. The following four items were described in detail:

- Item 1: Retaining wall on the Ann Street footpath
- Item 2: The Ann Street footpath
- Item 3: The cenotaph
- Item 4: Concrete stairs (around the cenotaph).

A summary was made of each item including the time and budget implications. Every item was photo-documented. The items were documented before and during the adaptation as the works were still in progress at the time of writing.

Plan – map of items

Figure 5.11 shows the Anzac Square restoration project including the proposed colonnade plan with a map of items and their locations.

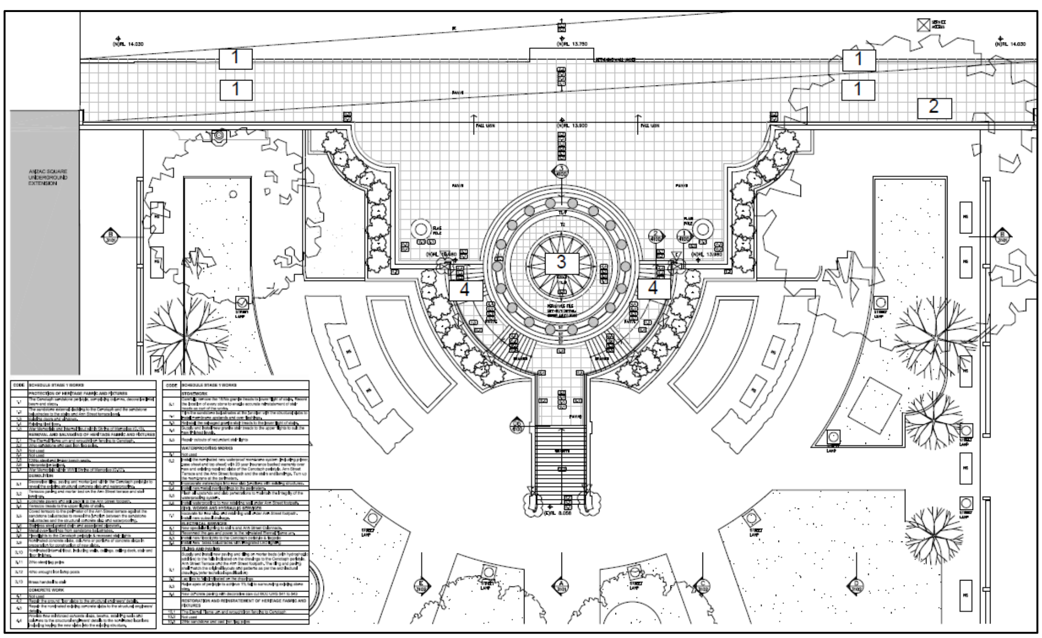
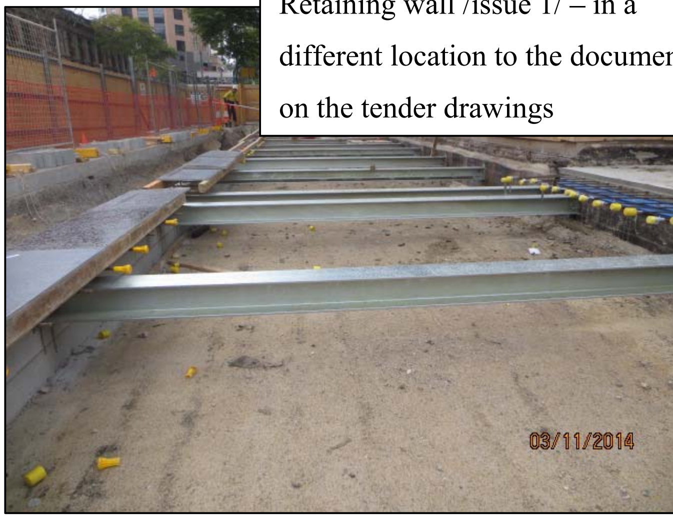


Figure 5.11: Anzac Square restoration project map of items and their locations

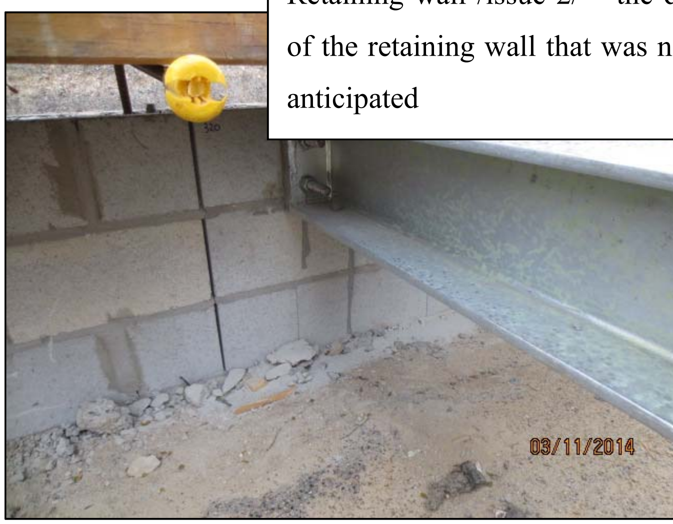
Item 1: Retaining Wall on the Ann Street Footpath

Reconstruction:

Retaining wall /issue 1/ – in a different location to the document on the tender drawings



Retaining wall /issue 2/ – the depth of the retaining wall that was not as anticipated



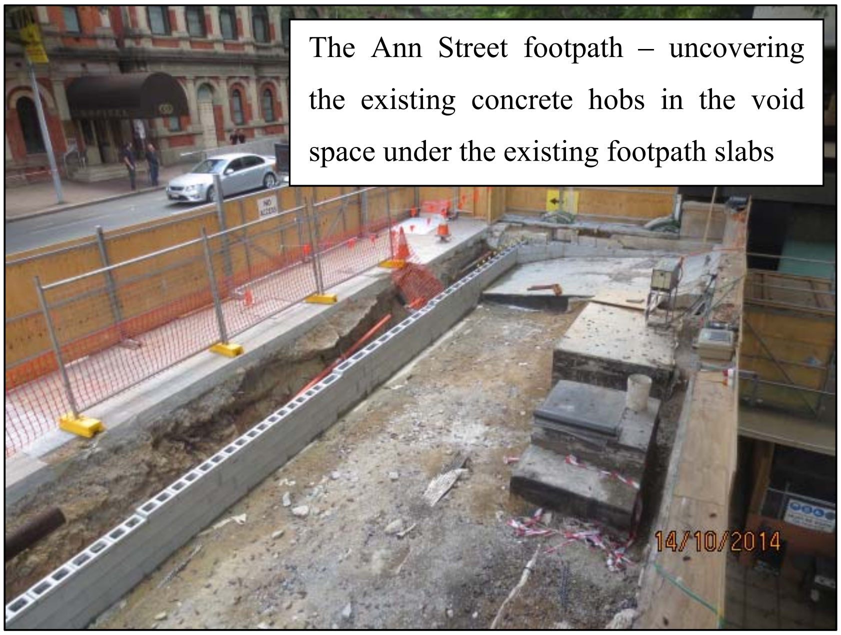
Summary of Anzac Square restoration – Item 1 delay: Following the removal of the concrete slabs, it was discovered two latent conditions in regards to the retaining wall. The retaining wall on the Ann Street footpath was in a different location to that documented on the tender drawings. The information from the tender drawings was based on old drawings found in archives. As a consequence, it added the additional work to increase the length of the steel beams and increase the amount of bondek formwork on top to pour the new concrete slabs. The above photos show the actual length of the void space under the existing concrete slabs.

The second discovery was the depth of the retaining wall that was not as anticipated. Again, this was based on old original drawings. This strengthens the theory of the importance of as-built drawings. This discovery involved an additional excavation up to 1000 mm and additional waterproofing to ensure the waterproofing integrity.

Time implications: Approximately two weeks delay.

Budget implications: The budget implications were unknown at the time of writing; however, an estimate would be approximately 5–8% to the cost in this area of work.

Item 2: The Ann Street Footpath



The Ann Street footpath – uncovering the existing concrete hobs in the void space under the existing footpath slabs

Summary of Anzac Square restoration – Item 2 delay: Another latent condition that has been found on site was existing concrete hobs in the void space under the existing footpath slabs (refer to photo above). This required modifications of the steel beams around this structure and also required cutting the top of the concrete hobs in order to be able to install the new bondek and suspended slab. Again, this information was based on original drawings. Over a period of time, modifications have been made to the structure and there has been no as-built drawings. This is very indicative of old buildings, as changes are made but are not documented. As a result, this added the additional scope of work and required the new design.

Time Implications: The approximate time implication would be one additional week.

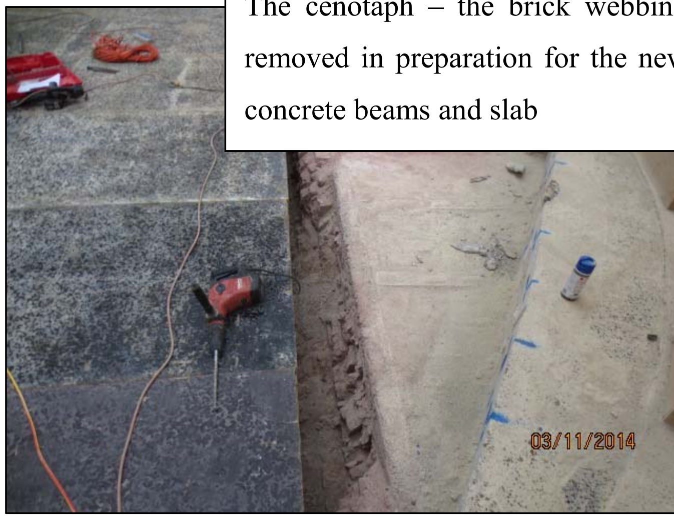
Budget implications: An estimate of the budget implications was an additional 2% cost.

Item 3: The Cenotaph

Before:

The cenotaph – there were no solid concrete beams under the slab however it was only existing brick

After:



The cenotaph – the brick webbing removed in preparation for the new concrete beams and slab

The cenotaph – the whole existing slab has been removed

Summary of Anzac Square restoration – Item 3 delay: The existing conditions in the cenotaph were uncovered once the existing concrete slabs were removed. The investigation of the structure had been undertaken by using non-destructive testing, such as an X-ray machine. It was anticipated that there were solid concrete beams under the slab; however, it was only existing brick webbing. Moreover, the existing brick webbing was not structurally adequate and the best solution to the problem involved installing two new concrete beams to support the new slab. As a result, the brick webbing was removed in preparation for the new concrete beams and slab which added to the additional scope of work and the new design.

Time implications: The approximate time implication would be one additional week.

Budget implications: An estimate of the budget implications was an additional 2% cost.

Item 4: Concrete Stairs (around the cenotaph)

Concrete stairs – The thickness of existing concrete stairs had been anticipated at 300 mm

Concrete stairs – The existing thickness when uncovered was approximately 600 mm thick

Summary of Anzac Square restoration – Item 4 delay: The latent condition was the thickness of the existing concrete stairs around the cenotaph. It was anticipated to be 300 mm thick when in fact it was approximately 600 mm thick, which increased the demolition time and cost in this area by approximately 75%. Due to the nature of the surrounding stone work, large demolition methods could not be used. Therefore, demolition had to be carried out using small hand-held breakers. This was very labour-intensive and therefore costs and delays increased.

Time implications: Approximately one additional week; this included the time to redesign, including the new details.

Budget Implications: An estimate of the budget implications was an additional 75% for this section of the demolition works.

5.7.5. Summary of Case Study 3

Based on the points discussed and highlighted by the Anzac Square project stakeholders, the main issues that affect the project performance and delivery can be summarised as follows:

a) Design is based on archived documents; however, problems arise because:

- Records are not kept
- The archived records are not often the last record

b) Documentation can be misleading due to:

- Lack of sufficient time for investigation work
- Lack of information of the building (“*make the best guess estimate*”)
- Lack of heritage experts who can take on the role of project managers
- Limitations of equipment for investigations using non-destructive techniques
- Assessing the condition of the building is difficult
- Assessments of the site is not made frequently enough
- High cost of post-design intervention

c) The discovery of previously unknown latent conditions leads to:

- Variations
- The project stopping and starting
- Redesigns involving the architect, engineer and contractor
- Going back to heritage authorities to get new designs approved
- Pricing problems
- Difficulties in sourcing the materials
- Difficulties in finding trade specialists to do the work.

d) The political agenda is an added pressure

e) The client's brief changes

f) Requests for information slow down the construction phase

g) The need for the design to be covered by the Building code (BCA) is an issue

h) Complying with the *Disability Discrimination Act 1992* (DDA) is a challenge

i) Small pool of subcontractors and suppliers

j) A demolition and investigation package is highly needed.

5.8. Cross-Case Study Analysis

Following the summary of the case studies, the cross-case analysis is summarised in Table 5.9 to provide a visual overview of the issues experienced in heritage projects. The issues were selected if they occurred in a minimum of two case studies. The items that had only one acknowledgment were not included.

A number of issues repeatedly emerged showing in the heritage project case studies. The interviews enabled the most frequently encountered issues to be highlighted and investigated in more detail. As set out in the discussion chapter (Chapter 7), the interviewees also suggested solutions to address the issues as each of the stakeholders was highly interested to identify what needs to be done to ensure the successful delivery of the projects. Table 5.9 presents the summary of the issues highlighted in the case studies and the identified causes.

Table 5.9: Cross-case study analysis – highlighted issues and causes

Delivering heritage project – ISSUES	**Case study - Experiencing an issues**			**Delivering heritage project - CAUSES**
	OGH	GB	AS	
• Records are not kept • Archived record not often the last record	Yes	Yes	Yes	➢ documentation/ drawings based on the archived records – not reliable 100%
• Lack of sufficient time for investigation work • (assessing the condition of the building)	No	Yes	Yes	➢ Fully extend what is required is unknown ➢ The best guess estimate
• Expertise in heritage projects	Yes	Yes	Yes	➢ Unrealistic time frame ➢ New rework
• Obtaining approval from the heritage bodies	Yes	Yes	Yes	➢ Multiple redesigns
• Visual inspection of the object	Yes	Yes	Yes	➢ Hard to define scope of the work, design and document without knowing enough about the building - results in inaccurate scope definition
• Inaccurate scope definition	Yes	Yes	Yes	➢ Incomplete tender set
• Incomplete tender set	Yes	Yes	Yes	➢ Latent conditions
• Latent conditions	Yes	Yes	Yes	➢ Multiple design, price and agree on the methodology : architect – engineer – contractor ➢ Heritage authorities - to get design approved ➢ Searching for trades specialist ➢ Sourcing materials ➢ Notice of likely delay (NOLD) ➢ Variations
• Specifications / site documentation	Yes	Yes	Yes	➢ Not enough documented results in numerous RFI
• Request for Information (RFI)	Yes	Yes	Yes	➢ Slow down the construction phase
• Sourcing the materials	Yes	Yes	Yes	➢ Overseas ➢ If hardly to match result Inadequate replacement
• Building Code of Australia (BCA)	Yes	Yes	Yes	➢ Hardly to comply with the current building code
• Discrimination Disability Act (DDA)				➢ Installations to satisfy disability access
• Multiple Stakeholder Management	Yes	Yes	Yes	➢ Project delivery is stakeholder driven ➢ Client brief change
• Media and political interest	Yes	No	Yes	➢ Attract considerable interest from media as well as from political arenas

Chapter 6

PROJECT MANAGEMENT CHALLENGES – SURVEY

6.1. Introduction

Chapter 5 examined the literature review, extended the knowledge, and clearly identified the challenges that heritage projects are facing by using the three case studies. The cross-case summary (Table 5.9) highlighted the challenges and causes identified in all three cases, thus helping to answer the second research question. This chapter presents the findings of an online survey conducted by using the Key Survey system of Queensland University of Technology. The key survey link was distributed to potential respondents and the survey was open for 37 days and during that period, 444 responses were received (a response rate of 60.1%). The sample of the survey respondents achieved the targeted level for a random sample to ensure that the data was representative of both external and internal stakeholder groups. In order to get accurate findings from the data, applicable statistical procedures were employed to ensure meaningful output from the collected data.

The analysis involved the application of descriptive statistics and multivariate statistical procedures. The descriptive statistics encompassed frequency distributions and measures of the individual mean, median and standard deviation. Furthermore, the CFA followed by SEM were employed to determine the significant correlation and direct influence between the proposed concept/model driven from the theory and rooted in practice through the respondents' many years of experience. The proposed model derived from the theory was tested through SEM in order to examine the fit to the sample data. The collected data was divided and analysed using two theoretical models to ensure accurate findings and to answer the targeted research question. Where applicable, the results from the CFA were enriched with interview highlights to form the best representative construct for the SEM.

6.2. Preliminary Results

The aim of the preliminary data analysis was to ensure the reliability of the data. This section discusses the results of the descriptive statistics related to the identification and appropriateness of the respondents, and the checking processes for missing data, outliers and normality distribution.

Demography of respondents

The questionnaire survey targeted two different stakeholder groups in order to obtain an accurate answer to the three research questions, namely, the internal stakeholder group (INTS) and external stakeholder group (EXTS). External stakeholder participants were targeted to answer the first research question/general questions, and the internal project stakeholders were targeted to answer the second and third research questions as these questions required the respondent to have real project experience.

External respondents

The external respondents were members of the general public with an interest in heritage, and included the end-users of heritage buildings/places, owners of the heritage building/place or tourism and related organisations. The aim of including the external respondents was to gather an overall 'picture' of public opinion regarding what heritage buildings and places mean to the general public. The results represented a reflection on the general level of interest of the public in retaining heritage places: 95% of the respondents were members of the general public, and the remaining 5% represented tourism operators and owners of heritage places.

Internal respondents

The internal stakeholder group consisted of all types of specific heritage project stakeholders, including project owners, project managers, contractors/builders, architects, heritage consultants, engineers (all disciplines), quantity surveyors, superintendents, heritage administration as an approval body, building tradespeople and archaeologists. The most highly represented groups among the internal respondents were contract builders (22.42%), architects (21.82%) and heritage consultants (21.21%). This significant distribution of respondents draws a range of views from a specifically targeted research population targeted at helping to improve the delivery phases (such as the planning and design) for future heritage projects.

Respondents' current location

The majority of respondents were Queensland-based (69.39%), followed by New South Wales (18.79%). The other states and territories were represented as follows: Victoria (7.27%), South Australia (6.06%), Western Australia (4.85%), Tasmania (1.82%), Australian Capital Territory (1.21%) and Northern Territory (0.61%).

Respondents' type of workplace

Most of the respondents were employed in the private sector (52.73%), followed by the public sector (31.5%) comprising state or federal government departments and agencies (21.82%), local government (9.7%) and non-profit organisations (3.03%). The remainder of the respondents were in "other" work situations including retirement (19.39%).

Respondents' membership of organisations

The survey questionnaire asked the respondents to indicate their membership of organisations, using a multiple response question that enabled the respondents to tick as many as applicable and also to add some other organisations that were not presented as an option. The results showed that most of the respondents were members of ICOMOS (38.79%), followed by "other" organisations (27.27%) (the list of other organisations is presented in Appendix F5). Respondents were also members of the National Trust (24.24%), Australian Institute of Architects (18.79%), Australian Institute of Project Management (5.45%), Master Builders Australia (4.85%), Australian Institute of Quantity Surveyors (2.42%), Australian Institute of Building Surveyors (1.82%), Australian Institute of Building (1.82%), Royal Institute of Chartered Surveyors (1.21%), and the Urban Development Institute of Australia (1.21%). A number of the respondents were not members of any related organisation (21.82%).

Respondents’ experience with heritage projects

It was important to determine the respondents’ experience in heritage projects. The results showed that the respondents with a high level of experience (20+ years) and the respondents with a low level of experience (0–5 years’ experience) were equally represented (30.3% and 30.3%, respectively). These groups were followed by respondents’ with 10–20 years’ experience (26.06%) and respondents with 5–10 years’ experience (13.33%).

Respondents’ work focus

The survey discovered the portion of the respondents’ work focus that was specifically related to heritage projects. The results indicated that work was 100% heritage related for 23% of the respondents. For 15% of the respondents, their work focus on heritage projects was 50–70%, and for 13% of the respondents their work focus on heritage projects was 25–50%. For almost half of the respondents (49%), their work focus on heritage projects was 0–25%.

Respondents’ project sizes

The questionnaire sought to gather data on the size of heritage projects that respondents had worked on, based on project cost. The results showed that 35% of respondents had worked on heritage projects with the estimated project cost between $1 million and $10 million, followed by 30% of respondents who had worked on projects with an estimated cost of less than $1 million. Furthermore, 18% of respondents had worked on projects with an estimated cost between $10 million and $50 million, and 15% had worked on projects with a cost of greater than $50 million.

Respondents’ experience based by state/territory

The majority of the heritage projects that the respondents had worked on were based in Queensland (49.09%), followed by New South Wales (23.64%), Victoria (9.09%), South Australia (6.67%), Western Australia (5.46%), Tasmania and the Australian Capital Territory (both 2.42%) and the Northern Territory (1.21%). Among the respondents with overseas experience (17%), the locations included: the United

Kingdom, South Africa, European Union, Nigeria, Hong Kong, Iran, United States of America, Saudi Arabia, Afghanistan, Sri Lanka, Spain, Bangladesh, Vietnam, Austria, New Zealand, Wales, Germany, China, Ireland, Pakistan and Dubai.

Respondents' experience based on listing of projects

The majority of respondents had worked on projects for heritage sites that were state-listed (75.32%), followed by locally-listed (65.19%), nationally-listed (50.63%) and world-listed sites (23.42%).

Respondents' project type

The questionnaire asked the respondents to rate one of their typical projects, providing information that allowed the researcher to interrelate the types of projects based on budget, timeframe, expenditure, contingency and other common issues.

Respondents' particular project experience within the certain listed level/s

Most of the projects chosen by the respondents for further discussion were state-listed (49%), followed by locally-listed (24%), nationally-listed (14%), and world-listed (4%). Five of the heritage projects selected for further questioning were not inscribed in any heritage register.

Respondents' particular project experience in regard to project cost

Most of the projects selected by the respondents for further questioning had a cost of less than \$1 million (41%), followed by projects with a cost between \$ 1 million and \$10 million (37%). Thus, most of the selected heritage projects cost less than \$10 million. Some of the projects selected by the respondents for further discussion cost between \$10 million and \$50 million (13%), while 9% of the projects selected by the respondents cost more than \$50 million.

Respondents' experience of project time goals

More than half of the projects had met time goals (59.39%), while 35.15% of the projects had experienced some kind of difficulties that resulted in the project falling behind schedule. Furthermore, 5.45% of the respondents' projects had been able to perform better than scheduled.

Respondents' experience of project budget goals

In terms of meeting project budget goals, 52.8% of the projects had been completed within the proposed budget, 40.99% of the projects required an additional budget due to unexpected circumstances, and 6.21% were successfully completed at a cost less than allocated.

Respondents' particular project experience in regard to project special requirements

The heritage impact statement was required for 29% of projects, followed by projects requiring a conservation management plan (27%) and other specialised reports (26%) and reports (17%) as shown in Appendix F1.

Respondents' experience of different needs for the contingency expenditure

In terms of the contingency expenditure on the specific problems in the project, in 41% of the respondents' projects the allocated contingency had been spent on unknown situations discovered after work started. Problems with particular materials such as stone, mortar and timber were the second specific problem (23%), followed by problems with the particular elements such as roof and windows (13%). Contingency expenditure for other purposes was required in 12% of the projects (AppendixF4), and contingency expenditure was required for termite infestation in 10% of the projects.

Respondents' experience of the allocated amount of contingency in the project

Almost every second project experienced the proposed contingency allocated for the project being insufficient to cover the additional work required (46.8%), with 53.15% of the respondents' projects being able to cover any additional work within the allocated contingency expenditure.

Respondents' suggestions regarding the amount of contingency

Regarding the required amount of contingeny, 49% of the respondentssuggested that the amount should be between 10%–20%, followed by 33% of the respondents who suggested that the amount of contingency for the project should be between 20%–30%. For 8% of the respondents, 8% of contingency was considered to be enough to cover the additional work, while 10% listed other recommended amounts (as shown in Appendix F7).

Respondents' challenges meeting the Building Code of Australia

In the work on heritage buildings, 50% of the respondents had faced some kind of difficulties in meeting the Building Code of Australia requirements for:

Fire safety – 70% of the respondents had faced difficulties in meeting the BCA, while 30% of the respondents had not faced this kind of difficulty.

Workplace safety – Half of the respondents had faced difficulties in meeting the BCA with regard to workplace safety.

Disability access – 78% of the respondents had faced some kind of difficulty in applying the BCA requirements in the project in regard to disability access.

Respondents' maintenance challenges

The respondents faced the following maintenance challenges: 'adjusting the design to get the approval' (20%), followed by 'finding the right materials' (17%). Both 'getting approval from council/government' and 'finding the skilled person' (15% including 'other') were in the third place. Further, the respondents found 'getting advice (architect, engineer, other specialist)' and 'finding helpful technical information (library, online, etc.)' to be the cause of maintenance challenges (10%).

6.3. Coding Data

As explained previously, the variables extracted from the key survey results were labelled (as shown in Appendix C). The data exported from the key survey results was given numerical values that were aligned with the text values to enable the reader to understand the results obtained from the different tests applied to both (Zikmund et al. 2010).

6.4. Missing Values

As previously stated, the parameters of the CFA model and the structural equation model were obtained using both the ML algorithm and the MLMV algorithm and the MLMV and ML procedures were run on all cases. The missing data did not have an impact on the model results, as the MLMV model statistically was similar to the ML results. The missing data across all the model variables was less than three percent.

6.5. Outliers

This research project used an online key survey with built-in validation rules so that responses could only take on allowable values from 1 to 5. Therefore, all the variables were within the ordinal scale range of 1 to 5. One record (ID No. 51) exhibited consistently low survey responses across most items. All multivariate statistics were run with this record included and with this record removed to ensure this observation did not bias the results. No differences in any of the multivariate tests were observed and this record was subsequently included in all analyses.

6.6. Normality of Distribution

The Shapiro–Wilk (SW) and the Shapiro–Francia (SF) tests for univariate normality were conducted across all relevant scale items, and the results are reported in Appendices D-2-1 – D-2-2. These tests have been shown to be reliable for samples between $4 \leq n \leq 2000$ observations for the SW procedure and between $5 \leq n \leq 5000$ observations for the SF procedure (Royston 1982; Royston 1991).

The results for the PM model construct showed that the data was normally distributed. The HR model result indicated that the following four values did not show normal distribution: a1 (q7a1), a3 (q7a3), a7 (q7a7) and b2 (q8a2). Table 6.1 shows the four indicated values that were not normally distributed.

Table 6.1: Values that were not normally distributed

Prob>z	**Data Code**	**Description**
0.00002	a1 (q7a1)	Appearance and design qualities
0.03797	a3 (q7a3)	Contribution to streetscapes and views
0.00001	a7 (q7a7)	Historical importance – evidence of past ways of life
0.00001	b2 (q8a2)	Cost/ Investment

CFA and structural equation models usually use the ML estimation function to determine model parameters. ML is the default model estimation procedure within most statistical packages including Stata; with the ML estimator being consistent, efficient and asymptotically normal if multivariate normality holds and the sample size approaches infinity (Long and Freese 2006, p.77). Although ML estimators are widely used to model small to large data sets, their exact behaviour in small data sets (less than 500 observations) is largely unknown. Potential estimators may not be consistent and efficient, and this situation may be made worse in the absence of multivariate normality (Long and Freese 2006, p.77). Stata provides four estimation methods for SEM models, the maximum likelihood (ML), quasi maximum likelihood (QML), asymptotic distribution free (ADF), and maximum likelihood with missing values (MLMV).

The assumptions one must make to establish the consistency of the SEM estimates and their asymptotic normality is determined by the method used to estimate them. To this end, ML is the default estimation method that SEM uses. In SEM, the function being maximized formally assumes the full joint normality of all the variables, including the observed variables. But the full joint-normality assumption can be relaxed, and the substitute conditional-on-the observed-exogenous-variables is sufficient to justify all reported estimates and statistics except the log-likelihood value and the model-versus-saturated χ^2 test.

QML uses ML to fit the model parameters but relaxes the normality assumptions when estimating the standard errors, however QML has little impact on remedying non-normality issues for latent variables, but in these situations, it does provide more robust latent construct estimates than ML.

ADF is a form of weighted least squares (WLS) and is a generalized method of moments. In simulations of the measurement model with $X \sim \chi^2(2)$, ADF produces excellent results , even for the standard error of the variance of X. However ADF is less efficient than ML when latent variables can be assumed to be normally distributed. If latent variables (including errors) are not normally distributed, ADF will produce more efficient estimates than ML or QML.

Given that the population of 'professionals' was less than 500 and some of the items showed non-normality, the CFA model and structural equation model were fit using the ML function, as well as the asymptotic distribution free function (ADF) function and the quasi-maximum likelihood (QML) function. The main advantage of the ADF and QML functions for the CFA model and structural equation model is that multivariate normality is not required (Acock 2013, p.15) and in the absence of multivariate normality, the ADF and QML estimators can be more consistent and more efficient than ML estimators. However, in the models developed in this research, 'little' difference was observed between the ML, ADF and QML estimators; hence, the ML estimator procedure was unbiased even with the small sample plus some items showing non-normality.

