Business School

Improving the Management of Change Requests in Construction of Large Building Projects in Saudi Arabia

Being a thesis submitted for the degree of Doctor of Philosophy in the University of Hull

BY

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Abstract

One of the challenges faced by project managers is frequent change requests, which usually lead to changes in the scope of a project. Change has been said to be inevitable, and without change everything stagnates. However, ad hoc changes can be adverse, and in some instances cause whole projects to stagnate, or fail. Therefore, studies on the causes and effects of change requests are critical. The latest official reports about government projects in Saudi Arabia suggested that 62% experienced change in the contract, and one project had cancelled 80% of the items of the contract, which changed the project completely. The extent of this problem posed a need to study the cause of stalled projects in the Kingdom. Responding to these concerns, the aim of this research is to explore the conceptualization of change requests, and how they occur, the causes and effects of change requests and the current methods of handling change requests and how effective they are in large building projects in Riyadh, Saudi Arabia. Based on the exploration the research provides a comprehensive analysis of issues surrounding change requests- including cultural impacts- from the perspectives of multiple stakeholder groups, in a distinctive, under- researched context. This in turn leads to development of a conceptual framework for understanding change requests and diagnosing related problems.

A qualitative approach and case study strategy was applied to study this phenomenon and to explore whether and how culture affects change requests in Saudi Arabia. Data collection was conducted by two means: Secondary data were collected from documents reporting change requests (n= 6) and change orders (n= 7) in large construction companies. Semi-structured interviews were conducted with 40 stakeholders of four large government construction projects: 4 owner representatives, 15 consultants, 4 project managers and 17 department managers.

The findings revealed inconsistent and confused conceptualizations of change requests, and failure to distinguish between change requests and change orders. None of the projects had standardised, formally documented change request procedures,

but relied on informal communications. A variety of causes for change requests, beyond those previously documented in the literature were identified, including internal causes arising from one or other of the project stakeholders, and external causes outside the stakeholders' control. Direct effects included time and cost overruns, while potential (indirect) effects included lowered morale and productivity, and loss of reputation. However, there could also be positive effects, such as improved quality and client satisfaction. Change requests are currently handled ad hoc as they occur. The findings also revealed the impact of Saudi culture (notably power distance and uncertainty avoidance) on project management generally, and change requests specifically.

It is concluded that change request frequency could be reduced and harmful impacts minimized by engagement of all stakeholders in the project design stage, use of a standard contract such as FIDIC to clarify parties' responsibilities and protect their rights, and use of formal documented change request procedures. However, for Saudi Arabia and other developing countries, which may be using non-standard contracts and ad hoc change request procedures, the framework proposal in this study can be used to aid consistency and clarity among stakeholders, diagnose bottlenecks and identify appropriate solutions to minimize change requests and mitigate harmful impacts on projects.

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Chapter 1: Introduction

1.1 Introduction

A project can be defined as " a temporary endeavour to create a unique product, service or result" (PMI, 2013:3). Another definition is: "A project is a complex, non-routine, one-time effort limited by time, budget and resources, and performance specifications designed to meet customer needs" (Larson & Gray, 2011:16). Project management (PM) is defined as **"**the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements." (PMI, 2013:554). In this era, project management can be deemed to be one of the greatest foundational developments of effective project execution (PMI, 2008). However, although it may be deemed one of the greatest developments in decades, project management has experienced its share of setbacks and challenges. Among the challenges this field encounters is unexpected change to the project requirements, whether design, specifications or scope (Cleland, 2004). The aim of this current project is to delve into the challenges brought about by change requests for project management, and how those challenges can be handled, with specific reference to large construction projects in Saudi Arabia.

Responding to change requests, the project manager (PM) and his/her team must first be able to identify the meaning of the change request, then the process of change request, then the ultimate source or cause of that change request. Upon identifying the nature of the change request, the PM must then consider the possible advantages and benefits of this change request for the project. This is because, contrary to many people's belief (Hanna et al., 1999) that change requests simply bring negative impacts to a project, change requests may also be a good source of benefits and opportunities for the project. While change is widely accepted as part of the project management process, the generation of change requests remains nerve-racking for any project manager (Arain & Pheng, 2005).

There is a need to accurately determine the causes, effects, and handling of change requests in Saudi Arabia, which has suffered from the delay and failure of most of its

projects, due to frequent change requests. There are various government reports in this regard, which have highlighted the problem; for example,

- According to the General Auditing Bureau, frequent change requests have caused failure and delay to some projects in Saudi Arabia. For example, in one project it was noticed that changes in the contract exceeded 62%, resulting in extended contract periods and increased financial and supervision costs, in addition to delayed benefit from the project. In another project, 80% of the items of the contract were cancelled, which changed the project completely (Alshahrany, 2012).
- Government agencies in Saudi Arabia face a lack of talent with up-to-date knowledge and technical expertise, and an insufficient number of qualified engineers. This forces them to form contracts with advisory offices and foreign engineers who depend on studies which are not appropriate for, or typical of Saudi Arabia (Alshahrany, 2012).

Clarifying the situation is important because of the potential implications for improving project management in the future. Therefore, this research will explore how project managers handle change requests, specifically in Saudi Arabia, where cultural and other factors might result in differences compared to the Western context, where most project management discourse and standards originated.

1.2 Aims & Objectives

This research seeks firstly to explore and identify what a change request is, and how it occurs. Inconsistencies and ambiguities in conceptualization of change requests, both in the literature and in company practice are analysed and suggestions made to reduce conceptual confusion by the proposal of a modified definition building on that of the PMI (2008); see section 2.5.1. Examples of specific change requests in selected projects are analysed in order to shed light on the roles of various parties-owners, consultants and contractors - in generating, processing, and approving change requests and the formal and informal processes involved. In this way it fills a research gap, given that previous studies have considered one or two of these stakeholders, but not all three (see sections 2.10 and 2.4). After that the research will determine what are the causes and effects of change requests in large building

projects. Internal causes emanating from various project elements, including the tendering process, the contract, stakeholder interests, design and specifications, as well as external causes such as climate, technological change and legislation are investigated as a first step towards understanding how change requests can be avoided or negative impacts mitigated. Such insights are intended to inform property clients, suppliers, government and other stakeholders of the implications of their change requests, for the project and ultimately the national economy.

Finally, it will attempt to derive implications for understanding, analysis and diagnosis of change requests issues in practice. All these objectives will be addressed with reference to the Kingdom of Saudi Arabia and its culture. Saudi Arabia offers a distinctive research context which has been little considered in previous PM research and it is of particular interest in this study to explore how cultural dimensions identified by Hofstede (1984) and discussed in section 2.3 influence the application of PM, with implications for the incidence and impacts of change requests.

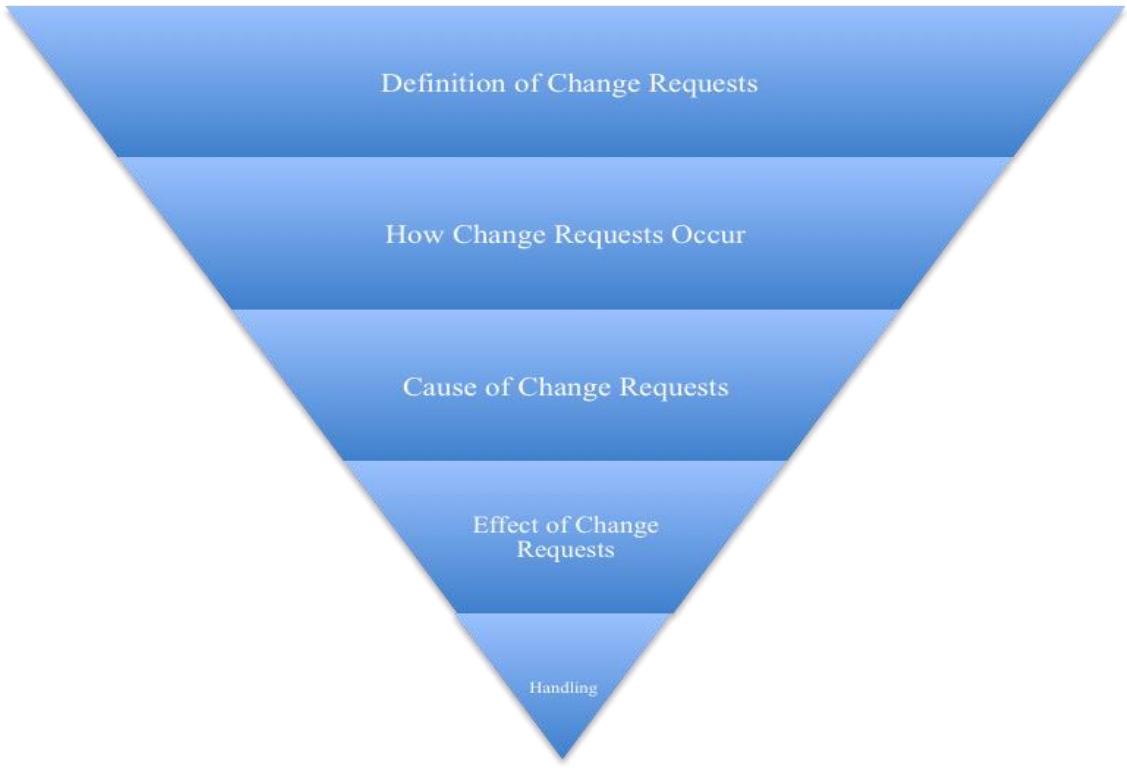


Figure 1 Objectives' Structure

The main objectives of this research are as follows:

1. To identify how project managers in Saudi Arabia conceptualize change requests**.**
2. To identify how change requests are used and processed in large building

projects in Saudi Arabia.

3. To determine the internal and external causes of change requests in large building projects in Saudi Arabia.
4. To identify the positive and negative, direct and potential effects of change requests in large building projects in Saudi Arabia.
5. To identify what methods stakeholders currently use or envisage to handle change requests in Saudi Arabia, and how effective they find them.
6. To derive implications for understanding, analysis and diagnosis of change requests issues in practice.

All these objectives will answer the research question, which are addressed based on the gaps in previous studies (see Chapter Two, section 2.10):

a) How do stakeholders in Saudi Arabia conceptualize change requests?

b) How do change requests occur in large building projects in Saudi Arabia?

c) How are change requests caused in large building projects in Saudi Arabia?

d) How do change requests affect large building projects in Saudi Arabia?

e) What methods do stakeholders currently use or envisage to handle change requests in Saudi Arabia, and how effective do they find them?

f) How can our analysis of change request issues provide assistance in understanding, analysis and diagnosis of change request issues in practice?

1.3 Significance of Study

In this study, some original contributions are put forward, in terms of implications for academic knowledge, project management practice and research methodology. The main contributions are summarised here; however, a more detailed account will be found in Chapter Six.

Firstly, the study identifies terminological confusion in the literature (see Chapter Two, section 2.5) and in practice (Chapter Four, section 4.2), with inconsistent and apparently indiscriminate use of the terms change request, change order and variation

order. It identifies the impact of such confusion on practice and contributes a new definition, for greater clarity. The researcher also adds to understanding of the complex issues raised by change requests, including the identification of causes, effects and methods of handling not previously reported. This broader, process-based understanding is supported by an illustrative model (Figure 24), which facilitates a more holistic perspective on change requests.

The research also contributes by applying and demonstrating the value of a stakeholder perspective in the new context of construction of large building projects in Saudi Arabia. In this way, it fills a gap in the literature, as few, if any previous studies have reflected the range of stakeholder perspectives and interests captured in this study.

As a further academic contribution, this study adds a new cultural dimension to PM theory. PM and related theory originated in the West, particularly the USA (Henrie & Sousa-Poza, 2005). More recently studies have been conducted on change requests in Saudi Arabia and in other contexts (e.g.Alsuliman, 2014) focusing on effective stakeholder engagement in change order management at the design stage of public sector construction projects. However, this study adds deeper understanding and more clarity to change request literature by determining the causes, effects, and means of handling change requests in a different culture, Saudi Arabia. In particular, the research demonstrates the usefulness of Hofstede's (1984; 2016) cultural dimensions for providing insights into project management issues, and highlights the impact of Saudi Arabia’s high Power Distance and Uncertainty Avoidance on the emergence and handling of change requests.

As a practical contribution, this study will help project managers by providing them with insights into the causes and effects of change requests and effective ways to handle change requests in large building projects in Saudi Arabia. Also, this can benefit project owners (including government), because effective PM, including better handling of change requests, can save time and cost, and increase the chance that the project will meet users’ needs. Among the practical implications identified are issues related to the tendering process, the potential value of applying a strict standardised contract such as FIDIC to clarify the rights and responsibilities of

stakeholders, authority for reviewing and approving or rejecting proposed change requests, and the importance of a formal, documented process. In this respect, a notable contribution is the researcher's inference, clarification and documentation of the informal processes currently applied in the investigated projects (Chapter Four, section 4.3). This mapping process could be emulated in the early stages of any project, to inform the development and documentation of formal procedures tailored to the circumstances of each project.

As a methodological contribution, this research is distinctive in adopting a qualitative approach and case study strategy to enable a deep and comprehensive study of this phenomenon. By contrast, most previous studies utilized a quantitative approach and survey questionnaire (e.g.Jawad et al., 2009), which is not enough to understand the phenomenon comprehensively. By gathering and analysing qualitative data from project stakeholders and company documents, this research offers a more rounded and nuanced account of the various perspectives and issues involved.

1.4 Structure of the Thesis

This thesis is structured in six chapters and this section will summarize the contents of each chapter of the thesis as follows:

Chapter One: This chapter is an introduction to the thesis, which describes the problem of the research, and sets out the aims and objectives of the research. Following that, the significance of the study and its contributions are highlighted.

Chapter Two: This chapter provides the research context and a review of relevant literature. It begins with the research context, starting with an overview of Saudi Arabia, introducing Riyadh and its construction projects. Then, Project Management is defined and dicussed in the light of national culture. Following that, the elements of projects are identified, defined and discussed. The conceptualization, process, causes, effects and normal handling of change requests are also considered. Suggestions in the literature for reducing the need for frequent change requests are discussed. The chapter ends with a summary of previous empirical studies, leading to identification of gaps in extant research. The aim of this chapter is to categorize the

main themes in the area of change requests, and to find the main authors and foremost articles that could assist in identifying the need for this research and in interpretation of the findings of the research.

Chapter Three: This chapter explains the methodology used to address the aims and objectives of the study. It includes the research philosophy, research paradigms, research ethical implications and methodology plan. In the methodology plan, a qualitative research approach and case study strategy involving four large government-owned construction projects are described. Also, it is explained how samples were selected and data from interviews and documents were collected and analysed.

Chapter Four: includes presentation of the findings and analysis. These are presented in five categories corresponding to the research objectives, with their themes and codes, to specify the main problems related to change requests in Saudi construction projects and the relationship between these findings. The chapter concludes with a model of the change request process, derived inductively from analysis of the selected projects.

Chapter Five: This is a discussion chapter, which interprets the findings in the light of the literature review according to the five research questions. It highlights current issues in the way change requests are generated and handled, based on stakeholders' perceptions, assesses their consistency with or difference from PM theory and practices reported elsewhere, and sheds light on the role played by distinctive features of the Saudi culture in affecting PM generally, and change requests in particular.

Chapter Six: Finally, the conclusion chapter summarises the research findings. Also, the research contributions are highlighted in terms of theoretical, practical and methodical contributions. Then, the research limitations are highlighted, and finally, a research agenda and suggestions for future research are offered.

Chapter 2: Research Context and Literature Review

2.1 Introduction

The aims of this chapter are to set this research in context, to connect the research with previous studies and to understand the existing theoretical literature on change requests in order to discover gaps in knowledge.

A traditional literature review was carried out (Jesson et al., 2011), using a variety of academic resources, including online databases such as EBSCO, Emerald, Scopus and ProQuest. Other resources included books on project management, resources identified by Google Scholar, and the journal of the Project Management Institute (PMI) of which the researcher is a member. For the Saudi context, Arabic books and the Saudi government database were consulted.

The first six months of the PhD programme were spent intensively reading the literature, although the review was updated regularly through the programme. The search was focused by using key words such as “change request”, “change order” and “variation order”, both singly and in combination with “construction” and/or “Saudi Arabia”. Most of the articles accepted were from journals ranked as 2-star and above. Initially, titles, abstracts and conclusions were skimmed in order to evaluate the relevance of resources to this project, prior to more detailed review, guided by the topics of the research questions.

The chapter begins by giving information about Saudi Arabia and its projects. The purpose of so doing is to establish the motivation and need for this study, by demonstrating that change requests in construction projects have been a long-standing problem in Saudi Arabia, with serious impacts. The broad area of project management (PM) of which change requests form a part is then introduced and, since this research is carried out in a context very different from the Western context where PM theory originated, consideration is given to the suggestion that PM is context-specific. In explaining this view, reference is made to Hofstede’s (1984) cultural dimensions and scores for Saudi Arabia (Hofstede, 2016).

Following this, the elements of projects are identified, with the rationale that projects are complex and multi-dimensional, and any of their components may give rise to change requests. Thus, a first step towards understanding change requests is to understand the nature of projects: their components and the people and issues involved with each. With this foundation in place, attention then turns to the main focus, the change requests themselves. Change requests are discussed in detail, regarding their conceptualization, process, causes, effects and normal handling, following the sequence of the research questions and reflecting on the attempt to begin with first principles (how change requests are defined and understood), to provide an overview of the responsibilities and procedures involved, and to track systematically how change requests occur and are experienced by project stakeholders. Prescriptions found in the literature for reducing the likelihood of change requests in relation to the project elements identified earlier are also discussed. Finally, previous studies are reviewed and research gaps identified, in order to summarise the current status of research on change requests and to highlight areas where this study can contribute further knowledge. Figure 2 illustrates the plan of this chapter.

Figure 2 Chapter Structure

2.2 Overview of Saudi Arabia, Riyadh and its Construction Projects

The purpose of this section is to set the present research in context by providing background information on the country, region and sector in which the study was conducted. The section begins by introducing geographic and economic factors which affect the demand for construction projects in Saudi Arabia and their execution. Then, the construction sector is introduced. In particular, construction in Riyadh, as the regional context of this study, is discussed. The section ends with an overview of problems facing construction projects in Saudi Arabia.

2.2.1 Geography and population

According to Saudi Arabia's Central Department of Statistics & Information (CDSI, 2013), the Kingdom of Saudi Arabia occupies approximately four fifths of the Arabian peninsula, with approximately 2,000,000 square kilometres. Saudi Arabia can be found at the furthermost area of south-western Asia. It is bordered by Oman and Yemen to the south; the Red Sea to the west; Iraq, Kuwait and Jordan to the north; and the United Arab Emirates, Arabian Gulf and Qatar to the east (see Figure 3). The total population of Saudi Arabia in 2014 was 30,770375 million, and the population growth rate is 2.1 per cent per year (CDSI, 2015). It is thought that Saudi Arabia is one of the highest growing nations compared with the population growth rate globally, which was estimated to be 1.5 per cent and 1.3 per cent in 1988-1998 and 1998-2008 respectively (Ngusu et al., 2015). Urban development and population are increasing significantly in Saudi Arabia, especially in Riyadh, the capital city. This massive population growth has affected the transportation infrastructure negatively. As a result, it has been noticed that there are delays in trips in and out of the city, in addition to the impact on internal movement, with frequent congestion and traffic jams (Aldalbahi & Walker, 2015).

In terms of climate, most areas of the kingdom are arid, although there are sometimes monsoon rains in the west, north and southwest, especially in the summer. Sometimes sporadic rain can occur in other areas, which may cause flooding if it occurs heavily, including in Riyadh, where the air and wind are very

dry. The central region contains a wide plateau with some mountains and arid valleys and rivers, and an almost desert area. Nevertheless, it is considered the heart of Saudi Arabia culturally and physically (MOFA, 2015).

Saudi Arabia's geographic and demographic characteristics are relevant to this project because of their implications for the construction industry. Rapid population growth and urbanisation generate growing needs for housing, business premises and infrastructure, consequently stimulating the initiation of large construction projects by government and private sector bodies and individuals. At the same time, topography and climatic conditions pose particular challenges for building, and need to be considered in project design and materials specification.

Figure 3 Saudi Map (Wikimedia, 2015)

2.2.2 Economy of Saudi Arabia

Saudi Arabia is one of the major petroleum exporting countries worldwide, and oil is the backbone of the Saudi economy (MOCI, 2015). According to OPEC, Saudi Arabia has a large number of the world's oil reserves, accounting for 22.1% (OPEC, 2014). Although oil is an essential resource in the Saudi economy, and revenues are very high, the Saudi government is aiming to reduce reliance on it and trying to find economic alternatives, because of the difficulties of using oil and the danger of

relying on a single, non-sustainable resource (Gallarotti, 2013). Rice (2004) states that the trend at the moment is to look for sources other than oil, and the provision of key supplies to citizens, such as housing and job opportunities to meet the needs of the dramatic increase in population growth.

The government invests widely in the national economy and works very hard to diversify the economy, using trade, industry, services and other sectors, to support the country's wealth in various fields. The Kingdom's large size supports it with an abundance of several natural resources, such as limestone, bauxite, gypsum, iron, phosphates and other industrial raw materials, many of which are inputs to the construction industry (MOCI, 2015).

According to the Saudi Arabia General Investment Authority (SAGIA, 2015b), the Ministry of Planning revealed that the size of government spending in the 9th five-year Development Plan increased by 97.5% from the 8th five-year Development Plan (from SR 51.4 BN to SR 101.5 BN). The growth of the economy and the aspiration for further progress have been reflected in the creation of a number of large economic cities, which have forced SAGIA to increase spending on investment in roads and traffic regulations resulting from the scale of this development.

Saudi Arabia provides aid and investment opportunities for exporters and investors in several sectors, making the kingdom the largest market in the Gulf region (Rice, 2004). According to SAGIA (2015a), Saudi Arabia is among the top 25 most economically competitive countries in the world. This position makes the Kingdom a favourable economic environment and source of attractive investment opportunities for the following reasons:

- Saudi Arabia is ranked third worldwide among countries with the most favourable tax systems.
- It is one of the 20 biggest economies in the world and the largest economy country in the Middle East.
- It has rapid economic growth and, indeed, is one of the fastest growing countries economically, with a growth rate of 3.6%.
- Its GDP represents 38% of the Arab GDP.

- It is ranked 49 among 189 countries in terms of doing business globally.
- It is considered to be the largest recipient of foreign investments in the Arab world.

These factors are reflected by foreign involvement in many economic activities in the Kingdom, including construction.

Workforce

According to MOCI (2015), it is reported that manpower in Saudi Arabia is distributed in three sectors, as follows:

- Engineering, with 3.56%, which is the lowest rate compared with other sectors.
- The scientific and technical sector, with 27.98%, which is better than engineering.
- Services, with 28.69%, which has the highest rate.

Non-Saudi manpower working in managerial occupations accounts for 1.14% of the workforce, with 41.07% in construction and production. In terms of the women's workforce, they work more in the scientific and technical professions.

Statistics report that the Kingdom of Saudi Arabia is still looking for several investments and projects which will enable the Kingdom to receive and employ more people who have degrees in higher education (MOCI, 2015).

Opoku and Abdul-Muhmin (2010) mentioned that there are other types of labourers, who come to the Kingdom of Saudi Arabia illegally. This type of labour constitutes a huge number of the non-Saudi workers, which may cause several problems to Saudi society in the short term, such as security issues, or in the long term socially, economically and politically.

Unskilled labour in Saudi Arabia earns about $1.17 per hour, which is very low compared to labourers working in France, who earn $22.60 per hour, and Mexican labourers, who earn $2.63 per hour (MOCI, 2015). Such a low wage rate may mean that the workers recruited are of poor quality, which may in turn have implications for their ability to execute projects correctly.

As a consequence of its large size, high population growth and strong economy, Saudi Arabia is currently undergoing an enormous proliferation of construction projects, especially in governmental construction building. The Kingdom's construction industry is introduced below.

2.2.3 Building construction in Saudi Arabia

This section begins with a general overview of the construction industry in the Kingdom, and then focuses more particularly on Riyadh, the capital, which is the location of many major projects. It is believed that progress in the construction sector is due to the prosperity of the Saudi economy, based on petroleum products, which in turn stimulates workers from all over the world to come and work, and has pushed the Kingdom to bring in workers from Asian nations, such as Pakistan and India, to work in this sector (Shah, 2012).

Another factor that has contributed to promote the construction of building projects in Saudi Arabia is government support for citizens to have privately owned accommodation. The Kingdom took several serious steps in the 8th National Development Plan, 2012 to achieve this, which has made the construction sector one of the most important sectors in the Kingdom. Between 2004 and 2012, construction increased by 20.1% compared with other government activities, such as electricity, which comes in second place with an increase of 13.2%, followed by mechanics and water activities and infrastructure, which increased by 10.7%. The government of Saudi Arabia pushed forward the construction of buildings in 2012 by funding the construction sector with 250 billion Riyals to build 500,000 properties, aiming to provide for every citizen who currently does not have a house to live in. The government also helps citizens by funding real estate to help them with purchase costs (RCOCI, 2012).

However, from another perspective, the construction sector is a driver of economic development in Saudi Arabia, not a result of prosperity. According to Opoku and Abdul-Muhmin (2010), the construction sector is one of the most important factors in the development of the Kingdom's economy. Through this sector, Saudi Arabia is trying to solve society's problems, such as shortage of housing, by both private and

public projects. In addition, construction is not limited to residential buildings for citizens in Saudi Arabia, but goes beyond that to giant construction projects, such as educational, health and commercial building projects, which will contribute significantly to the development of the Saudi economy, which is the biggest economic market in the Middle East (RCOCI, 2012). As noted before, many of these projects are located in and around Riyadh, the capital, which is also the focal region of this study. It is therefore worth considering construction in Riyadh in more detail.

2.2.4 Building construction in Riyadh

Riyadh is located in the heart of the Arabian Peninsula, and is the capital city of Saudi Arabia. It is one of the most modern cities in the world architecturally. King Khaled Airport is one of the latest designs with modern engineering that is noticed by foreign visitors, because it is designed in a way that combines the traditions of Arab style with the latest modern architectural design. Also, Riyadh has extensive highways and road networks and continues to grow (MOFA, 2015). Recently, the number of cars in the city of Riyadh has doubled, due to the prosperity and development of the city and population growth, which causes traffic congestion. Also, individual movement of citizens by large-capacity vehicles causes more traffic jams (Chorfi et al., 2015).

With this expansion of building and infrastructure, the number of construction licences granted for projects in Riyadh increased dramatically from 7339 in 2003 to 27794 in 2010. This large increase is considered evidence of a general development in the construction sector, encompassing an increase in government and social projects, property and commercial projects, industrial projects, and the building of schools, health facilities and mosques (RCOCI, 2012). Some examples of major projects in Riyadh are as follows:

1. Princess Nourah Bint Abudulrhman University (PNU), a very large university providing for 39,000 female students, making it the largest women's university in the world. A huge project such as PNU offers higher education with extraordinary opportunities in cultural and economic fields, on a par with those available in modern industrialized and developed countries.

2. The King Abdullah Financial District (KAFD), a new development under construction, one of the most distinguished projects in Riyadh, and an additional improvement to the economy of the Kingdom of Saudi Arabia, consisting of 59 towers in an area of 1.6 million square metres. The owner of this project is the Public Pension Agency (PPA), which is trying to complete the project to be compatible with the aspirations of the government (KAFD, 2015).

However, the Saudi construction sector faces a number of challenges, as indicated below.

2.2.5 Problems facing building construction projects in Saudi Arabia

There are several studies, which have examined government projects in Saudi Arabia, and identified a number of problems. An early study by Al-Hammad and Assaf (1992) focused on issues in the relationship between the design and execution of construction projects, with the aim of deriving lessons for future projects. Data were collected by means of a survey, in which participants were asked to rate the problems faced by building projects in terms of importance.

The following factors were rated highest in importance:

1. Working drawing details: This was one of the most important problems faced by contractors because such details were not included in the design, as the owner did not require them.

2. Unfamiliarity with local conditions: The importance of this factor was due to the large number of designs from foreign companies without previous experience in Saudi Arabia.

3. Lack of building codes and government regulations: This element was also important, because the absence of a building code and no clear government instructions affected design and implementation.

4. Buildability: The limited number of professional foreign designers familiar with the technologies in the field is a global problem affecting the designs in Saudi Arabia.

5. Economic situation: A rise or a sudden drop in the economy during the course of a project affects the work of the contractor and designer, and the difficulty in keeping to the budget affects the quality of the project.

6. Incomplete and inadequate plans and specifications: There were omissions in the plans and specifications, which affected the work of the contractor and the designer negatively during implementation.

7. Lack of knowledge: This factor is very important, because of foreign designers who were unfamiliar with the nature of building materials, and untrained labour coming from East Asia, which affected projects negatively.

There were other factors, which received moderate ratings and were not seen as of the highest priority, such as variation orders, work packaging design, lack of specialized construction managers, design complexity, owners' payment progress, fast track construction and unfamiliarity with site conditions.

The least important factors, which were ranked low in importance, included involvement of the contractor in the design, which was not considered to be an issue, because most government projects in Saudi Arabia are designed by consultants and contractors invited to submit their bids to implement the work. Weather conditions and nationalities of both construction firms and designers were also ranked low, because foreign companies were thought to be competent in reducing the problems caused by unexpected weather conditions and communication problems between stakeholders at the planning level.

A similarly wide-ranging survey, in terms of the number and diversity of factors considered, was that of Assaf et al. (1995), which addressed the problems facing construction projects from the perspective of causes of delay. This study was conducted in the Eastern Province of the Kingdom, and random samples of nine owners, 24 contractors, and 15 architectural / engineering firms were surveyed. In total, 56 reasons for delays in projects were identified. The causes of delays were grouped into nine categories, and the researchers asked the respondents to determine the level of importance of these groups. Overall, the result indicated that the most important cause of delay was problems with financing the projects, while the least important factor was the environment.

These early studies are useful in drawing attention to issues in the construction industry stemming from both within-industry and external factors, and identifying groups of salient stakeholders who might affect or be affected by these factors. Moreover, they reflect the twin themes of design and delay, which have characterized subsequent studies. Despite the declared intention of deriving lessons for other projects, however, it seems that any implications from these studies were not learned from, or acted upon. This becomes evident from the recurrence of similar themes in studies conducted over a period of some 20 years, to the present day.

Among the design-oriented studies was one that focused on the deficiencies of building design in Riyadh (Al-Negheimish et al., 2002). Data were collected on 41 building designs representing all kinds of designs in the city. The result showed that these designs were out-dated, lacked uniformity and contained errors. All of these results were attributed to the lack of a building code, which was said to be urgently needed, in order to address the problems of design, technically and legally, in Saudi Arabia. Furthermore, the researchers recommended continuous education and training for Saudi engineers, and continued support for research in the development of the building construction sector.

While Al-Negheimish et al. (2002) focused on design issues, the main concern addressed by subsequent researchers has been delay in building projects, whether due to problems at the design stage or during implementation. An example of such a study is that of Arain et al. (2004), which aimed to explain causes of delay in construction projects from the perspective of mismatch between building design and project execution. A questionnaire survey was conducted, involving 48 consultants and contractors. The study invites comparison with that of Al-Hammad and Assaf (1992) in terms of the attempt to relate design to execution, the number of factors identified, and the attempt to classify factors by relative importance. However, the outcomes were quite different, as regards the factors that emerged as most important. This study suggested that insufficiently detailed drawings, and poor coordination between workers in the project, were the reasons for deficiencies in the design. Also, making the designer a consultant or contractor was said to be one of the most significant problems, because he will not criticize any mistakes that he himself made in the design stage. However, other factors, such as diverse nationalities of professional designers, the incomplete use of project management in the design, and

the involvement of the contractor in the design, were considered as the least significant reasons for design problems and delays.

The continuing problem of delays in Saudi construction projects motivated Assaf and Al-Hejji (2006) to investigate the underlying causes. 73 causes of delay were identified through a literature review, and discussed with some stakeholders involved in the construction industry. Data were collected through a survey, analysed using severity, frequency and importance indices. The study involved 15 project owners, 19 consultants and 23 contractors. Identified reasons for the delay of projects were grouped into nine categories. All stakeholders groups in the research agreed that one reason for delay in projects is change orders issued by the owner during the construction period. The study also found that owners and consultants perceived the acceptance of the lowest tender as the most important reason for problems, leading to delay in projects. The owners blamed contractors and labour as the causes of delay. However, contractors believed that the causes of delay originated with the owners.

Another study looking at the reasons for delay in public construction projects in Saudi Arabia from the point of view of the owners was conducted by Mahamid (2013), who limited his study to 22 owners involved with government construction projects. Data were collected by means of questionnaires. The findings indicated that the tendering system and award of contracts to the lowest bidder was perceived to be one of the causes of delay. However, it was argued that there were other causes that contributed to the delay of projects, such as poor coordination and communication between construction parties, poor site management, reworking, poor labour productivity and delay.

In contrast to the above studies, Al-Kharashi and Skitmore (2009) indicated that delay is due solely to the shortage of professional workers in construction projects. Their survey ascertained the reasons for delay in construction projects through collection of data from 86 owners, consultants and contractors. The data collected included several factors related to stakeholders, such as materials, labour, contracts and the relationship between them. The result indicated that the main cause of delay was due to the lack of qualified manpower in relation to the large number of building construction projects.

Whereas the general tendency in the above studies was to cite a large number of obstacles to building project success at various stages of the project, and emanating from various sources, Alsuliman et al. (2012) took a different approach. They agreed that the problem of Saudi projects was in the design stage. However, their study focused on only one factor, which was change orders (they used the term variation orders) in the design stage. The researchers conducted interviews with design consultants and owners of public sector projects, to explore the actual practice of change orders in the design step of government construction projects. The data analysis revealed that there were no formal or clear steps to manage change orders in the design stage. The researchers concluded that *"there is a need to apply an appropriate variation order management system to Saudi public suggestions"* (Alsuliman et al., 2012).