ML also uses list-wise case deletion that produces unbiased estimators if the missing data is missing completely at random. The MLMV method in Stata 13 aims to retrieve as much information as possible from observations containing a small number of missing values. In this regard, the SEM methods of ML, QML and ADF "do a poor job" (Acock 2013; Rubin 1996, 1972). QML and ADF are known as list wise deleters. If variable x1 appears anywhere in a model and if x1 contains a missing value in observation 10, then observation 10 will not be used if list-wise deletion is employed. This occurs whether x1 is endogenous or exogenous and if x1 appears in some equations but not in others (Acock 2013, p.15). However, method

MLMV formally requires the assumption of joint normality of all variables, both observed and latent. Therefore, using the modified MLMV as another alternative, observation 10 will only be omitted in those regressions that require x1; if not required, the record is included and all other recorded variables are available for subsequent use (Stata Press 2013, p.43-45). The MLMV method was also used in all the CFA model and structural equation model in the present study to ensure the impact of missing data was minimised.

6.7. Reliability of the Data

Cronbach's alpha coefficient was used to examine the internal reliability of each scale. As already discussed, different researchers propose different justifications for the Chronbach alpha, and this research project followed the reliability level established by George and Mallery (2003) where >0.7 = acceptable, >0.8 = good fit, and >0.9 = excellent. The results for the reliability test for each construct KR, MC, PD, EC, Technical and M_stake are as shown in Table 6.2, indicating that all the constructs were able to be further examined as they were all reliable.

Table 6.2: Cronbach's alpha results

Chrombach's Alpha	Construct	Reliability level by George and Mallery (2003) (>0.7 = acceptable, >0.8 = good fit and >0.9 = excellent)
0.763	MC	Acceptable fit
0.809	KR	Good fit
0.884	PD	Good fit
0.895	EC	Good fit
0.900	Technical	Excellent fit
0.920	M_stake	Excellent fit

6.8. Descriptive Statistical Analysis

The results from the descriptive statistical analysis of the frequencies (Tables 6.3 to 6.8) show the top-ranked scores based on the mean values for each of the constructs, KR, MC, PD, EC, Technical and M_stake. The standard deviations in the tables show the measure of dispersion around the mean.

Table 6.3: Key reasons (KR)

Mean	Std. Dev.	Data Code	Description
4.58	0.666	a7 (q7a7)	Historical importance – evidence of past ways of life
4.33	0.750	a6 (q7a6)	Rarity
4.25	0.706	a2 (q7a2)	Landmark qualities

For mean score scale: from 1 = strongly disagree to 5 = strongly agree.

The KR results indicate that historic importance was given as the key reason for the preservation of heritage places. Based on its strong ‘highly agree’ rating, historical importance (evidence of past ways of life) was seen as an imperative factor. The rarity of the historic place, followed by the landmark qualities, were the next top key reasons for preserving heritage places. The lowest mean value was 3.65, which indicates that all ten measured key reasons were important. The results of the frequencies and descriptive statistics of the heritage retention (HR) construct, key reasons (KR) and main challenges (MC) can be seen in Appendix D-4-1.

Table 6.4: Main challenges (MC)

Mean	Std. Dev.	Data Code	Description
4.21	0.822	b2 (q8a2)	Cost/ Investment
4.14	0.766	b3 (q8a3)	Availability of funding sources (Gov, non-Gov, private, etc.)
3.93	0.966	b10 (q8a10)	Urban Development

For mean score scale: from 1 = strongly disagree to 5 = strongly agree.

The MC results showed that the two top-ranked challenges to retaining heritage places were related to the financial aspects of projects. The first main challenge was cost/investment’, which means that any action to retain heritage will be strongly connected with the perception of the project cost. This was followed by the availability of funding sources (public or private sector funds) which greatly influences the decision to retain heritage sites. The respondents saw urban development as a third main challenge. This echoes the emphasis placed by the Australian State of the Environment Committee (2011) on the importance of taking action to protect heritage places from further development pressure in order to retain their value. The lowest mean value was 3.38, which indicates that all ten measured challenges were believed to have an influence on heritage retention. The results of the frequencies and descriptive statistics of the heritage retention (HR) construct, key reasons (KR) and main challenges (MC) can be seen in Appendix D-4-1.

Table 6.5: Planning/Design (PD)

Mean	**Std. Dev.**	**Data Code**	**Description**
3.84	0.895	q27a3	Availability of funding sources
3.67	0.942	q27a6	Defining the scope accurately
3.63	1.017	q27a4	Political influence/interest
3.56	0.815	q27a1	Approvals – Timeframes for Local/State/Federal heritage

For mean score scale: from 1 = Not at all influential to 5 = Highest influence.

The results for the planning and design stage of the project management lifecycle confirmed once again the importance of availability of funding sources. The second challenge that was found to highly influence the ability to meet project delivery objectives (on time and on budget) was scope definition. Political influence/interest was the third-ranked challenge, showing the importance of heritage places that are often used as a political tool. The timeframes for local/state/federal heritage approvals were seen to have an influence on the final project time overrun and therefore the budget. The lowest mean value was 2.95, which indicates that all sixteen measured PD challenges were believed to have a degree of influence on the project delivery objectives. The results of the frequencies and descriptive statistics of heritage building project challenges and project performance (PP) can be seen in Appendix D-4-2.

Table 6.6: Execution/Construction (EC)

Mean	Std. Dev.	Data Code	Description
3.95	0.841	q28a15	Financial/budget considerations/constraints
3.90	0.837	q28a3	Qualifications/experience of contractor/subcontractors
3.72	0.991	q28a1	Qualifications/experience of project design team
3.70	0.965	q28a12	Lack of coordination/communication between design team/client/contractor

For mean score scale: from 1 = Not at all influential to 5 = Highest influence.

The survey results on the execution/construction phase also confirmed the top main challenge was again of a financial nature (financial/budget considerations/constraints). The qualifications/experience of the contractor/subcontractors and qualifications/experience of the project design team were the second and third main challenges faced in this phase of a heritage project lifecycle, concurring with the Australian State of the Environment Committee's (2011) report on the lack of skills and expertise. The lowest mean value was 3.32, which indicates that all fifteen measured execution/construction phase challenges were seen to have an influence on the project delivery objectives. The results of the frequencies and descriptive statistics of heritage building projects, challenges and project performance (PP) can be seen in Appendix D-4-2.

Table 6.7: Technical factors (Technical)

Mean	Std. Dev.	Data Code	Description
3.29	1.034	q29a6	System in place to identify what is significant fabric
3.27	1.074	q29a5	Heritage protocol doc.
3.21	1.097	q29a3	Procedures for repair or rebuild of: stone work, brick work, steel work, concrete work and timber work

For the mean score scale: from 1 = not needed, 2 = medium need, 3 = highly needed, 4 = already provided (more information required), and 5 = already provided (high quality).

The results on technical factors showed that the respondents believed that having a system in place to identify the significant fabric is highly necessary. The availability of heritage protocol documentation and the available procedures for the repair or rebuild (of stone work, brick work, steel work, concrete work and timber work) require more information and updating. The lowest mean value was 2.97, which indicates that all eight measured technical factors were believed to have an influence on the project delivery objectives. The results of the frequencies and descriptive statistics of heritage building projects, challenges and project performance (PP) can be seen in Appendix D-4-2.

Table 6.8: Multiple stakeholder factors (M_stake)

Mean	**Std. Dev.**	**Data Code**	**Description**
4.30	0.712	q36a12	Communicating with and engaging stakeholders effectively and frequently
4.28	0.652	q36a8	Keeping and promoting a good relationship
4.26	0.661	q36a2	Identifying stakeholder requirements

For the mean score scale: from 1 = strongly disagree to 5 = strongly agree.

The top three most important factors among the twelve multiple stakeholder tested factors were communicating with and engaging stakeholders effectively and frequently, keeping and promoting a good relationship, and identifying stakeholder requirements. The results indicate that good and frequent engagement and communication between stakeholders, while keeping a good relationship, are the most critical multiple stakeholder factors in successful project delivery. The third-ranked critical factor is to identify stakeholder requirements in the project. The lowest mean value was 3.79, which indicates that all twelve measured stakeholder factors were seen to have an influence on the project delivery objectives. The results of the frequencies and descriptive statistics of heritage building project, challenges and project performance (PP) can be seen in Appendix D-4-2.

6.9. Correlation within the Constructs

The Pearson correlation coeficients were run with the Bonferroni adjustment to correct for an enhanced probability of making Type I errors across the multiple pairwise comparison.That gives the confirmation of relationship between variables within each of the constructs and the correlation coeficient indicates the magnitude of the relationship. The correlation coeficient effect size is considered to be small if it is 0.1 – 0.3, medium if it is 1.3 – 0.5 and large if it is over 0.5 (Green and Neil 2008, p.259). Therefore, most of the correlations were moderately high.

The results of the Bonferroni test within the construct variables were as follows:

Key Reasons: The Pearson correlation coefficient between the appearance and design qualities (a1) and landmark qualities (a2) (0.55) and also the contribution to streetscapes (a3) and views, and the amenity of the suburb with consistent character (a4) (0.51) were shown as the most significant. All the other variables were correlated, and the lowest correlations were found between the historical importance of the heritage places as evidence of past ways of life (a7) and the prevention of negative environmental and/or social impact (a10) (0.15). The further correlation results on the key reasons are shown in Appendix D-5-1. For all the codes' explanations, refer to Appendix C-1.

Main Challenges: The Pearson correlation coefficient between cost/investment (b2) and availability of government, non-government and private funding sources (b3) (0.55) was shown as the most significant. All other correlated variables showed significance in correlation. The lowest correlation was found between uninformed client/customer (b4) and technical barriers/design/engineering (b5) (0.158), and also between compliance (heritage approvals/development approvals)/regulatory barriers/policy requirements (b1) and the problems of poor maintenance of current building stock (b7) (0.159). The further correlation results on the main challenges are shown in Appendix D-5-2.

Planning/Design: The most significant correlation was found between the lack of appropriate staff skills (q27a9) and qualifications/experience of the project team (q27a10) (0.69); further, the existing condition of the building (q27a13) was related to the lack of ability to fully ascertain the condition of the building (q27a14) (0.62). All other correlated variables were shown to have significance. The lower significant correlation was shown between the level of appropriate contingency (q27a2) and discontinuous or unknown existing building fabric/materials causing delay or rework (q27a16) (0.28). The further correlation results on planning/design are shown in Appendix D-5-3.

Execution/Construction: The most significant correlation was between qualifications/experience of the project design team (q28a1) and qualifications/experience of the project client team (q28a2) (0.63). A correlation was also found between the lack of coordination/communication between the design team/client/contractor (q28a12) and incomplete project construction documentation (q28a13) (0.61), followed by the qualifications/experience of the project design team (q28a1) and the qualifications/experience of the contractor/subcontractor (q28a3) (0.60). The lowest correlation was found between qualifications/experience of the project client team (q28a2) with an accurate pre-tender estimation (q28a5) (0.275), and the post-demolition investigation (q28a10) (0.278). The further correlation results on execution/construction are shown in Appendix D-5-4.

Technical Factors: The most significant correlations were found between the guidance of different construction methodologies used at various times and locations (q29a1) and consistent procedures on how to deal with specific issues – to help mediate this detail/issue (q29a2) (0.76). The lowest correlation was found between the guidance on different construction methodologies used at various times and locations (q29a1) and the heritage protocol documentation (q29a5) (0.33). The further correlation results on technical factors are shown in Appendix D-5-5.

Multiple Stakeholder Factors: The most significant correlation was found between predicting stakeholder reactions for implementing the strategies (q36a10) and analysing the change of stakeholder influence and relationship during the project process (q36a11) (0.76). All the other variables were shown to be significant except one. The lowest correlation was found between identifying stakeholder requirements (q36a2) and formulating appropriate strategies to manage stakeholders (q36a9) (0.27). The further correlation results on multiple stakeholder factors are shown in Appendix D-5-6.

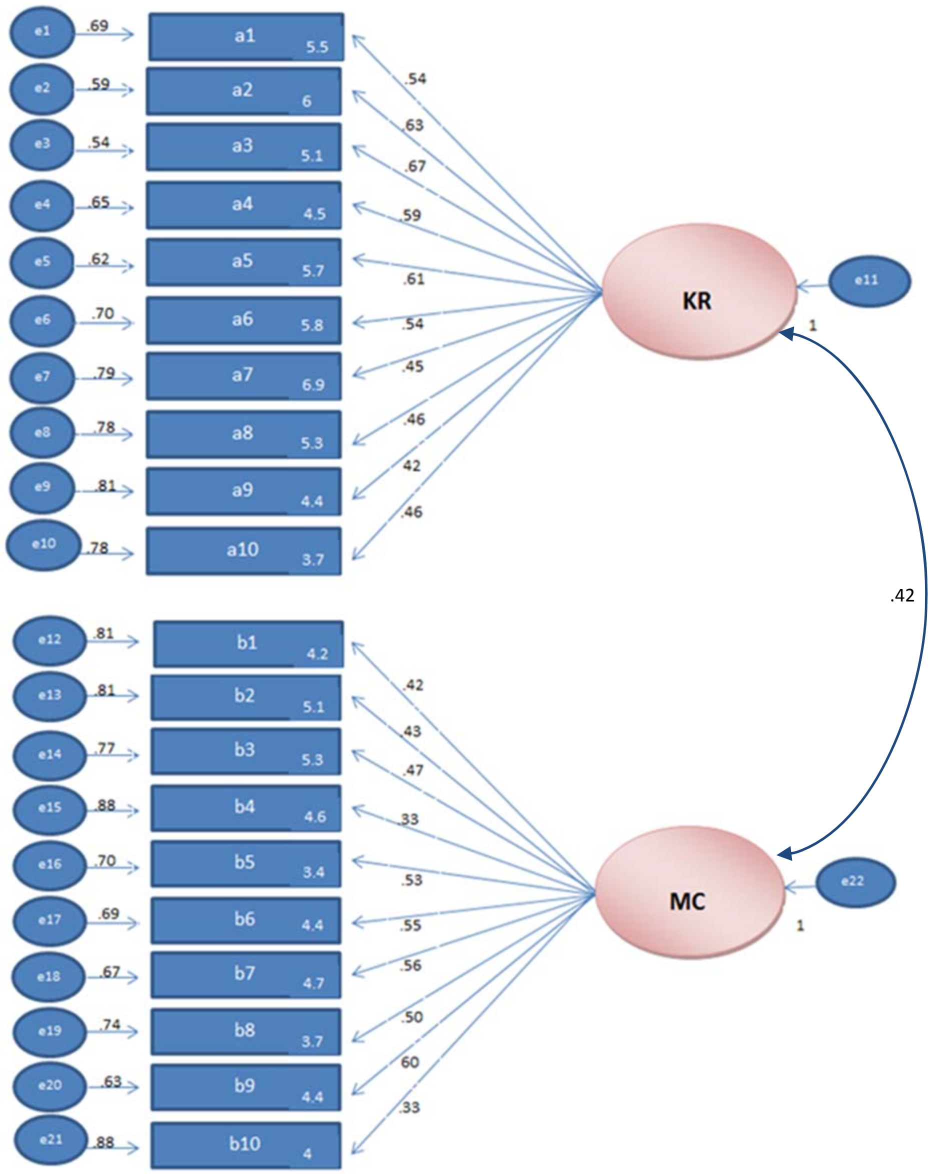
These results cannot indicate the correlation between constructs, only within the construct itself. The significant correlation that was found between each of constructs indicates the strong connection/relation between certain variables. Over 50% of the examined variables had significant correlation coefficients.

6.10. Confirmatory Factor Analysis

CFA facilitates theory development in a measurement context. The six proposed constructs were divided into two models and the CFA results are presented in this section.

6.10.1. Assessment of standardised CFA Model_Heritage Retention_Key Reasons (KR)_Main Challenges (MC)

The results of the CFA heritage retention, key reasons and main challenges model show the level of achieved values in comparison with the indexes to the proposed criteria for assessing the structural model fit (Figure 6.1). The proposed KR_MC model showed an acceptable fit which means that the data supported the proposed model (Table 6.9).



Model_CFA_KR_MC	**χ2**	**CMIN/DF <2.00**	**CFI >0.90**	**TLI >0.90**	**RMSEA <0.080**
Model_KR_MC_20	311.330	1.982	0.926	0.910	0.047

Figure 6.1: Heritage retention CFA Model_KR_MC_20

Table 6.9: Level of fit for the heritage retention model

CMIN/DF <2.00	χ2 = Chi Square = CMIN, DF= Degree of Freedom < 2 = excellent fit, 3-5 = acceptable fit, > 5= poor fit
1.982	**1.982<** 2 **Excellent fit** (KR_MC)
CFI >0.90	**Comparative Fit Index- Goodness-of-fit index** 0.90 <CFI< 0.95 = acceptable fit, 0.95 <CFI< 1.00 = perfect fit
0.926	0.90 <**0.926**< 0.95 **Acceptable fit** (KR_MC)
TLI >0.90	**Incremental Fit Index** 0.90 <TLI< 0.95 = acceptable fit, 0.95 <TLI< 1.00 = perfect fit
0.910	0.90 <**0.910**< 0.95 **Acceptable fit**(KR_MC)
RMSEA >0.08	**Badness-of-fit index** 0.03 <RMSEA< 0.08 = acceptable fit, < 0.03 = excellent fit
0.047	0.03 <**0.047**< 0.08 **Acceptable fit** (KR_MC)

The CFA analysis with the values of each variable indicates the ranking by importance of each examined variable within the KR model. The three first ranked variables for KR are shown in Table 6.10. As shown in the table 6.10, the contribution of the heritage place to the streetscapes and view is the first key reason indicating the importance of retaining heritage. Heritage buildings with their quality design and landmark style are not just about the past but about the future. The pleasing view of streets and harmony that heritage places create is irreplaceable. Moreover, every place that indicates the history is known as a landmark and symbolises the country, time, place, people and events. A special character is imprinted in heritage buildings and places. Every site has its own story.

Table 6.10: CFA top three reasons for heritage retention

CFA_KR	Data Code	Description
0.67	a3 (q7a3)	Contribution to streetscapes and view
0.63	a2 (q7a2)	Landmark qualities
0.61	a5 (q7a5)	Special character

- indicates the source from CFA
- indicates the source from CFA

The top three challenges for heritage retention, as found through the CFA analysis, are shown in Table 6.11. As shown in the table, the main challenge of heritage building/ places is ongoing maintenance after renovation that sometimes could be costly. The continuing decline in the availability of specialist heritage tradespersons has an impact on the cost of maintenance. Moreover, the poor maintenance of current building stock is a challenge. Poor maintenance influences the project's financial management and the program specification once it comes to the renovation.

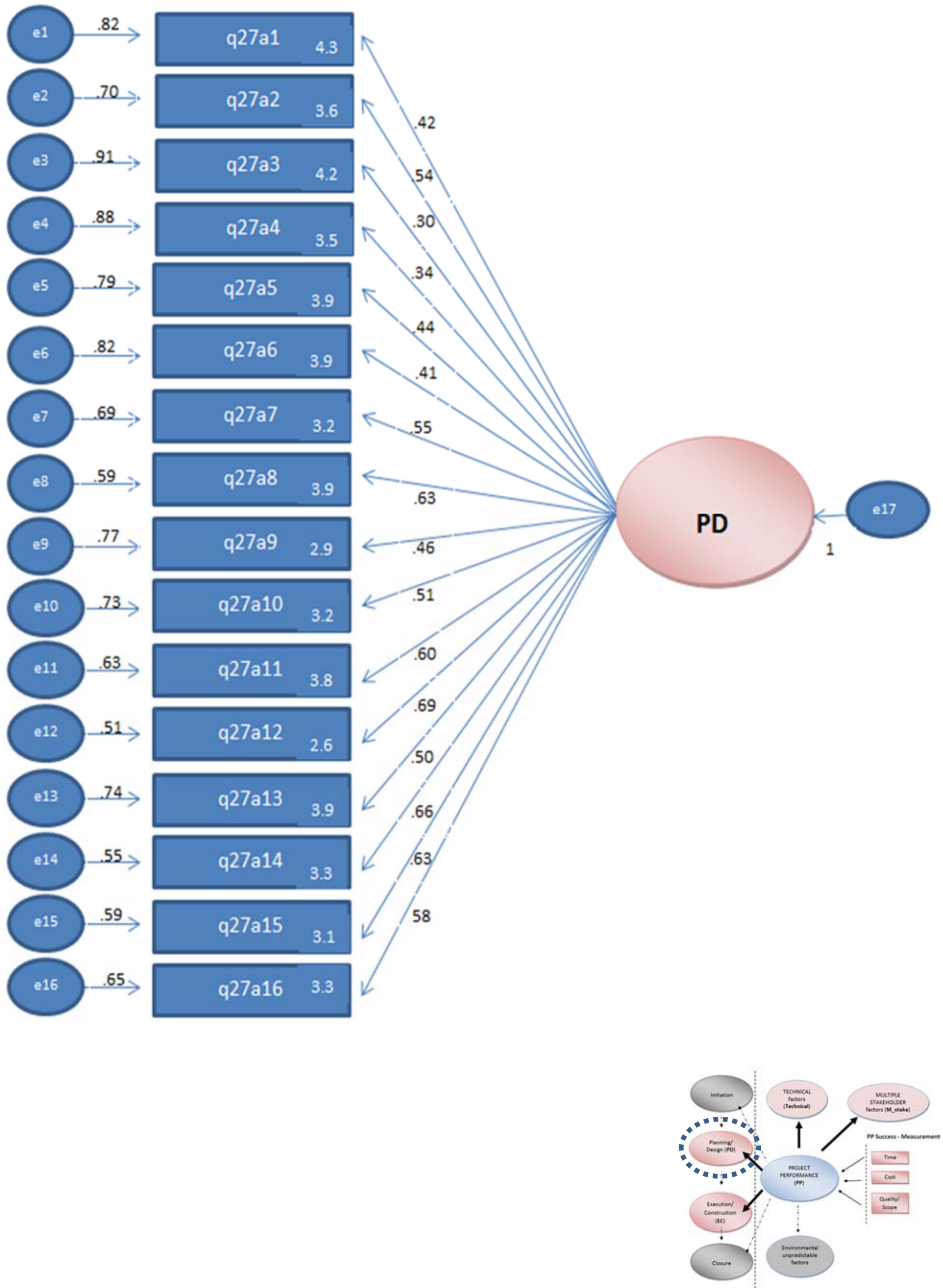
Table 6.11: CFA top three challenges for heritage retention

CFA_MC	Data Code	Description
0.60	b9 (q8a9)	Ongoing maintenance after renovation/ high cost
0.56	b7 (q8a7)	Poor maintenance of current building stock
0.55	b6 (q8a6)	Project risk (program/financial)

- indicates the source from CFA
- indicates the source from CFA

6.10.2. Assessment of standardised CFA Model_Planning/Design (PD)

The results for the CFA planning/design model show the level of achieved values in comparison with the indexes to the proposed criteria for assessing the structural model fit (Figure 6.2 and Table 6.12).



Model_CFA_PD	χ2	CMIN/DF <2.00	CFI >0.90	TLI >0.90	RMSEA <0.080
Model _PD_16	146.20	1.642	0.935	0.912	0.062

Figure 6.2: Planning design CFA Model_PD_16

Table 6.12: Level of fit for the CFA planning/design model

CMIN/DF **<2.00**	**$\chi 2$ = Chi Square = CMIN, DF= Degree of Freedom** < 2 = excellent fit, 3-5 = acceptable fit, > 5= poor fit
1.642	**1.642<** 2 **Excellent fit** (PD_16)
CFI **>0.90**	**Comparative Fit Index- Goodness-of-fit index** 0.90 <CFI< 0.95 = acceptable fit, 0.95 <CFI< 1.00 = perfect fit
0.935	**0.935**> 0.95 **Acceptable fit** (PD_16)
TLI **>0.90**	**Incremental Fit Index** 0.90 <TLI< 0.95 = acceptable fit, 0.95 <TLI< 1.00 = perfect fit
0.912	**0.912**<0.90 **Acceptable fit** (PD_16)
RMSEA **>0.08**	**Badness-of-fit index** 0.03 <RMSEA< 0.08 = acceptable fit, < 0.03 = excellent fit
0.062	0.03 <**0.062**< 0.08 **Acceptable fit** (PD_16)

The proposed model PD_16 showed acceptable results except for CMIN/DF with an excellent fit. From the sixteen factors analysed in CFA, five of them with the factor loading higher than 0.60 will be further analysed in SEM and all others (eleven factors) have been not applicable for further analysis. This indicated that five factors with the measured values had significant influence. These are shown in Table 6.13.

Table 6.13: CFA challenges for PD

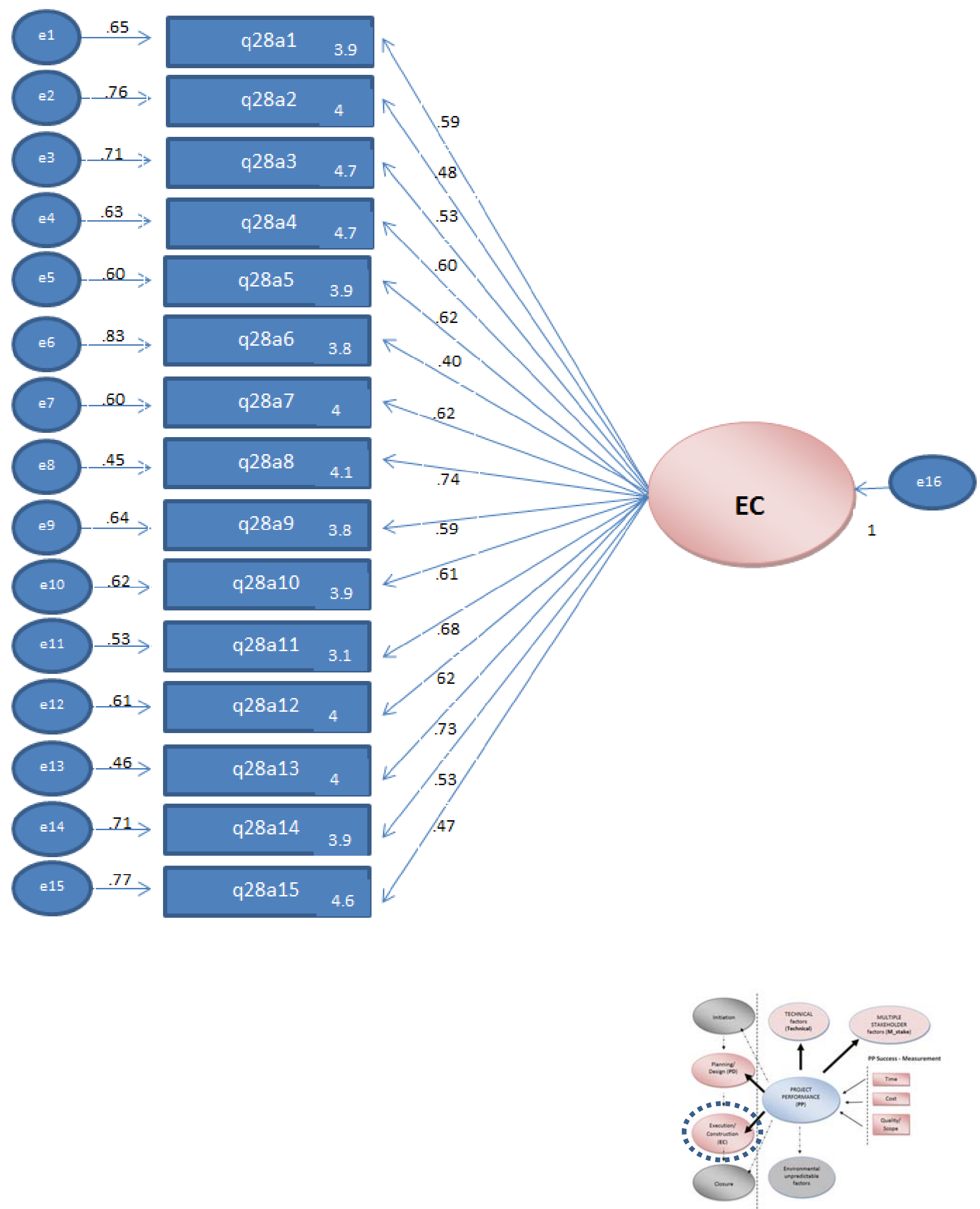
CFA_PD_5	**Data Code**	**Description**
0.69	q27a12	Non-availability or incomplete original building plans
0.66	q27a14	Lack of ability to fully ascertain the “condition of the building”
0.63	q27a8	Quantifying capital cost of works
0.63	q27a15	Limitations for methodology for repairs or new works due to heritage constraints
0.60	q27a11	Implications of change of use/ significant works causing compliance with current codes (BCA code)

- indicates the source from CFA
- indicates the source from CFA

The values from assessing the CFA measurement model_16 placed the first challenge in the design/planning stage as the non-availability or incomplete original building plans, followed by the lack of ability to fully ascertain the condition of the building which together influence clarification of the project design. The quantifying capital cost of works together with the limitations in the methodology for repairs or new works due to heritage constraints is the third most important challenge in the design/planning stage, followed by the implications of change of use/ significant works causing compliance with current codes (BCA code). All factors will be further analysed in SEM.

6.10.3. Assessment of standardised CFA Model_Execution/Construction (EC)

The results for the CFA execution/construction model show the level of achieved values in comparison with the indexes to the proposed criteria for assessing the structural model fit (Figure 6.3 and Table 6.14).