To summarize, it can be seen that in the past three decades, a number of studies have investigated the prevailing problem of project delay. Based on surveys of project owners, consultants and contractors, these studies have identified a variety of reasons for such delays, of varying perceived degrees of importance. They include problems in both design and implementation, such as lack of knowledge (e.g. of local weather conditions and materials, especially among foreign designers and labour), poor coordination, and quality problems resulting from the awarding of contracts to the lowest bidder, all exacerbated by a lack of building regulations. Few of these studies specifically mentioned change (or variation) orders. Two (Al-Hammad & Assaf, 1992; Assaf & Al-Hejji, 2006) listed variation orders simply as one among a number of problem factors in construction contracts. However, although change requests were not mentioned explicitly, research shows an ongoing problem of project delays and a number of recurring issues, such as low productivity, design flaws and unsuitability of materials which, it can be argued, are likely to result in, or flow from change requests. It was also noted that the various parties involved in the projects blamed each other for causing delays.

The absence of building codes and regulations plays a role here, because it leaves many issues to the discretion of designers, owners and contractors, who may have conflicting priorities, and in some cases lack locally relevant products and knowledge. This situation increases the likelihood of discovery of design flaws and

quality problems during project execution, forcing change in designs, specifications and schedules, and hence the need to issue change orders. Alsuliman et al. (2012) recognized the importance of such orders, but also the lack of a systematic approach to handle them. Such concerns suggest the importance of understanding the causes of change requests and how to manage them as key issues for improving project efficiency. Previous studies provide insufficient insight on these issues, especially as their survey approach generated lists and rankings of factors, rather than in-depth understanding of how and why they affect projects. All these concerns point to the salience of change requests as an area of study, and to the importance of obtaining deep qualitative information on the associated causes, procedures and outcomes.

2.3 Project Management and National Culture

Although a general understanding of the nature of project management was established through the definition presented earlier (Chapter One - Introduction), the actual practice involved and challenges encountered will differ from one context to another, under the influence of cultural factors. In this section, therefore, culture is defined, with particular emphasis on national culture, and the impacts of culture on project management are discussed. Following a general overview of the significant role of national culture, some pertinent features of culture affecting project management in Saudi Arabia are considered.

Culture, according to Schein (2010), is a set of assumptions that a given group has formed over time, which come to be shared, internalized and taken for granted. Cultures may be observed and studied at a number of levels. For example, an organisation may have its own culture, a "complex set of values, beliefs, assumptions, and symbols" (Barney, 1986:657) that shape its business practices. Culture can also be associated with particular professions; in such cases, culture is a set of work-related values and beliefs that guide members of a profession to think and act in accordance with the profession's norms and standards (Wang, 2001). In this thesis, however, the focus is on national culture, "an historically transmitted pattern of meanings embodied in symbols, a system of inherited conceptions" (Geertz, 1973:89) shared by members of a national or ethnic group, which shape

their understanding and attitudes. This focus on national, rather than organisational culture is salient, because this study is concerned with a context - Saudi Arabia - very different from the one where project management ideas and practices originated, which may affect the way they are perceived and applied, and also because Saudi construction projects often involve foreign designers and/or a multi-ethnic workforce, which could potentially be a source of misunderstandings and conflict.

National culture is widely recognized as affecting people's attitudes and beliefs (Adler & Gundersen, 2007) and their behaviour in individual, group and organisational situations (Humes & Reilly, 2008). In the project management context, the PMI (2013) acknowledges the impact of culture on the speed of working, decision-making and the degree of forethought or impulsiveness characterizing actions, all of which have the potential to generate stress and conflict, and to affect the performance of project managers and teams. Previous research provides evidence of cultural impact in a variety of contexts, affecting various aspects of a project. For example, Pagell et al. (2005) found national culture to be an explanatory factor in operations management decision-making, reflected in different behaviours among similar organisations in the same industry, located in different cultures. Thuesen and Rasmussen (2013), based on experience of working for construction contractors in three different cultural contexts -Ecuador, Denmark and Sweden - found significant influence of cultural context on construction practices, as well as challenges when interaction occurred between different cultures. The authors note that the cultural context of Ecuador is formal, hierarchical, collective, and characterized by a demand for structure and rules, whereas that of Denmark and Sweden (albeit with relative differences) is characterized by informality, network structure, autonomy, egalitarianism and a propensity to view rules as guidelines. Such differences were reflected in different project-based production practices, with Ecuador favouring scientific management and an integrated value chain controlled by formal codified agreements, whereas the Scandinavian countries' social values supported more flexible, locally tailored practices, able to cope with diversity, singularity and complexity. There were differences, however, between Denmark and Sweden, in the degree of emphasis on processes, rules and structures, and the level of detail, information and planning expected by project owners.

Such differences imply an important need for project managers, particularly when working in a cross-cultural context or with a diverse workforce, to have an awareness of culture and its potential implications, as a number of authors have emphasized. This was one of the conclusions derived by Henrie and Sousa-Poza (2005), based on a content analysis of 770 journal articles and 93 books, focusing on culture within project management. The review, encompassing peer-reviewed journal articles and books on project management published between 1993 and 2003, was conducted with the aim of assessing whether leading project management references provide coverage of culture, on the assumption that critical social aspects of project management are culturally specific. The authors used Hofstede et al. (1997) definition of culture as their benchmark, although they note that much of the published literature does not provide a definition. They also note that, generally, project management literature focuses more on tools, techniques and processes than culture. Nevertheless, they infer increased awareness of culture during the 1990s, and suggest that it can play an important role in issues such as team-building, leadership development and motivation.

Chen and Partington (2004) agreed on the importance of culture from a comparison of project management work. Their interpretive study, involving matched Western and Chinese project managers, revealed that, despite official adoption, supported by legislation and regulation, of Western project management processes such as enforced tendering and specifications in China, these were not necessarily supported by cultural values, which placed more emphasis on relationships than on contractual arrangements. Whilst the authors acknowledge the limitations of the small sample, they conclude that project management is not universal, but culture-sensitive, and that this must be recognized when trying to transfer theories and practices from one context to another. In another study focusing on the Chinese style of management, based on a case study of a hotel construction project, Pheng and Leong (2000) identify a pressing need for foreign project managers to be fluent in cross-cultural management and to understand the Chinese style of management.

Similarly, Milosevic (2001) argues that un-cultural project management is inappropriate, and that the imposition of practices typically rooted in Western culture has no rational basis and can pose a high risk of failure. Rather, project management must be culturally responsive, and not only demands the cultural competency of the

project-managers, but may even require cultural “translators” or facilitators to support the project delivery.

One way of gaining understanding of national cultural differences is through the application of frameworks such as those proposed by Hofstede. Based on cross-national research in IBM (Hofstede, 1984), Hofstede originally proposed four dimensions, in which he claimed national cultures may be differentiated. He subsequently added another two dimensions. Hofstede’s framework analyses culture based on the following six dimensions:

Power distance (PD): the extent to which members of society expect and accept the unequal distribution of power (Hofstede, 2016).

Uncertainty avoidance (UA): the extent to which members of a society feel anxious and threatened in the face of uncertainty and ambiguity, and try to avoid it - for example by means of beliefs, rules and institutions that offer certainty and control (Hofstede, 2016).

Individualism (IDV): the extent to which people’s interests are focused on themselves and those close to them, or, alternatively, are linked and even subordinated to a larger social group. In the latter case, collectivism, members of a society are linked by strong relationships and a sense of mutual responsibility (Hofstede, 2016).

Masculinity (MAS): the extent to which members of society are driven by “masculine” values such as competition, achievement and success, or “feminine” values such as care for others and quality of life (Hofstede, 2016).

Long-term orientation (LTO): the way in which members of society view the past, present and future. Societies scoring low on LTO prefer time-honoured traditions, and are suspicious of change, whereas those that score high are more future oriented, reflected in a propensity for thrift and long-term planning (Hofstede, 2016).

Indulgence (IND): the extent to which members of society are socialized to control their desires and impulses, viewed as a continuum from weak control (indulgence) to strong control (restraint) (Hofstede, 2016).

Other writers have proposed similar frameworks; for example, Trompenaars (1993) offers a seven-dimensional model which shows some similarities to that of Hofstede, for example in his Individualism/Achievement dimension. However, the Hofstede framework is possibly the best known, and has been widely used in business and management research for analysing and gaining insights into national cultural difference. Sui Pheng and Yuquan (2002), for example, used Hofstede's original four dimensions (PD, UA, IND, MAS) to compare Singaporean and Chinese culture and the impact of cross-cultural differences between them on construction projects. They found that a higher PD in Singapore was reflected in centralisation of power and an expectation that superiors are entitled to privileges, while these features were less accepted in China. These differences have implications for organisation structure, and for the accessibility of superiors to subordinates (easier in China), which could facilitate communication on project issues and enable speedier decision-making. On UA, Singapore showed a higher tolerance for ambiguity, greater propensity for risk-taking and constructive use of criticism, whereas Chinese culture was more formal, intolerant of deviance, risk-averse, and with a tendency to avoidance of criticism and conflict, for fear of unleashing destabilizing aggression. In a project context, a lower UA, being associated with greater risk propensity, might be reflected in greater willingness to try new construction materials and technology, and to apply new project management techniques. A high UA score might be reflected in greater rigidity, adherence to established methods and procedures, and suspicion of innovation. Singapore was more individualist and China more group-oriented. Such differences have implications for employee relations in the project, being reflected in calculative versus moral involvement of individuals with organisations. In a more collectivist culture employees view their employment like a family and can become very alienated if it fails to satisfy them. Collectivist cultures, moreover, are less inclined than individualist ones to adopt fashionable management ideas. Differences in MAS were reflected in an orientation to work for goals such as earning and promotion in China, and towards personal goals such as cordial relations with others, in Singapore. The authors associated these characteristics with higher and lower job

stress, respectively. Whilst the study is limited by the failure to consider possible intra-cultural differences, given China's vast area, they found the Hofstede indices provided an insightful view of the impact of cultural values on the two countries' organisational practices.

Chipulu et al. (2014) used Hofstede's original four dimensions as a framework to interpret project practitioners' perceptions of the relative importance of project success/failure factors. Their use of structural equation modelling to analyse the survey responses of 1313 practitioners from eight countries revealed two basic project orientations: Factor 1 (task focused, externally oriented) and Factor 2 (people-focused, internally oriented), each of which was found to be associated with particularly cultural orientations. Factor 1 managers showed more "masculine" characteristics, being tough-minded egotistical, materialistic, preferring to work within fixed role structures, and very independent (individualist) in decision-making. By contrast, Factor 2 managers made greater use of social intelligence and tended to be more collectivist. They also scored highly in uncertainty avoidance, which the authors interpreted as implying proactive engagement in efforts to reduce risk, which would be beneficial in managing novel or ambiguous projects. Thus, cultural values were seen not only as influencing practitioners' project management orientation and priorities, but also as having implications for matching project practitioners to project characteristics.

In another study, Chipulu et al. (2014) investigated the insights into cultural preferences contained in the candidate specifications of project management job advertisements placed by 2040 organisations across seven countries and seven industries. The rationale for the study was that job advertisements contain a set of behavioural dispositions derived from the environmental context. Hofstede's dimensions of collectivism, uncertainty avoidance and, to a lesser extent, power distance were found to be particularly salient. The authors conclude that Hofstede's dimensions provide a useful cultural language to facilitate cultural intelligence, which individuals and organisations can use to interrogate and understand their cultural preferences. In light of the above precedent, such factors will be considered in this study. Meanwhile, we consider below some previous authors' insights into project management in Saudi Arabia.

2.3.1 Cultural features of Project Management in Saudi Arabia

Because of the opportunities offered to foreign investors, exporters and business by the large Saudi market, it has long been recognized that some understanding of Saudi culture is a necessary preparation for involvement in business in the Kingdom (Barratt, 1989). The pressure to provide jobs and housing for a rapidly growing population has given rise to a plethora of construction projects in Saudi Arabia, while change in foreign investment regulations since 2000 permits 100% foreign ownership of projects, offering opportunities in this sector to foreign companies. Rice (2004) noted the importance, in this situation, of understanding that, despite a modern, high-tech lifestyle, the culture in the Kingdom remains extremely conservative, strongly influenced by Islamic values and Bedouin tradition.

While project management discourse and standards originated in the West, there may be factors that limit their applicability in other contexts, or local factors that are not explained in Western literature. Cultural factors are likely to have an impact on the application of project management and change requests and the way they are managed in Saudi Arabia, although no previous study has applied Hofstede's cultural insights in the Saudi project management context.

Hofstede (PMI, 2013:554) observed that it is important in a complex organisation for members and managers to know the culture map. Barratt (1989) stated that when organisations are going to embark on international business and investment, they must review the skills and preparation needed to fit the culture. There are disputes in the construction industry as a result of culture, and to solve this kind of problem, it is important to understand the culture in the workplace (Barratt, 1989).

According to Hofstede's (2016) cultural dimensions, Saudi Arabia is classified as high in uncertainty avoidance, collectivist (i.e. low in individualism), high in power distance, and having moderately masculine characteristics. Saudi Arabia and the United States can be compared in these dimensions. Regarding power distance and uncertainty avoidance, Saudi Arabia is much higher than the US, in masculinity approximately the same, and in individualism much lower (see Table 1). Hofstede

indicates that in Saudi Arabia, culture may prefer to focus more on commitment and strong relationships with families, factions and smaller groups, rather than focusing as a whole on the efficiency and effectiveness of the organisation.

Table 1 Hofstede's Culture Dimensions scores for the USA and Saudi Arabia

Cultural dimension	United States	Saudi Arabia
Uncertainty avoidance	46	80
Power distance	40	95
Masculinity	62	60
Individualism	91	25
Long-term orientation	29	36

Source: Hofstede (2016)

These features of Saudi culture have implications for project management. Looking at the individual dimensions more closely, Saudi Arabia's high PD implies an acceptance of organisational hierarchy and inequalities, and a tendency towards centralized and autocratic decision-making (Hofstede, 2016). This could pose difficulty for contractors seeking to adapt to conditions in the field, and might encourage peremptory change requests by owners, and rigid procedures for obtaining approval for suggestions lower down the hierarchy. The high UA score implies intolerance of uncertainty, which could be addressed by rigid rules and regulation, and reluctance to try new - especially foreign – ideas and practices, which could affect the ability to implement project management techniques. The low score on IDV characterizes Saudi Arabia as a collectivist society, where loyalty to the in-group may override considerations of efficiency and effectiveness, and may sway recruitment and promotion decisions (Hofstede, 2016). Group affiliation may also have implications for communication and relationships between various parties to the project, particularly if 'out-group' members (i.e. those from a different tribe, region or country) are involved. A score tending towards the masculine side of the MAS index suggests an expectation that managers will be decisive and assertive and a tendency to resolve conflicts by 'fighting them out' (Hofstede, 2016). The Kingdom's low score for LTO suggests normative thinking and concern with absolutes, respect for tradition and a focus on quick results rather than long-term

planning (Hofstede, 2016). It might be suggested that this low LTO would have implications for project design preferences and might also be a cause of hasty decisions and lack of forethought, which could give rise to change request situations when errors are discovered or unforeseen circumstances force a review of project parameters and practices.

As this brief review has shown, national culture has the potential to induce differences in work-related attitudes, values and behaviour, with implications for the way projects are managed, including the occurrence and handling of change requests. In this respect, this study in a Saudi Arabian context may provide some novel insights into the impact of national cultural characteristics on the applicability of ideas and practices of Western origin.

2.4 Elements of Projects

A construction project consists of a number of elements, which affect the course of the project and need to be handled carefully in order to avoid damaging effects. This section introduces key project components, as a foundation for later sections which address causes of change requests (section 2.6), and ways of reducing their likelihood (section 2.9). The elements considered are stakeholders, the tendering process, contracts, project scope, design and specifications.

2.4.1 Stakeholders

An important early step in any project is to identify stakeholders. In general, a stakeholder is "an individual, group, or organisation who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project" (PMI, 2013:30). Identifying stakeholders is the procedure for selecting the people, teams, or institutions that might influence or be dependent on a decision, some activity, or the final result of the project. It also entails examining and documenting relevant details about their needs, involvement, interdependencies, effect, as well as possible impact on project achievements (PMI, 2013). The main point of stakeholder identification is for project managers to understand exactly when and how to link up with these organisations and figure out who the significant connectors (stakeholders) are supposed to be. Unless due attention is paid to the requirements and expectations

of a varied selection of project stakeholders, a project probably will not be believed capable of being successful, even though the project manager may succeed in remaining within the intended time, scope and budget (Bourne & Walker, 2005).

Before going further in this section, therefore, it is important to identify stakeholders who are relevant to this research. In this research, the stakeholders who are involved in the projects are as follows:

Project Manager (PM): the Project Manager is the particular person assigned by the executing institution or company to guide the group, and who has the responsibility for achieving the project's aims (PMI, 2013).

Client or Customer: the Client or Customer (sometimes called the Owner) is a person or company that can authorize and control the project's consequences, resources, or the final product (PMI, 2013).