Model_CFA_EC	χ2	CMIN/DF <2.00	CFI >0.90	TLI >0.90	RMSEA <0.080
Model _EC_15	147.286	1.818	0.928	0.906	0.074

Figure 6.3: Execution/construction CFA Model_EC_15

Table 6.14: Level of fit for the CFA execution/construction model

CMIN/DF <2.00	$\chi 2$ = Chi Square = CMIN, DF= Degree of Freedom < 2 = excellent fit, 3-5 = acceptable fit, > 5= poor fit
1.818	1.818**< 2 Excellent fit** (EC_15)
CFI >0.90	**Comparative Fit Index – Goodness-of-fit index** 0.90 <CFI< 0.95 = acceptable fit, 0.95 <CFI< 1.00 = perfect fit
0.928	0.90 <**0.928**< 0.95 **Acceptable fit** (EC_15)
TLI >0.90	**Incremental Fit Index** 0.90 <TLI< 0.95 = acceptable fit, 0.95 <TLI< 1.00 = perfect fit
0.906	0.90 <0.906< 0.95 **Acceptable fit** (EC_15)
RMSEA >0.08	**Badness-of-fit index** 0.03 <RMSEA< 0.08 = acceptable fit, < 0.03 = excellent fit
0.074	0.03 <**0.074**< 0.08 **Acceptable fit** (EC_15)

The proposed model EC_15 showed mostly acceptable results, while CMIN/DF indicates an excellent fit. From the fifteen factors that has been analysed using CFA, eight of them have factor loading higher than 0.60 and will be further analysed, while seven factors with lower factor loading were considered as not applicable. The factors that will be further analysed are listed in Table 6.15.

Table 6.15: CFA challenges for EC

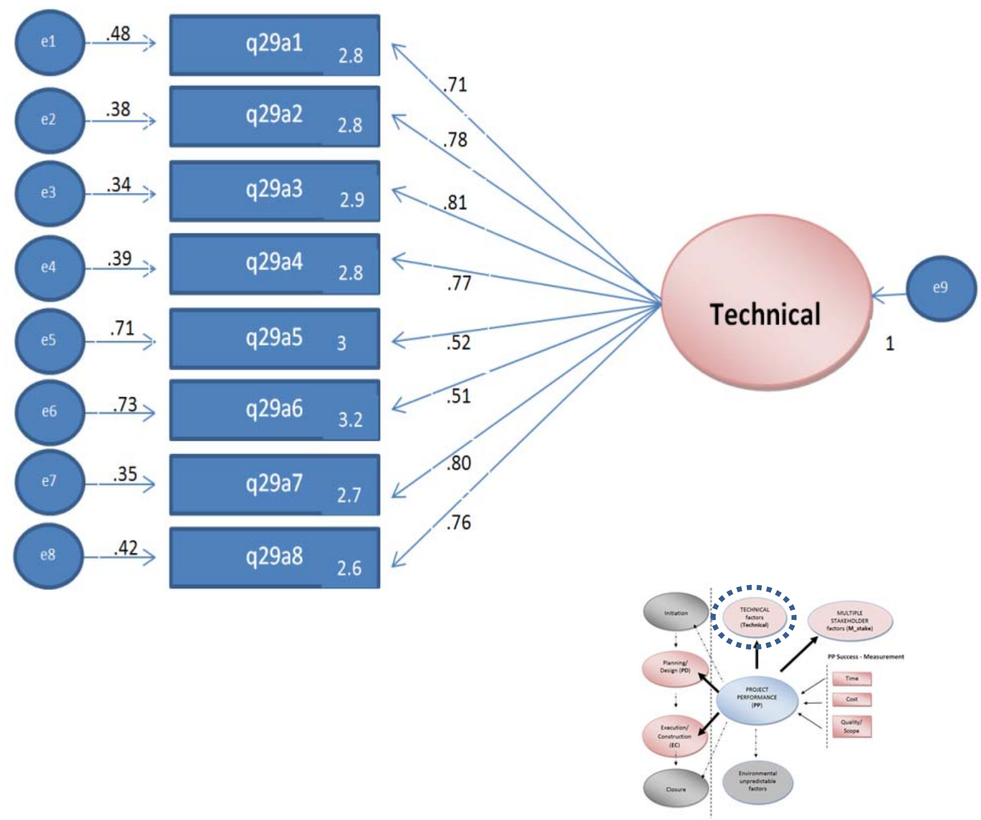
CFA_EC_8	Data Code	Description
0.74	q28a8	Documentation quality (on the site)
0.73	q28a13	Incomplete project construction documentation (lack of detail – results in variations)
0.68	q28a11	Administration
0.62	q28a5	Accurate Pre tender estimate
0.62	q28a7	Scope changes Client/Architect/Engineer
0.62	q28a12	Lack of coordination/communication between design Team/Client/Contractor
0.61	q28a10	Post demolition investigation
0.60	q28a4	Gaps in tender documentation

- indicates the source from CFA
- indicates the source from CFA

The execution/construction project phase as seen from the CFA_EC_15 results highlighted the documentation quality on the site and incomplete project construction documentation as a highest challenges. Administration was ranked as the third main challenge in the execution/construction phase. Accuracy in pretender estimate will highly improve execution/construction performance. All eight factors will be further examined in SEM.

6.10.4. Assessment of standardised CFA Model_Technical factors (Technical)

The results for the CFA technical factors model show the level of achieved values in comparison with the indexes to the proposed criteria for assessing the structural model fit (Figure 6.4 and Table 6.16).



Model_CFA_Technical	**χ^2**	**CMIN/DF <2.00**	**CFI >0.90**	**TLI >0.90**	**RMSEA <0.080**
Model _Technical_8	26.347	1.882	0.983	0.967	0.073

Figure 6.4: Technical factor CFA Model_Technical_8

Table 6.16: Level of fit for the CFA technical model

CMIN/DF **<2.00**	**χ2 = Chi Square = CMIN, DF= Degree of Freedom** < 2 = excellent fit, 3-5 = acceptable fit, > 5= poor fit
1.882	1.882**< 2 Excellent fit** (Technical_8)
CFI **>0.90**	**Comparative Fit Index – Goodness-of-fit index** 0.90 <CFI< 0.95 = acceptable fit, 0.95 <CFI< 1.00 = perfect fit
0.983	0.95<**0.983**< 1.00 **Perfect fit** (Technical_8)
TLI **>0.90**	**Incremental Fit Index** 0.90 <TLI< 0.95 = acceptable fit, 0.95 <TLI< 1.00 = perfect fit
0.967	0.95<0.967< 1.00 **Perfect fit** (Technical_8)
RMSEA **>0.08**	**Badness-of-fit index** 0.03 <RMSEA< 0.08 = acceptable fit, < 0.03 = excellent fit
0.073	0.03 <**0.073**< 0.08 **Acceptable fit** (Technical_8)

The proposed Technical_8 model showed an excellent, mostly perfect fit and acceptable fit. Six factors extracted from the Technical_ CFA results indicated the factors with factor loading higher than 0.60. Two factors with the lower factor loading would not have be further analysed. Therefore, the six factors that will be further analysed are listed by the ranked score in Table 6.17.

Table 6.17: CFA factors for Technical

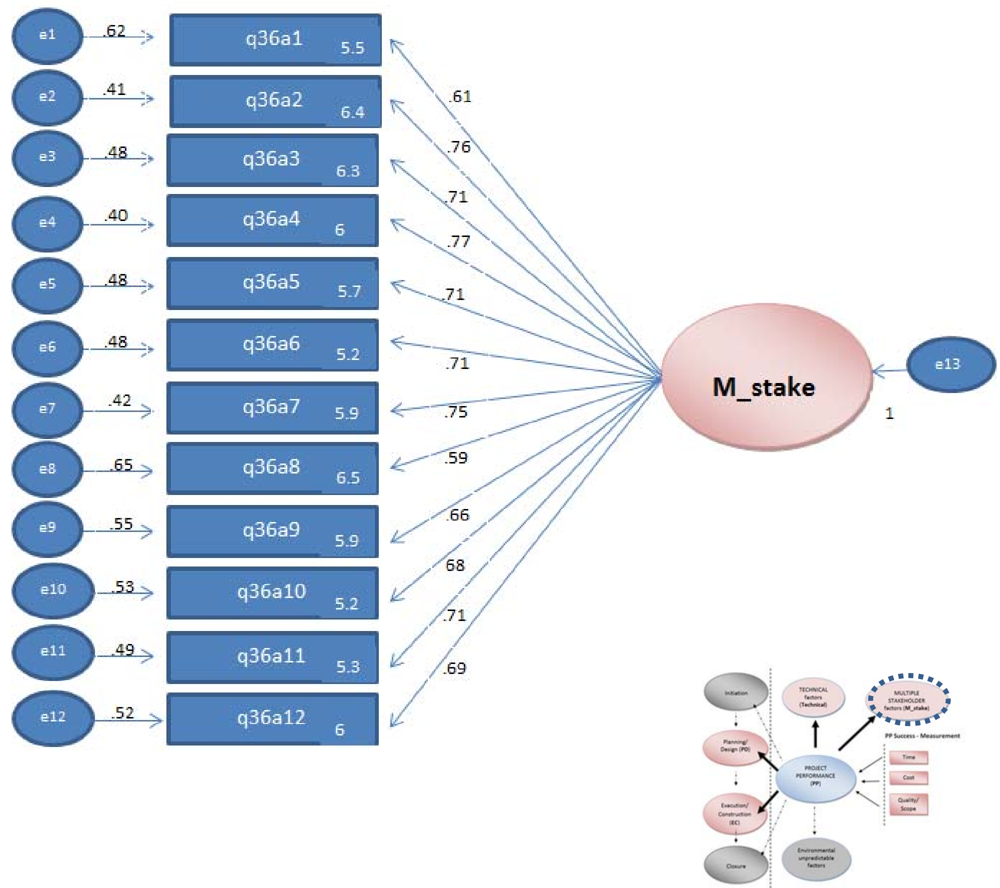
CFA_Technical_6	Data Code	Description
0.81	q29a3	Procedures of repair or rebuild of: stone work, brick work, steel work, concrete work and timber work.
0.80	q29a7	Architectural detailing
0.78	q29a2	Consistent procedures how to deal with specific issues – to help mediate this issue
0.77	q28a4	Design in regard to the proposed usage (e.g. BCA)
0.76	q28a8	Structural testing
0.71	q29a1	Guidance on different construction methodologies used at various time & locations

- indicates the source from CFA
- indicates the source from CFA

The technical factors by CFA_Technical_8 model results suggest the importance of having procedures for the repair or rebuilding of stone work, brick work, steel work, concrete work and timber work available as a best practice experience – “knowledge book”. Architectural detailing followed by the consistent procedures how to deal with specific issues – to help mediating this detail/ issue are certainly one of the most important needs for heritage projects together with the procedures of repair and architectural detailing. The questionnaires, professionals marked the BCA as difficult to follow in many ways. This indicates the need to revise and adapt the current BCA with the heritage building requirements.

6.10.5. Assessment of standardised CFA Model_Multiple Stakeholders (M_stake)

The results for the CFA multiple stakeholders model show the level of achieved values in comparison with the indexes to the proposed criteria for assessing the structural model fit (Figure 6.5, Table 6.18).



Model_CFA_M_stake	χ2	CMIN/DF <2.00	CFI >0.90	TLI >0.90	RMSEA <0.080
Model_M_stake_12	74.411	1.958	0.969	0.946	0.077

Figure 6.5: Multiple stakeholders CFA Model_M_stake_12

Table 6.18: Level of fit for the CFA multiple stakeholders model

CMIN/DF **<2.00**	**χ2 = Chi Square = CMIN, DF= Degree of Freedom** < 2 = excellent fit, 3-5 = acceptable fit, > 5= poor fit
1.958	**1.958<** 2 **Excellent fit** (M_stake_12)
CFI **>0.90**	**Comparative Fit Index – Goodness-of-fit index** 0.90 <CFI< 0.95 = acceptable fit, 0.95 <CFI< 1.00 = perfect fit
0.969	0.95 <**0.969**< 1.00 **Perfect fit** (M_stake_12)
TLI **>0.90**	**Incremental Fit Index** 0.90 <TLI< 0.95 = acceptable fit, 0.95 <TLI< 1.00 = perfect fit
0.946	0.90<**0.946**< 0.95 **Acceptable fit**(M_stake_12)
RMSEA **>0.08**	**Badness-of-fit index** 0.03 <RMSEA< 0.08 = acceptable fit, < 0.03 = excellent fit
0.077	0.03 <**0.077**< 0.08 **Acceptable fit** (M_stake_12)

The proposed model M_stake_12 showed the mostly acceptable and also perfect and excellent fit. Results from M_stake_12 suggested that eleven factors have been identified with factor loading higher than 0.60 and only one factor with the lower factor loading would not be further analysed. Table 6.19 shows the ranking of the eleven factors by the score from the multiple stakeholders model CFA analysis.

Table 6.19: CFA factors for M_Stake

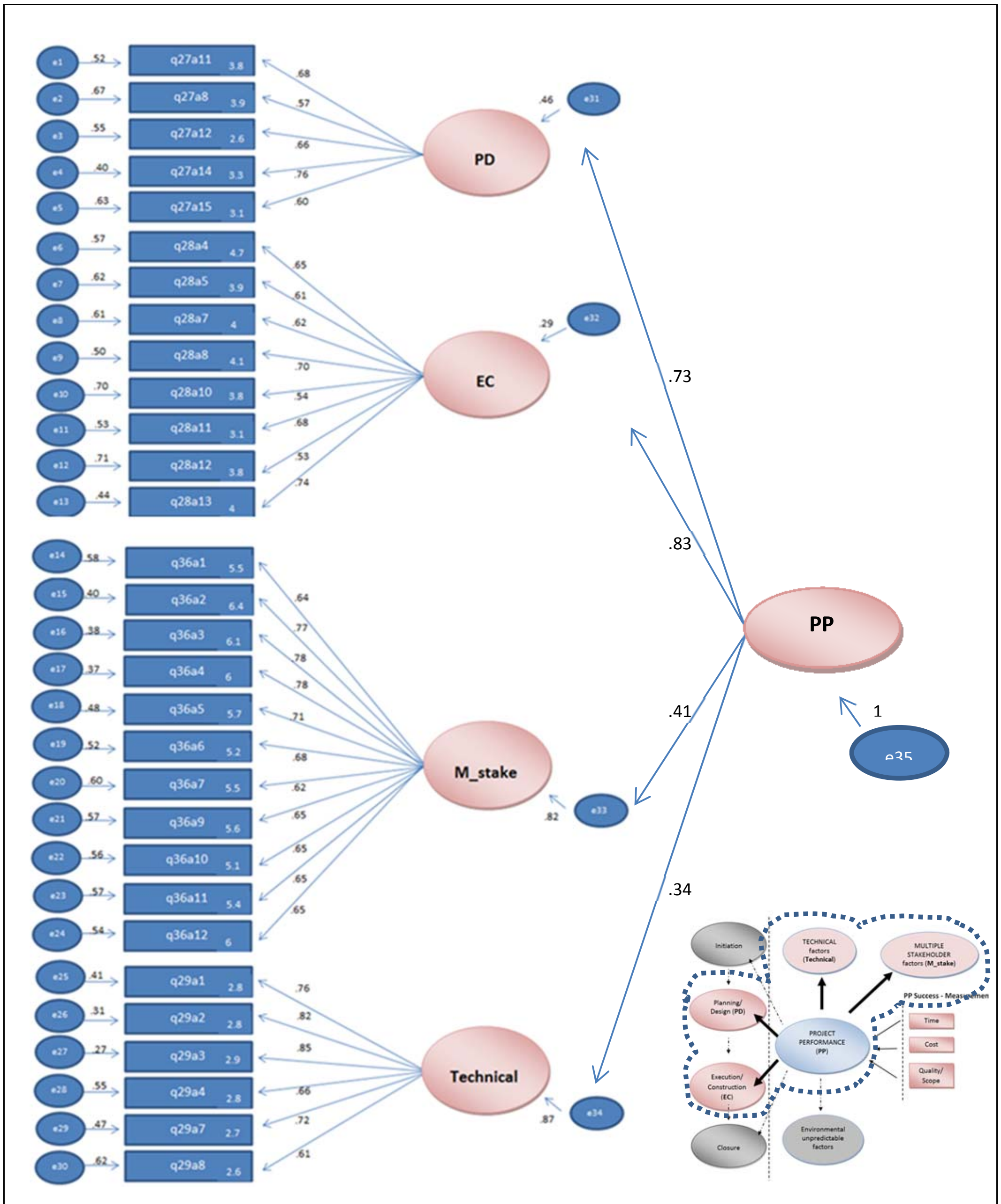
CFA_M_stake_11	Data Code	Description
0.77	q36a4	Exploring stakeholder needs and constraints
0.76	q36a2	Identifying stakeholder requirements
0.75	q36a7	Resolving conflicts among stakeholders effectively
0.71	q36a6	Analysing conflicts and coalitions among stakeholders
0.71	q36a3	Understanding area of stakeholder interest
0.71	q36a5	Assessing stakeholder attributes (urgency and proximity)
0.71	q36a11	Analysing the change of stakeholder influence and relationship during the project process
0.69	q36a12	Communicating with and engaging stakeholders effectively and frequently
0.68	q36a10	Predicting stakeholder reactions for implementing the strategies
0.66	q36a9	Formulating appropriate strategies to manage stakeholders
0.61	q36a1	Identifying stakeholders on the project

- indicates the source from CFA
- indicates the source from CFA

The M_stake factors by CFA_M_stake_12 results indicate that the most important is to explore stakeholder needs and constraints, and to identify the stakeholders' requirements. The third most important factor in the multiple stakeholder management is the effectiveness in resolving the conflicts among stakeholders followed by the importance of analysing conflicts and coalitions among stakeholders effectively together with understanding the area of stakeholder interest, assessing stakeholder attributes (urgency and proximity) and analysing the change of stakeholder influence and relationship during the project process. All eleven factors will be further analysed in SEM.

6.11. Assessment of standardised SEM Model_ Project Performance (PP)

Figure 6.6 presents the structural equation model _Project Performance (PP) with the results, which indicate that the model has achieved fitness.



Model_SEM_PP	**χ2**	**CMIN/DF <2.00**	**CFI >0.90**	**TLI >0.90**	**RMSEA <0.080**
Model_PP_30	592.40	1.558	0.917	0.906	0.058

Figure 6.6: Structural equation model _Project Performance (PP)

The results show the level of achieved values in comparison with the indexes to the proposed criteria for assessing the structural model fit (Table 6.21).

Table 6.20: Level of fit for the SEM Project Performance Model

CMIN/DF <2.00	CMIN/DF - $\chi 2$ = Chi square = CMIN, DF= Degree of freedom < 2 = Excellent fit, 3–5 = Acceptable fit, > 5 = Poor fit
1.558	**1.558** < 2 Excellent fit

CMIN/DF **Excellent fit**

CFI >0.90	CFI – Comparative Fit Index – Goodness-of-fit index 0.90 <CFI< 0.95 = Acceptable fit, 0.95 <CFI< 1.00 = Perfect fit
0.917	0.90 <**0.917**< 0.95 Acceptable fit

CFI **Acceptable fit**

TLI >0.90	TLI – Incremental fit Index 0.90 <TLI< 0.95 = Acceptable fit, 0.95 <TLI< 1.00 = Perfect fit
0.906	0.90<**0.906**< 0.95 Acceptable fit

TLI **Acceptable fit**

RMSEA >0.08	RMSEA – Badness-of-fit index 0.03 <RMSEA< 0.08 (0.07) = Acceptable fit, < 0.03 = Excellent fit
0.058	0.03 <**0.058**< 0.08 Acceptable fit

RMSEA **Acceptable fit**

Planning/Design_SEM Model_Project Performance (PP)

The planning/design challenges analysed in SEM indicated that lack of ability to fully ascertain the "condition of the building" was the most significant challenge that is worth further consideration together with the implications of change of use/ significant works causing compliance with current codes (BCA code) followed by non-availability or incomplete original building plans and limitations for methodology for repairs or new works due to heritage constraints. All of these challenges are closely connected and have an influence on getting the scope right. Due to the factor loading lower than 0.60, q27a8 (quantifying capital cost of works) has not been included in the table 6.21. Table 6.21 presents the main challenges for planning/design from the SEM analysis.

Table 6.21: SEM_ main challenges for PD

SEM_PD_4	Data Code	Description
0.76	q27a14	Lack of ability to fully ascertain the "condition of the building"
0.68	q27a11	Implications of change of use/ significant works causing compliance with current codes (BCA code)
0.66	q27a12	Non-availability or incomplete original building plans
0.60	q27a15	Limitations for methodology for repairs or new works due to heritage constraints

- indicates the source from SEM

- indicates the source from SEM

Execution/Construction_SEM Model_Project Performance (PP)

The execution/construction challenges analysed in SEM identified incomplete project construction documentation (lack of detail – results in variations) as the main concern. Documentation quality (on the site) were shown to be highly important in the execution/construction phase and needed to be considered in further analyses. Administration was the third main challenge, followed by the gaps in tender documentation. All of identified challenges influence on the project performance - time and has as a consequence an impact on the budget. Due to the factor loading lower than 0.60, q28a10 (post demolition investigation) and q28a12 (lack of coordination/communication between design team/ client/ contractor) have not been included in the table 6.22. Table 6.22 presents the top challenges for execution/construction from the SEM analysis.

Table 6.22: SEM_ main challenges for EC

SEM_EC_6	Data Code	Description
0.74	q28a13	Incomplete project construction documentation (lack of detail – results in variations)
0.70	q28a8	Documentation quality (on the site)
0.68	q28a11	Administration
0.65	q28a4	Gaps in tender documentation
0.62	q28a7	Scope changes Client/Architect/Engineer
0.61	q28a5	Accurate Pre tender estimate

- indicates the source from SEM
- indicates the source from SEM

Technical_SEM Model_Project Performance (PP)

The technical factors derived from CFA were further examined using SEM. The very high result indicates that the procedures for the repair or rebuilding of stone work, brick work, steel work, concrete work and timber work, together with the consistent procedures on how to deal with specific issues, are the main needs for heritage projects. Furthermore, the guidance on different construction methodologies used at various time & locations, together with architectural detailing has been identified as a highly needed. Table 6.23 presents the main needs for technical factors derived from the SEM analysis.

Table 6.23: SEM_ main factors for Technical

SEM_Technical_6	Data Code	Description
0.85	q29a3	Procedures of repair or rebuild of: stone work, brick work, steel work, concrete work and timber work.
0.82	q29a2	Consistent procedures how to deal with specific issues – to help mediate this issue
0.76	q29a1	Guidance on different construction methodologies used at various time & locations
0.72	q29a7	Architectural detailing
0.66	q28a4	Design in regard to the proposed usage (e.g. BCA)
0.61	q28a8	Structural testing

- indicates the source from SEM
- indicates the source from SEM

M_stake_SEM Model_Project Performance (PP)

The SEM analysis of the multiple stakeholder factors suggests that it is highly important to explore stakeholder needs and constraints, together with understanding the areas of stakeholder interest, followed by identification of stakeholder requirements and assessment of stakeholder attributes (urgency and proximity). Table 6.24 presents the top three multiple stakeholder challenges from the SEM analysis.

Table 6.24: SEM_ main factors for M_stake

SEM_M_stake_11	Data Code	Description
0.78	q36a4	Exploring stakeholder needs and constraints
0.78	q36a3	Understanding area of stakeholder interest
0.77	q36a2	Identifying stakeholder requirements
0.71	q36a5	Assessing stakeholder attributes (urgency and proximity)
0.68	q36a6	Analysing conflicts and coalitions among stakeholders
0.65	q36a10	Predicting stakeholder reactions for implementing the strategies
0.65	q36a12	Communicating with and engaging stakeholders effectively and frequently
0.65	q36a11	Analysing the change of stakeholder influence and relationship during the project process
0.65	q36a9	Formulating appropriate strategies to manage stakeholders
0.64	q36a1	Identifying stakeholders on the project
0.62	q36a7	Resolving conflicts among stakeholders effectively

- indicates the source from SEM
- indicates the source from SEM

6.12. Summary

The results of the survey and interviews were interpreted in this chapter, and project performance challenges/factors that were identified as concerns in heritage projects were presented. Firstly, the challenges/factors were examined within each separate construct by CFA. Once the challenges/factors were identified from CFA (each construct was run analysed separately) with factor loading 0.60 and higher, they were then further analysed using the structural equation model. Thus, the formed constructs with the strong evidence in sets of results acted as reliable constructs that represented the factors to be further examined using SEM.

Secondly, the SEM Model_ Project Performance was employed to examine the main challenges/factors derived from CFA. The factors (with the factor loading 0.60 and higher) were presented together with the results and were ranked by the result score with the data code description. The SEM results has been triangulated with the interview findings and discussed/validated by the Focus Group in the next chapter.

The next chapter presents the results of the focus group discussion on the findings from the case study interviews and survey questionnaire results presented in this chapter.

Chapter 7

FOCUS GROUP DISCUSSION AND VALIDATION OF RESULTS

7.1. Introduction

This study utilised a mixed-method research design, and Chapters 5 and 6 presented and discussed the findings from the data collected from three comparative case studies and the survey. The data was further analysed using the quantitative and qualitative techniques.

A focus group was formed to validate the findings from both the qualitative and quantitative data. The focus group comprised five experts who had worked on heritage projects all over Australia and each of whom had more than twenty years' experience.

The first part of this chapter presents a summary of the findings from the case studies and the survey regarding the four areas of challenges faced in the of heritage projects, including the comments made by the focus group members on these challenges. The second part of the chapter discusses the focus group validation of the presented findings. Finally, the chapter discusses the valuable suggestions made by the focus group members based on their extensive heritage project experience. These suggestions are presented to supplement the main research findings and for use in the conclusion chapter.

7.2. Project Performance and Delivery Challenges

The identification of the commonly raised factors in the case studies and surveys led to the creation of a concise list of issues faced in heritage projects. These issues are grouped in four areas: in the planning/design phase; in the execution/construction phase; in the management of multiple stakeholders; and in the management of technical issues. The findings on the challenges faced in each of these four areas were considered by the focus group, as discussed next.

7.2.1. Challenges in the planning/design phase

The case study analysis showed that heritage documentation and drawings rely on the archived records, which are not always totally reliable. Some of the archived records do not represent the last 'as-built' information. Further case study analysis showed that the drawings portrayed a situation that was different from the situation uncovered after the construction phase commenced. This was supported by the findings from the survey. Thus, the non-availability or incompleteness of the building plans was identified as an important factor in heritage project delays.

The lack of ability to fully ascertain the condition of the building due to the limited inspection permission by the relevant statutory bodies was identified as the second most important factor affecting the project performance. According to the findings of both the survey and the case study, the lack of sufficient time to perform investigative work (assessing the condition of the building) forces the project team to make the "the best guess estimate", with the full extent of what is actually required remaining largely unknown. This, together with the lack of expertise that exists in many heritage project teams, can lead to the proposal of unrealistic timeframes and risk of not achieving agreed time frame, which in turn leads to the need for major rework to already completed or in-progress portions of projects.

Both the above highlighted factors directly relate back to the scope definition and project design. If the basic documents of a project are inaccurate, revisions of the scope can be expected. Moreover, tender documentation that is based on an inaccurate scope definition can also be expected to be incomplete and so to lead to variations during project execution.

The focus group members also emphasised that obtaining approval from heritage bodies was a problem as it required multiple re-designs (for local/state/federal heritage bodies) resulting in additional cost and time delays .

A further focus group concern has been related to the allocation of inappropriate amounts of contingency funds at the beginning of the project. The allocation of a realistic contingency fund is necessary to ensure that projects could overcome any latent adverse conditions during the construction phase.

7.2.2. Challenges in the execution/construction phase

Challenges are faced in the execution/construction phase of heritage projects due to the constraints of the initial building investigation, the inaccurate scope definition and the incomplete tender documentation. Furthermore, due to the incomplete tender documentation, the discovery of latent conditions often leads to disputes or huge variations, which require multiple re-designs and re-negotiations of the price and possibly the construction methodology (involving the architect, engineer and contractor) each time an unknown condition is uncovered.

The administrative process involved in getting the approvals from the heritage authorities for newly submitted designs is time consuming, and this process occurs each time a new latent condition is exposed. The submitted design often requires a significant amount of additional work, resulting in extra costs and fees.

Furthermore, the findings of the study showed that the execution phase faces the challenge of incomplete project construction documentation on the site (i.e. a lack of detail in the specifications). This leads to numerous requests for information which, in turn, slows down the construction process and ultimately leads to variations and claims.

Finally, the findings on the problems faced in the execution/construction phase indicated that recruiting tradespeople with the required skills to do the work is a challenge. Much of the knowledge of constructing to heritage standards or dealing with heritage details and materials has not been passed along via trades and some of the old building techniques unfortunately have now been lost.

7.2.3. Challenges in the management of multiple stakeholders

Project delivery is often stakeholder-driven (individual stakeholder interest); therefore, exploring the stakeholders' needs and constraints is very important. Moreover, it is necessary for project teams to understand the stakeholders' interest in their heritage projects. Spending time to manage stakeholders in the initial phase was highly recommended by the respondents. Furthermore, heritage projects attract considerable interest from the media as well as within various political arenas. Anticipating proactively what the political pressures are and how to deal with that is important to be considered as acknowledged by interview respondents.

Every stakeholder has a different perception of the project and a different set of objectives: this leads to different ideas about the design, which in turn often leads to conflict among stakeholders' interests. The need to analyse such conflicts and understand the coalitions that form among stakeholders was raised by the respondents as an important factor. In order to counter this, the project team needs to possess the necessary skills to successfully resolve conflict, thus ensuring that projects are able to move forward. Getting all the stakeholders "on the same page" and working together towards the same goal was identified as highly important by all the interviewees in the case studies.