Users: Users are the individuals, institutions or companies which use the project's product, facility, or outcome (PMI, 2013).

Contractor: A "contractor is a successful bidder"; in other words, it is an individual or company that has been awarded a contract to provide specific goods and/or services required to realize the project (Prosser & Buchanan, 1994).

Consultant Engineer: A Consultant Engineer is a professional engineer involved with the customer to contribute high quality services as identified and outlined in the contract terms and conditions (Dugdale, 1994).

Youker (1992) explains that uncertainty is a dilemma for the project manager, as a consequence of the dependency association between the project and the out of control features in its own workplace. According to Cleland (1986) and Olander and Landin (2005), it is essential, for handling a productive project, to be able to control a variety of stakeholders and keep an acceptable balance among their interests. The implications of stakeholder conflict for change requests will be discussed in section 2.6.1.3.

2.4.2 Tendering

Definitions

Tendering is a system in which a client such as government, agency or organisation, invites potential contractors to submit their quotations for the provision of goods or services, as part or the whole of a proposed project (Doloi, 2011). The aim is to enable comparison of competing offers in order to select a suitable contractor, able and willing to provide the required product, to time and other criteria at an acceptable price, and draw up a contract accordingly (Eriksson & Westerberg, 2011). In building and construction, it is common for clients to solicit tenders in this way, interested parties being expected to submit a detailed breakdown of costs anticipated in completion of the project (Chan et al., 2007). Typically, tenders (sometimes referred to, confusingly, as bids) remain sealed until a specified date, whereupon they are publicly opened and compared; the winning tender is then publicly announced (Evenett & Hoekman, 2006). Although the tender invitation and the submitted tenders may contain quality and time specifications, in practice, price is commonly the main, or only basis of selection, i.e. the contract is awarded to the lowest bidder. Holt et al. (1995), reviewing contractor selection practice in the UK construction industry, found that 87% of clients based their selection decisions on price.

As noted by Chan et al. (2007), there are a number of types of tendering. The traditional approach is open competitive tendering, whereby offers may be submitted by any contractor interested in the project. A similar procedure is selective competitive tendering, the difference being that participation is restricted to a pre-selected list of invitees, normally selected on the basis of their good reputation. A different approach to either of the foregoing is negotiated tendering, in which the client and potential tenderers confer, with the aim of agreeing terms acceptable to both parties.

Competitive tendering is popular in public procurement, because it promotes non-discrimination and transparency in the award of government contracts and is therefore a means of protecting against corruption (Gazula & Vadali, 2012). The

procedure also has advantages - at least in theory - for both client and contractor. For the client, competitive tendering tends to drive down price, while for a contractor, the competitive context is a strong incentive to evaluate the use of resources carefully, in order to be able to produce a realistic estimate that will allow them to make a profit (Chinyio, 2011). The system is not, however, without its critics. Potential problems with competitive tendering will be discussed in a later section.

Tender process in Saudi Arabia

In Saudi Arabia, construction contracts, particularly for government projects, are normally awarded on the basis of open competitive tendering (IBP, 2015). By law tenderers are to be provided with clear, full and uniform information on the required work, and should be treated equally. Government tenders must be announced in the official Gazette, in two local newspapers, and by electronic media, together with the submission deadline and the time and place for opening of selected bids. In the case of government contracts, the relevant authorities form a committee for opening and evaluating the submitted tenders. Normally, the contract is awarded to the lowest tender. If the submitted bids are higher than market prices, or their value exceeds the budget available for the project, the evaluation committee may negotiate with the tenderer of the lowest bid with the aim of securing a lower tender, or cancel or reduce some items to bring costs down. If a compromise cannot be reached, they may then negotiate with the next lowest bidder, and so forth. If an acceptable price is not agreed, the tender will be cancelled and a new invitation issued (Saudi-Law, 2009) .

2.4.3 Contract

Of all the documents that control works pertaining to a construction project, the most important is the contract (Asiri et al., 2013). The contract is a binding agreement between two or more parties, obligating them to perform - or not perform - specific actions (Van Der Veen & Korthals Altes, 2012), for example an undertaking by the seller to perform a particular service or provide a product, and an undertaking by the

buyer to pay for it (PMI, 2013). It provides a guideline to the main features of the product (Robertson, 2010).

According to Handford and Matous (2015), it is important for parties to a project to be subject to legal obligation, because of transfer of responsibility on completion of a project. Projects involve a variety of stakeholders, with various interests, involved in a web of relationships, and facing a range of challenges. In this situation, it is important that guidelines are laid down for operational standards, and that responsibilities and liability are clearly assigned. Van Der Veen and Korthals Altes (2012) suggest that this need has become particularly acute in complex urban projects, because of the growing role of private parties, necessitating contractual agreements to guide the cooperation between developers and planning authorities.

Contracts may take a variety of forms, differing in the money paid to the contractor and the way risk is apportioned between the parties (Yayla & Tas, 2010). Thus, it is important to choose the right type of contract to suit the nature of the project in question in terms of the scope of the project, the degree of certainty with which costs can be predicted, and the anticipated level of risk (Collier, 2001). The following are the most common types:

Lump-sum (fixed price) contracts

In this type of contract, the contractor undertakes to perform all the work specified, at a fixed price (In't Veld & Peeters, 1989). The preponderance of risk lies with the contractor, who must meet his costs and make his profit at the agreed price, and perform all his contractual obligations, but may face unexpected circumstances. This type of contract, therefore, is most suited to projects where the scope is well-defined, costs are predictable, and risk is low (Collier, 2001). This is the type of contract applied in Saudi public works projects. A clause in the standard form of contract requires the contractor to apply his knowledge and experience in pricing his bid, and to provide an assurance that the agreed price will suffice to cover all expenses incurred until his obligation is fulfilled. However, in the economic crisis of 2008, huge increases in the price of materials, which contractors could not accommodate, led to the stoppage of many construction projects, with damaging effects on the

Kingdom's economy (Asiri et al., 2013)

Unit-price contracts

This type of contract is based on the unit price for each part of the construction. It combines elements of fixed-price and reimbursable contracts. The owner bears the risk of whether the work will be completed within the budget, while the contractor takes the risk that the cost of performing a unit of work may exceed the estimation (Cleland, 2004). The choice of this type of contract depends on the level of risk, which in turn depends on the amount of information available (Collier, 2001). It works best for projects where the nature of the work is well-defined, but the total quantity, and hence the cost, is uncertain (Cleland, 2004).

Cost-plus-fee contracts

This type of contract, with its variant forms (cost plus fixed fee contracts, cost plus percentage contracts, cost plus incentive fee contracts and maximum cost plus fee contracts) is derived by adding a pre-determined percentage mark-up to each item in the schedule of works, or by applying a pre-determined fee to cover overheads and profit (Poage, 1990). It has the benefit of flexibility for the owner and reduces the risk to the contractor. However, Ferreira and Rogerson (1999) argue that it encourages specification of high-cost features and excessive design changes by the owner, with the attendant risk of time and cost over-runs.

Guaranteed maximum price contracts (GMP)

In this type of contract, a maximum sum is agreed, which is not to be exceeded. The contractor guarantees to complete the project as specified and that, in any event, the cost to the owner will not exceed the pre-determined price (Clough & Sears, 2015). GMP contracts give the owner an opportunity to reduce costs, and the contractor to increase his profit.

A number of organisations offer standard form of construction contracts to guide owners and contractors; the American Institute of Architects (AIA) (www.aia.org), and International Federation of Consulting Engineers (FIDIC) (www.fidic.org), are just two examples. Such standard contracts, based on similar purposes and clauses, are widely accepted in the construction industry (Yayla & Tas, 2010).

2.4.4 Scope of project

An important consequence of change requests, which may either be harmful or beneficial, is change in the scope of a project. Clarity about scope from the outset may reduce the need for change requests and control their impact. Project managers are faced with the daunting task of overseeing adherence to the project scope. As an ongoing aspect of project management, project scope is defined by Chandramouli (2011):74) as "the work that must be done to deliver a product the specified features and function" As a result, the project scope determines the abilities of the project manager to deliver the specified and expected products, services or other forms of results, with commensurate features. A number of researchers have defined scope in a similar manner, focusing on a wide array of dimensions of the term. These definitions are process and result oriented, with emphasis on both dimensions of project completion. As a result, looking further than the action-orientation, scope plays a primary role in ensuring that the management of quality, time and cost are achieved in a successful manner, and so is highly influential in the key success factors of any project (Molly, 2007).

In any project, the planning and design stage provides an outline of the various aspects of a project, including the scope. As a result, the project manager and other stakeholders are presented with an intricate and comprehensive portrayal of the various elements which represent the scope of the project, as indicated by Shelly and Rosenblatt (2009). A comprehensive definition of scope should include a definition of the work relating to the construction documents, including drawing and specification reference, dates, numbers, and dates of addenda to the document "additional work to be performed by the subcontractor; exclusion from work described in the construction documents; any additional specific information relating to the project such as schedule dates or delivery dates; and description of included alternatives and negotiated additions or deletions to the agreement" (Mincks & Johnston, 2010:268). The project scope is defined in the project scope statement, which outlines precisely the nature of work to be produced by the project (Nilsson, 2012). This document provides a baseline, rendering change decisions easy to make, since the original requirements and deliverables are specifically indicated.

2.4.5 Design

The engineering design process is defined as " a component, or process to meet desired needs. It is a decision-making process (often iterative) in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing and evaluation" (Ertas & Jones, 1996:2). In the context of construction, decisions on design are crucial in order to satisfy clients' needs, ensure product quality and enable construction within agreed time and cost parameters (AboMoslim & Russell, 2005).

Design is a complex undertaking, with no single, standard approach, since each client has unique requirements, and so, in turn, the design needs of each project are unique (Fredrickson, 1998). In the Arabian Gulf region, ambitious building projects in recent years have pushed the frontiers of design with super-high-rise building construction, including one of the tallest buildings in the world in Mecca, Saudi Arabia. Such projects, which attract huge investment, and, if successful, confer international prestige on designer and client, draw on international best practice and technology (AboMoslim & Russell, 2005).

According to Mohammed (2007) there is no professional organisation in the Saudi construction industry to provide standards or model best practices in design development. Saudi firms, therefore, tend to look to international recognized practice. Typical referents in this regard are the American Institute of Architects (AIA) and the Royal Institute of British Architects (RIBA), depending on the designer's background and experience.

Mohammed's (2007) study of existing systems in the Saudi construction industry identified a typical four-stage design process, consisting of:

- A preliminary (i.e. pre-design) briefing or programming phase, in which client needs are ascertained.
- The master plan (preliminary stage) in which site analysis is conducted and schematic designs or sketch plans are produced.
- Design development, in which the design is translated into detailed working

drawings.

- Contract document phase. Some Saudi consultants divide this into two stages, one to deliver the final design, including all types of drawings, and one for the preparation of the construction document, including the contract, specifications, bills of quantities and so on.

Each of these stages plays a vital role in the success of the project. If done well, they contribute to the buildability of the project, the contractor's ability to perform on schedule and client satisfaction (Arain et al., 2004). If not, they can give rise to errors and misunderstandings, increasing the need for change requests and contributing to tension among project participants, delays and even project failure (Mendelsohn, 1997; Assaf & Al-Hejji, 2006), as will be seen in a later section.

2.4.6 Specifications

An important role in any project is played by the specifications, which set out the standards of performance to be met by the contractor, and establish the responsibilities of parties to the project contract (Jackson, 1990). A detailed definition of the technical specification is provided by Koenig et al. (2009), who note that it "lays down the characteristics required of a product, such as levels of quality, performance, safety, or dimensions, including the requirement applicable to the product as regards the name under which the product is sold, terminology, symbols, testing and test methods, packaging, marking or labelling and conformity assessment procedures" (p.619). Similarly, Fenves et al. (1976) indicate that the technical specification includes a detailed breakdown of all technical characteristics involved in production of the product (such as construction of building), including the materials, technology and devices to be used, relevant production conditions, physical, mechanical and/or chemical features as appropriate, trade names and product codes where relevant and the technology to be applied. The authors go on to note that technical specification documents should be prepared systematically, accurately and structured according to the particular construction type.

The importance of the technical specification document lies in its role as a point of reference controlling construction performance. It is therefore important that the representatives of contractors and owners, as the primary parties to the construction project, should understand the nature and underlying purpose of each specification, their legal implications, and how they are to be implemented in the field; moreover, these matters should be interpreted consistently (Jackson, 1990). Clearly thoughtout and consistently interpreted technical specifications protect the contractor's rights in relation to decisions on methods of construction, and also safeguard the owner's interest in the performance delivered by the finished product. This, in turn, tends to lead to better relations between the parties and reduces the likelihood of time-wasting and expensive disputes (ibid). The key here, however, is in the words, "consistently interested". As Eden et al. (2005) point out, the existence of a functional specification does not necessity guarantee clarity, differences of interpretation are not uncommon. Achieving a specification that is enough to eliminate all ambiguity is difficult, but efforts should be made to reduce the scope for conflicting interpretation as far as possible. Nevertheless, lack of knowledge or care in the preparation of technical specifications is a common problem, resulting in change requests, delays, disputes and litigation, as discussed in section 2.6.1.5.

2.5 Change Requests

This section is devoted to establishing a basic understanding of change requests, which are the main issue of concern in this thesis. It provides a definition of change request, distinguishing it from related terms, highlights the importance of such requests, and considers the process involved in making and approving a change request.

2.5.1 Conceptualization of change request

In order to ensure clarity as to the scope of this research, it is necessary to understand exactly what is meant by a change request. This warrants clarification due to the use in literature of a number of related terms (change request, change order, variation order), which are not always clearly distinguished. In this section, therefore, the

concepts of change and variation in the context of construction projects are first defined, then definitions of change request and change or variation order are examined, in order to identify the distinction between them. The terminology used in this thesis is then identified and justified.

In the context of construction projects, change is a common occurrence, as aspects of the projects may need to be modified in response to situations and conditions that emerge in the course of the construction process (Hanna et al., 2002). Change can be defined as an event that leads to any modification of the original terms of the project, such as deferral of the completion date, or change in the cost of work (Rashid et al., 2012). Stevens (2002) offers a more detailed definition that takes account of the initiators of such change, as well as its relationship to the original project agreement. He notes that change refers to change in the intentions of the client or those of the project manager towards the project, which is implemented on the ground. He further notes that change can conveniently be identified as "an event that causes a significant change in any formally issued project contract document, drawing or specification" (1-2, Section 34).

Some authors and practitioners use the term 'variation', rather than 'change'. Mohammed et al. (2010) comment that there is no single definition of what a variation is, but suggest that as a matter of common practice, a standard form of building contract will set out the specific actions and activities that will be deemed to constitute a variation. Arain and Pheng (2005)**,** however, propose a general definition of variation as any deviation from an agreed clearly specified scope and schedule. Elaborating further, they explain that it implies a change or modification to the instructions issued to the contractor by the owner or owner's representative, and they note that such modification may be manifested in amendments to plans, specifications, or any other documents pertaining to the contract. The similarity of this definition to Stevens' (2002) definition of change suggests that the terms change and variation reflect the same concept, and that the change or variation is identified with reference to a previously agreed formal project description reflected in the project documents. The interchangeability of the terms 'variation' and 'change' is further supported by authors. According to Charoenngam et al. (2003), a change request denotes the request for a variation, while Chan and Kumaraswamy (1997)

comment that ‘change orders’ may arise from “client-initiated variations or necessary variations for the works”. Elsewhere, Keane et al. (2010) suggest the interchangeability of the terms by referring to a ‘variation or change’, defined as any departure from the agreed project scope or schedule.

Change, as Yawalekar et al. (2015) point out, is a very common occurrence, and may arise due to a range of factors, such as a change to the original design, or rectification of an error, additional or different requirements, change in the work schedule, or any unforeseen circumstances that give rise to adverse impacts on project constraints, time, cost and quality. Such changes give rise to a change request, which the PMI (2008:428) defines as a **“** formal proposal to modify any document, deliverable, or baseline**”.**

Stackpole (2013) notes that such a request can result in modification of anything related to the project, whether it be the product, requirements, documents or any other matter pertaining to the project. He elaborates on the form of the change request as a formal document, which is submitted to an official review panel, known as the Change Control Board or some similar designation. As Stackpole (2013) points out, a change request will typically contain the following information:

- The name of the person initiating the request.
- A change number or similar identifier.
- The category of change.
- Detailed description of the proposed change.
- The rationale for the proposed change.
- The implications of the proposed change in terms of, for example, project scope, quality, requirements, cost, schedule and impact on project documents.
- Disposition of change.
- Justification.