The inability to visualise the final project design means that some of the stakeholders, including the client, will request changes when the work is completed. This inability to visualise the final project causes a set of difficulties of which the client and the project team are often not aware. Changes in the client's brief have direct impacts on the budget and time allocated to the project, as the development of a new design during the construction phase costs considerably more. Therefore, an effective client design team will ensure that the client has enough information to clearly visualise the final project outcomes.

The community, as an external stakeholder, plays the important role of a third-party 'consultant' due to the public's interest in heritage places. The findings showed that community consultation was considered to be one of the key necessities in delivering heritage projects and that accurately allocating this activity into the project programme is critical. In particular, the findings highlighted the need for sensitivity in dealing with heritage defence sites. In those cases, it is especially necessary to acknowledge the memories and associations connected to such places by members of the public.

In the discussion on the challenges faced in the management of multiple stakeholders, the focus group made useful and timely suggestions that follow in the next sub-section 7.2.4. Firstly, the focus group pointed out the potential opportunities for the education precinct projects carried out by universities (often involving the repurposing of heritage buildings) to be used as practical placements for project management students. Such projects could be used for educating a new generation of managers who are specialised in delivering heritage projects. Secondly, the focus group recommended the development of a heritage project mobile application ("app") to be used by heritage practitioners as a resource for successful project management.

7.2.4. Challenges in the management of technical issues

As mentioned in relation to the challenges in the execution/construction phase, the findings of the study highlighted the difficulty in recruiting skilled tradespeople. Finding people with the knowledge to do the specialised work involved in heritage projects is often difficult. In the case studies, these difficulties were particularly found to relate to the repair or rebuilding of stone work, brick work, steel work, concrete work and timber work.

As highlighted in relation to the challenges in the planning and design stage, the study found that matching the design with the proposed usage (e.g. BCA compliance) was very difficult. The Building Code of Australia (The Australian Building Codes Board 2013)is entirely appropriate for controlling the construction of conventional building projects; however, the findings of this study indicate that heritage projects constantly face issues in trying to comply with the current code.

Sourcing of materials was identified (by the project stakeholders during the interviews) as another important issue/challenge for heritage projects. Challenges in sourcing the materials sometimes lead to inadequate or incorrect replacement materials having to be specified. Often the materials for heritage buildings can only be sourced from outside Australia (primarily the UK). This sourcing issue requires early and accurate planning.

The case study interviewees also pointed that it was difficult to identify the significant fabric due to the lack of requisite experience and knowledge. This is another technical problem that may affect the completeness and accuracy of the project design.

7.3. Validation – Focus group method

The focus group method was employed to justify the research findings and validate the usefulness of the conducted research. The findings from the qualitative and quantitative data collection were presented to the focus group in the form of a PowerPoint presentation and printouts.

The focus group panel consisted of five highly reputable Australian heritage experts, each with more than twenty years' experience working on heritage projects all over Australia. Table 7.1 summarises the criteria applied in the selection of the focus group members and therefore the relevance of their involvement in this research.

Table 7.1: Application of criteria to select the focus group panel

Focus Group Panel	**Selection Criteria**				**Applicability for this Research**
	Over 20 years' experience	Work experience on projects (national /state/local)	Works in decision-making position	Recipient of award	
RF1	√	√	√	√	Yes
RF2	√	√	√	√	Yes
RF3	√	√	√	√	Yes
RF4	√	√	√	√	Yes
RF5	√	√	√	√	Yes

The focus group discussion was organised in such a way that the panel members could ask questions during the presentation. This opened the discussion and enabled the panel members to make recommendations for action during the presentation. During the presentation, the panel members talked freely and openly about the issues related to successful project delivery. The researcher considered all of the suggested actions together with the feedback on the presented findings to ensure the efficacy of the contribution of the research to future research and heritage project outputs (particularly in the planning/design and execution phases). The conclusions on the presented findings together with the suggestions from the focus group panel members were documented and emailed to the panel members who were asked to agree with the conclusions and/or make any further comments. Further suggestions were received from three panel members, and these suggestions were considered and included in the final conclusion.

The focus group panel expressed personal interest in this research and supported its aim to accomplish useful outcomes through the set of actions to be undertaken in future heritage projects.

7.3.1. Focus group insights into the heritage project management process

One of the aims of the study was to identify ways to influence the beginning stages of a heritage project, because concentrating on the planning/design stage and proposing the "call for action" guidance will ensure the improvement of the overall project performance and delivery. The findings were evaluated [RF1, RF2, RF3, RF4 and RF5] and conclusions were reached through the content analysis and through an analysis of the clarity of the proposed actions, each of which is discussed next.

7.3.2. Validation of the Project Performance and Delivery Challenges

The data obtained from the mixed-method approach used in this research required validation by experts in the field in order to prove or disprove the utility of the conducted research. Such validation involved:

- content analysis – recognising the value of the results that may benefit future projects
- clarity of the conclusion – where a merger of results (both qualitative and quantitative) underlines the core project issues/challenges and causes/risks
- proposals for action – where a set of actions is recommended to ensure future project success.

A. Content analysis

Based on the results of the focus group validation of the findings on the challenges facing heritage projects, the factors that will assist the successful project performance and delivery of heritage projects are:

a) Improvement to the steps in the preliminary investigation phase (concept stage) of heritage projects including:

- Undertaking initial research into the history of the place

The results of research into the history of a place can ameliorate the effects caused by the later discovery of archaeological deposits that may need to be excavated prior to further construction works being undertaken

- Understanding the construction of the building

  Identifying the significant fabric and the most appropriate design to apply is crucial. There is a need for in-depth understanding of a place, in terms of both its significance) and its condition. This understanding is critical during the planning stage and the design decision-making.

- Identifying suitable/unsuitable uses for the building/place

  During the planning stage, the future use of the building must be designed in such a way that does not go far from the original use of the building and that satisfies the current owner's needs. The design must accommodate both purposes.

- Understanding the incentives available for keeping heritage places

  One of the main challenges for keeping heritage places is the lack of available funding sources (either government or non-government). The community plays an important role; therefore, listening to and acknowledging community organisations can help to conserve a heritage place (e.g. through the provision of donations).

- Assembling a team of professionals

  The qualifications and experience of the contractor, subcontractor team and project design team are critical for the successful management of projects. It is important to assemble a team of experienced contractors and tradespeople who understand the Burra Charter and who can apply traditional techniques during construction.

- Undertaking thorough documentation (drawings, details, schedules and specification), and understanding new services to be inserted into the building/place

  Quality documentation is the key factor in project cost and time savings.

- Detailing carefully the time and cost of solutions for best practice conservation and sympathetic changes during the design and documentation stage
- Understanding the implications of the conditions attached to the development application, especially in relation to time delays

  Understanding the requirements of the development application process will ensure timely preparation of the necessary documentation.
- Noting the insurance cost as one of the important factors to be considered when making estimations for heritage projects

  The relationship between the contingency sum allocated and the insurance coverage for the project must be addressed

b) Improvement to the steps in the planning/design phase of heritage projects including:

- Implementing the conservation management plan before the design starts
- Identifying potential issues as part of the scope of works and, where appropriate, negotiating 'deemed to satisfy' alternatives to avoid changing the heritage fabric
- Performing an early and thorough investigation of the building prior to defining the scope (noting, however, that heritage approval is sometimes required for detailed investigation and time delays can occur)
- Addressing statutory requirements (the quality of documentation is fundamental)
- Highlighting the risk associated with time and cost on the project in order to ensure the right amount of contingency is in reserve
- Ensuring that the conservation management plan covers the maintenance costs (on yearly basis)

c) Improvement to the steps in the execution/construction phase of heritage projects including:

- Undertaking "opening-up' works before decisions are made

Opening up may or may not reveal unexpected problems and construction needs that are different to those assumed (such as hazardous materials or archaeological or historic evidence) and may prevent later time delays

- Recognising the direct link between the quality and compliance of the documentation to the construction outcome

d) Improvement to aspects of the management and roles of various stakeholders/professionals in all phases of heritage projects including:

- Making heritage a higher priority to the project manager, depending on the type of protection and the level of heritage significance of the place (balancing the project team's typical priorities of time and budget)
- Assembling a team of appropriate professionals to undertake the works with an understanding of the issues that may arise
- Encouraging experienced team members to respond to changing circumstances faster and anticipate potential problems earlier in the project, thereby reducing time delays
- Employing a project manager with heritage qualification/skills

  The assessment of the prospective project manager's qualifications and skills should take place during the stakeholder identification within the planning stage in order to avoid "design blame"
- Building a closer relationship with the heritage authorities and the key stakeholders from the beginning of the planning stage
- Recognising that the part played by political decisions/issues has a disproportional effect on many projects (both positive and negative)

e) Improvement in managing the technical factors in the early phase of heritage projects including:

- Developing innovative solutions and/or finding strategy to deal with the difficulties in complying with *the Building Code of Australia 2013*
- Developing innovative solutions and/or finding strategy to comply with the *Disability Discrimination Act 1992*
- Performing early procurement to ensure the materials arrive on a time (noting that some materials are only available overseas).

B. Clarity of conclusions

The aim of the study was to identify the causes of the project delays and cost overruns through an investigation of the existing policies and procedures for heritage building projects, impeding technical barriers and stakeholders' involvement. Evaluating the current procedures through the case studies and survey led to findings—subsequently validated by the focus group discussion—that clearly identified the areas where changes need to be undertaken to facilitate the successful project performance and delivery of a heritage project. Thus, the study explored two project management life cycle phases (planning/design and execution/construction), multiple stakeholder involvement and technical factors regarding what needs to be done to make future projects more successful in terms of time, budget and scope definition, and to minimise the impact of the perceived challenges and it's causes/risks to their lowest possible level. This was in line with the focus of this study, which was to identify the major heritage project performance and delivery challenges based on the literature review and data collection, and to use the validated findings to develop guidance for use in the planning of future heritage building projects.

C. Proposals for actions

The conclusions of the overall research, based on a merging of the qualitative and quantitative results, underline the core project issues and causes/risks and form the basis of appropriate recommended actions that can be followed to ensure the success (time, cost and scope) of future heritage projects. The critical factors that need to be improved in order to ensure the successful completion of heritage projects within the time and cost parameters are summarised in Table 7.2.

SUMMARY DELIVERING HERITAGE PROJECTS – "CALL FOR ACTION" *(3 case studies including observations and 19 interviews + 444 survey responses)*		
CHALLENGES	**CAUSES/ RISKS**	**ACTION**
Project Stakeholders		
• Project stakeholders identification	➢ Right skills has not been procured	✓ Process of selection in place to ensure right stakeholders for the project
• Lack of qualification and experience of the project team members in heritage projects	➢ Misunderstanding of what is happening/needed ➢ Risk in achieving agreed timeframe ➢ Design risk	✓ Assemble an experienced project team to ensure the realistic timeframe ✓ The project manager is preferred to have heritage background qualification/skills/experience/
• Managing multiple stakeholders on the project	➢ Individual stakeholder interest ➢ Client brief changes	✓ Project delivery must be conservation-driven ✓ Design team has to ensure the clarity with the owner at the design stage
• Media and political interest	➢ Projects attract considerable interest from media as well as from political arenas	✓ Anticipate proactively what the political pressure are and how to deal with that
• Community (if not involved)	➢ Public interest has not been considered	✓ To be consulted as a key player in a project program

Table 7.2: Summary of the validated findings – conclusions and recommended actions

Table 7.2: Summary of the validated findings – conclusions and recommended actions (continued)

CHALLENGES	CAUSES/ RISKS	ACTION
Planning /Design		
• Original building documentation/plans/ drawings /records	➢ Documentation/plans/drawings are not kept ➢ Archived records are often not the last record - not 100% reliable	✓ Early investigation to document accurate building solutions
• Lack of sufficient time for investigation work - assessing the condition of the building	➢ Full extent of what is required is unknown ➢ The best guess estimate ➢ Lack of understanding about the construction of the building	✓ Allowing enough time for design stage will ensure the quality of the estimation
• Lack of expertise of the design team in heritage projects	➢ Failure to identify the significant fabric ➢ Lack of understanding about the archaeological and intangible values ➢ Poor heritage interpretation	✓ Architects and designers should be experienced in heritage and familiar with the Burra Charter for the heritage interpretation
• Future Maintenance of the building	➢ Maintenance cost not included ➢ Loss of original building character over time	✓ Conservation Management Plan has to ensure maintenance cost will be covered (on yearly basis)
• Obtaining approval from the heritage bodies	➢ Multiple redesigns resulting in additional cost and time delays	✓ Early involvement of heritage bodies during the design and concept stages
• Limited inspection permission by relevant statutory bodies	➢ Hard to define the scope of the work, design and document without knowing enough about the building, resulting in inaccurate scope definition	✓ To be considered in the approval for 'detailed investigation of the building' to be able to define a scope and produce a good quality document
• Scope definition (if not well defined)	➢ Risk of time and budget overruns ➢ Due to lack of scope definition that causes inaccurate tender documentation which leads to large number of latent conditions that causes: • Multiple design, price and agreement on the methodology (architect– engineer – contractor) • Heritage authorities (to get design approved) • Discovery of archaeological deposits • Searching for trade specialists • Sourcing additional materials • Notice of likely delay • Variations	✓ Ensure scope well defined ✓ Detailed investigation during design stage – which allows to "open up" to get the building assessment right to minimise the occurrence of unexpected problems during the execution stage ✓ Conduct initial research into the history of the place ✓ Excavate any archaeological deposits prior to construction works/ execution stage

Table 7.2: Summary of the validated findings – conclusions and recommended actions (continued)

CHALLENGES	CAUSES/ RISKS	ACTION
Execution/Construction		
• Specifications / site documentation	➢ Not enough detailed documentation, leading to numerous requests for information	✓ Ensure the quality and compliance of documentation
• Requests for information	➢ Slows down the construction phase	✓ Ensure the quality and compliance of documentation
• Latent conditions	➢ Heritage authorities to get redesign approved	✓ Accurate tender documentation
Technical Factors		
• Sourcing the materials	➢ Some materials only available overseas ➢ If difficult to match, the result is inadequate replacement	✓ Early procurement will ensure the materials arrive on a time ✓ Inadequate replacement should not occur
• Building Code of Australia	➢ Difficult to comply with the current building code	✓ Finding strategy to comply with the BCA code
• Disability Discrimination Act	➢ Challenges to satisfy DDA	✓ Finding strategy to meets DDA

7.4. Summary

This chapter presented the focus group validation of the findings from the case studies and survey. The validated findings support the proposition discussed in the opening chapters that there is a greater ability to influence cost saving at the beginning of a heritage project; therefore, a heavier investment in the planning and design stages will ultimately cost the project owner less than advancing with unresolved critical issues. Once the on-site operation starts, the inclusion of changes such as dealing with latent conditions would cost the owner considerably more than envisaged in project budgets used to gain approvals for works and let contracts.

The proposed heritage building practice guidances were developed as recommended actions (Figure 7.2) on the basis of the research findings reported in this thesis and with the input of experts with more than 20 years' experience each in heritage building projects. The guidance are designed to ensure that realistic cost targets and delivery timeframes are set in future heritage projects. The evaluation of the results during the focus group discussion generated the final recommended actions to be included as part of the research recommendations. The need for urgent action in the delivery of current and future heritage projects is clear, and significant improvements in current practices are necessary in order to overcome the problems of cost and time overruns in future heritage projects. The following chapter presents the conclusions related to the answers to the research questions and summarises the current status of the research problem area, as well as detailing implications for theory and practice and offering suggestions for directions in further research.

Chapter 8

CONCLUSION

Heritage is not just the past, but the present interacting with the past in the ongoing growth of cultural tradition.

Pearson and Sullivan (1995, p. 195)

8.1. Introduction

The previous chapter discussed the focus group validation of the results from the qualitative and quantitative data and proposed the heritage building practice guidance that were developed on the basis of the research findings (Table 7.2). This chapter provides the conclusion of the study based on the results and discusses the findings in relation to the research objectives and questions. This is followed by a discussion of the actions within the proposed guidance, the study's contribution to the knowledge area and suggestions for directions in further research.

8.2. Background

The importance of preserving and protecting heritage places for future generations is globally recognised. Managing heritage projects is often seen as a sensitive issue, with projects sometimes facing criticism due to running over time and over budget. Despite the development of principles, policies and guidelines, many problems still exist that affect the management of heritage projects.

Therefore, the aim of this research project was to investigate the factors that affect the successful project performance and delivery of heritage building projects. This aim was accomplished as follows:

<u>Theoretical base</u> – Establishing the base for the research, the literature review identified the global problem of delivering heritage projects on time and on budget. The focus of the study was narrowed down to the Australian context in order to investigate and contribute to Australian heritage projects. The literature review identified the gaps in knowledge and informed the development of the research objectives and questions. The evidence of challenges that Australian heritage sites continue to face further guided the researcher to test and extend the issues

highlighted in the literature through the use of real case study examples and by collecting views and responses from concerned stakeholders. Furthermore, literature on the phases in the project management lifecycle was studied and two key phases were identified as the research target, namely, the design phase and execution phase.

Practical base – To achieve the research goal, this study focused on project delivery problems with the focus on the two phases (planning/design and execution/construction) in the project management lifecycle and their challenges. As heritage projects attract political attention, the further investigation of the impact of multiple stakeholders and their interest in the project has been a major focus of this research. From the case studies that have been selected to examine why heritage projects often fail to successfully deliver, the technical factors have been pointed out as of significant importance. Therefore, the relevant impacting technical factors identified from the interviews of the case study stakeholders open another dimension and set of issues to be investigated in future.

The problems experienced in the design and execution phases were examined through three case studies (involving interviews and observations) and a survey, with the proposition that improvements in the design phase can directly contribute to the successful overall project delivery. A generic project management model was adopted from PMBOK (Figure 8.1), to ensure clarity and common understanding in position and sequence proposed actions to modify current project management planning related to heritage building projects (while answering the research questions).

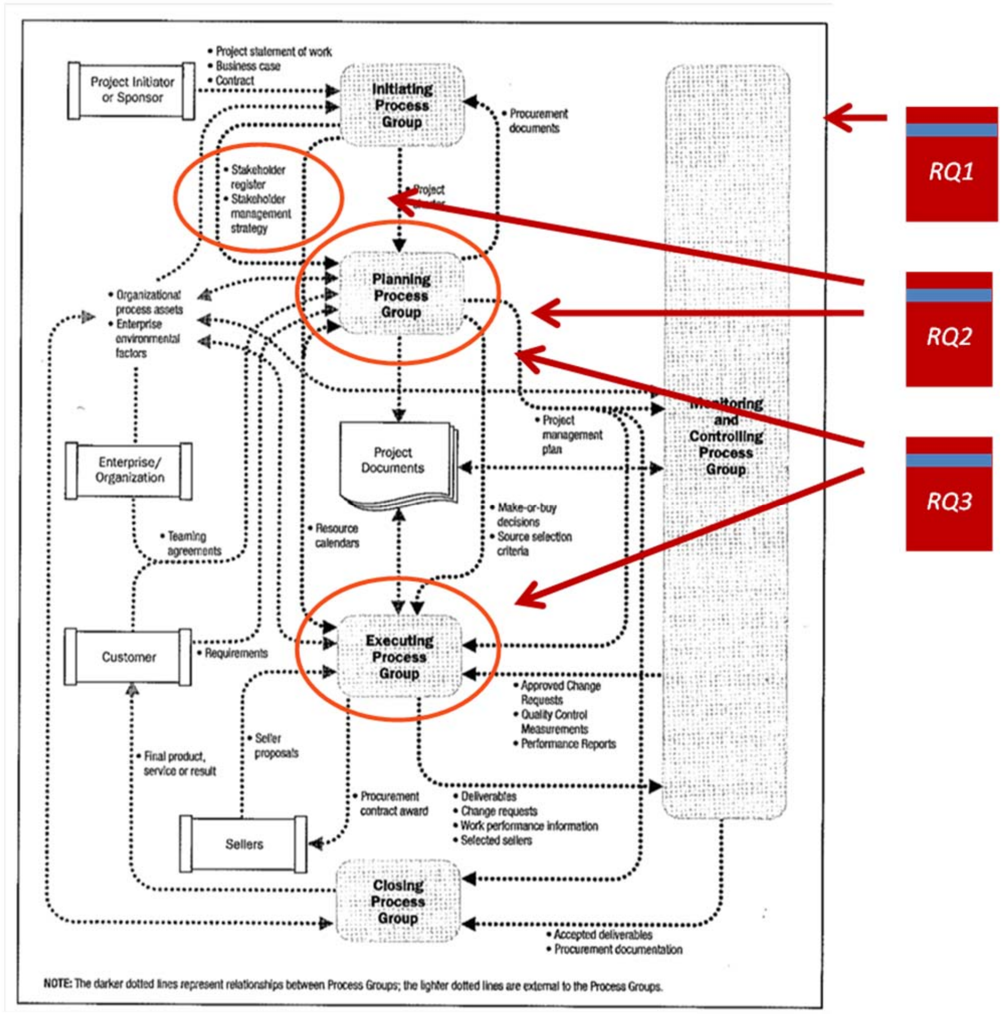


Figure 8.1: Targeted project stages and research questions

8.3. Conclusion

Literature review

The significance of historic sites has been well recognised in most developed countries. The need to preserve the outstanding universal value of heritage buildings and places is emerging as a task of high importance. Heritage buildings are also seen as an important element of Australia's social capital (Bullen and Love 2011). Australian leadership in taking action to protect heritage places has been recognised internationally (Australian State of the Environment Committee 2011). The Australian State of the Environment Committee (2011) highlighted the importance of taking action to protect heritage places from further development pressure in order to retain their values. In 2013, the Australian Government called on heritage practitioners and experts across Australia to come forward with their ideas and suggestions for the Australian Heritage Strategy (Strategy 2011).

Heritage is part of a nation's identity. The way in which action is taken to protect heritage signifies pride in a nation's culture and background. Furthermore, taking action to ensure the protection of others' heritage is a way to show respect to them and their cultural background.

Researchers globally have argued that the cost of preserving a heritage building as a multi-valuable resource is sometimes more economical and sustainable than engaging in the new construction (Maeer and Fawcett 2011; Rypkema 2001; Wilkinson, James and Reed 2009). Nevertheless, the wholesale destruction of the traditional urban fabric is being witnessed in many places due to the view held by many owners, investors and developers that adapting and refurbishing an historical building would cost considerably more than developing new construction. The World Heritage Committee (Australia) in the List of World Heritage in Danger (Department of Sustainability Environment Water Population and Communities 2012b) identifies new development projects as the most prevalent threat to future heritage preservation.

To help weigh the argument in favour of recognising the viability of heritage preservation projects rather than automatically choosing new development, one of the major areas of focus in this research was to understand the factors that influence the successful delivery of heritage projects. Every project, especially heritage projects, is challenged to meet time and cost impositions. Moreover, the existing project management methodologies are subject to some criticism by the research community (Winter et al. 2006), underpinning the need for a fresh look at current approaches.

The management of multiple stakeholder relationships has been the theme of many research studies which have sought to identify how to best deal with different stakeholder requirements and interests even in new construction projects, given that such interests often compete and may lead to conflict. Hence, it is especially important for heritage projects to interconnect all the stakeholders in order for them to work cohesively towards facilitating mutually satisfying goals and ensure a high degree of project success.

Therefore, the aim of this study was to investigate the causes of the project delivery failure in heritage projects to adequately define the project scope and to meet time and budget requirements. This was achieved by investigating the challenges that heritage projects face in the two project management stages planning/design and execution/construction, together with the factors related to multiple stakeholder involvement and technical needs.

Accordingly, the three research objectives and the related research questions were:

RO1. To document the values of heritage-listed buildings and to address the main challenges in protecting and maintaining an existing building rather than constructing a new one.

RQ1. What are the main challenges that form the key reasons and make the decision on retaining existing heritage places?

RO2. To evaluate the current policy and procedures relevant to heritage projects and identify ongoing project challenges and causes.

RQ2. What are the challenges (and their causes) in complying with policies and procedures that affect the management and delivery of heritage projects?

RO3. To recognise the challenges in the management process, elaborate its causes and propose a set of actions to maximise the effectiveness of heritage project performance.

RQ3. How can the project management process be improved for more effective management in the operation and delivery of heritage building projects?

In order to attain the objectives and answer the three research questions with a deeper understanding of current and past heritage project practices, the case study and survey methods were applied.

Case Studies

An evaluation of current management practices (in the policies, procedures and processes) was conducted with the cooperation of the project stakeholders who were interested in sharing their experience to improve the project delivery of future projects. Three case studies that satisfied the criteria (Chapter 5, Table 5.1) were selected to examine and extend the heritage project issues identified in the literature review.

The case studies, all located in Brisbane, Queensland Australia, were:

I. Old Government House

II. Queensland University of Technology (QUT) Precinct 2 - Gona Barracks

III. Anzac Square.

The investigation of the causes of the project delays included observation of two ongoing projects (Old Government House and Gona Barracks). Eighteen interviews were conducted with project stakeholders who included project owners, project managers, superintendents, architects or heritage architects, engineers, quantity surveyors, builders and programmers.

Survey

The current practices (in relation to the policies, procedures and processes) in managing heritage sites were explored in a comprehensive survey that received 444 responses. The interest of heritage practitioners in the survey topic "managing the future of heritage" was seen in the response rate of 60.1%. Today the contribution of the general public to heritage project discussions and policies is well recognised and their opinion is valued in managing the future of the heritage places. Therefore, members of the public also participated in the survey, as the involvement of the public and their opinions and experiences added significant value to this research and as an important factor to be considered/ listened to in every heritage project.

To answer the first research question (RQ1) and to reach the first research objective (RO1), the online survey investigated the key reasons for, and challenges in, retaining heritage buildings and places by use of a set of questions that enabled the research to focus on the main facts to be considered to ensure the future of the heritage retention. Data analysis was then performed to examine how the relevant constructs were correlated and to identify the most significant factors in-between the constructs by employing confirmatory factor analysis (CFA). Furthermore the CFA has proved that the relation between the key reasons (KR) and the main challenges (MC) exists.

8.4. Research objectives reached and research questions addressed

The findings both from the case studies and the survey have been triangulated under the each research question to achieve that the research objectives are reached and the research questions are addressed as follows:

RQ1: Key reasons for and challenges in retaining heritage sites

<u>Case Study:</u> According to the data gathered from interviews with the case study stakeholders, the main reason for retaining heritage places is the community's appreciation of the cultural significance of the place. Retaining heritage places is considered to be a long-term goal for the benefit of the community. Furthermore, the interviewees identified the duty of care to preserve the architectural fabric and make changes in a sensitive manner. Moreover, the rarity of the heritage buildings/places is emphasised, as no two buildings are the same. Every building/place has its own story and the retaining of those places for the future generations ensures that they will be able to connect the story with the place and significance of the past events.

<u>Survey:</u> The main reason given by the survey respondents for the retention of heritage buildings and places was the contribution of the heritage buildings and places to the streetscape and view. Due to their unique quality and design, heritage buildings mark not just the past but the future. The pleasing view of streets and the harmony that heritage places create are irreplaceable. Moreover, every place that indicates the history is recognised as a landmark and symbolises the country, time, place, people and events. A special character is imprinted in heritage buildings and places. Every site has its own story.

RQ2: Main challenges/causes that affect the project delivery

<u>Case Study:</u> The case study interviewees identified that the main problems in heritage retention were the poor condition of the building due to the lack of maintenance over long periods. In some cases, the heritage site has been neglected or

deliberately left to ruin for the purpose of developing new construction on the site. This is the most significant challenge as it has a direct impact on the decision to keep the building. A further problem is related to undertaking the adaptive reuse as it was sometimes difficult to define a new use for the space.

Community consultation was also identified as a key task. As the case study buildings and places were owned by the public, community consultation was one of the key aspects in delivering these projects. Programming this activity into the program is critical, especially for defence heritage places.

The need to have a system in place to identify the significant fabric for retention/repair/further investigation has been identified as a challenge. The project design team should be qualified and experienced in undertaking heritage work and be familiar with the Burra Charter (1999) in order to carry out the heritage interpretations.

The interviews also examined the issues for heritage projects in current policy, procedures and processes with a focus on the causes (Chapter 5, Table 5.9) of the time overrun and budget implications related to the time. Time is a particular issue for heritage projects due to the difficulty in sourcing the materials that are "like to like".

According to the interviewees, the main technical problem at the beginning of a heritage project is the assessment of the significance of the place. Understanding the place and its fabric is crucial for well-managed projects that can guarantee the quality will be maintained and the various categories of significance will be satisfied.

Another technical issue was the problem of records that have not been archived or—if they have been archived—that may not be the latest record. Thus, the available documentation is used without knowing whether or not it is 100% reliable.

Difficulties arise from having to define a scope of the work which cannot be clearly determined due to the limitations on the building investigation. The visual inspection of the building cannot uncover what is behind the walls and under the floors, and thus cannot determine the full extent of the work that has to be considered. From the poor scope definition, several other difficulties arise such as an incomplete tender set with documentation omissions when items are not included. This leads to variations together with the latent conditions once the construction phase starts. The latent conditions are linked to multiple redesigns and price and agreement negotiations which involve the owner, architect, engineer and builder and then the heritage authorities for the approval. This problem is compounded when the latent conditions are uncovered one after another. Another difficulty is faced in applying the *Disability Discrimination Act 1992* (1992) when disability access was not considered at the time the heritage building was constructed. Further, all the design has to comply with the Building Code of Australia (2013); according to the interviewees, meeting the current code is usually difficult for a heritage building as the code was designed for conventional building projects. Heritage projects require specific knowledge; therefore, finding the trades and specialists to do the work sometimes could be difficult, together with the sourcing of the materials.

Another major challenge is the quality of the documentation delivered on the site which results in numerous requests for information and slows down the construction process. According to the interviewees, insufficient project contingency was a problem. They recommended that the contingency should be a minimum of 30% to 40% of the estimated contract sum.

The involvement of multiple stakeholders, each with different interests in the project, was identified as a challenge. This is especially the case if there is a lack of experience in the project team. As an added pressure, the political and media interest in a heritage project is an issue.

The findings on the important role played by the community as a stakeholder in heritage projects reflect the government's recognition of the community's role in future planning for Australian heritage places (Strategy 2011). Despite the recognised role of the community, the destruction of heritage places still occurs due to the developers' focus on profit without fully considering the impact on the community. In its favour, an organised group of community members has a powerful voice. Many heritage projects have been initiated by community groups and have become popular sites especially when community members understand and can see that the project team has taken care of their places of memories.

The findings on the challenges in heritage projects and the causes of project delays helped to answer the second research question and were also directly linked to answering the third research question which aimed to propose the actions that would improve the management process for the future operation and delivery of the heritage projects.

Survey: According to the survey results, the main problems for heritage retention were the ongoing maintenance after renovation, the high cost, and the failure to include maintenance in the site's conservation management plan. Further, the poor maintenance of the current building stock was seen as a difficulty, as the condition of the building from the structural point of view means that it cannot be replaced "like to like" and/or must be upgraded to ensure its safe use. The next problem highlighted in the survey response was the project risk (program/financial) that arises due to the policy that does not allow the proper building investigation to be carried out prior to approval. This leads to the program/scope not being accurately defined. Such a scope can be expected to require revisions, which certainly affects the financial side of the project. Furthermore, the latent conditions emerge as a result of the poor scope definition.

The survey results further highlighted problems faced in the planning/design and execution/construction phases, together with examining the stakeholder factors and technical factors. All of these factors were explored through confirmatory factor analysis followed by structural equation modelling in order to answer the second and third research questions.

The main problem in the planning/design stage by confirmatory factor analysis was found to be the non-availability or incompleteness of the original building plans. This was a challenge because the design has to be based on the archived documentation (if it exists) and to ascertain if it is 100% reliable. The lack of capability to fully ascertain the "condition of the building" as the second ranked challenge was confirmed numerous times as highlighted in the interview findings. Furthermore, the main problem identified in the survey data of PD construct through structural equation modelling was the lack of availability of fully ascertained "condition of the building". The implications of change of use/ significant work causing compliance with current codes (BCA code) created problems for the engineers and builders. Finding the strategy to comply with the current BCA code is a task to be further examined.

In regard to the execution/construction phase, the main problem by confirmatory factor analysis has found that the poor documentation quality (on the site) together with the incomplete project construction documentation (lack of detail – resulting in variations) were important challenges. A project slows down with every new request for more information. The administrative work involved in dealing with the relevant heritage bodies was the third main problem identified for the execution phase. Every latent condition discovered during the execution phase has to go back to the design phase and obtain the approval from the heritage body. Administrative dealings are sometimes a long process as there is no set timeframe for the heritage body's reply. Furthermore, the SEM analysis confirmed the incomplete project construction documentation (lack of detail – results in variation) followed by the documentation quality on the site as a major challenge. Not enough detailed documentation leads to numerous requests for information and this slows down the construction process.

A high level of training and experience among the design team is desirable for heritage projects and is not often the case. If the project team members – especially the project manager – have no heritage qualifications and/or practical experience it may have a significant effect on the project delivery.

The third factor that has an effect on the project delivery success is the issue of the multiple stakeholder management. The involvement of multiple stakeholders in the project poses multiple challenges if the project team has not explored the stakeholders' needs followed by the identification of the stakeholder requirements as the major factors by the confirmatory factor analysis. The SEM analysis has confirmed the importance of exploring the stakeholders' needs and constraints together with the understanding of the stakeholders' interests from the early stages of the project as a major factor that needs to be considered for successful management in the multiplicity of the stakeholder's involvement in the project. Identifying stakeholder requirements over and above assessing the stakeholder attributes (urgency and proximity), the failure to address the stakeholders' interests immediately can lead to conflict between the stakeholders. Analysing conflicts and coalitions among the stakeholders then becomes an important task to be given attention throughout the whole project.

In regard to the technical factors, the fourth factor that influences the project delivery data examined in the CFA has found that another main problem in heritage projects is the procedure involved in the repair or rebuild of stone work, brick work, steel work, concrete work and timber work and it has been confirmed as a major factor with the SEM analysis. Therefore this was the main technical challenge in both CFA and SEM data analysis. While the CFA results as a second major factor is architectural detailing the SEM the survey results highlighted the need for consistent procedures on how to deal with specific issues related to repair and rebuild procedures. This would help mediate this issue especially in the construction phase. The knowledge on such procedures has not been passed along and tradespeople on heritage projects are now "doing their best" to achieve the quality level of the project. Some of the techniques are irretrievably lost.

Engineers are facing difficulties in complying with the BCA when working on heritage building projects, and the survey indicated the need for finding the strategy how to comply to the BCA Code and to meets DDA.

RQ3: Management processes being improved in operation and delivery

To achieve improvements in future heritage projects, a summary of the factors (challenges, causes and call for action) that were validated and enriched by the focus group was provided (Chapter 7, Table 7.2). This research project identified the factors and circumstances that caused delays and proposed guidance for instigating a set of actions that will improve the project delivery. The steps that should be carefully followed to achieve operational improvements in heritage project management and delivery are shown in Figure 8.2.

8.5. Summary

Heritage buildings/places belong to the community and thus the social value assessment or genuine community consultation is highly important. Failure to do this properly results in appeals on development proposals and the loss of intangible and tangible values.

Everything that happens in the execution/construction stage relies to a great extent on the design; however, during the design phase, a limited amount of investigation is often undertaken for various reasons (Chapter 7, Table 7.2). This means the project is designed with a lack of information and the scope cannot be clearly outlined, resulting in omissions in the tender documentation when items are not included. Overall, therefore, the most significant risk in heritage project management is the scope definition. This risk can be overcome by implementing the series of proposed actions (Chapter 7, Table 7.2).

The significance and contribution of the research to the field of heritage project management are summarised in a Table 7.2 Chapter 7. The guidance can be utilised to undertake proposed specific actions that have been clearly drawn from the examination of the relationship of the current challenges and the associated causes/risks. Therefore this "call for action" should be considered primarily by the heritage authorities in the development and review of the relevant policies and procedures in order to improve the scope definition and enhance the overall success of project performance and delivery to the satisfaction of all the project stakeholders. All project stakeholders have to work to the common goal which is high quality 220the rewiew of the current nproject performance/delivery. Everybody's task is to ensure the timely and' within budge't project conclusion undertaken to excellent quality building conservation levels at the same time. Furthermore, the maintenance plan (cost) as a part of the conservation management plan would ensure that the building will be maintained on the regular basis and remain in a good condition through the decades.

8.6. Limitations of the Study

This study was undertaken with the aim to make a contribution to the management of future heritage projects in Australia. The data was collected exclusively from Australian practitioners, experts (including some with overseas experience), Australian heritage authorities and members of the public. This may affect the ability of the findings to be exactly repeated or generalised to the practices of heritage project management in other countries.

8.7. Contribution of the Study and Directions in Future Research

As far as the author is aware, this is the first research project that has been undertaken to encompass all project challenges and causes of delay across all Australian states. The project brought together heritage practitioners and experts interested to make a contribution to the success of future heritage projects in Australia.

The study's comprehensive investigation of heritage project management helps to fill the gap in knowledge due to the absence of research focusing on the causes of heritage project delays and in particular on the time, budget and quality/scope implications.

Drawing on the findings, this study proposes practical guidance that are framed as a call for action (Chapter 7, Table 7.2). The targets of these guidance are the Australian heritage authorities that have the power to implement the proposed actions and break the chain of project challenges and causes of delay by considering the intervention point as illustrated in Figure 8.2.

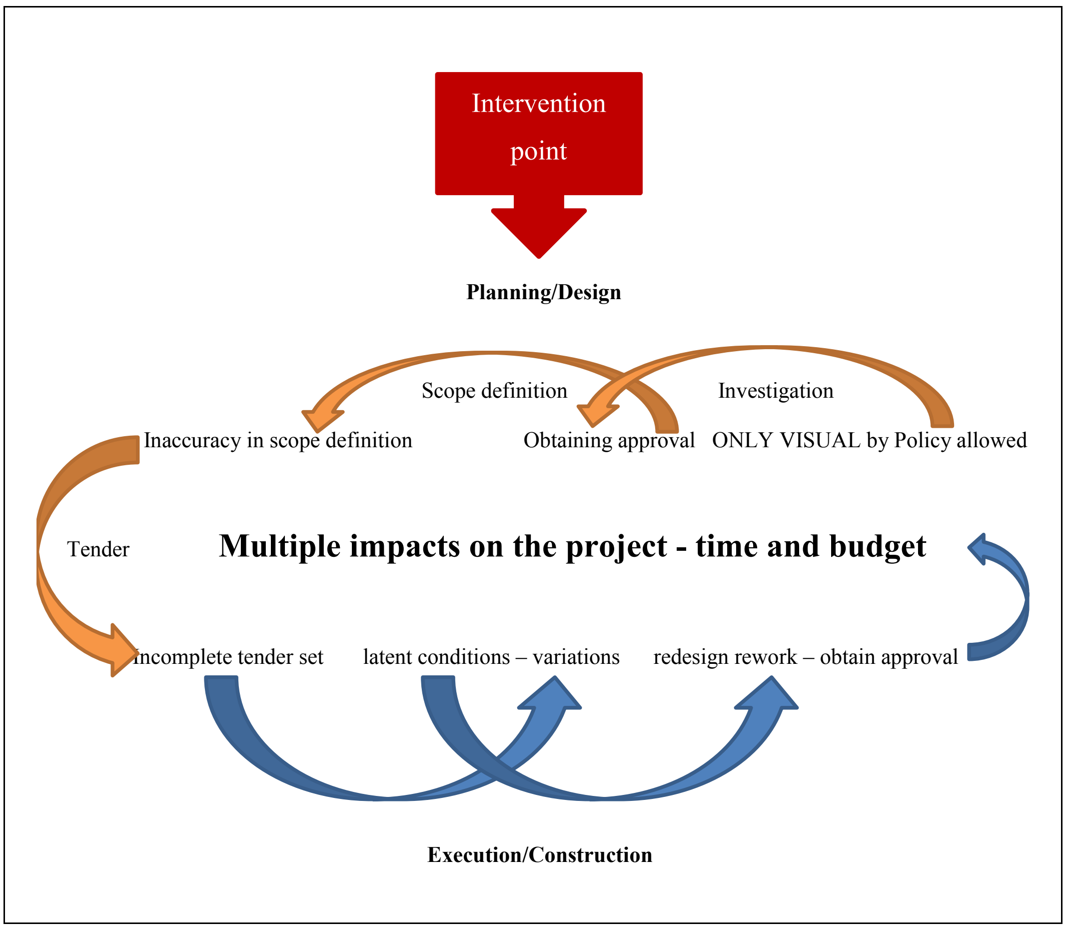


Figure 8.2: Intervention points in the project chain of challenges and causes

The results of this research can be tested on other Australian heritage projects as well as in other countries, to investigate whether the set of actions is applicable or can be applied with certain modification. It is also suggested that future research builds on the current study by pursuing the following objectives:

- To review the current policy/procedures by considering the impact of the non-destructive ‘demolition investigation packet’ on the scope definition
- To review the Building Code of Australia and propose strategy to comply with or amendments that will suit the particular needs of heritage buildings
- To explore the potential of implementing the maintenance plan/cost as a part of conservation management plan
- To create a heritage project app to be used by heritage practitioners as a resource for successful project performance

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Appendices

Appendix A: Survey Questionnaire

Which of the following best represents you?

○ User/Public (Bookshop, Cafe, Museum, etc.) ○ Occupier (Bookshop, Cafe, Museum, etc.) ○ Tourism and related organisations	Go to Section A
○ Project Owner/Client ○ Project Financiers/Sponsors/Grant givers ○ Project Manager ○ Contractor/Builder ○ Architect ○ Heritage Consultant ○ Engineers Discipline (All) ○ Quantity Surveyor ○ Superintendent ○ Heritage Administration ○ Building Tradesperson ○ Conservator ○ Archaeologist	Continue to Section B

Section A

A1: General Background

In which state/territory you are located?

- ○ ACT
- ○ NSW
- ○ QLD
- ○ VIC
- ○ TAS
- ○ SA
- ○ WA
- ○ NT

Which of the following organizations are you currently a member of? Please tick relevant option/s.

- ○ National Trust (NT)
- ○ International Council on Monuments and Sites (ICOMOS)
- ○ Australian Institute of Architects (AIA)
- ○ Australian Institute of Project Management (AIPM)
- ○ Australian Institute of Building Surveyors (AIBS)
- ○ Australian Institute of Quantity Surveyors (AIQS)
- ○ Royal Institution of Chartered Surveyors (RICS)
- ○ Engineers Australia (EA)
- ○ EA/National Professional Engineers Register (NPER)
- ○ Australian Institute of Building (AIB)
- ○ Master Builders Australia (MBA)
- ○ The Urban Development Institute of Australia (UDIA)
- ○ None
- ○ Other (please specify)

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A2: Retention of Heritage Places

What do you consider to be the key reasons for retaining heritage buildings/places? Please select one option for each of the following.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Appearance and design qualities	○	○	○	○	○
Landmark qualities	○	○	○	○	○
Contribution to streetscapes and views	○	○	○	○	○
The amenity of a suburb with a consistent character	○	○	○	○	○
Special character	○	○	○	○	○
Rarity	○	○	○	○	○
Historical importance - evidence of past ways of life	○	○	○	○	○
Their connection to people – groups in the community	○	○	○	○	○
Tourism	○	○	○	○	○
Preventing negative environmental and/or social impacts	○	○	○	○	○

What do you consider to be the main challenges to retaining heritage buildings/places?

Please select one option for each challenge.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Compliance (heritage approvals – development approvals) / regulatory barriers/ policy requirements	○	○	○	○	○
Cost/ Investment	○	○	○	○	○
Availability of funding sources (Gov., non Gov., private, etc.)	○	○	○	○	○
Uninformed client/customer	○	○	○	○	○
Technical barriers/design/engineering	○	○	○	○	○
Project Risk (program/financial)	○	○	○	○	○
Poor maintenance of current building stock	○	○	○	○	○
Contamination (asbestos, contaminated soil etc.)	○	○	○	○	○
Ongoing maintenance after renovation/ high cost	○	○	○	○	○
Urban Development	○	○	○	○	○

What is your view about the level of funding available to retain and/or maintain heritage places and buildings from these funding sources? Please select one option for each funding source.

	Poor		Good		Excellent
Government support funds	○	○	○	○	○
Non-government support funds	○	○	○	○	○
Institutional funds (Universities/Councils, etc.)	○	○	○	○	○
Private funds	○	○	○	○	○

Do you own/occupy or manage/maintain or have previously owned/occupied or managed/maintained, a heritage listed building?

- ○ Yes
- ○ No

What challenges did you face in maintaining your building? Please list specific challenge/s you find significantly difficult.

- ○ Finding helpful technical information (library, online, etc.)
- ○ Getting advice (architect, engineer, other specialist)
- ○ Finding the right materials
- ○ Finding skilled trades person
- ○ Getting approval from council/government
- ○ Adjusting the design to get the approval
- ○ Other

....
....

Do you have any further suggestion? What has not been covered that will help you better maintain your building?

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

A3: Remarks about the Survey

Are you willing to being contacted by the researcher to further discuss/be interviewed regarding any of your answers?

- ○ Yes
- ○ No

Section B

B1: General Background

In which state/territory you are located?

- ○ ACT
- ○ NSW
- ○ QLD
- ○ VIC
- ○ TAS
- ○ SA
- ○ WA
- ○ NT

What is the type of the organisation/institution you are currently working with?

Please tick relevant option

- ○ Private
- ○ State or Federal Government departments and agencies
- ○ Local Government
- ○ Non-profit organisation
- ○ Other (please specify)

....

Which of the following organizations are you currently a member of? Please tick relevant option/s.

- ○ National Trust (NT)
- ○ International Council on Monuments and Sites (ICOMOS)
- ○ Australian Institute of Architects (AIA)
- ○ Australian Institute of Project Management (AIPM)
- ○ Australian Institute of Building Surveyors (AIBS)
- ○ Australian Institute of Quantity Surveyors (AIQS)
- ○ Royal Institution of Chartered Surveyors (RICS)
- ○ Engineers Australia (EA)
- ○ EA/National Professional Engineers Register (NPER)
- ○ Australian Institute of Building (AIB)
- ○ Master Builders Australia (MBA)
- ○ The Urban Development Institute of Australia (UDIA)
- ○ None
- ○ Other (please specify)

....

How long have you been involved in heritage projects?

- ○ 0-5 years
- ○ 5-10 years
- ○ 10 -20 years
- ○ 20+ years

What percentage of your work is heritage related?

- ○ 0-25%
- ○ 25-50%
- ○ 50-75%
- ○ 100%

How many building projects have you worked on that have had a heritage component?

- ○ 0-10
- ○ 10-50
- ○ 50 +

What is the largest estimated project cost you have worked on?

- ○ Less than $1 million
- ○ Between $1 million - $10 million
- ○ Between $10 million - $50 million
- ○ Greater than $50 million

In which state/territory have the majority of your heritage projects been located?

Please tick relevant option/s.

- ○ ACT
- ○ NSW
- ○ QLD
- ○ VIC
- ○ TAS
- ○ SA
- ○ WA
- ○ NT
- ○ Overseas (please specify)

………

In what levels of heritage listing have you have had experience?

- ○ World listed level
- ○ National listed level
- ○ State listed level
- ○ Local listed level

Please think about ONE typical project that you have been involved in, when answering the following nine questions

In what levels of heritage listing have you have had experience?

- ○ World
- ○ National
- ○ State
- ○ Local
- ○ None

What was the project cost?

- ○ < $1 million
- ○ Between $1 million - $10 million
- ○ Between $10 million - $50 million
- ○ $50 million +

How successful was the project in meeting project time goals?

- ○ Ahead of schedule
- ○ On time
- ○ Behind schedule

How successful was the project in meeting project budget goals?

- ○ Under budget
- ○ On budget
- ○ Required additional budget

Were you require to prepare any of the following

- ○ Conservation Management Plan
- ○ Heritage Impact Statement
- ○ Other specialised reports
- ○ Other

………………………………………………………………………………………………………

If there was a contingency amount allowed in the budget, what was the use of contingency?

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

What percentage of the total budget was allocated for contingencies?

....

Was the proposed contingency enough to cover any additional work?

- ○ Yes
- ○ No

Were the key items that required contingency expenditure?

- ○ unknown situations discovered after work started
- ○ termite infestation
- ○ problems with particular elements, such as windows, roofs
- ○ problems with particular materials such as stone, mortar, timber
- ○ Other

....

B2: Retention of Heritage Places

What do you consider to be the key reasons for retaining heritage buildings/places? Please select one option for each of the following.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Appearance and design qualities	○	○	○	○	○
Landmark qualities	○	○	○	○	○
Contribution to streetscapes and views	○	○	○	○	○
The amenity of a suburb with a consistent character	○	○	○	○	○
Special character	○	○	○	○	○
Rarity	○	○	○	○	○
Historical importance - evidence of past ways of life	○	○	○	○	○
Their connection to people – groups in the community	○	○	○	○	○
Tourism	○	○	○	○	○
Preventing negative environmental and/or social impacts	○	○	○	○	○

What do you consider to be the main challenges to retaining heritage buildings/places?

Please select one option for each challenge.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Compliance (heritage approvals – development approvals) / regulatory barriers/ policy requirements	○	○	○	○	○
Cost/ Investment	○	○	○	○	○
Availability of funding sources (Gov., non Gov., private, etc.)	○	○	○	○	○
Uninformed client/customer	○	○	○	○	○
Technical barriers/design/engineering	○	○	○	○	○
Project Risk (program/financial)	○	○	○	○	○
Poor maintenance of current building stock	○	○	○	○	○
Contamination (asbestos, contaminated soil etc.)	○	○	○	○	○
Ongoing maintenance after renovation/ high cost	○	○	○	○	○
Urban Development	○	○	○	○	○

B3: Heritage Building Projects – Challenges

To what extent do you think that the following challenges during design/preconstruction phase have an influence on meeting project delivery objectives (on time and on budget)?

Please select one option for each challenge.

	Not at all influential	Low influence	Medium influence	High influence	Highest influence
Approvals - Timeframes for Local/State/Federal heritage	○	○	○	○	○
Level of appropriate Contingency	○	○	○	○	○
Availability of funding sources	○	○	○	○	○
Political influence/interest	○	○	○	○	○
Multiple stakeholders input	○	○	○	○	○
Defining the scope accurately	○	○	○	○	○
Defining the consultants fee to do the work	○	○	○	○	○
Quantifying capital cost of works	○	○	○	○	○
Lack of appropriate staff skills	○	○	○	○	○
Qualifications/experience of Project Team	○	○	○	○	○
Implications of change of use/ significant works causing compliance with current codes (BCA code)	○	○	○	○	○
Non availability or incomplete original building plans	○	○	○	○	○
Existing condition of building	○	○	○	○	○
Lack of ability to fully ascertain "condition of the building"	○	○	○	○	○
Limitations with methodology for repairs or new works due to heritage constraints	○	○	○	○	○

Discontinuous or unknown existing building fabric/materials causing delay or rework	○	○	○	○	○

What do you consider to be the key challenges in execution/construction phase of heritage building projects? Please select one option for each challenge.

	Not at all influential	Low influence	Medium influence	High influence	Highest influence
Qualifications/experience of Project Design Team	○	○	○	○	○
Qualifications/experience of Project Client Team	○	○	○	○	○
Qualifications/experience of Contractor/Subcontractors	○	○	○	○	○
Gaps in tendered documentation (all actions has not been covered by tender)	○	○	○	○	○
Accurate Pre tender estimate	○	○	○	○	○
Latent conditions	○	○	○	○	○
Scope changes Client/Architect/Engineer	○	○	○	○	○
Documentation quality (on the site)	○	○	○	○	○
Pre Demolition phase/detailed investigation of building	○	○	○	○	○
Post demolition investigation	○	○	○	○	○
Administration	○	○	○	○	○
Lack of coordination/communication between Design Team/Client/Contractor	○	○	○	○	○
Incomplete project construction documentation (lack in detail – results with variations)	○	○	○	○	○
Discontinuous/unknown existing building fabric/materials	○	○	○	○	○
Financial/budget considerations/constraints	○	○	○	○	○

To what extent do you think that there is a NEED for industry wide checklists, specifications, procedures and guidelines? Please select one option for each need.

	Not needed	Medium need	High needed	Already provided (more information required)	Already provided (high quality)
Guidance on different construction methodologies used at various times & locations	○	○	○	○	○
Consistent procedures how to deal with specific issues – to help mediating this detail/ issue	○	○	○	○	○
Procedures for repair or rebuild of: stone work, brick work, steel work, concrete work and timber work	○	○	○	○	○
Design in regard to the proposed usage (e.g. BCA code)	○	○	○	○	○
Heritage protocol doc.	○	○	○	○	○
System in place to identify what is significant fabric	○	○	○	○	○
Architectural detailing	○	○	○	○	○
Structural testing	○	○	○	○	○

Would quality measures, which provide a basis for assessment against the best conservation practice and processes for heritage building fabric, be a useful tool? Please provide a comment.

....
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....

What do you think is an appropriate percentage for contingency for projects with a substantial heritage component?

○ Less than 10%

○ 10% -20%

- ○ 20% - 30%
- ○ Other

....

In work on heritage buildings have you faced challenges with meeting the National Construction Code (Building Code of Australia) requirements for:

	Yes	No
Fire safety	○	○
Workplace safety	○	○
Disability access	○	○

Do you think the outcome for heritage was:

Positive	Neutral	Negative
○	○	○

In retrospect, would the outcome have been improved if your team had:

	Yes	No
Better knowledge of the code requirements	○	○
Access to better technical solutions	○	○

B4: Multiple Stakeholder Management

To what extent do you think the following factors are critical to the project delivery? Please select one option for each factor.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Identifying stakeholders on the project	○	○	○	○	○
Identifying stakeholder requirements	○	○	○	○	○
Understanding area of stakeholder interest	○	○	○	○	○
Exploring stakeholder needs and constraints	○	○	○	○	○
Assessing stakeholder attributes (urgency and proximity)	○	○	○	○	○
Analysing conflicts and coalitions among stakeholders	○	○	○	○	○
Resolving conflicts among stakeholders effectively	○	○	○	○	○
Keeping and promoting a good relationship	○	○	○	○	○
Formulating appropriate strategies to manage stakeholders	○	○	○	○	○
Predicting stakeholder reactions for implementing the strategies	○	○	○	○	○
Analysing the change of stakeholder influence and relationship during the project process	○	○	○	○	○
Communicating with and engaging stakeholders effectively and frequently	○	○	○	○	○

Do you use any formal project management framework (such as PRINCE2, PMBOK, Logical Framework, etc.) to deliver heritage projects?

- ○ Yes
- ○ No

Please indicate what limitations you have found in framework you use. ……………………………………………………………………………………………… ……………………………………………………………………………………………… ……………………………………………………………………………………………… ………………………………………………………………………………………………

Do you use any other/s (then PRINCE2, PMBOK, Logical Framework, etc.), please give details. ……………………………………………………………………………………………… ……………………………………………………………………………………………… ……………………………………………………………………………………………… ………………………………………………………………………………………………

B5: Remarks about the Survey

Are there any other issues/experiences regarding heritage projects that you have worked on that have not already been covered in this survey?
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....
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....

What other measures are needed (or desirable) to assist the conservation of heritage buildings/places?
....
....
....
....

Are you willing to being contacted by the researcher to further discuss/be interviewed regarding any of your answers?

- ○ Yes
- ○ No

Appendix B: Semi-Structured Interviews

INTERVIEW - Participant group from Case Study

Interview objectives are:

- To determine differences between traditional building projects and projects with heritage components
- To address limitations in current policies and procedures for heritage building projects
- To determine what the main causes of project delays are on heritage building projects
- To investigate how different stakeholders influence project delivery of heritage building projects

The interview will be divided into three main sections, as follows:

Introduction (10 min) will allow participant to ask any question that they may have regarding the research project.

Interview questions (60 min):

1. What did you find different in managing/designing a heritage building project from a traditional project?
2. Have you experienced any difficulties in finding appropriate contractors and specialist consultancy staff for such projects?

3. What would you consider to be the most difficult component of a heritage project? (procedures/design/management)

    a) Policies/procedures
    b) Scope definition
    c) Tender documentation
    d) Decision making
    e) Managing within time
    f) Lack of information of building
    g) Managing multiple stakeholders

4. Usually due to lack of technical information/hence lack of scope definition a large contingency is regarded. How difficult was it to convince the project owner of the necessity for the contingency amount?
   (Only Project manager)

Conclusion (15 min):

Key points will be summarised and the participant will be asked if they have any question/s(arising from the interview).

Appendix C: Data Coding

Appendix C-1: Key Reasons for Heritage Retention

Q. What do you consider to be the key reasons for retaining heritage buildings/places?

Code	Description
a1 (q7a1)	Appearance and design qualities
a2 (q7a2)	Landmark qualities
a3 (q7a3)	Contribution to streetscapes and views
a4 (q7a4)	The amenity of a suburb with a consistent character
a5 (q7a5)	Special character
a6 (q7a6)	Rarity
a7 (q7a7)	Historical importance - evidence of past ways of life
a8 (q7a8)	Their connection to people – groups in the community
a9 (q7a9)	Tourism
a10 (q7a10)	Preventing negative environmental and/or social impacts

Appendix C-2: Main Challenges of Heritage Retention

Q. What do you consider to be the main challenges for retaining heritage buildings/places?

Code	Description
b1 (q8a1)	Compliance (heritage approvals – development approvals) / regulatory barriers/ policy requirements
b2 (q8a2)	Cost/ Investment
b3 (q8a3)	Availability of funding sources (Gov., non Gov., private, etc.)
b4 (q8a4)	Uninformed client/customer
b5 (q8a5)	Technical barriers/design/engineering
b6 (q8a6)	Project Risk (program/financial)
b7 (q8a7)	Poor maintenance of current building stock
b8 (q8a8)	Contamination (asbestos, contaminated soil etc.)
b9 (q8a9)	Ongoing maintenance after renovation/ high cost
b10 (q8a10)	Urban Development

Appendix C-3: Planning/Design Phase

Q. To what extent do you think that the following challenges during design/preconstruction phase have an influence on meeting project delivery objectives (on time and on budget)?