Some writers use the terms ‘change order’ or ‘variation order’ instead of change request. An extensive search in the literature showed no clear distinction between ‘change order’ and ‘variation order’. The interchangeable use of ‘change’ and ‘variation’ to denote any departure from any aspect of the agreed terms of the project has already been noted. Charoenngam et al. (2003) use only the term ‘change order’,

while indicating that such an order is issued to authorize a ‘variation’. They further note that the ICE conditions of contract “refer to change orders as ordered variations”. To avoid confusion, the term ‘variation order’ is not used in this thesis. If ‘change’ and ‘variation’ are the same as the literature suggests, this still leaves the issue of the distinction between a ‘request’ and an ‘order’. Indeed, some authors appear to use the terms interchangeably, moving from one to the other with no clear distinction. For example Cleland (2004) discusses the need for the occurrence of changes to be identified and recorded, and notes that if a change is needed in the scope of the project team’s work, a change *order* should be issued for both project time and money. Then, in the next sentence, he notes that time *requests* are usually accompanied by an analysis of time implications, with reference to the original schedule. Such inconsistent or inexact use of terminology is potentially a source of conceptual confusion. This raises the question, what is the difference, if any, between a change request and a change (or variation) order?

Some definitions of change orders, like those of change requests, focus more on the ‘change’ part of the definition, identifying the potential scope of such changes and their impact on the project. For example, Ndihokubwayo (2008) notes that variation orders involve adding, removing, changes and substitutes in terms of the product quality, quantity and schedule. Desai et al. (2015) point out that such orders are used to cover alteration to the scope of work, amounts of materials, design errors and unit rate changes. They include the addition or removal of work from the original scope of the project as detailed in the contract, which results in a change to the amount of the project or its completion date. Such explanations do not demonstrate a clear distinction between a change order and change request. More helpful in this regard are those definitions that focus more on the formal form or status of the change order. Oladapo (2007), for example, defines it as “a written instruction by the architect requiring the contractor to alter the work”. More specifically, the American Institute of Architects (2007) defines a change order as “a written instrument prepared by the architect and signed by the owner, contractor and architect stating their agreement upon all of the following:

- The change in the work;
- The amount of any the adjustment, if any in the Contract sum; and

- The extent of the adjustment, if any, in the project duration and completion date.

It is worth pointing out, however, that the order may not mean that all three parties are in full agreement; some authors distinguish between a bilateral change order, issued to the contractor when he and the owner have agreed on the time and cost changes necessitated by the order (Claudet, 2015) and a unilateral change order, issued by the owner without agreement with the contractor on the new work price (Stocks & Singh, 1999).

In light of the above, it can be concluded that change request and change order are similar in the scope of the issues they may address, and their implications for a project. However, they differ in relation to their source, timing and status. Whereas a change order is prepared by the architect, a change request may be initiated by another party, such as the owner. In terms of timing, the change order comes after the change request, following review of the request and its implications. Moreover, a change request is simply an expression of a wish to modify the project in some respect, while the issue of a change order indicates that the proposed change has been approved and agreed, so it is a formal authorisation for implementation of the proposed change. Consistent with this view, Keane et al. (2010) define a change order as the formal document that authorizes matters pertaining to the project and becomes part of the related documentation, while Stasis et al. (2013) succinctly note that "a change request denotes the request for a variation, while the order characterizes the employer-authorized instruction for it" (p.178).

In fact, the PMI (2013) avoids this terminological confusion by using, instead of the term 'change order' the term, 'approved change request' . Both the term used, and the definition given, as "those requests reviewed and approved for implementation by the change control board" clarify the change in timing (since it is after review) and status (approved) compared to the initial request. Nevertheless, the list of possible contents and purposes makes clear that approval may be granted to any type of request: to correct a mistake, prevent a problem,

change policies, plans and procedures, adjust cost, or revise schedules (PMI, 2013).

The PMI's explanation essentially reiterates the notion of change request discussed earlier; the only distinction is that the request, which can apply to any part or aspect of the project, is now formally approved for implementation by the project team.

Figure 4 Difference between Change Request and Change Order

In this thesis, the term change request will be used in preference to change order or variation order for two reasons:

1. This is the only formal definition which is used in the Project Management Body Of Knowledge PMBOK (PMI, 2008:428).
2. Based on the above-stated distinction between change request and change order, this research considers mainly the change request before it occurs, or when it is first raised, although if we find cases where a request is approved and becomes a change order, they are still considered in our analyses.

However, the expressions change order or variation order may be used when quoting other writers.

As a provisional definition, that of the PMI cited earlier ("formal proposal to modify any document, deliverable, or baseline") is adopted in the thesis, as it is broad enough to encompass the range of change likely to be encountered, and avoids the confusion inherent in some other definitions. However, after analysing the data collected during the course of this research project, the researcher will suggest a new definition to describe change requests more clearly in terms of this differentiation from change orders and potential impact (positive or negative) on the project.

The main terms and definitions identified above and the definition selected for this study, or summarized in table 2

Table 2 Terms and definitions found in the literature

Terminology	Definition	Reference
Change request	Request for a variation A formal proposal to modify any document, deliverable, or baseline A formal document submitted for review, requesting and justifying a change in agreed project schedule	Charoenngam et al. (2003) PMI (2008) Stackpole (2013)
Variation order	Addition, removal, change or substitution in project quality, quantity and schedule	Ndihokubwayo (2008)
Change order	An order issued to authorize variation in a project Written instruction by the architect requiring the contractor to alter the work Written instruction prepared by architect, signed by the owner, contractor and architect agreeing a change in work.	Charoenngam et al. (2003) Oladapo (2007) AIA (2007).
Approved change request	Request that has been reviewed and approved for implementation	PMI (2013)
In this study		
Change request	A formal proposal to modify any document, deliverable, or baseline	

From the above account of the potential scope of change requests and subsequent change orders, it can be seen that they potentially play a significant role in construction because of their impact on cost, schedule, safety and productivity (Desai et al., 2015). Authors such as Desai et al. (2015) see such requests as inevitably problematic, because they focus on negative impacts such as cost and time overruns, to the extent that such requests have been viewed as one of the major causes of project failure. Even though change requests may be intended to improve a project,

change in projects can arguably be regarded as a risk, necessitating the implementation of change control and management techniques to safeguard against potential adverse impacts (Yawalekar et al., 2015). The risk posed by changes in a project and the potential pervasive impacts throughout the project and for all parties make change requests a significant feature of construction projects, that warrants careful attention from project owners, managers and contractors. Accordingly, the importance of change requests is addressed in the next section.

2.5.2 Importance of change requests

Before proceeding further, it is worth briefly considering why change requests are attracting interest and concern. Almahmoud et al. (2012) indicated that the fraught process involved in assessment of the required resources is complicated by challenges in prediction of changes in the future. Uncertainties in the short- and long-term necessitate appreciation of the need and emergence of change requests (Park, 2003). Although efforts between project managers, owners, contractors and other stakeholders to reduce the need for change requests sometimes succeed, this can only be measured once the project is completed successfully. It is thus the role of the project manager, as the go-between for other stakeholders, to minimize the negative effects of change requests on the quality, cost and timing of the project. Change requests are normally complicated by litigation procedures between the stakeholders.

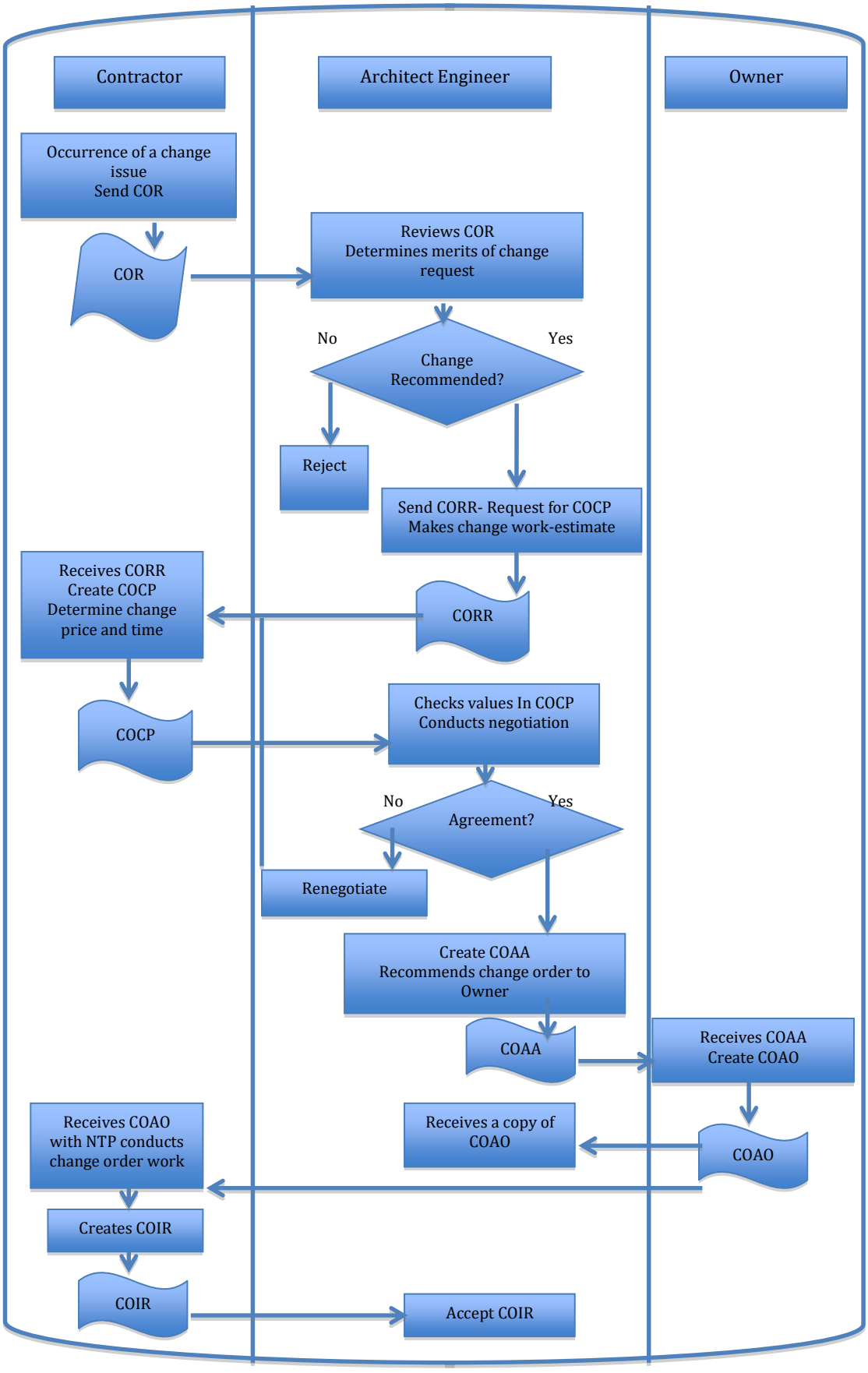
Mohammad et al. (2010) classified variation orders as either beneficial or detrimental, depending on their outcomes, as opposed to the means to achievement of the outcome. For example, if a change request is made because of increase in costs, with the primary aim being to enhance quality, this will be considered a beneficial variation, although it entails elements of increase in costs. Beneficial variation orders are defined as those skewed towards improvement and enhancement in the standards and quality of the project (Ndihokubwayo & Haupt, 2007). These variation orders seek to minimize costs, project duration, and complexity in completion of the project and optimize the ability of the contractor to achieve efficiency and effectiveness in the project. Detrimental variation orders have negative effects on the value to the client or performance of the project. Clients

experiencing financial challenges may place change requests in order to obtain authority to use cheaper and more affordable materials (Ibrahim et al., 2010).

2.5.3 Process of change request

The term ‘process’ is defined by the Oxford Dictionary as “a series of actions or steps taken in order to achieve a particular end”. In an operational context, Hammer et al. (1993) view a process as a sequence of activities, beginning with one or more inputs and leading to an outcome of value to the client. Applying these ideas to the specific contexts of change requests, the change request process is the set of activities whereby the request for a change in some aspect(s) of the project is initiated, raised to the relevant individual or body, evaluated in respect of feasibility, time and cost implications and so on, authorized and formally issued as a change order. Yayla and Tas (2010) suggest that before a change order is prepared, a problem will have been identified, requirements, causes and solutions indicated, and cost factors and the likely impact of the proposed changes determined in coordination between the architect/engineer and contractor.

The process will differ according to the type of project, the parties involved, the expertise available and so on. Nevertheless, it is possible to find in the literature a number of accounts or depictions of the change request process, whether generic outlines, or descriptions of the process in particular cases. Charoenngam et al. (2003) for example, depict the change request process in a flow diagram (see Figure 5), while Lee et al. tabulate the process as shown in Table 3.



CO=Change order; COAA=Change Order with Architect/Engineer's Approval; COAO= Change order with owner's Approval; COCP=Change order Cost Proposal; COIR= Change Order Interim Report; COR= Change Order request; and CORR=Correspondence

Source: Charoenngam et al. (2003)

Figure 5 Flow diagram of the change order procedure

Table 3 Change Order Steps, Tasks and Involved Parties

Step	Task	Involved Party		
		Contractor	Supervisor/ Engineer	Owner
1. Requirement review	Review requirements for change orders Review contracts Inspect site status	✓		
2. Change report	Report change orders Prepare change order application Prepare change order statement. Prepare quantity report Prepare cost report	✓		
3. Report review	Review change report Check change issues and related party Review quantity and costs Produce review report		✓	
4. Change approval	Approve change orders Make decision to change work			✓
5. Notice of approval	Notification of change orders approvals Prepare and deliver notice of approval		✓	
6. Construction	Perform change work	✓		
7. Contract documentation for changed works	Contract documentation for changed works Prepare summary report for change Prepare statement of change orders Prepare quantity change report Prepare cost change report	✓		
8. Investigate/ Confirmation	Investigate and confirm changes Produce review report Produce investigation report		✓	
9. Contract change	Sign contracts for changes	✓		✓

Source: (Lee et al., 2010).

Although the two depictions differ in format, it can be seen that they share certain characteristics. Both identify not only the tasks performed, but also the documentation involved and the parties concerned at each step, divided between the contractor, architect/engineer and project owner. Interestingly, both depictions show the change request as initiated by the contractor, and then negotiated between the contractor and the architect/engineer, consistent with the assumption made by Yayla and Tas (2010). It is noticeable that there is very little involvement of the owner in either scheme; both Charoenngam et al. (2003) and Lee et al. (2010) show the owner's role as confined to approving the request developed and documented by the other two parties, and in the case of Lee et al. (2010), final signature of contracts for change. Neither scheme envisages change requests being initiated by the owner.

A number of points may be raised with regard to the change request process. One feature that is evident in both the schemes depicted above is the emphasis on written documentation at every step. Lee et al. (2010) note the importance of documental authorisation, arguing that all steps taken should be in written form, especially for public projects. However, they admit that because of the time involved in preparing and reviewing documentation, in practice it is not always possible to document every process involved in a project. Charoenngam et al. (2003) also raise the issue of documentation, although they suggest that the initial request for change, made by the engineer, could be made orally. Nevertheless, they still envisage that an oral request should be confirmed in writing, if not by the engineer then by the contractor, as depicted in Figure 6.

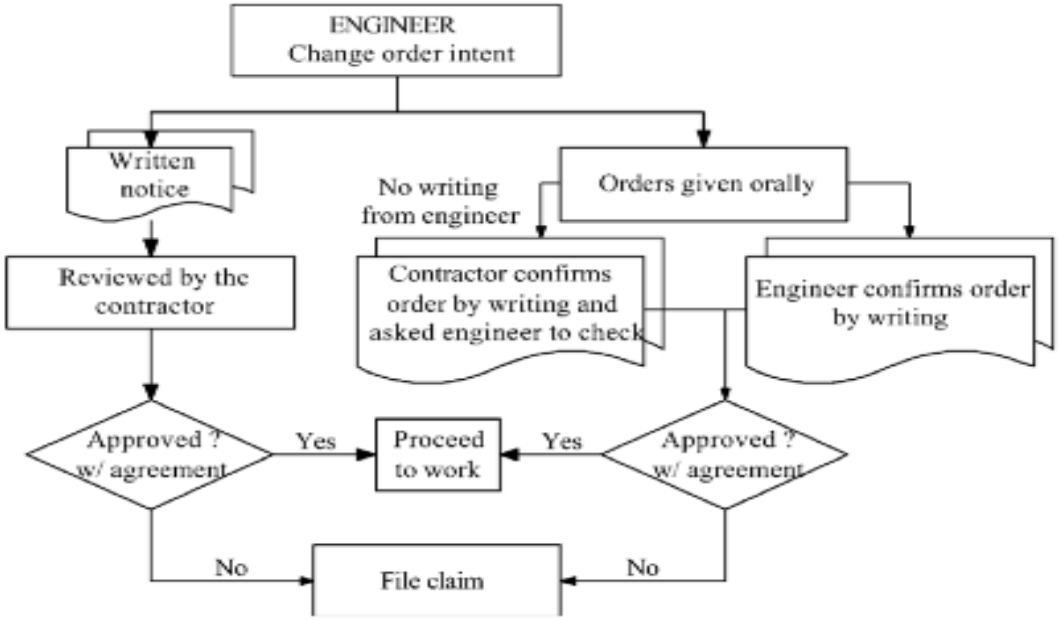


Figure 6 Variation order process

Source: Charoenngam et al. (2003).