Code	Description
q27a1	Approvals - Timeframes for Local/State/Federal heritage
q27a2	Level of appropriate Contingency
q27a3	Availability of funding sources
q27a4	Political influence/interest
q27a5	Multiple stakeholders input
q27a6	Defining the scope accurately
q27a7	Defining the consultants fee to do the work
q27a8	Quantifying capital cost of works
q27a9	Lack of appropriate staff skills
q27a10	Qualifications/experience of Project Team
q27a11	Implications of change of use/ significant works causing compliance with current codes (BCA code)
q27a12	Non availability or incomplete original building plans
q27a13	Existing condition of building
q27a14	Lack of ability to fully ascertain "condition of the building"
q27a15	Limitations with methodology for repairs or new works due to heritage constraints
q27a16	Discontinuous or unknown existing building fabric/materials causing delay or rework

Appendix C-4: Execution/Construction Phase

Q. What do you consider to be the key challenges in execution/construction phase of heritage building projects?

Code	Description
q28a1	Qualifications/experience of Project Design Team
q28a2	Qualifications/experience of Project Client Team
q28a3	Qualifications/experience of Contractor/Subcontractors
q28a4	Gaps in tendered documentation (all actions has not been covered by tender)
q28a5	Accurate Pre tender estimate
q28a6	Latent conditions
q28a7	Scope changes Client/Architect/Engineer
q28a8	Documentation quality (on the site)
q28a9	Pre Demolition phase/detailed investigation of building
q28a10	Post demolition investigation
q28a11	Administration
q28a12	Lack of coordination/communication between Design Team/Client/Contractor
q28a13	Incomplete project construction documentation (lack in detail – results with variations)
q28a14	Discontinuous/unknown existing building fabric/materials
q28a15	Financial/budget considerations/constraints

Appendix C-5: Technical Factors

Q. To what extent do you think that there is a NEED for industry wide checklists, specifications, procedures and guidelines?

Code	Description
q29a1	Guidance on different construction methodologies used at various times & locations
q29a2	Consistent procedures how to deal with specific issues – to help mediating this detail/ issue
q29a3	Procedures for repair or rebuild of: stone work, brick work, steel work, concrete work and timber work
q29a4	Design in regard to the proposed usage (e.g. BCA code)
q29a5	Heritage protocol doc.
q29a6	System in place to identify what is significant fabric
q29a7	Architectural detailing
q29a8	Structural testing

Appendix C-6: Multiple Stakeholders' Factors

Q. To what extent do you think the following factors are critical to the project delivery?

Code	Description
q36a1	Identifying stakeholders on the project
q36a2	Identifying stakeholder requirements
q36a3	Understanding area of stakeholder interest
q36a4	Exploring stakeholder needs and constraints
q36a5	Assessing stakeholder attributes (urgency and proximity)
q36a6	Analysing conflicts and coalitions among stakeholders
q36a7	Resolving conflicts among stakeholders effectively
q36a8	Keeping and promoting a good relationship
q36a9	Formulating appropriate strategies to manage stakeholders
q36a10	Predicting stakeholder reactions for implementing the strategies
q36a11	Analysing the change of stakeholder influence and relationship during the project process
q36a12	Communicating with and engaging stakeholders effectively and frequently

Appendix D: Preliminary Data Analysis

Appendix D-1: Normality

Appendix D-1-1: Normality Test – Heritage Retention Construct: Key Reasons and Main Challenges

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
q7a1	279	0.96685	7.185	4.166	0.00002
q7a2	273	0.99860	0.298	-2.552	0.99465
q7a3	274	0.98913	2.319	1.775	0.03797
q7a4	274	0.99946	0.115	-4.571	1.00000
q7a5	274	0.99834	0.355	-2.185	0.98555
q7a6	275	0.99691	0.662	-0.871	0.80809
q7a7	278	0.95697	9.299	4.710	0.00001
q7a8	273	0.98978	2.174	1.638	0.05067
q7a9	277	0.99181	1.764	1.199	0.11529
q7a10	272	0.99911	0.188	-3.521	0.99979
q8a1	274	0.99530	1.003	0.005	0.49782
q8a2	277	0.96199	8.187	4.440	0.00001
q8a3	271	0.99757	0.513	-1.407	0.92028
q8a4	276	0.99932	0.146	-4.065	0.99998
q8a5	277	0.99791	0.450	-1.686	0.95413
q8a6	271	0.99943	0.121	-4.462	1.00000
q8a7	274	0.99904	0.205	-3.346	0.99959
q8a8	273	0.99513	1.037	0.076	0.46984
q8a9	275	0.99517	1.034	0.071	0.47163
q8a10	272	0.99314	1.455	0.791	0.21438

Note: the next Q7a1 = a1; q7a2=a2;

Appendix D-1-2: Normality Test – Project Management Construct: Planning/Design, Execution/Construction, Technical Factors and Multiple Stakeholders' Factors

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
q27a11	162	0.99820	0.245	-2.865	0.99791
q27a8	164	0.99813	0.257	-2.776	0.99725
q27a12	164	0.99472	0.726	-0.654	0.74358
q27a14	165	0.99425	0.795	-0.469	0.68037
q27a15	161	0.99905	0.129	-4.171	0.99998

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
q28a4	163	0.99919	0.111	-4.480	1.00000
q28a5	164	0.99910	0.123	-4.271	0.99999
q28a7	164	0.99891	0.149	-3.881	0.99995
q28a8	163	0.99891	0.149	-3.882	0.99995
q28a10	160	0.99958	0.056	-5.873	1.00000
q28a11	164	0.99719	0.387	-1.939	0.97375
q28a12	164	0.99906	0.130	-4.168	0.99998
q28a13	163	0.99650	0.479	-1.501	0.93336

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
q36a1	165	0.99576	0.587	-1.088	0.86178
q36a2	165	0.99337	0.917	-0.177	0.57039
q36a3	165	0.99963	0.052	-6.054	1.00000
q36a4	164	1.00000	0.000	-28.209	1.00000
q36a5	165	0.99971	0.040	-6.549	1.00000
q36a6	165	0.99450	0.760	-0.561	0.71245
q36a7	165	0.98833	1.613	0.977	0.16436
q36a9	165	0.98841	1.603	0.964	0.16765
q36a10	164	0.99689	0.427	-1.735	0.95860
q36a11	164	0.99928	0.099	-4.717	1.00000
q36a12	165	0.99568	0.597	-1.052	0.85356

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
q29a1	161	0.99857	0.193	-3.349	0.99959
q29a2	164	0.99711	0.398	-1.881	0.97003
q29a3	165	0.99850	0.207	-3.214	0.99935
q29a4	161	0.99840	0.217	-3.115	0.99908
q29a7	162	0.99611	0.530	-1.296	0.90250
q29a8	159	0.98563	1.925	1.335	0.09100

Appendix D-2: Reliability Test of Measures in the Questionnaire

Appendix D-2-1: Reliability Test – Key Reasons for Heritage Retention

Case Processing Summary

		N	%
Cases	Valid	408	91.9
	Excluded[a]	36	8.1
	Total	444	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.809	10

Appendix D-2-2: Reliability Test – Main Challenges of Heritage Retention

Case Processing Summary

		N	%
Cases	Valid	409	92.1
	Excluded[a]	35	7.9
	Total	444	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.763	10

Appendix D-2-3: Reliability Test – Planning/Design Phase

Case Processing Summary

		N	%
Cases	Valid	143	86.7
	Excluded[a]	22	13.3
	Total	165	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.884	16

Item Statistics

	Mean	Std. Deviation	N
q27a1	3.5734	.80919	143
q27a2	3.2308	.87768	143
q27a3	3.7832	.89710	143
q27a4	3.5804	1.03061	143
q27a5	3.5315	.88655	143
q27a6	3.7063	.93321	143
q27a7	2.9580	.94104	143
q27a8	3.4126	.85026	143
q27a9	3.1958	1.09582	143
q27a10	3.3986	1.06903	143
q27a11	3.4406	.86905	143
q27a12	3.0210	1.10357	143
q27a13	3.5385	.94025	143
q27a14	3.4755	1.01975	143
q27a15	3.3147	1.03065	143
q27a16	3.2797	.96710	143

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
q27a1	50.8671	78.947	.471	.880
q27a2	51.2098	77.660	.514	.878
q27a3	50.6573	79.311	.392	.882
q27a4	50.8601	77.051	.457	.880
q27a5	50.9091	78.421	.456	.880
q27a6	50.7343	77.802	.468	.880
q27a7	51.4825	76.040	.576	.875
q27a8	51.0280	76.746	.598	.875
q27a9	51.2448	74.735	.551	.877
q27a10	51.0420	75.139	.545	.877
q27a11	51.0000	76.493	.600	.875
q27a12	51.4196	72.949	.648	.872
q27a13	50.9021	76.807	.527	.877
q27a14	50.9650	75.555	.552	.876
q27a15	51.1259	74.294	.620	.873
q27a16	51.1608	76.094	.554	.876

Appendix D-2-4: Reliability Test – Execution/Construction Phase

Case Processing Summary

		N	%
Cases	Valid	149	90.3
	Excluded[a]	16	9.7
	Total	165	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.895	15

Item Statistics

	Mean	Std. Deviation	N
q28a1	3.7248	.96464	149
q28a2	3.6107	.89828	149
q28a3	3.9128	.82144	149
q28a4	3.6309	.77415	149
q28a5	3.5101	.89002	149
q28a6	3.5302	.91944	149
q28a7	3.5503	.88100	149
q28a8	3.5638	.86464	149
q28a9	3.6174	.94866	149
q28a10	3.3221	.84844	149
q28a11	2.9664	.95448	149
q28a12	3.7047	.94084	149
q28a13	3.6309	.89555	149
q28a14	3.3557	.84688	149
q28a15	3.9396	.84812	149

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
q28a1	49.8456	61.740	.610	.887
q28a2	49.9597	63.363	.542	.890
q28a3	49.6577	63.727	.573	.888
q28a4	49.9396	64.138	.579	.888
q28a5	50.0604	62.733	.596	.887
q28a6	50.0403	65.796	.354	.897
q28a7	50.0201	63.047	.579	.888
q28a8	50.0067	62.155	.662	.885
q28a9	49.9530	62.194	.590	.888
q28a10	50.2483	63.161	.596	.888
q28a11	50.6040	61.673	.623	.886
q28a12	49.8658	62.360	.584	.888
q28a13	49.9396	61.557	.681	.884
q28a14	50.2148	64.291	.509	.891
q28a15	49.6309	64.883	.463	.893

Appendix D-2-5: Reliability Test – Technical Factors

Case Processing Summary

		N	%
Cases	Valid	148	89.7
	Excluded[a]	17	10.3
	Total	165	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.900	8

Item Statistics

	Mean	Std. Deviation	N
q29a1	2.9797	1.07203	148
q29a2	2.8514	1.03913	148
q29a3	3.1959	1.09208	148
q29a4	2.9595	1.06827	148
q29a5	3.2365	1.08397	148
q29a6	3.2838	1.03701	148
q29a7	3.0000	1.11270	148
q29a8	3.0405	1.16571	148

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
q29a1	21.5676	34.655	.673	.889
q29a2	21.6959	34.458	.719	.885
q29a3	21.3514	33.549	.756	.881
q29a4	21.5878	34.053	.731	.883
q29a5	21.3108	35.590	.583	.897
q29a6	21.2635	36.454	.541	.900
q29a7	21.5473	33.066	.781	.878
q29a8	21.5068	33.408	.708	.886

Appendix D-2-6: Reliability Test – Multiple Stakeholders' Factors

Case Processing Summary

		N	%
Cases	Valid	162	98.2
	Excluded[a]	3	1.8
	Total	165	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.920	12

Item Statistics

	Mean	Std. Deviation	N
q36a1	4.0679	.73194	162
q36a2	4.2531	.66231	162
q36a3	4.0988	.65190	162
q36a4	4.1235	.68493	162
q36a5	3.9506	.68527	162
q36a6	3.9321	.75697	162
q36a7	4.1667	.70711	162
q36a8	4.2840	.65436	162
q36a9	4.0802	.68686	162
q36a10	3.7963	.74048	162
q36a11	3.8272	.71870	162
q36a12	4.3025	.71444	162

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
q36a1	44.8148	31.692	.644	.914
q36a2	44.6296	32.272	.641	.914
q36a3	44.7840	31.823	.719	.911
q36a4	44.7593	31.563	.715	.911
q36a5	44.9321	31.741	.689	.912
q36a6	44.9506	30.917	.718	.911
q36a7	44.7160	31.571	.687	.912
q36a8	44.5988	32.900	.560	.918
q36a9	44.8025	32.060	.643	.914
q36a10	45.0864	31.421	.670	.913
q36a11	45.0556	31.481	.686	.912
q36a12	44.5802	31.773	.652	.914

Appendix D-3: Descriptive Statistics by Frequencies Test

Appendix D-3-1: Frequencies Test – Key Reasons and Main Challenges

Statistics

	N		Mean	Median	Mode	Std. Deviation
	Valid	Missing				
a1	443	1	4.23	4.00	4	.766
a2	436	8	4.25	4.00	4	.706
a3	436	8	4.14	4.00	4	.793
a4	436	8	3.85	4.00	4	.854
a5	439	5	4.23	4.00	4	.733
a6	437	7	4.33	4.00	5	.750
a7	443	1	4.58	5.00	5	.666
a8	438	6	4.19	4.00	4	.783
a9	440	4	4.00	4.00	4	.893
a10	435	9	3.65	4.00	4	.967
b1	436	8	3.74	4.00	4	.876f
b2	440	4	4.21	4.00	4	.822
b3	436	8	4.14	4.00	4	.766
b4	440	4	3.75	4.00	4	.802
b5	441	3	3.38	3.00	4	.991
b6	432	12	3.57	4.00	4	.797
b7	438	6	3.90	4.00	4	.831
b8	435	9	3.63	4.00	4	.962
b9	438	6	3.81	4.00	4	.859
b10	437	7	3.93	4.00	4	.966

Appendix D-3-2: Frequencies Test – Project Management Challenges

Statistics

	N		Mean	Median	Mode	Std. Deviation
	Valid	Missing				
q27a1	164	1	3.5610	4.0000	4.00	.81546
q27a2	162	3	3.2160	3.0000	3.00	.87561
q27a3	163	2	3.8405	4.0000	4.00	.89530
q27a4	163	2	3.6380	4.0000	4.00	1.01727
q27a5	163	2	3.4785	3.0000	3.00[a]	.88428
q27a6	160	5	3.6750	4.0000	4.00	.94203
q27a7	164	1	2.9573	3.0000	3.00	.92246
q27a8	164	1	3.4390	3.5000	4.00	.87357
q27a9	162	3	3.2099	3.0000	3.00	1.09449
q27a10	165	0	3.4364	4.0000	4.00	1.07233
q27a11	162	3	3.4383	3.5000	4.00	.90507
q27a12	164	1	2.9634	3.0000	2.00	1.12904
q27a13	159	6	3.5157	4.0000	4.00	.91993
q27a14	165	0	3.4545	4.0000	4.00	1.04447
bq27a15	161	4	3.2609	3.0000	3.00	1.03996
q27a16	163	2	3.2393	3.0000	3.00	.98026
q28a1	165	0	3.7212	4.0000	4.00	.99135
q28a2	164	1	3.5915	4.0000	3.00	.89863
q28a3	164	1	3.9024	4.0000	4.00	.83790
q28a4	163	2	3.6380	4.0000	4.00	.77636
q28a5	164	1	3.5061	4.0000	4.00	.88267
q28a6	164	1	3.5000	3.0000	3.00	.92345
q28a7	164	1	3.5366	4.0000	4.00	.88193
q28a8	163	2	3.5521	4.0000	4.00	.86176
q28a9	163	2	3.5951	4.0000	3.00	.97903
q28a10	160	5	3.3250	3.0000	3.00	.86548
q28a11	164	1	2.9695	3.0000	3.00	.96200
q28a12	164	1	3.7073	4.0000	4.00	.96551
q28a13	163	2	3.6503	4.0000	4.00	.89948
q28a14	160	5	3.3438	3.0000	3.00	.86908
q28a15	163	2	3.9571	4.0000	4.00	.84144
q29a1	161	4	3.0062	3.0000	3.00	1.06358
q29a2	164	1	2.8780	3.0000	3.00	1.03189
q29a3	165	0	3.2121	3.0000	3.00	1.09760
q29a4	161	4	2.9752	3.0000	3.00	1.05446
q29a5	162	3	3.2716	3.0000	3.00	1.07498
q29a6	159	6	3.2956	3.0000	3.00	1.03455
q29a7	162	3	3.0185	3.0000	2.00	1.10038
q29a8	159	6	3.0629	3.0000	2.00	1.16209
q36a1	165	0	4.0788	4.0000	4.00	.73242
q36a2	165	0	4.2606	4.0000	4.00	.66164
q36a3	165	0	4.0909	4.0000	4.00	.67008
q36a4	164	1	4.1159	4.0000	4.00	.68641
q36a5	165	0	3.9394	4.0000	4.00	.68696
q36a6	165	0	3.9333	4.0000	4.00	.75815
q36a7	165	0	4.1515	4.0000	4.00	.74577
q36a8	163	2	4.2822	4.0000	4.00	.65272
q36a9	165	0	4.0606	4.0000	4.00	.72159
q36a10	164	1	3.7927	4.0000	4.00	.73872
q36a11	164	1	3.8293	4.0000	4.00	.71453
q36a12	165	0	4.3091	4.0000	4.00	.71242

a. Multiple modes exist. The smallest value is shown

Appendix D-4: Correlation by Bonferroni Test

Appendix D-4-1: Bonferroni Test – Key Reasons

```
pwcorr a1-a10, bonferroni print(.05) sig star(.05)

             |       a1       a2       a3       a4       a5       a6       a7
-------------+---------------------------------------------------------------
          a1 |   1.0000
             |
             |
          a2 |   0.5561*  1.0000
             |   0.0000
             |
          a3 |   0.4789*  0.4617*  1.0000
             |   0.0000   0.0000
             |
          a4 |   0.3339*  0.3702*  0.5100*  1.0000
             |   0.0000   0.0000   0.0000
             |
          a5 |   0.2825*  0.3728*  0.4286*  0.4467*  1.0000
             |   0.0000   0.0000   0.0000   0.0000
             |
          a6 |   0.2940*  0.3932*  0.3023*  0.3385*  0.4769*  1.0000
             |   0.0000   0.0000   0.0000   0.0000   0.0000
             |
          a7 |   0.2439*  0.3167*  0.2373*  0.2035*  0.3265*  0.4502*  1.0000
             |   0.0000   0.0000   0.0000   0.0009   0.0000   0.0000
             |
          a8 |   0.2125*  0.2837*  0.2691*  0.2418*  0.2556*  0.2735*  0.5004*
             |   0.0003   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
             |
          a9 |   0.2448*  0.2473*  0.2420*  0.2031*  0.2288*  0.1888*  0.2699*
             |   0.0000   0.0000   0.0000   0.0009   0.0001   0.0035   0.0000
             |
         a10 |   0.2695*  0.2557*  0.3705*  0.2519*  0.2610*  0.2425*  0.1573*
             |   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0454
             |

             |       a8       a9      a10
-------------+---------------------------
          a8 |   1.0000
             |
             |
          a9 |   0.3129*  1.0000
             |   0.0000
             |
         a10 |   0.2507*  0.2003*  1.0000
             |   0.0000   0.0012
             |

. pwcorr b1-b10, bonferroni print(.05) sig star(.05)
```

Appendix D-4-2: Bonferroni Test – Main Challenges

	b1	b2	b3	b4	b5	b6	b7
b1	1.0000						
b2	0.3783*	1.0000					
	0.0000						
b3	0.2853*	0.5539*	1.0000				
	0.0000	0.0000					
b4				1.0000			
b5	0.3783*	0.1822*	0.1875*	0.1585*	1.0000		
	0.0000	0.0056	0.0038	0.0387			
b6	0.2512*	0.1973*	0.2580*	0.2094*	0.4699*	1.0000	
	0.0000	0.0017	0.0000	0.0005	0.0000		
b7	0.1593*	0.1893*	0.2349*	0.2352*	0.2998*	0.3753*	1.0000
	0.0412	0.0032	0.0000	0.0000	0.0000	0.0000	
b8	0.1790*	0.1789*			0.3474*	0.3461*	0.3255*
	0.0086	0.0081			0.0000	0.0000	0.0000
b9	0.3144*	0.3512*	0.3473*		0.3263*	0.2717*	0.2926*
	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000
b10	0.1609*				0.2197*		0.1969*
	0.0364				0.0002		0.0017

	b8	b9	b10
b8	1.0000		
b9	0.3747*	1.0000	
	0.0000		
b10	0.1755*	0.3170*	1.0000
	0.0113	0.0000	

Appendix D-4-3: Bonferroni Test – Planning/Design Phase

```
. pwcorr q27a1-q27a16, bonferroni print(.05) sig star(.05)

             |    q27a1    q27a2    q27a3    q27a4    q27a5    q27a6    q27a7
-------------+---------------------------------------------------------------
       q27a1 |   1.0000 
             |
             |
       q27a2 |   0.3032*  1.0000 
             |   0.0105
             |
       q27a3 |            0.3362*  1.0000 
             |            0.0016
             |
       q27a4 |   0.3291*           0.4526*  1.0000 
             |   0.0021            0.0000
             |
       q27a5 |   0.3455*                    0.3945*  1.0000 
             |   0.0008                     0.0000
             |
       q27a6 |                              0.3630*  0.2845*  1.0000 
             |                              0.0003   0.0334
             |
       q27a7 |            0.3799*           0.2818*           0.3265*  1.0000 
             |            0.0001            0.0322            0.0030
             |
       q27a8 |            0.4270*  0.3413*                    0.3091*  0.4345*
             |            0.0000   0.0010                     0.0084   0.0000
             |
       q27a9 |                              0.2951*           0.3234*  0.3330*
             |                              0.0174            0.0041   0.0018
             |
      q27a10 |                              0.3118*           0.3366*  0.3344*
             |                              0.0061            0.0016   0.0015
             |
      q27a11 |   0.3098*  0.3161*           0.4035*  0.4137*           0.3234*
             |   0.0076   0.0059            0.0000   0.0000            0.0034
             |
      q27a12 |   0.3090*  0.2877*                    0.3669*           0.3401*
             |   0.0068   0.0247                     0.0002            0.0010
             |
      q27a13 |            0.2889*
             |            0.0306
             |
      q27a14 |            0.3643*
             |            0.0002
             |
      q27a15 |   0.3389*  0.3454*                                      0.4024*
             |   0.0013   0.0010                                       0.0000
             |
      q27a16 |                                       0.2867*           0.2768*
             |                                       0.0259            0.0417
             |
```

	q27a8	q27a9	q27a10	q27a11	q27a12	q27a13	q27a14
q27a8	1.0000						
q27a9		1.0000					
q27a10	0.3518*	0.6975*	1.0000				
	0.0005	0.0000					
q27a11	0.3869*	0.2981*	0.3524*	1.0000			
	0.0000	0.0162	0.0005				
q27a12	0.3025*	0.3118*	0.3317*	0.4779*	1.0000		
	0.0099	0.0064	0.0017	0.0000			
q27a13				0.3559*	0.5273*	1.0000	
				0.0006	0.0000		
q27a14	0.4628*		0.3499*	0.3866*	0.4998*	0.6292*	1.0000
	0.0000		0.0005	0.0000	0.0000	0.0000	
q27a15	0.3173*			0.3608*	0.4984*	0.5313*	0.4914*
	0.0049			0.0004	0.0000	0.0000	0.0000
q27a16	0.3527*	0.2977*		0.3146*	0.4417*	0.5309*	0.4570*
	0.0005	0.0150		0.0061	0.0000	0.0000	0.0000

	q27a15	q27a16
q27a15	1.0000	
q27a16	0.5991*	1.0000
	0.0000	

Appendix D-4-4: Bonferroni Test – Execution/Construction Phase

```
. pwcorr q28a1-q28a15, bonferroni print(.05) sig star(.05)

             |    q28a1    q28a2    q28a3    q28a4    q28a5    q28a6    q28a7
-------------+---------------------------------------------------------------
       q28a1 |   1.0000 
             |
             |
       q28a2 |   0.6369*  1.0000 
             |   0.0000
             |
       q28a3 |   0.6017*  0.5972*  1.0000 
             |   0.0000   0.0000
             |
       q28a4 |   0.3514*  0.3390*  0.4197*  1.0000 
             |   0.0004   0.0011   0.0000
             |
       q28a5 |   0.3498*  0.2756*  0.3824*  0.5544*  1.0000 
             |   0.0005   0.0388   0.0000   0.0000
             |
       q28a6 |                              0.3086*  0.3374*  1.0000 
             |                              0.0068   0.0011
             |
       q28a7 |   0.2898*           0.3112*  0.3328*  0.3217*  0.4021*  1.0000 
             |   0.0175            0.0055   0.0016   0.0030   0.0000
             |
       q28a8 |   0.3101*           0.3241*  0.4381*  0.4756*           0.5091*
             |   0.0059            0.0027   0.0000   0.0000            0.0000
             |
       q28a9 |   0.3321*  0.3368*  0.3240*  0.2979*  0.4456*  0.4216*  0.3321*
             |   0.0016   0.0012   0.0027   0.0124   0.0000   0.0000   0.0017
             |
      q28a10 |   0.3218*  0.2786*  0.3575*  0.3240*  0.3377*  0.3705*  0.3278*
             |   0.0035   0.0396   0.0004   0.0033   0.0013   0.0002   0.0026
             |
      q28a11 |   0.3646*  0.2952*  0.4192*  0.3394*  0.3868*           0.4958*
             |   0.0002   0.0137   0.0000   0.0010   0.0000            0.0000
             |
      q28a12 |   0.5732*  0.4159*  0.4743*  0.3324*  0.2901*           0.3297*
             |   0.0000   0.0000   0.0000   0.0015   0.0173            0.0018
             |
      q28a13 |   0.4486*  0.3261*  0.3353*  0.5547*  0.4890*           0.3877*
             |   0.0000   0.0024   0.0014   0.0000   0.0000            0.0000
             |
      q28a14 |   0.3089*  0.2803*  0.2797*           0.3483*  0.3907*  0.4635*
             |   0.0074   0.0362   0.0374            0.0007   0.0000   0.0000
             |
      q28a15 |   0.3178*  0.3247*  0.3192*  0.2974*  0.3116*           0.3114*
             |   0.0037   0.0026   0.0037   0.0128   0.0054            0.0058
             |
```

	q28a8	q28a9	q28a10	q28a11	q28a12	q28a13	q28a14
q28a8	1.0000						
q28a9	0.3671*	1.0000					
	0.0002						
q28a10	0.4025*	0.6112*	1.0000				
	0.0000	0.0000					
q28a11	0.4585*	0.3265*	0.3564*	1.0000			
	0.0000	0.0022	0.0004				
q28a12	0.3662*	0.2802*	0.3153*	0.5650*	1.0000		
	0.0002	0.0306	0.0051	0.0000			
q28a13	0.5313*	0.3622*	0.3675*	0.5251*	0.6144*	1.0000	
	0.0000	0.0002	0.0002	0.0000	0.0000		
q28a14	0.3522*	0.4158*	0.4442*	0.3082*			1.0000
	0.0006	0.0000	0.0000	0.0077			
q28a15				0.3571*	0.3597*	0.4008*	0.3061*
				0.0003	0.0003	0.0000	0.0087

	q28a15
q28a15	1.0000

Appendix D-4-5: Bonferroni Test – Technical Factors

```
. pwcorr q29a1-q29a8, bonferroni print(.05) sig star(.05)

             |    q29a1    q29a2    q29a3    q29a4    q29a5    q29a6    q29a7
-------------+---------------------------------------------------------------
       q29a1 |   1.0000
             |
             |
       q29a2 |   0.7631*  1.0000
             |   0.0000
             |
       q29a3 |   0.6533*  0.7134*  1.0000
             |   0.0000   0.0000
             |
       q29a4 |   0.5143*  0.5079*  0.5878*  1.0000
             |   0.0000   0.0000   0.0000
             |
       q29a5 |   0.3317*  0.3583*  0.3915*  0.5233*  1.0000
             |   0.0006   0.0001   0.0000   0.0000
             |
       q29a6 |   0.3765*  0.3434*  0.4228*  0.3987*  0.5889*  1.0000
             |   0.0000   0.0003   0.0000   0.0000   0.0000
             |
       q29a7 |   0.5794*  0.6133*  0.6075*  0.6748*  0.4704*  0.4712*  1.0000
             |   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
             |
       q29a8 |   0.4978*  0.5315*  0.4950*  0.6610*  0.4727*  0.4190*  0.7478*
             |   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
             |

             |    q29a8
-------------+---------
       q29a8 |   1.0000
             |
```

Appendix D-4-6: Bonferroni Test – Multiple Stakeholders' Factors

```
. pwcorr q36a1-q36a12, bonferroni print(.05) sig star(.05)

             |    q36a1    q36a2    q36a3    q36a4    q36a5    q36a6    q36a7
-------------+---------------------------------------------------------------
       q36a1 |   1.0000 
             |
             |
       q36a2 |   0.6243*  1.0000 
             |   0.0000
             |
       q36a3 |   0.5693*  0.6477*  1.0000 
             |   0.0000   0.0000
             |
       q36a4 |   0.4720*  0.6372*  0.6470*  1.0000 
             |   0.0000   0.0000   0.0000
             |
       q36a5 |   0.4579*  0.5045*  0.6214*  0.6636*  1.0000 
             |   0.0000   0.0000   0.0000   0.0000
             |
       q36a6 |   0.5476*  0.5089*  0.5041*  0.4969*  0.5659*  1.0000 
             |   0.0000   0.0000   0.0000   0.0000   0.0000
             |
       q36a7 |   0.4134*  0.3767*  0.4847*  0.4345*  0.4227*  0.6758*  1.0000 
             |   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
             |
       q36a8 |   0.3227*  0.4444*  0.4581*  0.3650*  0.3928*  0.4213*  0.5282*
             |   0.0018   0.0000   0.0000   0.0001   0.0000   0.0000   0.0000
             |
       q36a9 |   0.4178*  0.2732*  0.4677*  0.4920*  0.5118*  0.4755*  0.5494*
             |   0.0000   0.0253   0.0000   0.0000   0.0000   0.0000   0.0000
             |
      q36a10 |   0.4035*           0.4462*  0.4837*  0.4865*  0.5220*  0.5239*
             |   0.0000            0.0000   0.0000   0.0000   0.0000   0.0000
             |
      q36a11 |   0.3646*  0.3280*  0.4466*  0.4974*  0.4570*  0.5591*  0.6055*
             |   0.0001   0.0012   0.0000   0.0000   0.0000   0.0000   0.0000
             |
      q36a12 |   0.3737*  0.5266*  0.4773*  0.5518*  0.3998*  0.3996*  0.4507*
             |   0.0001   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
             |
```

```
             |    q36a8    q36a9   q36a10   q36a11   q36a12
-------------+---------------------------------------------
       q36a8 |   1.0000 
             |
             |
       q36a9 |   0.3498*  1.0000 
             |   0.0003
             |
      q36a10 |   0.3380*  0.6549*  1.0000 
             |   0.0007   0.0000
             |
      q36a11 |   0.4078*  0.5561*  0.7622*  1.0000 
             |   0.0000   0.0000   0.0000
             |
      q36a12 |   0.5281*  0.3785*  0.4705*  0.4885*  1.0000 
             |   0.0000   0.0000   0.0000   0.0000
             |
```

Appendix E: Confirmatory Factor Analysis

Appendix E-1: Confirmatory Factor Analysis - Key Reasons and Main Challenges

```
Endogenous variables

Measurement:  a1 a2 a3 a4 a5 a6 a7 a8 a9 a10 b1 b2 b3 b4 b5 b6 b7 b8 b9 b10

Exogenous variables

Latent:       Key_reasons Main_challenges

Estimation method  = mlmv
Log likelihood     = -9739.9405
( 1)  [a1]Key_reasons = 1
( 2)  [b1]Main_challenges = 1
```

```
--------------------------------------------------------------------------------------------
                             |                 OIM
                Standardized |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------------------+--------------------------------------------------------------
Measurement                  |
  a1 <-                      |
                 Key_reasons |   .5477358   .0420696    13.02   0.000     .4652809    .6301907
                       _cons |   5.551051   .1916747    28.96   0.000     5.175375    5.926726
  ---------------------------+--------------------------------------------------------------
  a2 <-                      |
                 Key_reasons |    .637624   .0365402    17.45   0.000     .5660066    .7092413
                       _cons |   6.036091   .2095691    28.80   0.000     5.625344    6.446839
  ---------------------------+--------------------------------------------------------------
  a3 <-                      |
                 Key_reasons |   .6739725   .0362466    18.59   0.000     .6029304    .7450146
                       _cons |   5.159242   .1832686    28.15   0.000     4.800042    5.518442
  ---------------------------+--------------------------------------------------------------
  a4 <-                      |
                 Key_reasons |   .5910247    .040183    14.71   0.000     .5122676    .6697819
                       _cons |   4.520149   .1599618    28.26   0.000      4.20663    4.833669
  ---------------------------+--------------------------------------------------------------
  a5 <-                      |
                 Key_reasons |   .6161246   .0382778    16.10   0.000     .5411015    .6911476
                       _cons |   5.780724   .2005151    28.83   0.000     5.387722    6.173727
  ---------------------------+--------------------------------------------------------------
  a6 <-                      |
                 Key_reasons |   .5456832   .0418162    13.05   0.000     .4637249    .6276414
                       _cons |   5.800986   .2010977    28.85   0.000     5.406842    6.195131
  ---------------------------+--------------------------------------------------------------
  a7 <-                      |
                 Key_reasons |   .4528287   .0450541    10.05   0.000     .3645243    .5411332
                       _cons |   6.904771   .2349012    29.39   0.000     6.444374    7.365169
  ---------------------------+--------------------------------------------------------------
  a8 <-                      |
                 Key_reasons |   .4605788   .0447059    10.30   0.000     .3729568    .5482007
                       _cons |   5.366319   .1870825    28.68   0.000     4.999644    5.732994
  ---------------------------+--------------------------------------------------------------
  a9 <-                      |
                 Key_reasons |   .4297889   .0459155     9.36   0.000     .3397961    .5197817
                       _cons |   4.481181   .1583105    28.31   0.000     4.170898    4.791464
  ---------------------------+--------------------------------------------------------------
  a10 <-                     |
                 Key_reasons |    .467134   .0445096    10.50   0.000     .3798968    .5543713
                       _cons |   3.779642   .1365856    27.67   0.000     3.511939    4.047345
  ---------------------------+--------------------------------------------------------------
```

```
  b1 <-                         |
                Main_challenges |    .427148   .0477722     8.94   0.000     .3335162    .5207798
                          _cons |   4.280471   .1521991    28.12   0.000     3.982167    4.578776
  ------------------------------+----------------------------------------------------------------
  b2 <-                         |
                Main_challenges |   .4308081   .0477086     9.03   0.000      .337301    .5243152
                          _cons |   5.170362    .178451    28.97   0.000     4.820604    5.520119
  ------------------------------+----------------------------------------------------------------
  b3 <-                         |
                Main_challenges |    .477716     .04598    10.39   0.000     .3875969    .5678352
                          _cons |    5.38875   .1895699    28.43   0.000     5.017199      5.7603
  ------------------------------+----------------------------------------------------------------
  b4 <-                         |
                Main_challenges |    .338708   .0528696     6.41   0.000     .2350854    .4423306
                          _cons |   4.680009   .1647984    28.40   0.000      4.35701    5.003008
  ------------------------------+----------------------------------------------------------------
  b5 <-                         |
                Main_challenges |   .5386805   .0441977    12.19   0.000     .4520546    .6253064
                          _cons |   3.421675   .1243797    27.51   0.000     3.177896    3.665455
  ------------------------------+----------------------------------------------------------------
  b6 <-                         |
                Main_challenges |   .5515109   .0443259    12.44   0.000     .4646338     .638388
                          _cons |   4.481842    .159926    28.02   0.000     4.168392    4.795291
  ------------------------------+----------------------------------------------------------------
  b7 <-                         |
                Main_challenges |   .5660525   .0422316    13.40   0.000     .4832801     .648825
                          _cons |   4.705469   .1657654    28.39   0.000     4.380575    5.030363
  ------------------------------+----------------------------------------------------------------
  b8 <-                         |
                Main_challenges |   .5034982   .0452832    11.12   0.000     .4147447    .5922516
                          _cons |   3.778362   .1367324    27.63   0.000     3.510371    4.046352
  ------------------------------+----------------------------------------------------------------
  b9 <-                         |
                Main_challenges |   .6063761   .0425912    14.24   0.000     .5228988    .6898534
                          _cons |   4.437429   .1573864    28.19   0.000     4.128958    4.745901
  ------------------------------+----------------------------------------------------------------
  b10 <-                        |
                Main_challenges |   .3376308   .0523969     6.44   0.000     .2349347    .4403269
                          _cons |   4.076331    .145693    27.98   0.000     3.790778    4.361884
```

```
--------------------------------+----------------------------------------------------------------
                      var(e.a1)|   .6999855    .046086                       .6152437    .7963994
                      var(e.a2)|   .5934357   .0465978                       .5087866    .6921683
                      var(e.a3)|   .5457611   .0488585                        .457931    .6504369
                      var(e.a4)|   .6506898   .0474982                       .5639479    .7507735
                      var(e.a5)|   .6203905   .0471678                       .5345016    .7200808
                      var(e.a6)|   .7022299   .0456368                       .6182457    .7976227
                      var(e.a7)|   .7949461   .0408036                       .7188638    .8790808
                      var(e.a8)|   .7878672   .0411812                       .7111503    .8728601
                      var(e.a9)|   .8152815    .039468                       .7414822     .896426
                     var(e.a10)|   .7817858   .0415839                       .7043874    .8676888
                      var(e.b1)|   .8175446   .0408116                       .7413439    .9015778
                      var(e.b2)|   .8144044   .0411065                       .7376941    .8990915
                      var(e.b3)|   .7717874   .0439308                       .6903139    .8628767
                      var(e.b4)|   .8852769   .0358147                       .8177921    .9583305
                      var(e.b5)|   .7098234   .0476169                       .6223711     .809564
                      var(e.b6)|   .6958357   .0488924                       .6063141    .7985751
                      var(e.b7)|   .6795845   .0478106                        .592051    .7800597
                      var(e.b8)|   .7464896      .0456                       .6622581    .8414343
                      var(e.b9)|    .632308   .0516526                       .5387594    .7421001
                     var(e.b10)|   .8860055   .0353816                       .8193032    .9581382
                var(Key_reasons)|         1          .                              .           .
           var(Main_challenges)|         1          .                              .           .
--------------------------------+----------------------------------------------------------------
cov (Key_reasons,Main_challenges)|   .4242337   .0557529     7.61   0.000       .31496
.5335073
-------------------------------------------------------------------------------------------------
LR test of model vs. saturated: chi2(157) =    311.33, Prob > chi2 = 0.0000
```

```
. estat gof,stats(all)

----------------------------------------------------------------------------
Fit statistic        |      Value   Description
---------------------+------------------------------------------------------
Likelihood ratio     |
        chi2_ms(157) |    311.330   model vs. saturated
            p > chi2 |      0.000
        chi2_bs(190) |   2275.505   baseline vs. saturated
            p > chi2 |      0.000
---------------------+------------------------------------------------------
Population error     |
               RMSEA |      0.047   Root mean squared error of approximation
 90% CI, lower bound |      0.039
         upper bound |      0.055
              pclose |      0.729   Probability RMSEA <= 0.05
---------------------+------------------------------------------------------
Information criteria |
                 AIC |  19625.881   Akaike's information criterion
                 BIC |  19924.876   Bayesian information criterion
---------------------+------------------------------------------------------
Baseline comparison  |
                 CFI |      0.926   Comparative fit index
                 TLI |      0.910   Tucker-Lewis index
---------------------+------------------------------------------------------
```

Appendix E-2: Confirmatory Factor Analysis – Planning/Design Phase

```
Endogenous variables

Measurement:  q27a1 q27a2 q27a3 q27a4 q27a5 q27a6 q27a7 q27a8 q27a9 q27a10 q27a11 q27a12
q27a13 q27a14 q27a15 q27a16

Exogenous variables
Latent:       PD
Estimation method  = mlmv
Log likelihood     = -3153.4188

 ( 1)  [q27a1]PD = 1
```

```
                     |                 OIM
        Standardized |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------------+----------------------------------------------------------------
Measurement          |
  q27a1 <-           |
                  PD |   .4217582   .0718154     5.87   0.000     .2810027    .5625138
               _cons |   4.381864   .2540677    17.25   0.000     3.883901    4.879828
  -------------------+----------------------------------------------------------------
  q27a2 <-           |
                  PD |   .5460123    .061889     8.82   0.000     .4247121    .6673125
               _cons |   3.675074   .2193019    16.76   0.000      3.24525    4.104898
  -------------------+----------------------------------------------------------------
  q27a3 <-           |
                  PD |   .2994599   .0776845     3.85   0.000     .1472011    .4517187
               _cons |   4.293767   .2499417    17.18   0.000      3.80389    4.783643
  -------------------+----------------------------------------------------------------
  q27a4 <-           |
                  PD |   .3454804   .0745183     4.64   0.000     .1994272    .4915337
               _cons |   3.595055   .2097505    17.14   0.000     3.183951    4.006158
  -------------------+----------------------------------------------------------------
  q27a5 <-           |
                  PD |   .4477133   .0683657     6.55   0.000      .313719    .5817075
               _cons |   3.946615   .2320774    17.01   0.000     3.491752    4.401478
  -------------------+----------------------------------------------------------------
  q27a6 <-           |
                  PD |   .4124598   .0708705     5.82   0.000     .2735561    .5513635
               _cons |   3.912764   .2324146    16.84   0.000      3.45724    4.368289
  -------------------+----------------------------------------------------------------
  q27a7 <-           |
                  PD |   .5551225   .0602612     9.21   0.000     .4370127    .6732323
               _cons |   3.214371    .193975    16.57   0.000     2.834187    3.594555
  -------------------+----------------------------------------------------------------
  q27a8 <-           |
                  PD |   .6392469   .0552355    11.57   0.000     .5309873    .7475065
               _cons |   3.961383   .2314829    17.11   0.000     3.507685    4.415081
  -------------------+----------------------------------------------------------------
  q27a9 <-           |
                  PD |   .4692529   .0675275     6.95   0.000     .3369014    .6016043
               _cons |   2.932557   .1808522    16.22   0.000     2.578093    3.287021
  -------------------+----------------------------------------------------------------
  q27a10 <-          |
                  PD |   .5151547   .0637727     8.08   0.000     .3901624    .6401469
               _cons |   3.232094   .1924811    16.79   0.000     2.854838    3.609351
  -------------------+----------------------------------------------------------------
  q27a11 <-          |
                  PD |   .6061806   .0557618    10.87   0.000     .4968895    .7154718
               _cons |   3.823709   .2252948    16.97   0.000     3.382139    4.265278
  -------------------+----------------------------------------------------------------
  q27a12 <-          |
                  PD |   .6977912   .0484907    14.39   0.000     .6027513    .7928312
               _cons |   2.639215   .1648648    16.01   0.000     2.316086    2.962344
  -------------------+----------------------------------------------------------------
  q27a13 <-          |
                  PD |   .5081165   .0645722     7.87   0.000     .3815573    .6346757
               _cons |   3.906533   .2280135    17.13   0.000     3.459635    4.353432
  -------------------+----------------------------------------------------------------
  q27a14 <-          |
                  PD |   .6689005   .0506753    13.20   0.000     .5695788    .7682222
               _cons |   3.306411   .1979876    16.70   0.000     2.918362    3.694459
  -------------------+----------------------------------------------------------------
  q27a15 <-          |
                  PD |   .6360417   .0542108    11.73   0.000     .5297904    .7422929
               _cons |   3.173364   .1913658    16.58   0.000     2.798294    3.548434
  -------------------+----------------------------------------------------------------
  q27a16 <-          |
                  PD |   .5838409   .0590918     9.88   0.000     .4680231    .6996586
               _cons |   3.314226   .1988899    16.66   0.000     2.924409    3.704043
```

```
var(e.q27a1)|     .82212   .0605774                      .7115656    .9498511
         var(e.q27a2)|   .7018706   .0675843                      .5811569     .847658
         var(e.q27a3)|   .9103238   .0465268                      .8235516    1.006238
         var(e.q27a4)|   .8806433   .0514893                      .7852938      .98757
         var(e.q27a5)|   .7995528   .0612164                      .6881392    .9290049
         var(e.q27a6)|   .8298769   .0584625                      .7228513    .9527489
         var(e.q27a7)|    .691839   .0669047                      .5723861    .8362209
         var(e.q27a8)|   .5913634   .0706183                      .4679585    .7473113
         var(e.q27a9)|   .7798017   .0633749                      .6649769     .914454
        var(e.q27a10)|   .7346157   .0657057                      .6164911    .8753738
        var(e.q27a11)|    .632545   .0676035                       .513002    .7799448
        var(e.q27a12)|   .5130874   .0676727                      .3962084    .6644449
        var(e.q27a13)|   .7418176   .0656204                      .6237359    .8822538
        var(e.q27a14)|   .5525722   .0677934                      .4344678    .7027816
        var(e.q27a15)|    .595451   .0689607                      .4745328     .747181
        var(e.q27a16)|   .6591299   .0690004                      .5368633    .8092416
              var(PD)|          1          .                             .           .
---------------------+----------------------------------------------------------------
LR test of model vs. saturated: chi2(89)  =    146.20, Prob > chi2 = 0.0001
```

```
.    estat gof,stats(all)

----------------------------------------------------------------------------
Fit statistic        |      Value   Description
---------------------+------------------------------------------------------
Likelihood ratio     |
         chi2_ms(89) |    146.195   model vs. saturated
            p > chi2 |      0.000
        chi2_bs(120) |    996.431   baseline vs. saturated
            p > chi2 |      0.000
---------------------+------------------------------------------------------
Population error     |
               RMSEA |      0.062   Root mean squared error of approximation
 90% CI, lower bound |      0.044
         upper bound |      0.080
              pclose |      0.130   Probability RMSEA <= 0.05
---------------------+------------------------------------------------------
Information criteria |
                 AIC |   6432.838   Akaike's information criterion
                 BIC |   6628.512   Bayesian information criterion
---------------------+------------------------------------------------------
Baseline comparison  |
                 CFI |      0.935   Comparative fit index
                 TLI |      0.912   Tucker-Lewis index
---------------------+------------------------------------------------------
```

Appendix E-3: Confirmatory Factor Analysis – Execution/Construction Phase

```
Endogenous variables

Measurement:  q28a1 q28a2 q28a3 q28a4 q28a5 q28a6 q28a7 q28a8 q28a9 q28a10
q28a11 q28a12 q28a13 q28a14 q28a15

Exogenous variables
Latent:       EC
Estimation method  = ml
Log likelihood     = -2454.1902
 ( 1)  [q28a1]EC = 1
```

Standardized	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
Measurement						
q28a1 <-						
EC	.5904071	.0591282	9.99	0.000	.4745179	.7062963
_cons	3.936322	.2391768	16.46	0.000	3.467544	4.4051
q28a2 <-						
EC	.4862053	.0690203	7.04	0.000	.350928	.6214826
_cons	4.033172	.2475806	16.29	0.000	3.547923	4.518421
q28a3 <-						
EC	.5334404	.0647687	8.24	0.000	.406496	.6603847
_cons	4.779344	.2887246	16.55	0.000	4.213454	5.345234
q28a4 <-						
EC	.6013538	.0591627	10.16	0.000	.4853971	.7173106
_cons	4.705957	.2846515	16.53	0.000	4.14805	5.263864
q28a5 <-						
EC	.6292804	.0562176	11.19	0.000	.5190959	.7394648
_cons	3.957135	.2434292	16.26	0.000	3.480023	4.434247
q28a6 <-						
EC	.4039518	.0755481	5.35	0.000	.2558802	.5520234
_cons	3.869699	.2368439	16.34	0.000	3.405493	4.333904
q28a7 <-						
EC	.6281747	.0565298	11.11	0.000	.5173784	.738971
_cons	4.04348	.2481449	16.29	0.000	3.557125	4.529835
q28a8 <-						
EC	.7405802	.0441209	16.79	0.000	.6541049	.8270555
_cons	4.135594	.2531876	16.33	0.000	3.639355	4.631833
q28a9 <-						
EC	.5930269	.059702	9.93	0.000	.4760131	.7100408
_cons	3.82607	.2362936	16.19	0.000	3.362943	4.289197
q28a10 <-						
EC	.6146604	.057557	10.68	0.000	.5018509	.72747
_cons	3.928825	.2418856	16.24	0.000	3.454738	4.402912
q28a11 <-						
EC	.6812991	.0505641	13.47	0.000	.5821952	.780403
_cons	3.11841	.1983523	15.72	0.000	2.729646	3.507173
q28a12 <-						
EC	.6229014	.0570332	10.92	0.000	.5111185	.7346844
_cons	4.032904	.2437208	16.55	0.000	3.55522	4.510588
q28a13 <-						
EC	.7309009	.0460656	15.87	0.000	.640614	.8211879
_cons	4.068024	.2494872	16.31	0.000	3.579038	4.55701
q28a14 <-						
EC	.5393214	.064689	8.34	0.000	.4125332	.6661096
_cons	3.975779	.2444466	16.26	0.000	3.496672	4.454886
q28a15 <-						
EC	.4785987	.0691317	6.92	0.000	.3431031	.6140943
_cons	4.66079	.2821471	16.52	0.000	4.107792	5.213788

```
          var(e.q28a1)|   .6514194   .0698195                      .5279934    .8036981
          var(e.q28a2)|   .7636044   .0671161                      .6427663    .9071597
          var(e.q28a3)|   .7154414   .0691005                      .5920539    .8645435
          var(e.q28a4)|   .6383736   .0711554                       .513094     .794242
          var(e.q28a5)|   .6040062   .0707533                         .4801    .7598907
          var(e.q28a6)|   .8368229   .0610356                      .7253527    .9654236
          var(e.q28a7)|   .6053965   .0710211                      .4810415    .7618988
          var(e.q28a8)|    .451541   .0653501                      .3400208    .5996375
          var(e.q28a9)|    .648319   .0708098                      .5233834    .8030777
         var(e.q28a10)|   .6221926    .070756                      .4978814    .7775418
         var(e.q28a11)|   .5358316   .0688986                      .4164651    .6894107
         var(e.q28a12)|   .6119938   .0710521                      .4874421     .768371
         var(e.q28a13)|   .4657838   .0673388                      .3508532    .6183629
         var(e.q28a14)|   .7091324   .0697764                      .5847522    .8599691
         var(e.q28a15)|   .7709433   .0661726                      .6515698    .9121871
               var(EC)|          1          .                             .           .
----------------------+----------------------------------------------------------------
LR test of model vs. saturated: chi2(81)  =    147.29, Prob > chi2 = 0.0000
```

```
. estat gof,stats(all)
----------------------------------------------------------------------------
Fit statistic        |      Value   Description
---------------------+------------------------------------------------------
Likelihood ratio     |
         chi2_ms(81) |    147.286   model vs. saturated
            p > chi2 |      0.000
        chi2_bs(105) |   1019.836   baseline vs. saturated
            p > chi2 |      0.000
---------------------+------------------------------------------------------
Population error     |
               RMSEA |      0.074   Root mean squared error of approximation
 90% CI, lower bound |      0.055
         upper bound |      0.093
              pclose |      0.022   Probability RMSEA <= 0.05
---------------------+------------------------------------------------------
Information criteria |
                 AIC |   5016.380   Akaike's information criterion
                 BIC |   5178.593   Bayesian information criterion
---------------------+------------------------------------------------------
Baseline comparison  |
                 CFI |      0.928   Comparative fit index
                 TLI |      0.906   Tucker-Lewis index
---------------------+------------------------------------------------------
```

Appendix E-4: Confirmatory Factor Analysis – Technical Factors

```
Endogenous variables

Measurement:  q29a1 q29a2 q29a3 q29a4 q29a5 q29a6 q29a7 q29a8

Exogenous variables

Latent:       Technical

Estimation method  = mlmv
Log likelihood     = -1554.3936

 ( 1)  [q29a1]Technical = 1
```

```
------------------------------------------------------------------------------------
                    |                 OIM
       Standardized |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------------+---------------------------------------------------------------
Measurement         |
  q29a1 <-          |
          Technical |   .7148006   .0451577    15.83   0.000     .6262932    .8033081
              _cons |   2.840017   .1757393    16.16   0.000     2.495574     3.18446
  ------------------+---------------------------------------------------------------
  q29a2 <-          |
          Technical |   .7838331   .0405487    19.33   0.000      .704359    .8633071
              _cons |   2.813617   .1730995    16.25   0.000     2.474348    3.152886
  ------------------+---------------------------------------------------------------
  q29a3 <-          |
          Technical |   .8116559   .0349931    23.19   0.000     .7430707    .8802412
              _cons |   2.935399   .1793639    16.37   0.000     2.583852    3.286945
  ------------------+---------------------------------------------------------------
  q29a4 <-          |
          Technical |   .7781428   .0378785    20.54   0.000     .7039023    .8523833
              _cons |   2.843334   .1756252    16.19   0.000     2.499115    3.187553
  ------------------+---------------------------------------------------------------
  q29a5 <-          |
          Technical |   .5291993   .0620135     8.53   0.000     .4076551    .6507435
              _cons |   3.041165   .1860579    16.35   0.000     2.676498    3.405832
  ------------------+---------------------------------------------------------------
  q29a6 <-          |
          Technical |   .5108415   .0627577     8.14   0.000     .3878388    .6338443
              _cons |   3.206337   .1952102    16.43   0.000     2.823732    3.588942
  ------------------+---------------------------------------------------------------
  q29a7 <-          |
          Technical |   .8030729   .0359905    22.31   0.000     .7325329     .873613
              _cons |   2.757467   .1713585    16.09   0.000     2.421611    3.093324
  ------------------+---------------------------------------------------------------
  q29a8 <-          |
          Technical |   .7610318   .0472622    16.10   0.000     .6683995     .853664
              _cons |   2.664247   .1672201    15.93   0.000     2.336502    2.991993
```

```
--------------------+---------------------------------------------------------------
       var(e.q29a1)|   .4890601   .0645575                      .3775729    .6334664
       var(e.q29a2)|   .3856057   .0635669                      .2791408    .5326765
       var(e.q29a3)|   .3412147   .0568047                      .2462189    .4728616
       var(e.q29a4)|   .3944938   .0589498                      .2943364    .5287331
       var(e.q29a5)|   .7199481    .065635                       .602144    .8607996
       var(e.q29a6)|   .7390409   .0641184                      .6234751    .8760278
       var(e.q29a7)|   .3550738    .057806                      .2580733    .4885334
       var(e.q29a8)|   .4208307   .0719361                      .3010262    .5883157
     var(Technical)|          1          .                             .           .
--------------------+---------------------------------------------------------------
LR test of model vs. saturated: chi2(14)  =     26.35, Prob > chi2 = 0.0234
```

```
. estat gof,stats(all)

----------------------------------------------------------------------------
Fit statistic        |      Value   Description
---------------------+------------------------------------------------------
Likelihood ratio     |
         chi2_ms(14) |     26.347   model vs. saturated
            p > chi2 |      0.023
         chi2_bs(28) |    769.852   baseline vs. saturated
            p > chi2 |      0.000
---------------------+------------------------------------------------------
Population error     |
               RMSEA |      0.073   Root mean squared error of approximation
 90% CI, lower bound |      0.026
         upper bound |      0.116
              pclose |      0.172   Probability RMSEA <= 0.05
---------------------+------------------------------------------------------
Information criteria |
                 AIC |   3168.787   Akaike's information criterion
                 BIC |   3261.966   Bayesian information criterion
---------------------+------------------------------------------------------
Baseline comparison  |
                 CFI |      0.983   Comparative fit index
                 TLI |      0.967   Tucker-Lewis index
---------------------+------------------------------------------------------
```

Appendix E-5: Confirmatory Factor Analysis – Multiple Stakeholders' Factors

```
Endogenous variables

Measurement:  q36a1 q36a2 q36a3 q36a4 q36a5 q36a6 q36a7 q36a8 q36a9 q36a10
q36a11 q36a12

Exogenous variables

Latent:       M_stake

Estimation method  = ml
Log likelihood     = -1478.4978

 ( 1)  [q36a1]M_stake = 1
```

Standardized	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
Measurement						
q36a1 <-						
M_stake	.6149758	.0531741	11.57	0.000	.5107566	.7191951
_cons	5.567258	.3189974	17.45	0.000	4.942035	6.192482
q36a2 <-						
M_stake	.7647868	.0428705	17.84	0.000	.6807622	.8488114
_cons	6.478838	.365108	17.74	0.000	5.76324	7.194436
q36a3 <-						
M_stake	.7169971	.0435728	16.46	0.000	.6315961	.8023981
_cons	6.306956	.359087	17.56	0.000	5.603159	7.010754
q36a4 <-						
M_stake	.773526	.0356774	21.68	0.000	.7035996	.8434523
_cons	6.038885	.3445704	17.53	0.000	5.363539	6.71423
q36a5 <-						
M_stake	.7145889	.0432669	16.52	0.000	.6297873	.7993904
_cons	5.782923	.3307408	17.48	0.000	5.134683	6.431163
q36a6 <-						
M_stake	.71775	.0426943	16.81	0.000	.6340707	.8014294
_cons	5.241083	.3001334	17.46	0.000	4.652832	5.829333
q36a7 <-						
M_stake	.757278	.0440795	17.18	0.000	.6708838	.8436723
_cons	5.911784	.3362473	17.58	0.000	5.252752	6.570817
q36a8 <-						
M_stake	.5909149	.0525664	11.24	0.000	.4878866	.6939433
_cons	6.567072	.3732012	17.60	0.000	5.835611	7.298533
q36a9 <-						
M_stake	.6641828	.0484324	13.71	0.000	.569257	.7591086
_cons	5.958825	.3402414	17.51	0.000	5.291964	6.625686
q36a10 <-						
M_stake	.6821596	.0455072	14.99	0.000	.592967	.7713521
_cons	5.215583	.2964419	17.59	0.000	4.634568	5.796599
q36a11 <-						
M_stake	.7112171	.0437046	16.27	0.000	.6255576	.7968766
_cons	5.341653	.3069828	17.40	0.000	4.739978	5.943328
q36a12 <-						
M_stake	.6912827	.0429682	16.09	0.000	.6070666	.7754989
_cons	6.041308	.3445893	17.53	0.000	5.365926	6.716691

```
----------------------+----------------------------------------------------------------
         var(e.q36a1)|   .6218047   .0654015                      .5059697    .7641587
         var(e.q36a2)|   .4151012   .0655736                      .3045717    .5657418
         var(e.q36a3)|   .4859152   .0624831                      .3776641    .6251945
         var(e.q36a4)|   .4016575   .0551947                      .3068217    .5258063
         var(e.q36a5)|   .4893628   .0618361                      .3820083    .6268867
         var(e.q36a6)|   .4848349   .0612877                      .3784373    .6211461
         var(e.q36a7)|     .42653   .0667609                      .3138475    .5796696
         var(e.q36a8)|   .6508195   .0621246                      .5397695    .7847166
         var(e.q36a9)|   .5588612    .064336                      .4459785     .700316
        var(e.q36a10)|   .5346583   .0620864                      .4258256    .6713065
        var(e.q36a11)|   .4941703    .062167                      .3861846    .6323512
        var(e.q36a12)|   .5221282   .0594064                      .4177627    .6525662
         var(M_stake)|          1          .                             .           .
----------------------+----------------------------------------------------------------
LR test of model vs. saturated: chi2(38)  =     74.41, Prob > chi2 = 0.0004
```

```
. estat gof,stats(all)

----------------------------------------------------------------------------
Fit statistic        |      Value   Description
---------------------+------------------------------------------------------
Likelihood ratio     |
         chi2_ms(38) |     74.411   model vs. saturated
            p > chi2 |      0.000
         chi2_bs(66) |   1228.987   baseline vs. saturated
            p > chi2 |      0.000
---------------------+------------------------------------------------------
Population error     |
               RMSEA |      0.077   Root mean squared error of approximation
 90% CI, lower bound |      0.051
         upper bound |      0.103
              pclose |      0.047   Probability RMSEA <= 0.05
---------------------+------------------------------------------------------
Information criteria |
                 AIC |   3060.996   Akaike's information criterion
                 BIC |   3221.551   Bayesian information criterion
---------------------+------------------------------------------------------
Baseline comparison  |
                 CFI |      0.969   Comparative fit index
                 TLI |      0.946   Tucker-Lewis index
---------------------+------------------------------------------------------
```