The importance of written documentation is related to the importance of tracking baseline change, which Douglas (2000) acknowledges can be laborious and time-consuming. He emphasises the necessity of establishing rules and time-frames for change submissions and the associated discussions. A change control board (which the PMI (2013) defines as a "formally chartered group responsible for reviewing, evaluating, approving, delaying, or rejecting changes to the project, and for recording and communicating such decisions") is advised to conduct reviews according to a clearly specified schedule, in order to maintain project momentum (Douglas, 2000).

Douglas's comments raise another key issue in the change request process; that of timeliness. Kasen and Oblas (1996) suggest that in many cases, inefficiencies arising from change requests are related to timing issues, such as the period of notice between identification of the change and the scheduled date for commencement of the work. If the time-frame is too short, planned sequencing will be adversely affected. If it is too long, the contractor is forced to begin work and move on at his own expense (Kasen & Oblas, 1996). Farbarik (2004) similarly identifies change processing time as one of the major contributors to project impact, while Ibbs (1997) suggests that the degree of impact will also be affected by the point in the project

when the change occurs, with changes taking place later in the project having more impact.

Although the burden of documentation and the criticality of timing pose challenges for change request processing, both can be alleviated with the aid of technology. Samad (2002) advises automation of the process, while Charoenngam et al. (2003) recommend that the potential of Internet technology be exploited for managing the change request process in construction projects. They note that doing so confers the advantages of standardisation of facilitation procedures, prompt delivery of information to the concerned party, the ability to confirm that the other party has read the document in question, centralized record keeping and avoidance of document mismanagement.

Apart from the use of technology, authors suggest a number of ways in which change request processing may be improved. McGreevy (2009), in an article targeting contractors, advises the following:

- Give notice of the proposed change.
- Consider time extension.
- Demand written authorisation for the change.
- Consult with the relevant trades about change impact.
- Document costs in detail.
- Negotiate payment terms for change costs.
- Be aware of applicable prompt-pay laws.
- Negotiate contract terms to verify that the client is able to pay for the change.

Whilst McGreevy (2009) focuses on measures to protect the rights of the contractor in the change request process, other suggestions concern methodologies for facilitating and accelerating the process, to reduce project impact. Gardner and Block (2004) evaluate the impact of modifications to the change request process in a government agency operating airports in Orlando, Florida. Rapid growth in passenger demand necessitated large construction projects, challenging the need for consistency and oversight. The authority concerned had a well-established change request procedure, beginning with the initiation of a request by the general contractor

to the owner's representative, who would give advance notice of the change to the agency's construction committee, pending negotiation of the change order package, which was then submitted to the committee for approval (see Figure 7).

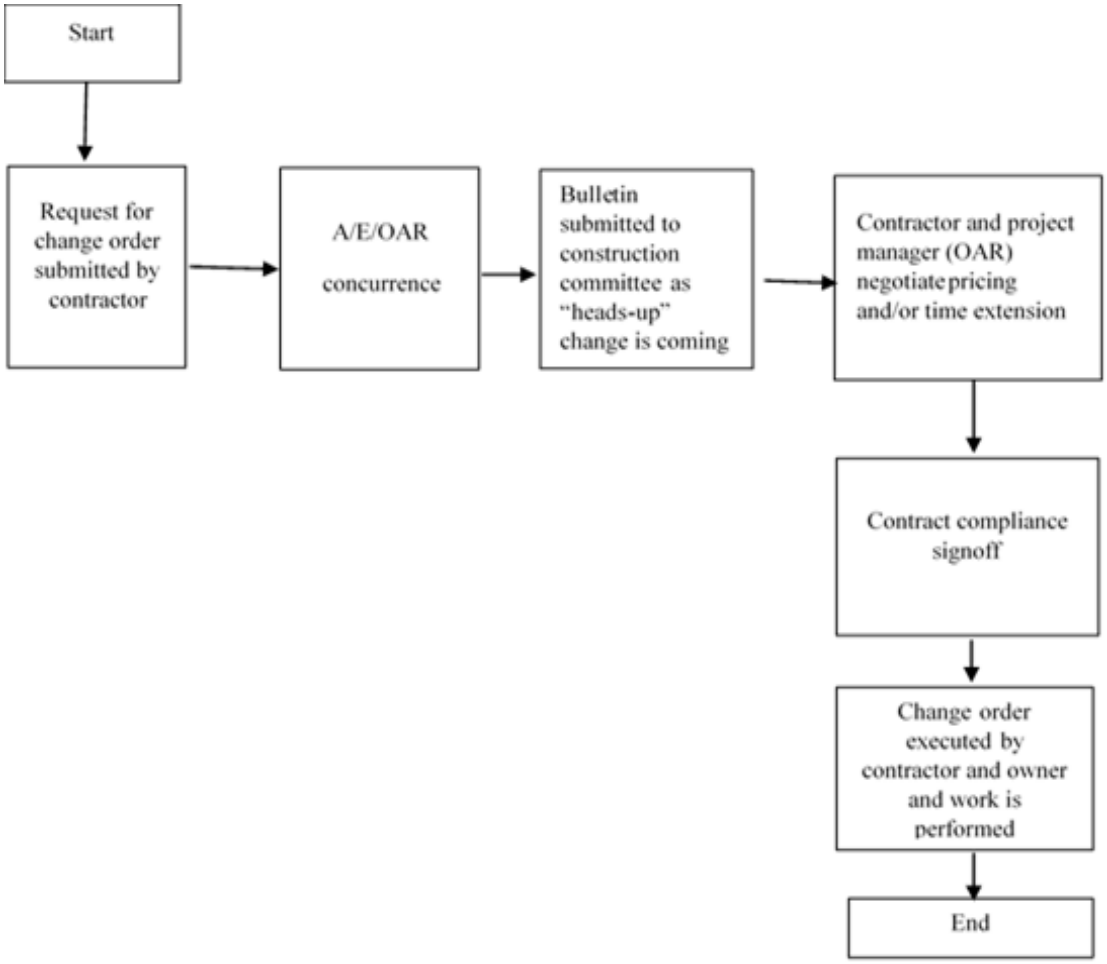


Figure 7 Old Change Process

Source: Gardner and Block (2004)

Concerned to maintain a consistent approach to the change request review process, the agency implemented a new process (see Figure 8), which was the focus of Gardner and Block's evaluation.

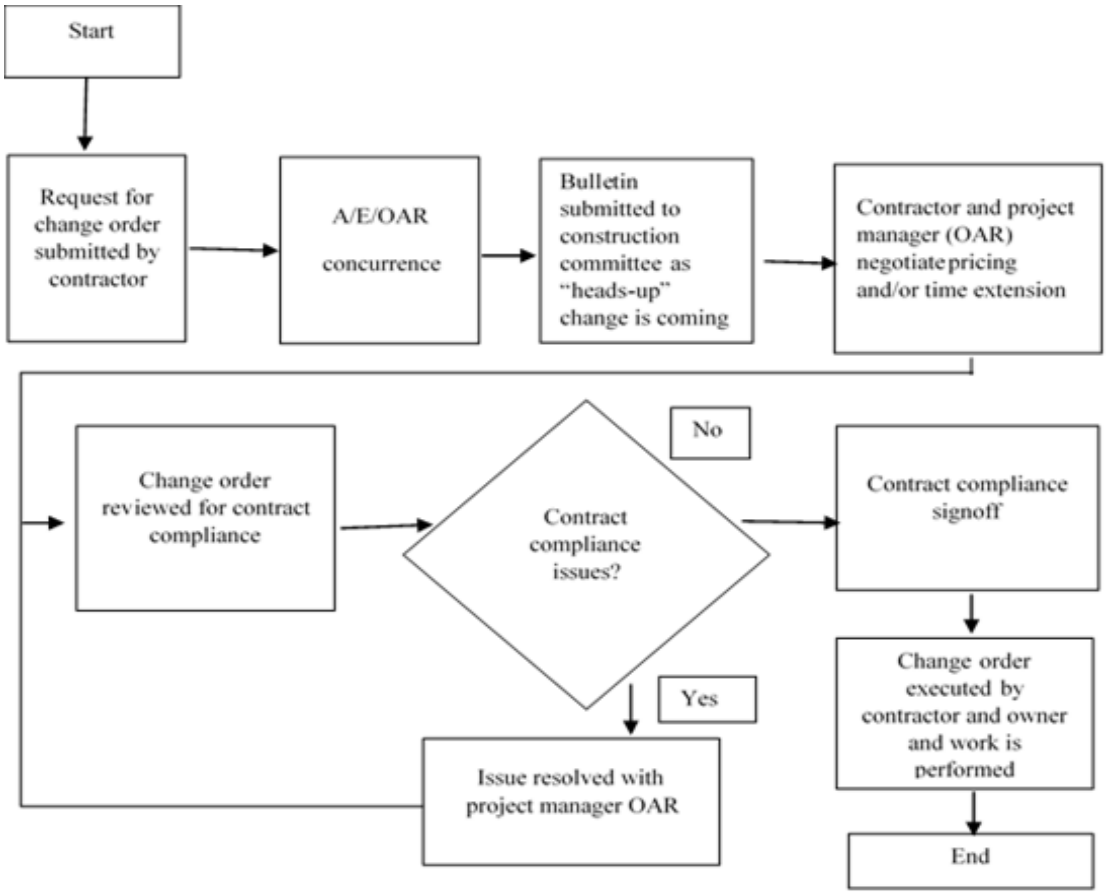


Figure 8 Revised Change Order Process

Source: Gardner and Block (2004)

As the figure shows, the new process is more complex, because it adds extra stages, concerning review for contract compliance. The added steps were outsourced to an independent consultant, both to source technical expertise that was not available in the agency at the time, and to have compliance reviews performed by a company that did not have vested interests in the project or contractual relationships with the parties engaged in the design and construction. Gardner and Block (2004) evaluated the impact of the change from two perspectives: the time taken by the revised process, relative to the original, and the ability of the new process to identify and prevent non-compliance and administrative issues. Their analysis found a 45% reduction in review time within the years taken for implementation of the new process, while maintaining the independent oversight consultant provided valuable training to owner representatives, through the change request process. This, together with owner commitment, was identified as key to the success of the process.

In a more recent paper, Jing Du et al. (2012) presented a quantitative analysis framework for accelerating change request processing in facility management settings, based on a combination of Discrete Event Simulation (DES) and Sensitivity Analysis (SA). First, a set of DES models were built to simulate the change request process for Engineering and Architectural Service projects at a U.S. university. Then a set of SA were conducted to examine the relative importance of proposed improvements. The outcome revealed that two proposed improvements had significant impact in accelerating the change request process. The first was optimum batch size (the number of change items included within one change request), which was directly related to the average processing time per change request. The second significant improvement was streamlining the complex approval process, based on the dollar amount of the changes, whereby the layers of approval required were reduced for lower-value projects. The authors concluded that the combination of DES and SA can help to optimize the change request process, which in turn is beneficial in reducing cost and risk for all project participants.

As noted in this section, there is no single universally agreed process for initiating, evaluating and authorising change requests; thus there is no single change request process that suits all projects and all organisations. Similarly, there can be no single "one size fits all" solution to improving the process. Nevertheless, this section has provided some insights into typical tasks involved, the parties concerned and the issues to be considered when designing and evaluating such a process. It also affords ideas as to possible avenues for exploration, with a view to accelerating the process. This discussion may provide a useful basis of comparison by which to analyse the processes employed in the selected Saudi companies, and inform subsequent critique and recommendations.

2.6 Causes of Change Requests

In order to consider how to avoid or handle change requests, it is necessary to understand why they occur. There are many reasons for issuing a change request in large projects. Some are internal causes, which come from inside the project; for instance the project manager wants to alter the design of the project (Stevens, 2002).

However, causes of change requests may also be external, when they are not related directly to the stakeholders, for example, weather changes, which may cause severe damage to the project (Mohammad et al., 2010). Identifying the cause of the change early is very important in order to avoid potential changes in future projects or minimize their effects and handle them effectively (Ibbs, 1997). Common causes of change requests identified in the literature are reviewed below.

2.6.1 Internal causes

Change requests can arise from a number of within-project causes and be initiated by various parties, as indicated in the following outline, which reflects all those causes found in the literature so far.

1. Changes initiated by consultant

Change requests may occur when the project manager wants to modify the design of the project, description of the work requirements for correcting a fault, or causing observed development on a specific occasion (Stevens, 2002). In more detail, causes of changes initiated by the consultant are as follows:

- Consultant's lack of knowledge of available equipment and materials (Mohammad et al., 2010)
- Architectural designer needs new designs (Oladapo, 2007; Mohammad et al., 2010)
- Design complexity (Mohammad et al., 2010)
- Unanticipated work by designer/consultant during project (Rashid et al., 2012)
- When contractor is asked to do inadequate work (Mohammad et al., 2010)
- Incomplete design or poor structural drawing (Fayek & Nkuah, 2002; Al Duaij et al., 2007)

2. Change by owner

The owner or client, in some cases, may cause a direct change order, when he fails to fulfil some requirements which are important to carry out and achieve the project. Several types of changes may be caused by the owner. Mohammad et al. (2010) categorized changes initiated by owners as follows:

a) Change of plan

One of the significant causes of change requests in the project is a change of plan by the owner. The majority of these changes are formally initiated as new requirements and needs (Nadia et al., 2006:5; Reddi & Moon, 2012). This type of change occurs for several reasons. First of all, the owner is not involved in the development of the design. Secondly, the owner cannot imagine and understand the design. Finally, the owner believes it is just a change in thought, without estimating its effects (Jawad et al., 2009).

b) Owner's financial problems. The owner may face some financial difficulties, which may force him to ask for a reduction in project cost or scope (Memon et al., 2014b).

c) Change of schedule

Every project has a time limit. However, the owner may make some changes by speeding up the action plan and trying to ask for delivery sooner than planned, due to a surprise change in the needs of the client (Fayek & Nkuah, 2002). In some cases, there is an adjustment in the project schedule when the owner delays in approving shop drawings or releasing the site to start construction (Hansen, 1994). Also, the schedule will be delayed if the owner delays payment for the project as recorded in the schedule (Fayek & Nkuah, 2002).

d) Replacement of materials. Replacement of materials could be a result of the non-availability or slow delivery of the required materials, or lack of equipment and materials. (Fayek & Nkuah, 2002). Replacing materials is usually done by the owner when he needs some change (Mohammad et al., 2010).

3. Change in specifications by stakeholders

The most common source of differences is in the range of specifications, which occurs due to entrepreneurs, consultants and experts. This can be a consequence of the change in the income of the owner, or a change in interests and needs, errors in design or not having enough time to prepare the contract documents (Oladapo, 2007). Oladapo (2007) stated that change orders may come from the architectural designer when there is a difference in the specifications or he would like new designs. Modifying specifications is one of the causes of changes, and usually takes place by the company during the design of the project. Nadia et al. (2006) and Al Duaij et al. (2007) have said that a reason for variation orders could be unclear specifications, while Fayek and Nkuah (2002) acknowledged that variation orders can be caused by incomplete specifications.

4. Contract-related changes

The majority of change requests are a consequence of fault or neglect in the contract documents. Some of these changes may expand or reduce the scope of the project. Change in the contract could be due to:

- Inconsistencies in the contract document (Al Duaij et al., 2007)
- Error in the type of contract (Fayek & Nkuah, 2002)
- Difference between two or more terms of the contract
- Inconsistency between the contract and any legal requirement
- Fault or negligence in the clauses of the contract (Fayek & Nkuah, 2002; Oladapo, 2007)
- Amendments by the contractor due to points that are not clear in order to be developed
- Suspension of work due to insufficient budget
- Correction of contract document errors and omissions (Fayek & Nkuah, 2002; Ndihokubwayo, 2008)
- Failure to involve the contractor in design
- Unobtainability of equipment

- Unobtainability of skilled manpower
- Financial difficulties of contractor
- Poor workmanship (Mohammad et al., 2010)

In the following sub-sections, causes of change requests related to key project elements are considered in more detail.

2.6.1.1 Problems with competitive tendering

Whilst the literature has not explicitly linked tendering procedure with the occurrence of change requests, critics of competitive tendering identify a number of problems with the system, which could result in difficulties in the relationship between the parties, inaccurate cost estimations and various kinds of project risk.

As Perng et al. (2006) point out, open tendering procedures are often extremely complex, uncertain and costly. Moreover, the system tends to encourage a short-term, project-by-project focus, rather than long-term client-contractor relationships, which leads to the dominance of self-interest and potential unfairness, associated with the unequal bargaining power of the parties (Williamson et al., 2004). In a case study of a food-court refurbishment project, Williamson et al. (2004) found that despite the provision of the Australian Standard Code of Tendering AS4120 (Standard-Association-of-Australia, 1994), such self-interest resulted in exploitative behaviour on the clients' part, which the contractors endured because of their lesser bargaining power and their own self-interest in staying in business (Williamson et al., 2004).

One of the reasons for the complexity and uncertainty of comparative tendering is that it necessitates the assessment of risk. In other words, when estimating time scales, project costs and so forth, the contractor must consider the possibility of risk factors over which he may have little or no control. According to Towner and Baccarini (2012), based on their investigation of competitive tendering projects in Australia, tender prices must take account of risks related to resource availability, weather conditions, design errors and buildability. Pricing these necessitates consideration of project factors such as the type of contract, completeness of documentation, project complexity and contractor's workload. Risk can be accounted

for in the tender price by the addition of a percentage or lump sum amount over the base estimate, either on a trade-by-trade basis or for the overall project. A significant role in this process is played by experience, intuition and judgement, which may be available to different degrees from one contractor or project to another. The same issue of risk was raised by Adedokun et al. (2013) in their study of competitive tendering in the context of educational building projects in Nigeria. They noted the prevalence of not only financial but also logistical and political risk factors, resulting in high premiums in the tender process in a survey of 70 organisations - 46 clients and 24 project consultants - in the Gaza Strip, Palestine. Enshassi et al. (2013) found materials (prices, availability, supply, quality and imports, project team experience, consultant's skill and experience, and the clarity of drawings and specifications to be among the main factors affecting the accuracy of cost estimation. Like Towner and Baccarini (2012), cited above, they note the high level of knowledge and expertise required to produce accurate pre-tender cost estimations. In light of these studies, it is very possible that, during the course of a project, circumstances may arise, which due to incomplete knowledge or lack of experience, were unforeseen or, if anticipated, incorrectly priced by the contractor at the time of submitting his bid. In the view of this researcher, such eventualities have the potential to result in change requests, although the authors do not expressly make this connection.

A final point worth noting is that the traditional competitive tender procedure, with its tendency to focus predominantly or solely on price, may not result in the best selection decision (Holt et al., 1995). Failure to scrutinize the tenders' capability to meet time and quality, as well as budget criteria can result in client dissatisfaction with project progress outcomes. In this author's submission, such a situation, again, has potential to lead to change requests.

2.6.1.2 The contract as a factor in change requests

A number of studies have indicated that one of the main consequences of problems with construction contracts is the need for change requests, which in turn have negative impacts, such as delay, increased cost and even termination of the project. For example, Davison and Sebastian (2009a), based on an electronic survey of members of the National Institute of Government Purchasing (NIGP) in which data

were gathered from 557 respondents, found that construction contracts were perceived as the most problematic of the seven types of contracts investigated and that change orders and delays were the main problems. Building on this research, the same authors (Davison & Sebastian, 2009c) surveyed NIGP and Institute of Supply Management members regarding the perceived impact of various types of contract administration problems. Such problems were perceived to generate problematic consequences in the majority of cases, particularly for construction projects, where the perceived likelihood of problematic consequences was 68.9%.

A serious potential outcome of change requests can be the occurrence of claims by one party against another, for money perceived to be owed as a result of failure to fulfil contractual obligations. According to Shapiro (2005), at least 95% of all claims arising out of construction situations arise out of the contractual relationships between the parties. Since contracts define the major obligations between parties, they also generate most of the claims by the parties against each other. A particularly acute manifestation of such problems is reported in the Egyptian construction sector by Amr and Elnemr (2007). They found change orders to be the main cause of claims in the sector, and in particular, problems arose out of oral change orders (present in 76% of the projects investigated), in many cases resulting in loss of rights, due to lack of contract awareness and improper documentation. The precise implications of change orders, however, differ according to the type of project. In a fixed price contract, for example, a contractor will be reluctant to perform duties beyond those to which he is contractually obligated without additional compensation, so the change order becomes a contractual procedure to adjust compensation (Bajari et al., 2009). In unit price contracts, variations in quantities beyond the thresholds envisaged in the contract give rise to the need to negotiate a new unit price (Manzo, 1997). The potential for such a scenario to occur may give rise to a risky strategy by contractors, who seek to profit from inquiry or uncertainty on quantities in the contract by understating prices for items perceived likely to underrun and overstating prices for items expected to overrun. In so doing of course, the contractor runs the risk that variations may not occur, or will not perform to expectations, or that overstated items will be deleted from the contract (Manzo, 1997).

Whilst there is both theoretical and empirical support for a relationship between the contract and the occurrence of change requests, it is not always clear from the

literature, however, whether or to what extent the problems reported arise from the contract itself. This situation arises because of inconsistency in the use of the term ‘contract’. As noted in an earlier section, a contract is, strictly speaking, a legal document governing a relationship between two or more parties. In much of the construction literature, however, there is a tendency to use the word ‘contract’ to refer to the project itself, or at least that portion of it governed by a particular contract. Thus, for example, in a study by Chan et al. on risks and mitigation measures in GMP contracts in Hong Kong (Chan et al., 2010) and the United Kingdom (Chan et al., 2011b) the authors identified risk factors for the project, such as unforeseen ground conditions, rather than problems associated with the terms of the contract itself. Similarly, Davison and Sebastian (2009, a,b,c), cited earlier, referred to “contract administration problems’, covering project-related problems which affected the ability to perform the contract as stated, rather than weaknesses in the contract itself. Thus, two types of contract related issues can be distinguished: those where a change request arises directly out of ambiguity or error in the contract itself, and those where a change request arises for other reasons. In the latter case, the issue is whether, or to what extent, the contract recognizes and provides for the possibility of change.

Regarding change requests and associated claims resulting from problems with the contract itself, Lee et al. (2010), in a study of factors causing change order claims based on a survey of construction engineers, identified controversial contract provisions and unfair conditions among the external causes (i.e. system-related, as opposed to personal attitudes and choices) of such claims. Mendis et al. (2013), based on observation of four commercial construction projects in Columbia, Canada, looked at levels of reworking (and consequent waste) and separately identified items generated owing to the contract agreement. They identified ambiguity and errors in contract documents as a source of reworking and waste, as well as rework arising out of disclaimer clauses intended to prevent contractor claims. They perceived deficiencies in all the contracts reviewed.

The second issue, that of whether and how contracts do (or should) recognize the possibility of variations is controversial. If a contract is rigid, making no provision for the possibility of change, the contractor would be expected to fulfil the terms of the contract without omission, substitution, alteration or addition (Nahod, 2012). As

Miller and Lessard (2008) point out, such contracts make it difficult for the contractor to make even minor changes, for whatever reason, without incurring liability. Van Der Veen and Korthals Altes (2012), moreover, suggest that failure to recognize the possibility of circumstances giving rise to a need for change orders paradoxically increases the need for change, as the parties are bound to implement terms which, in the changed circumstances, may yield unsatisfactory results. Alternatively, it may be necessary to enter into a new contract.

Given the prevalence in the construction industry of contingencies resulting in change orders, it may appear that a more flexible type of contract is preferable, which recognizes and provides for such contingencies. Ndihokubwayo (2007) indicated that since construction projects are subject to variations, contracts may contain certain clauses related to the limitations and boundaries to which variations can be introduced to the contract. The provision of these clauses in the original contracts makes it possible for inclusion of variations without the necessity of entering into a new contract. However, such contracts are open to criticism on the grounds that contractors may over-rely on such clauses and propagate abstract and amorphous changes to the original project (Keane et al., 2010). It may be argued that the conflict of interest between the two parties restricts project owners to strict contractual relationships, with alterations based on agreements by the two parties. Moreover the provision of contractual clauses to recognise the impact of variations could encourage complacency about failure of contractors to meet the standards. Since a multiplicity of opportunity is available, with an unrestricted resource basket, they sometimes venture into projects without fully conceptualizing them. Eventually, in case they run into challenges, they are quick to put a change request through, and base their decision on the binding contractual clauses (Ndihokubwayo & Haupt, 2007).

Attempts to resolve this dilemma are made in the standard contract forms proposed by various professional bodies in the form of conditions that recognize the possibility of contingences arising that may result in change requests, and try to contract and unify the associated procedures, as well as to delimit the authority of various parties in relation to making change requests. According to Charoenngam et al. (2003) for example, the ICE and FIDIC contracts provide for variations in the form of “additions, omissions, substitutions, alterations, changes in quality, form, character,

kind, position, dimension, level or line and changes in any specified sequence or method or timing of construction required by the contract". Conditions include such aspects as valuation of change orders, the right of the engineer to instruct the contractor to make changes of the kinds listed, and notice of claims.

From the above discussion, it is clear that there is a reciprocal relationship between the contract and change requests. On the one hand, errors, ambiguities and omissions in the contract can give rise to change requests; on the other hand, contingencies arising in the project may create difficulty in fulfilling the contract, and such contingences may or may not be provided for in the contract, thereby influencing the likelihood of claims, and the possibility that the contract will have to be terminated and a new one negotiated. Clearly, it is preferable if the contract is drawn in such a way as to avoid unclear, incorrect, or unfair conditions or omissions, likely to necessitate change orders, and also to regulate the terms on which any change requests deemed necessary are handled. The role of the contract in reducing the occurrence of change requests, or of related problems, is discussed in a later section.

2.6.1.3 Stakeholder interests and conflict

As a result of identifying and being familiar with the stakeholders, it becomes apparent that construction project stakeholders are of many kinds and have multiple interests, which should be determined and taken into account in the process of evaluating stakeholder requests (Cleland, 1986). Conflict appears when arguments occur in a social situation. Therefore, analysing conflicts and combinations among stakeholders is a necessary component of stakeholder management (Freeman, 2011). Project managers should be aware about the possibility of conflicts resulting from diverse interests (Frooman, 1999). In a study conducted in the Saudi public sector, Al-Sedairy (1994) found conflict among stakeholders to construction projects to be widespread, particularly in the later stages, and could interfere with the closure of the project. Conflict was found to be most frequent and severe in relationships between contractor and client, and between contractor and consultant, and could occur in relation to all major aspects of a project. The most frequently reported conflicts were in relation to timing, but conflicts over project concepts, costs and specifications

were also common. The main causes were reported to be differences in perceptions, priorities and goals. Such differences may not always be apparent in the early stages of a project and, indeed, Al-Sedairy (1994) suggests that sometimes conflict may be deliberately engineered by a stakeholder for strategic reasons, to serve an undeclared interest.

Rantanen et al. (2007) indicated in their study that the existence of a large number of stakeholders who have conflicting needs is regarded as one of the four fundamental causes of dilemma and problems in public sector institutions. Olander and Landin (2008) expressed the view that a negative opinion and attitude towards a construction work project by stakeholders might seriously disrupt its achievement. This kind of obstruction will lead to overruns in time and cost, and bad quality. Rowley and Moldoveanu (2003) went further, by saying that the simple fact of stakeholder environments is that often stakeholder groups introduce several roles in their environment, so there is a possibility of conflict in their interests. Considering stakeholder groups' overlap in regard to their interests, memberships and identities, it is crucial to take into consideration how these associated stakeholder groups' relationships affect the mobilisation of a specific stakeholder group. The overlapping identities and interests of stakeholder groups result in a variety of perspectives in relation to stakeholder group performance.

To add to the complexity, as Nash et al. (2010) point out, not only do stakeholder groups have diverse interests, but they also differ in power, so that sometimes more powerful stakeholders may sway decisions or determine actions, either by dominating negotiations, or simply by imposing their will on others. It is important to recognize, however, that the interest and power of stakeholder groups varies across the course of a project, depending on their knowledge and expertise, authority and ownership status in relation to the aspect of the project in question. Shifts in the balance of power between stakeholders, therefore, can disrupt the course of a project. In view of all these considerations, it is clearly important for a project manager not only to identify the stakeholder in a project, but also to understand their interests and relative power, and the implications for the project. This is the task of stakeholder analysis.

There is empirical evidence that conflict between project managers and external

stakeholders depends to a significant degree on their expectations of each other. A successful stakeholder analysis must identify what reasonable trade-offs might occur when determining a solution, and the impact on the functioning of the project. Thus, the purpose of the stakeholder analysis must be to recognize the degree to which the concerns and needs of external stakeholders are able to be achieved, and to analyse the possible results when they are not (Olander & Landin, 2008). Kujala et al. (2012), in an informative article, analysed stakeholder relationships in a conflict situation. The focus of the analysis was how to realize stakeholder relationships, including strategic and ethical issues, as well as how the interests of various stakeholders can be justified. Their study used media texts reporting on the situation of an overseas investment project to clarify stakeholder relationships. The clarification reveals how relationships progress and how they create several problems related to the conflict. The researchers focused on the problems by analysing stakeholder relationships and their salience. Also, they examined how different stakeholder interests are justified, related to the conflict. By giving more detailed qualitative analysis, they concentrated on the strategic and ethical nature of stakeholder relationships.

Yu et al. (2007) argued that managing stakeholders is a significant variable in the briefing process. Additionally, they suggested that it is essential to measure the individual stakeholders' commitment and power leading up to the briefing process, and to take into account the balance between the interests of all stakeholders. In order to achieve this, McLeod et al. (2012) suggested that the reason for the project needs to be known, and comments from stakeholders should be solicited to be able to obtain a balance between the project team and stakeholders. Many problems could be eliminated if efforts are made to involve the stakeholders from the beginning in planning, and engage them with the project team. They pointed out that in this way, expectations might be managed, hidden agendas brought to the surface, and project needs and demands established. Youker (1992) reveals that exploring stakeholder needs can provide an indication of stakeholder group problems, stakeholder requirements relevant to the projects and the challenges facing the project team. Doloi (2013) indicated that insufficient understanding and awareness by contractors of the project design and specifications usually contributes to poor construction and deficient on-site performance. This could be a cause of disputes and conflicts,

contributing to extra costs in the project. Obviously, these kinds of conflict contribute to the weak handling of cost records and lead to fundamental cost overruns. However, the PMI (2013) explained that conflict is unavoidable in a project situation. Incongruent needs, failures in communication, competition for materials and several other causes could turn into sources of conflict. Conflict within a project's environment may lead to dysfunctional results. However, if positively handled, conflicts can actually enable the group and the team to obtain better treatment.

2.6.1.4 Design as a cause of change requests

Design-related problems, resulting in change requests and failure to meet time and cost targets, have been identified as a source of poor performance in the construction industry (Al-Khalil & Al-Ghafly, 1999). Changes in design have obvious implications for procurement and construction; hence, the design stage can be a source of problems that undermine the whole project (Koskela et al., 2002).

A number of writers have highlighted the prevalence of design-related problems. Mohammad et al. (2010) in a study conducted in Selangor, Malaysia, found that more than half of the changes affecting construction projects were design changes of various types. Some changes were caused by improvement as a result of design reviews, or to incorporate technical advances. Others, such as scope changes, were requested by the project owner. A third category comprised changes requested by the engineer or consultant, based on their practical experience, for example identifying a need for addition of some device or instrument to improve the operation of the facility under construction. Mendelsohn (1997) went further, to claim that as many as three-quarters of on-site problems originate in the design phase. While not giving a quantitative estimate, Kazaz et al. (2012) found that design changes were a dominant factor in construction project delay in their Turkish study. Greenwood et al. (2001), discussing the reasons for delay in the building of a hospital in Tripoli, Libya, found that ten extensions, totalling 155 months, were granted to the contractor between 1984 and 1996, when the project was eventually completed. Much of the delay was due to re-designs necessitated by requested modifications, and to the preparation of

the variation orders that these entailed.

Design related issues can result in change requests at any stage of a project. Previous studies have identified specific issues arising in the pre-design, design and construction stages that may give rise to such requests. In the pre-design stage, for example, a problem identified by Assaf and Al-Hejji (2006) as a cause of change requests in large construction projects in Saudi Arabia was insufficient data collection and surveying prior to beginning the design, so that the design produced did not meet the requirements (Arain et al., 2004), or was not feasible in the prevailing conditions, and had to be rectified later. Misunderstanding of the client's requirements was another pre-design issue observed in the same study. Arain et al. (2004) similarly note that designers who rely on their own perceptions may produce designs that do not satisfy the client's wishes and expectation, resulting in requests for changes from the project owner. This could stem from insufficient or poor quality communication between the designer and client and can be seen as related to the above-mentioned problem of insufficient information gathering. Also, information problems can arise when one part of the design team is waiting for information, and the delay in the schedule is not known to another part of the design team, which is trying to deal with changes in customer requirements. The consequence is that the team (while working out of schedule) is unaware of the change, and produces a product that no longer meets requirements (Eden et al., 2005). Such problems may be exacerbated in cases where the design is produced by a foreign team (as is often the case in Saudi projects), as foreigners may lack requisite knowledge of relevant environmental, cultural and social factors, resulting in inappropriate designs that are unworkable or unsatisfactory to the client, and giving rise to change requests as the design process proceeds, or after construction has begun. Such problems arising from foreign designers' inadequate understanding of the project context have been reported in China by Wang (2000), and in Saudi Arabia by Assaf and Al-Hammad (1988).

After the pre-design stage comes the design stage, which gives rise to its own set of problems. Prominent among these is time pressure. If sufficient time is not allowed for the design process, the design cannot be developed properly, as pointed out by Thomas and Priyanka (2015). Undue haste in the design stage can be a contributing factor in design errors (Motawa, 2012), as well as ambiguity in design details and

insufficiently detailed working drawings, resulting in confusion among other project participants, discrepancies between design and construction, and ultimately the need for reworking (Arain et al., 2004-2006; Assaf & Al-Hejji, 2006). Rework can occur at various stages of the engineering and manufacturing phases. This may be necessitated by, for example, discovery of an internal error, or the client's request for a change to the design. In such cases, the design must be referred back to the engineering function for additional work (Howick & Eden, 2001). Even if there are no time pressures and a design is produced with clearly detailed working drawings, this is not to say the design will be fit for purpose. Inexperience and lack of knowledge on the part of the designer - for example regarding available materials and equipment - may result in an unsuitable design (Adrian, 1983), while inexperienced clients may approve an inappropriate design (Arain & Pheng, 2007). In either case, change requests are likely, as problems become evident during the course of the project, and drawings, specifications and contract terms need to be changed accordingly.