Appendix F: Structural Equation Modelling

Appendix F-1: Structural Equation Modelling - Project Performance Model

```
Endogenous variables

Measurement:  q27a11 q27a8 q27a12 q27a14 q27a15 q28a4 q28a5 q28a7 q28a8 q28a10 q28a11
q28a12 q28a13 q36a1 q36a2 q36a3
              q36a4 q36a5 q36a6 q36a7 q36a9 q36a10 q36a11 q36a12 q29a1 q29a2 q29a3 q29a4
q29a7 q29a8
Latent:       PD EC M_stake Technical

Exogenous variables

Latent:       PP

Estimation method  = mlmv
Log likelihood     = -5032.8968

 ( 1)  [q27a11]PD = 1
 ( 2)  [q28a4]EC = 1
 ( 3)  [q36a1]M_stake = 1
 ( 4)  [q29a1]Technical = 1
 ( 5)  [PD]PP = 1
```

```
---------------------------------------------------------------------------------------
                      |                 OIM
         Standardized |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------------+----------------------------------------------------------------
Structural            |
  PD <-               |
                   PP |   .7315382   .0865638     8.45   0.000     .5618763    .9012001
  --------------------+----------------------------------------------------------------
  EC <-               |
                   PP |   .8374865    .091002     9.20   0.000     .6591258    1.015847
  --------------------+----------------------------------------------------------------
  M_stake <-          |
                   PP |    .414396   .0885614     4.68   0.000     .2408189    .5879731
  --------------------+----------------------------------------------------------------
  Technical <-        |
                   PP |   .3499688   .0917254     3.82   0.000     .1701904    .5297473
----------------------+----------------------------------------------------------------
Measurement           |
  q27a11 <-           |
                   PD |   .6865036   .0593858    11.56   0.000     .5701096    .8028976
                _cons |   3.820647   .2253617    16.95   0.000     3.378947    4.262348
  --------------------+----------------------------------------------------------------
  q27a8 <-            |
                   PD |   .5700556   .0607618     9.38   0.000     .4509647    .6891466
                _cons |     3.9436   .2316701    17.02   0.000     3.489535    4.397665
  --------------------+----------------------------------------------------------------
  q27a12 <-           |
                   PD |   .6668125   .0532724    12.52   0.000     .5624005    .7712245
                _cons |    2.62707   .1650147    15.92   0.000     2.303647    2.950493
  --------------------+----------------------------------------------------------------
  q27a14 <-           |
                   PD |   .7691499     .05024    15.31   0.000     .6706813    .8676185
                _cons |   3.317544   .1985256    16.71   0.000     2.928441    3.706647
  --------------------+----------------------------------------------------------------
  q27a15 <-           |
                   PD |   .6073625   .0596279    10.19   0.000     .4904939    .7242311
                _cons |   3.150727   .1917943    16.43   0.000     2.774817    3.526637
  --------------------+----------------------------------------------------------------
  q28a4 <-            |
                   EC |   .6526254   .0558761    11.68   0.000     .5431102    .7621405
                _cons |     4.7077   .2715758    17.33   0.000     4.175422    5.239979
  --------------------+----------------------------------------------------------------
  q28a5 <-            |
                   EC |   .6141568   .0572827    10.72   0.000     .5018848    .7264287
                _cons |    3.98144    .233492    17.05   0.000     3.523804    4.439076
  --------------------+----------------------------------------------------------------
  q28a7 <-            |
                   EC |   .6216997   .0561324    11.08   0.000     .5116822    .7317171
                _cons |   4.022974   .2353213    17.10   0.000     3.561753    4.484196
  --------------------+----------------------------------------------------------------
  q28a8 <-            |
                   EC |   .7030646   .0481925    14.59   0.000      .608609    .7975203
                _cons |   4.135004   .2418593    17.10   0.000     3.660968    4.609039
  --------------------+----------------------------------------------------------------
  q28a10 <-           |
                   EC |   .5426957    .062995     8.61   0.000     .4192278    .6661636
                _cons |   3.854194    .229238    16.81   0.000     3.404896    4.303492
```

```
--------------------+----------------------------------------------------------------
q28a11 <-           |
                 EC |   .6853547   .0507594    13.50   0.000      .585868    .7848413
              _cons |   3.098503   .1879102    16.49   0.000     2.730206    3.466801
--------------------+----------------------------------------------------------------
q28a12 <-           |
                 EC |   .5338649   .0642609     8.31   0.000     .4079158    .6598139
              _cons |   3.867306   .2259776    17.11   0.000     3.424398    4.310214
--------------------+----------------------------------------------------------------
q28a13 <-           |
                 EC |   .7442051   .0437818    17.00   0.000     .6583944    .8300158
              _cons |    4.06258   .2384127    17.04   0.000     3.595299     4.52986
--------------------+----------------------------------------------------------------
q36a1 <-            |
            M_stake |   .6441639   .0511463    12.59   0.000      .543919    .7444087
              _cons |   5.598194   .3171118    17.65   0.000     4.976666    6.219722
--------------------+----------------------------------------------------------------
q36a2 <-            |
            M_stake |   .7708664   .0390248    19.75   0.000     .6943792    .8473536
              _cons |   6.467146   .3633221    17.80   0.000     5.755048    7.179244
--------------------+----------------------------------------------------------------
q36a3 <-            |
            M_stake |   .7832838   .0350433    22.35   0.000     .7146003    .8519674
              _cons |   6.123724   .3459725    17.70   0.000     5.445631    6.801818
--------------------+----------------------------------------------------------------
q36a4 <-            |
            M_stake |   .7882448   .0342392    23.02   0.000     .7211372    .8553525
              _cons |   6.024384   .3408753    17.67   0.000     5.356281    6.692487
--------------------+----------------------------------------------------------------
q36a5 <-            |
            M_stake |   .7171368   .0428245    16.75   0.000     .6332022    .8010713
              _cons |   5.751987   .3260663    17.64   0.000     5.112909    6.391065
--------------------+----------------------------------------------------------------
q36a6 <-            |
            M_stake |   .6883336     .04465    15.42   0.000     .6008213     .775846
              _cons |   5.207664   .2965287    17.56   0.000     4.626478     5.78885
--------------------+----------------------------------------------------------------
q36a7 <-            |
            M_stake |   .6275458   .0512763    12.24   0.000     .5270462    .7280455
              _cons |   5.583703   .3170782    17.61   0.000     4.962241    6.205165
--------------------+----------------------------------------------------------------
q36a9 <-            |
            M_stake |   .6529139   .0512674    12.74   0.000     .5524317     .753396
              _cons |    5.64442   .3203193    17.62   0.000     5.016605    6.272234
--------------------+----------------------------------------------------------------
q36a10 <-           |
            M_stake |   .6567236   .0510843    12.86   0.000     .5566002    .7568469
              _cons |   5.158813   .2946274    17.51   0.000     4.581354    5.736272
--------------------+----------------------------------------------------------------
q36a11 <-           |
            M_stake |   .6540004   .0500805    13.06   0.000     .5558445    .7521564
              _cons |   5.409333   .3062942    17.66   0.000     4.809007    6.009658
--------------------+----------------------------------------------------------------
q36a12 <-           |
            M_stake |    .654176     .04823    13.56   0.000      .559647    .7487051
              _cons |   6.066959   .3429285    17.69   0.000     5.394832    6.739087
--------------------+----------------------------------------------------------------
q29a1 <-            |
          Technical |   .7664203   .0435955    17.58   0.000     .6809746     .851866
              _cons |   2.832352   .1756322    16.13   0.000     2.488119    3.176585
--------------------+----------------------------------------------------------------
q29a2 <-            |
          Technical |   .8282251   .0367329    22.55   0.000     .7562299    .9002202
              _cons |   2.801563   .1728952    16.20   0.000     2.462695    3.140431
--------------------+----------------------------------------------------------------
q29a3 <-            |
          Technical |   .8538635    .034106    25.04   0.000     .7870171      .92071
              _cons |   2.935399   .1793639    16.37   0.000     2.583852    3.286945
--------------------+----------------------------------------------------------------
q29a4 <-            |
          Technical |   .6637994   .0518519    12.80   0.000     .5621716    .7654272
              _cons |   2.843056   .1756868    16.18   0.000     2.498717    3.187396
--------------------+----------------------------------------------------------------
q29a7 <-            |
          Technical |    .724796   .0452359    16.02   0.000     .6361353    .8134567
              _cons |   2.755325   .1713402    16.08   0.000     2.419505    3.091146
--------------------+----------------------------------------------------------------
q29a8 <-            |
          Technical |   .6102836   .0571632    10.68   0.000     .4982457    .7223216
              _cons |   2.649259   .1671325    15.85   0.000     2.321685    2.976832
--------------------+----------------------------------------------------------------
```

```
----------------------+----------------------------------------------------------------
        var(e.q27a11)|   .5287128   .0815371                      .3907951    .7153039
         var(e.q27a8)|   .6750366   .0692752                      .5520434    .8254321
        var(e.q27a12)|   .5553611   .0710454                      .4321994    .7136195
        var(e.q27a14)|   .4084085   .0772842                      .2818511     .591793
        var(e.q27a15)|   .6311108   .0724315                      .5039816    .7903084
         var(e.q28a4)|   .5740801   .0729323                      .4475424    .7363951
         var(e.q28a5)|   .6228115   .0703611                      .4991069    .7771765
         var(e.q28a7)|   .6134895   .0697949                      .4908722    .7667361
         var(e.q28a8)|   .5057001   .0677649                       .388893    .6575911
        var(e.q28a10)|   .7054813   .0683742                      .5834294    .8530662
        var(e.q28a11)|    .530289   .0695764                      .4100445    .6857949
        var(e.q28a12)|   .7149883   .0686133                      .5923987    .8629464
        var(e.q28a13)|   .4461588   .0651652                      .3350922    .5940385
         var(e.q36a1)|   .5850529   .0658932                      .4691657     .729565
         var(e.q36a2)|    .405765   .0601658                      .3034315     .542611
         var(e.q36a3)|   .3864664   .0548976                      .2925488    .5105345
         var(e.q36a4)|   .3786701   .0539778                      .2863689    .5007214
         var(e.q36a5)|   .4857148   .0614221                      .3790887    .6223316
         var(e.q36a6)|   .5261968   .0614682                      .4185182    .6615796
         var(e.q36a7)|   .6061862   .0643564                      .4923085    .7464055
         var(e.q36a9)|   .5737035   .0669463                      .4564146    .7211332
        var(e.q36a10)|   .5687142   .0670965                      .4513048    .7166683
        var(e.q36a11)|   .5722834   .0655053                      .4572777    .7162132
        var(e.q36a12)|   .5720537   .0631018                      .4608323    .7101183
         var(e.q29a1)|   .4125999    .066825                      .3003778    .5667486
         var(e.q29a2)|   .3140432   .0608462                      .2148168    .4591035
         var(e.q29a3)|   .2709171   .0582437                       .177762    .4128893
         var(e.q29a4)|   .5593703   .0688385                      .4394879    .7119539
         var(e.q29a7)|   .4746708   .0655736                      .3620787    .6222746
         var(e.q29a8)|   .6275539   .0697716                      .5046778    .7803471
            var(e.PD)|   .4648519   .1266495                      .2725233    .7929129
            var(e.EC)|   .2986164   .1524259                       .109806    .8120847
       var(e.M_stake)|    .828276    .073399                      .6962168    .9853842
     var(e.Technical)|   .8775218   .0642021                      .7602939    1.012825
              var(PP)|          1          .                             .           .
----------------------+----------------------------------------------------------------
LR test of model vs. saturated: chi2(380) =    592.40, Prob > chi2 = 0.0000
```

```
. estat gof,stats(all)

----------------------------------------------------------------------------
Fit statistic        |      Value   Description
---------------------+------------------------------------------------------
Likelihood ratio     |
        chi2_ms(380) |    592.396   model vs. saturated
            p > chi2 |      0.000
        chi2_bs(435) |   3009.147   baseline vs. saturated
            p > chi2 |      0.000
---------------------+------------------------------------------------------
Population error     |
               RMSEA |      0.058   Root mean squared error of approximation
 90% CI, lower bound |      0.049
         upper bound |      0.067
              pclose |      0.071   Probability RMSEA <= 0.05
---------------------+------------------------------------------------------
Information criteria |
                 AIC |  10295.794   Akaike's information criterion
                 BIC |  10652.977   Bayesian information criterion
---------------------+------------------------------------------------------
Baseline comparison  |
                 CFI |      0.917   Comparative fit index
                 TLI |      0.906   Tucker-Lewis index
---------------------+------------------------------------------------------
```

Appendix G: Heritage Legislation Summary

Heritage Legislation Table Summary

KEY HERITAGE LEGISLATION AND ESTABLISHMENT DATE OF NATIONAL TRUSTS - 1945-2011

Jurisdiction	Heritage legislation	Local Heritage Protection (Places and Areas) – via Planning Legislation	Archaeology/ Indigenous heritage	National Trusts
ACT	ACT Heritage Act, 2004 – recently reviewed and currently being considered for amendment Objects of the Act: (a) to establish a system for the recognition, registration and conservation of natural and cultural heritage places and objects, including Aboriginal places and objects; (b) to establish the heritage council; (c) to provide for heritage agreements to encourage the conservation of heritage places and objects; (d) to establish enforcement and offence provisions to provide greater protection for heritage places and objects; (e) to provide a system integrated with land planning and development (Planning and Development Act 2007) to consider development applications having regard to the heritage significance of places and heritage guidelines. Heritage Act 2004 http://www.legislation.act.gov.au/a/2004-57/default.asp	No local heritage legislation - Territory level legislation only	ACT Heritage Act, 2004	1976

Jurisdiction	Heritage legislation	Local Heritage Protection (Places and Areas) – via Planning Legislation	Archaeology/ Indigenous heritage	National Trusts
Commonwealth	Environment Protection and Biodiversity Conservation 1999 (protects the heritage values of Commonwealth land, protects heritage from Commonwealth actions) Australian Heritage Council Act 2003 Protection of Movable Cultural Heritage Act 1986 (Repealed in 2004. Other repealed legislation includes the World Heritage Properties Conservation Act 1983, used in the Franklin Dam case) Historic Shipwrecks Act 1976 Australian Heritage Commission Act, 1975 – repealed	Native Title Act 1993 (enables native title holders & claimants to negotiate protection of sacred/traditionally significant sites) Aboriginal Land Rights (Northern Territory) Act 1976 (protects all sacred sites in NT and gives the NT Government the ability to legislate in this area) Protection of Movable Cultural Heritage Act 1986 (protects certain items of Indigenous heritage from being exported) Aboriginal and Torres Strait Islanders Heritage Protection Act 1984 (last resort, time-limited protection of sacred/traditionally significant sites from specific threats)	Environment Protection and Biodiversity Conservation 1999 (protects the Indigenous heritage values of nationally significant places) Aboriginal and Torres Strait Islanders Heritage Protection Act 1984	
New South Wales	NSW Heritage Act 1977-major amendments in 1996, 2008 and 2011. Established the NSW Heritage Council and provides for the listing of items of state heritage significance. It also provides for Heritage Council approval for any re-development or adaptive re-reuse of any listed items. The Heritage Act prevents the Heritage Council from approving the whole demolition or partial demolition which would affect the heritage significance of the item. Historic Houses Act, 1980 National Trust Act 1990- major amendments 1995, 2000, 2001 and 2007.	Environmental Planning and Assessment Act 1979. Allows for the listing of local heritage items (including conservation areas and natural areas) in the heritage schedules of local planning instruments. Items of heritage significance can also be listed in State Environmental Planning Policies where they cover geographic areas.	National Parks and Wildlife Act, 1974	1945

Jurisdiction	Heritage legislation	Local Heritage Protection (Places and Areas) – via Planning Legislation	Archaeology/ Indigenous heritage	National Trusts
Northern Territory	Heritage Conservation Act, 1991 Soon to be superseded by the Heritage Act Lists State Heritage Register items, objects and Areas	No protection provided at the local level via Planning Schemes	Aboriginal Sacred Sites Act, 1989	1976
Queensland	Queensland Heritage Act, 1992 QH Act establishes registers and requires development of listed places to be regulated. **State-level heritage** Queensland Heritage register is established. Queensland Heritage Council (QHC) decides which places to enter. QHC provides recommendations to the State about development it is proposing on listed places. **Local Heritage** Local heritage registers are established under Heritage Act (unless the LGA is exempt – 14 LGAs listed in schedule 1 Heritage Reg). Local government decides about local heritage places. A code in Heritage regulation is used to assess development on local heritage places.	Sustainable Planning Act 2009 Department of Environment and Heritage Protection (EHP) assess development on State listed places as a concurrence agency under the SP Act. Development adjoining state registered places is referable to EHP for advice. Protection of cultural heritage is a core matter for planning schemes. Provisions to protect heritage areas and heritage places may be included in local planning schemes by local government. Local government may assess heritage against a code in its planning scheme rather than the QH Regulation. Some local planning schemes contain heritage areas and character areas. Heritage policy is included in 7 regional plans.	Aboriginal Cultural Heritage Act 2003 Torres Strait Islander Cultural Heritage Act 2003	1963
South Australia	South Australian Heritage Act 1978, updated 1993 - Heritage Act 1993 and revised 2005 – Heritage Places Act 1993 Establishes SA Heritage Council and provides for the listing of State Heritage Places	Development Act 1993 Allows for listing of Local Heritage Places and creation of State Heritage Areas and Historic Conservation Areas (applied over existing zones) in Development Plans via Development Plan Amendments (DPA process).	Aboriginal and Historic Relics Preservation Act 1967 Aboriginal Heritage Act, 1988	1955

Jurisdiction	Heritage legislation	Local Heritage Protection (Places and Areas) – via Planning Legislation	Archaeology/ Indigenous heritage	National Trusts
Tasmania	Historic Cultural Heritage Act 1995, which is currently proposed to be amended by the Historic Cultural Heritage Amendment Bill 2012	Heritage Schedules (soon to be Historic Heritage Codes) in Planning Schemes, linked to provisions in the Land Use Planning and Approvals Act 1993 Schedules can provide protection for local places, precincts, significant trees and areas of high archaeological sensitivity.	Aboriginal Relics Act 1975	1960
Victoria	Historic Buildings Preservation Act 1974 (repealed) Historic Buildings Act 1981 (repealed) Heritage Act 1995 -creates the Victorian Heritage Register for places, shipwrecks and objects and the Heritage Inventory for known archaeological sites. Heritage Rivers Act 1992 – provides for the protection of rivers of cultural heritage value.	Town and Country Planning Act 1944 (repealed) Town and Country Planning Act 1961 (and amended in 1972 to create area heritage controls – the 'Maldon Amendment') (repealed) Planning and Environment Act 1987 – established the Victorian Planning Provisions in the mid 1990s, which included the heritage overlay control for individual properties and heritage areas.	Archaeology and Aboriginal Relics Preservation Act 1972 (repealed) Historic Shipwrecks Act 1981 (repealed) Aboriginal Heritage Act 2006 - creates the Aboriginal Heritage Council and Registered Aboriginal Parties with responsibility for identifying and managing aboriginal cultural heritage and establishes an aboriginal cultural heritage register.	1956

Jurisdiction	Heritage legislation	Local Heritage Protection (Places and Areas) – via Planning Legislation	Archaeology/ Indigenous heritage	National Trusts
Western Australia	Heritage of Western Australia Act, 1990 Establishes the Heritage Council of WA Establishes the State Register of Heritage Places – mostly individual places, but can be a precinct. Heritage Council provides statutory advice to decision-making authorities on development proposals. Requires local government authorities to establish an inventory of local heritage places, commonly referred to as a Municipal Heritage Inventories –MHI's to not confer statutory protection for places included in them.	Planning and Development Act 2005 Allows local government authorities to establish a Heritage List attached to the local planning scheme. Also refer to State Planning Policy 3.5 Historic Heritage Conservation.	Aboriginal Heritage Act 1972	1959

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May 2012

New Futures for Heritage Buildings: Responsible Adaption, Additions and Reuse. Australian Institute of Architects

Appendix H: Survey results - Additional

Q1: Other experienced heritage plans, assesments and reports?

	Responses
2	Assessment of impact on heritage values
6	strata title plans
9	N/A
22	Heritage Project Plan related with Architects Plan of Work
31	not applicable
66	transport impact assessment
73	No
81	None
98	n/a
168	safety in design report
187	n/a
222	Services investigation report
234	CONSTRUCTION DOCUMENTATION
236	Public access risk assessment (industrial heritage site)
238	Heritage Interpretation Plan and implementation
244	Heritage assessment at planning permit stage of approval
251	Wrote World Heritage nomination for Sydney Opera House as the NSW Heritage Office's Project Manager of the nomination process
259	n/a
260	Architectural documentation
263	Heritage Management Strategy
267	Post-construction rectification reports
268	Archaeological Excavation Report
279	architectural documentation
287	design and documentation
290	Engineering Heritage Recognition Nomination (EHA Program)
293	Bill of quantities
301	The work structure in Germany is slightly different from what it is in Australia. We had beginning 1970 already very strict guidelines, at the City where I was involved in Heritage building, we had to follow. There was a strict procedure to get a building permit equivalent to DA and BA in QLD.
303	these were done for the project for me by others
311	These were done by consultants
315	Paint Test Analysis & Adaptive Reuse Study.
325	Heritage interpretation strategy plan, negotiation with Aboriginal Elders, changing of the boundary
328	Drawings
330	World Heritage Management Plan
331	None
344	I assessed the heritage consultant's work
412	NA
417	dilapidation report; photographic record; paint colour analysis report; lead, PCD and asbestos surveys and reports;
434	No

Q: If there was a contingency amount allowed in the budget, what was the use of contingency?

	Responses
9	To cover Latent Conditions
10	Contingency amount is paramount to every project. It is meant to cover any unexpected expenses required along the project development. Items which are not identified or reported from the dilapidation survey.
11	to cover cost of works expected but not quantifiable
16	Basic construction
22	To cover unforeseen issues and work
26	Unforseen rectification works i.e. termite damage
81	unexpected/unknown expenditure
90	About 25%
97	unknowns were expected as high level access was to reinstate a removed stone with fibreglass pediment
130	Repair, refurbishment and re-use of existing heritage materials and fittings.
139	construction
164	Unforeseen costs associated with construction
219	latent site conditions
220	Unforseen heritage and archaeology costs
221	$15,000
222	for additional work that may have been required that was unknown in initial investigative stage.
231	additional works due to unforseen latent conditions
233	not known
234	For works unable to be identified prior to erection of scaffolds
236	Barriers, signage and protection measures eg. decontamination, asbestos and lead (Pb) surveys
238	In case of construction overrun
242	Unforeseen works discovered during the selective demolition of extraneous fabric
243	$50,000
246	Structural issues that was unknown prior to works.
247	The contingency was designed to meet unexpected costs - such as removing cladding and finding pest infestations and requirements for replacement of timber members
248	Allowance for unexpected costs with regards to heritage materials and trades.
253	Unforeseen repairs/reconstruction
256	Due to funding constraints there was little to no amount allowed for contingency. Basically works get reduced if one element is over budget.
257	Unknown
258	To allow for unforseen damage/conservation works not apparent on the fabric surfaces
261	yes - unforeseen works
262	Nil
263	Latent conditions
266	building conservation works and interpretation fit out
267	Repair of sandstone window frames
268	not really
274	Actual costs greater than estimated costs
276	No contingency. Project was a finite funding assisted budget. The scope was varied to cover any unanticipated works.
279	To address previously unidentified damage exposed during 'opening up' works
280	To allow for rectification of unknowns uncovered by demolition of later additions. Also to cover extras requested by client.

283	Design and construction contingency allowances
284	For unknown conditions discovered after work started
287	This job has many parts and is ongoing It is managed within an overall budget per year so it one component is above budget then work on another component is brought in under budget or work is deferred. For reports then they have a fixed fee agreed to. For building work there are inevitable extras that occur with heritage and non-heritage sites.
291	To cover the unforeseen costs
293	The contingency was expended on contingency items & on items with inadequate budget allowances. The funds from work completed under budget were reallocated back into the contingency fund.
294	NA
301	In Heritage building there must be always a higher contingency than at "normal" construction projects. Often the problems which lead to additional cost hidden behind false walls, plaster, foundation and structural conditions.
302	Allowance for management of additional costs arising from latent defects and other variations.
304	Additional remediation works beyond that original anticipated
305	any project related scope amendments and also construction variations
306	There was, but it was managed by the Client.
307	latent asbestos
308	Termite infestation Lead paint Contaminated soil
310	dealing with latent conditions
311	Asbestos removal, latent conditions
314	Overruns
318	Not privy to details
321	No Contingency
324	YEs, contingency was for unforeseen items during the works.
325	we used the contingency to implement heritage interpretation scheme
328	We advised client 10%
331	n/a
336	Unforeseen conditions and additional client nominated scope
338	Approx. 50% of contingency used
344	n/a
351	delays incurred due to unforeseeable circumstances through demolition or rectifcation works
364	n/a
377	As the Project Manager for the Construction company, I'm unsure what contingencies were allowed but knew there is a contingency through discussions with the Client.
381	Out of my scope
404	(1) Latent Conditions; (2) In the event that substantial amount of additional structural upgrade works are required; (3) Provisional Sum allowances not adequate.
407	damage to heritage components
412	NA
416	Mainly used for additional structural timber works required subsequent to demolition phase that uncovered previously unknown structural damage.
433	no visibility of contingencies
434	The Contingency is for instructed variation for design and construction works
436	For works uncovered that were not apparent at the outset
437	Mainly for latent conditions / unknowns and extension of time claims - some scope had to be cut to accommodate these latent conditions
441	Not used

Q: The other items that required contingency expenditure?

	Responses
4	unknown material
16	structural
22	issues with funding bodies
98	asbestos removal
187	Not in my fled of expertise
220	tree preservation
222	additional specialised engineering to protect building damage
233	the heritage consultant is not privy to this information
236	lead, explosives magazines, unbonded asbestos
243	asbestos
257	High cost of delivery of sandstone for repair
279	procurement of specialised materials
280	Extras by client.
285	Original budget unrealistic to begin with.
293	Unstable structure.
301	Often craftsmanship, because it is not always easy to find a person who is able to replicate the old style and technics, if required.
306	plus additional Client requested scope
308	Hazardous material
336	Client added scope
338	mistakes by contractors that couldn't be claimed
344	INCOMPLETE CMP
416	timber rot
417	Design issues, rusted roof sheeting

Q: Other appropriate percentage for contingency for projects?

#	Responses
90	20-30% as an average, however a greater amount may be required depending on how much invasive investigations have been carried out.
233	not qualified to answer
244	Would depend on the quality of information/documentation known at tender stage
251	Don't know
270	Projects vary so attracting a % is too difficult to measure
274	Too difficult to generalise
291	40%
293	Impossible to answer as mut be project specific and a function of the precontract understanding of the quantity of work required.
303	at least 30 % for the heritage part separate to overall
324	really depends on the project and the level of risk.
325	in heritage buildings at least 30% for unforeseen discoveries during survey of the building, which might require design/work redesign and adjustments
344	10-20% depends on nature of significance
360	depends on the building and how well you can determine its condition; also on what scope of work is intended
364	as with any project the contingency should be relative to that project's specifics
367	50%
433	Dependent on extent of heritage component 30%+

Q: Other suggestion for better maintenance?

	Responses
7	putting air-conditioning into the building
32	Before purchasing a heritage building council to provide you with information about the challenges and impediment in renovating a heritage building (e.g. cost, length of time to obtain approval, changes need to be in sympathy with the era of the house, etc.)
43	What quantum of heritage is required to maintain the character of the building, while modernising it and ensuring that it has better sustainability and essential services such as computer networks?
68	I don't necessarily believe buildings need to be retained, but mediocre architectural design kills all aesthetics. heritage colours are also silly. Quality is key. A really excellent rejuvenation project is self evident, it will leave you a-gasp.
155	Current construction methods and materials are unlikely to survive (or be able to be sustained) into the future where they will be valued as heritage (unlike stone based construction of previous eras).
273	Good heritage architect 'saved' us from Council's Uniform Building Regulations, e.g. fire system prevented need for 2 hour fire-rated ceilings (destroying cornices) and enclosed stair in heritage B & B.
409	Heritage architects and conservationists seem to know only one standard - their notion of perfection. This often results in restoration that makes old appear new which is entirely the wrong approach. Many more buildings would be saved if there was an appreciation of maintenance of "faded elegance" rather than insisting on "new for old".