Further problems that originate in the design stage are manifested in the construction stage, again potentially giving rise to change requests. A design that is very complex, for example, may result in discrepancies at project interfaces (Arain et al., 2004; Assaf & Al-Hejji, 2006), while a designer's lack of familiarity with construction methods may result in designs that lack 'buildability', that is, they are impractical or difficult to implement (Al-Hammad & Assaf, 1992). It may sometimes happen, moreover, that some materials prove to be unavailable or in short supply, necessitating a substitution. This in turn may require design changes to adapt to the specifications and characteristics of the alternative materials (Arain et al., 2004). Another issue noted in a number of studies is the need for design change arising from poor communication and differences of perception among project stakeholders, especially where diverse nationalities are involved (Arain et al., 2004). In a Chinese study, for instance, Wang (2000) noted the delays, cost overruns and quality issues (and, hence change requests) that could arise as a result of ineffective working relationships between foreign designers and the local project partners.

To summarize, a variety of design-related problems occurring in the pre-design, design and construction stages of a project can result in inappropriate or unworkable designs, or ambiguities and misunderstandings. Dissatisfaction with the design,

errors and discrepancies and inability to execute the design as intended (for example due to materials shortages) can all give rise to change requests to correct errors, improve buildability and performance, accommodate changes in materials and satisfy the client.

2.6.1.5 Problems related to specifications

Product specifications have been identified as one of the main causes of delay and disputes in construction projects, regardless of project type and size, and particularly with regards to mechanical equipment and systems products (Ibbs Jr, 1985). Such problems may arise for a variety of reasons. The issue pointed out by Ibbs Jr (1985) is directly related to the competitive tender system discussed earlier. The fierce competition in the industry can induce tenderers, particularly when relying on information from sub-contractors and suppliers, to propose cheap products that barely meet the requirements of the specifications. Should it eventually transpire that a product is unacceptable, the issue arises of upgrading or substitution, with consequent implications for project cost and time schedule - all potentially giving rise to change requests. The same problem of poor quality materials used in an attempt to maximize profits under competitive conditions was observed by Erdis and Ozdemir (2013) in the Turkish construction industry. The proprietary product specification method (relying on brand names) has also been criticized as an inadequate strategy for ensuring conformity with required performance standards (Ibbs Jr, 1985).

A significant problem in the preparation of technical specifications noted by Erdis and Ozdemir (2013) is recourse to a hasty cut-and-paste approach, resulting in lack of project specificity and failure to keep up to date with product and technical developments. Such haste can lead to a lack of consideration of project environmental conditions, such as climate, which could affect product performance and life-cycle. Such a problem was noted by Folorunso and Ahmad (2013) with regards to architects' lack of knowledge of the parameters for building materials in Nigeria. Difficulty can also arise when designers specify products that are unfamiliar to the project engineer (Ibbs Jr, 1985). Another common reason for disputes related

to technical specifications, which could give rise to change requests, is misunderstanding or conflicting understanding of the specification due to ambiguities in the document. Abeynayake (2008) found errors, omissions and ambiguities to be a significant source of disputes in construction projects. Similarly, in Singapore, Lam et al. (2004), based on a survey of clients, consultants and contractors, reported widespread complaints that specifications lacked clarity and contained ambiguities, irrelevant clauses and inappropriate standards. A similar problem was observed in Turkey by Erdis and Ozdemir (2013). Such complaints, and the problems to which they give rise, have been attributed to the poor quality of writing of construction specifications, which Kululanga and Price (2005) identify as one of the greatest challenges facing contractors. Attention also has been drawn (Erdis & Ozdemir, 2013) to the problem of inexperienced contractor and technical staff, particularly when a project is awarded to a relatively young company.

As Jackson (1990) points out, poor quality specifications undermine both work quality and relations between the parties to the project, because they result in inconsistent decisions, confusion as to the responsibilities of the parties, and uncertainty, since the contractor may decide (or be forced) to change the project specifications. Precautions to reduce such risks are addressed in section 2.9.4.

2.6.2 External causes

Some projects are categorized by unstable environmental and other considerations, which are normally out of the control of the project team. This type of complexity comes from uncertainty related to future restrictions, the anticipation of change and even worries about the future of the system and its existence. It is possible to find temporal complexity in projects vulnerable to unanticipated environmental effects, which seriously disrupt the project, such as civil unrest, rapid and unanticipated legislative changes and catastrophes, or the development of new technologies. This kind of complexity is usually related to fear and expectancy on the part of the workers within the company. Complexity associated with change by external impacts may occur at any time throughout the project life cycle (Remington & Pollack, 2007).

There are several causes of change requests which are outside the control of stakeholders; those identified in the literature are as follows:

a) Change in government regulations

One of the reasons for change requests is change of legislation after the completion of the bidding. (Yayla & Tas, 2010), or change for legal reasons (Fayek & Nkuah, 2002), or due to economic conditions imposed by the government which forces stakeholders to make changes to the original plan after starting work on the project (Sunday, 2010).

b) Weather changes

In some cases, unexpected circumstances and differences may occur in the workplace (Al Duaij et al., 2007), for example, delay through acts of God on the ground or in equipment (Fayek & Nkuah, 2002). Damage caused by accident or inclement weather is a possible cause of variation orders in project management (Ndihokubwayo, 2008). A contractor may be forced to alter his work schedule due to weather conditions such as high temperatures, high winds, or earthquake.

c) Unforeseen problems

Projects may face unforeseen problems, which cause variation orders (Sunday, 2010). Unforeseen uncertainty cannot be determined in project planning. There is no Plan B, and the team is either unaware of the event's possibility, or has not considered it (De Meyer et al., 2002).

d) Socio-cultural factors

Every country and every nation has its own culture, which may differ from others. Therefore, in terms of project management, Barratt (1989) recommended that companies looking for business or facing competition in the global business scene must review the skills and preparation needed to cope with cultural issues. For example, large and complex projects in Singapore have been built, which attracted contractors from international countries, but most of them did not have a sufficient understanding of the cultural, social and physical dynamics of Singapore. This

situation, combined with inexperienced owners, led to insufficient designs, causing many changes to specifications, plans and contract terms (Arain & Pheng, 2005).

Assaf et al. (1995) identified 56 causes of delay of achievement in large construction projects in Saudi Arabia. The most important factors in the delay, based on surveys of contractors, were as follows: approval and preparation of shop drawings, delays in the progress of the contractor, payment by the owners and change in the design. From the point of view of architects and engineers, cash problems during construction, and the relationship between the subcontractors and the slow process of decision-making by the owner were the main reasons for the delay. However, the owners agreed that errors in design, inadequate labour skills, and labour shortages were factors that play a big role in delay.

2.6.3 Summary of change request causes

Based on the foregoing literature review, the main causes of variation orders identified in the literature are summarized and categorized in Table 4

Table 4 Causes of Variation Orders and their Categorization**.**

Category of Variation	**Causes of Variation**	**Author(s)**
Design Consultant related changes	Change in design by consultant; Errors and omissions in design; Conflicts between contract documents; Inadequate scope of work for contractor; Technology change; Lack of coordination; Design complexity; Inadequate working drawing details; Inadequate shop drawing details; Consultant's lack of judgement and experience; Lack of consultant's knowledge of available materials and equipment; Consultant's lack of required data; Obstinate nature of consultant; Ambiguous design details.	Al-Hammad and Assaf, 1992; CII, 1994a; Assaf, *et al.,1995;* Chappell and Willis, 1996; Fisk, 1997; O'Brien, 1998; Mokhtar, *et al.,* 2000; Wang, 2000.
Owner related changes	Change of plans or scope by owner; Change of schedule by owner; Owner's financial problems; Inadequate project objectives; Replacement of materials or procedures; Impediment in prompt decision-making process; Obstinate nature of owner; Change in specifications by owner.	Fisk, 1997; O'Brien, 1998; Wang, 2000; Gray and Hughes, 2001; Arain and Pheng (2005); Mokhtar, *et al.,* 2000; Gray and Hughes, 2001.
Contractor related changes	Complex design and technology; Lack of strategic planning; Contractor's lack of required data; Lack of contractor's involvement in design; Lack of modern equipment; Unfamiliarity with local conditions; Lack of a specialized construction manager; Fast track construction; Poor procurement process; Lack of communication; Contractor's lack of judgement and experience; Shortage of skilled manpower; Contractor's financial difficulties; Contractor's desired profitability; Differing site conditions; Defective workmanship; Long lead procurement.	Al-Hammad and Assaf, 1992; Thomas and Napolitan, 1994; Clough and Sears, 1994; Assaf, *et al.,* 1995;Puddicombe, 1997; Fisk, 1997; O'Brien, 1998; Wang, 2000; Arain and Pheng, 2005.
Other changes	Weather conditions; Safety considerations; Change in government regulations; Change in economic conditions; Socio-cultural factors; Unforeseen problems.	Fisk,1997;Kumaraswamy, *et al.,* 1998; O'Brien, 1998; Wang, 2000; Arain and Pheng, 2005.

Source: Sunday (2010).

2.7 Effects of Change Requests

As indicated previously, change requests can have beneficial or detrimental impacts, which may be direct or indirect. The nature of the likely or possible impacts will obviously have implications for the way change requests are viewed and handled.

Several studies have revealed that change orders in general lead to cost and time overruns to projects. Oladapo (2007) asserted that time and cost overruns are a consequence of variation orders. Eden et al. (2000) found that acceptance of change orders is one of the most common causes of disruption in large projects, and it is harder to control the management of multiple change orders compared with controlling a single one. Also, it is difficult to estimate the cost of change orders, and clients lack appreciation of the effect of change orders and their impact on project delay and disorder. There are several benefits and drawbacks of variation orders:

Beneficial variation orders

One of the benefits of variation orders could be to amend any deficiencies, whether due to lack of specifications or plans, or through direct contractor proposals, which had previously been approved by the engineer and the client. (Al Duaij et al., 2007). Changes may reduce the degree of difficulty, cost, or schedule in a project (Arain & Pheng, 2005). Variation orders may be initiated to make a balance between the functionality, cost, and durability aspects of any project to attain client satisfaction. Also unnecessary costs from a project may be eliminated by a variation order.

Detrimental variation orders

Frequent changes lead to a lack of continued flow of work. It is difficult to assess and determine the cost of frequent changes and their impact on the schedule. There is a negative impact on the project if there are multiple small changes, including extending the project time without compensation. In addition, it frustrates staff supervision, which leads to more errors, wasting time and money (Fayek & Nkuah, 2002). Project performance and client needs are affected by a detrimental variation order (Arain & Pheng, 2005). Hanna et al. (1998), in a study of change order effects

across the electrical construction industry around the USA, identified a number of damaging impacts of change orders, which affected labour productivity, with consequent impacts on product schedule, quality and costs. In particular, they noted that changes in project scope could mean the original plans no longer met requirements. Frequent change consequently resulted in the necessity for frequent re-planning. Efficiency was lost because, when project scope was changed, the required tools, labour and materials might not be available; moreover, productivity was impeded by interruptions and interference. Such lack of continuity also resulted in the loss of learning curve effects. Overall, the difficulties arising from frequent change orders increased the cost of project management. Moreover, they created difficulty in tracking labour performance, and determining just compensation for the parties involved. These and other adverse effects were incorporated into an extensive framework by Arain and Pheng (2005) in a typology of potential effects of change orders, as follows:

Potential effects

There are numerous potential effects of variation orders. Arain and Pheng (2005) classified the types of potential effects of variation orders into 16 categories as follows:

Progress

- Progress is affected but without any delay. Quality and project progress may be affected by variations (Assaf et al., 1995). However, project completion time may not be affected by variation orders, because it is usual for the contactor to try to adjust the variation by using free floats in the construction schedule. So, in this situation, variation affects the progress without any delay in the project performance (Arain & Pheng, 2005).

- Hiring new professionals. Change orders arise in technological projects (Yayla & Tas, 2010). Complex technological projects need specialized manpower for their completion (Fisk & Reynolds, 2013). Hiring new professionals or changing the project team may be required in case of variations. In this case, it is expected that the project will be greatly affected

because new professionals may not be readily available (Arain & Pheng, 2005).

- Productivity degradation. Delays, interruption and redirection of work, related to variation orders, cause a harmful effect on labour productivity. Thomas and Napolitan (1995) asserted that the most important kind of disruptions occur due to lack of information, materials and work out of sequence. The most significant cause of disruption is lack of material. To avoid such disruption, it is necessary to handle variation. However, it is difficult to avoid disruptive effects in many cases (Arain & Pheng, 2005).

- Rework and demolition. Demolition and reworking often occur when there are variations in construction projects (Clough & Sears, 2015), depending on the specific time of the variations.

Financial

1. Increase in project cost. Increase in project cost is one of the most common effects of variations during the construction phase (Oladapo, 2007). Project cost will increase when there is any alteration in the design, or major addition to the project. (Assaf et al., 1995). In the context of construction projects in the Seychelles, Sunday (2010) found significant percentage differences between initial contract sums and final costs as a result of change orders, particularly for projects managed by the consultants, rather than in-house professionals. To mitigate such effects, a contingency sum is usually allocated in a construction project to cater for any possibility of variations in the project, keeping the overall project cost unharmed (Arain & Pheng, 2005).

2. Increase in overhead expenses. Increases in the overhead expenses for all the participants concerned are a consequence of the implementation and process of variations in construction projects. Generally, these overhead charges are delivered from the contingency supply allocated for the construction project (Arain & Pheng, 2005).

3. Delays in payment. Variations in construction projects may cause delay in payment. In this case, payment to the contractors may be affected. Occasionally, serious trouble may arise due to this delay, leading to delays in payment to the subcontractors, as the main contractors may not be able to pay the subcontractors, unless the owner pays them first (Arain & Pheng, 2005).

4. Additional payments to contractor. Additional payments to the contractor as a consequence of additional work are a potential effect of variation in construction projects (O'Brien, 1998). The contractor in this case may look forward to variations in the construction project, due to additional payments (Arain & Pheng, 2005).

Quality

Quality degradation. If there are frequent variations, quality of work may be negatively affected (Fisk & Reynolds, 2013). The quality of work is often poor if there are frequent variations (Arain & Pheng, 2005).

Delay

a) Procurement delay. Special equipment and new materials may cause frequent variation, which cause delay in procurement. Hester et al. (1991) stated that procurement delays were normal effects of variations associated with new resources for construction projects.

b) Logistics delays. Logistics delays could appear due to variations which require new equipment and materials. Fisk and Reynolds (2013) suggested that logistics delays were the most important effects of variation in construction projects. They occur due to ordering and transportation of the equipment and materials on site.

c) Delay in schedule completion. Completion delay is a consequence of variations in construction projects (Ibbs, 1997). Yogeswaran et al. (1998) studied the expansion of time in Hong Kong's civil engineering projects in terms of excusable delays. Their result suggested that 50% of delays in construction projects are due to variation orders (Arain & Pheng, 2005).

Reputation

Damage to firm's reputation. It is believed that variations are a major source of construction disputes and claims (Yogeswaran et al., 1998; Fisk & Reynolds, 2013). These may affect the firm's reputation harmfully, and even lead to collapse.

Safety

Poor safety conditions. Variations may affect the safety conditions in construction projects (Arain et al., 2004). This is due to variations in construction approaches, equipment and materials, which may need more safety measures during the construction phase (Arain & Pheng, 2005).

Relationships

a) Poor professional relations. Construction changes are one of the major causes of construction disputes (Fisk & Reynolds, 2013). Obviously, variations may affect the relationship of experts/professionals, which leads to disputes (Arain & Pheng, 2005).

b) Disputes among professionals. Disputes among professionals are also potential effects of frequent variations in construction projects. Adopting regular communication and strong organisation can assist in reducin the disputes between professionals (Arain & Pheng, 2005).

Syal and Bora (2016) found cost-related disputes to be one of the main sources of contention arising from change orders. Many of these disputes arise from contractors' and subcontractors' sense of injustice when they feel they are not allowed to fully reflect their direct costs at a realistic percentage of overhead profit in change orders. It is common for contractors to feel that change order work reduces their profit margin, compared to the original tender.

The same list of potential effects identified by Arain and Pheng (2005) has been used by subsequent researchers as a framework to investigate perceptions of the impacts of change orders on construction projects. Osman et al. (2009), for example, used the same list to investigate potential effects of change orders in construction projects in the Penang region of Malaysia. According to their report, of the five most frequent

impacts of change requests, three were related to the finance category: increase in project costs, additional payment to contractors, and increase in overheads. The other major effects reported were reworking and demolition, and delays in the completion schedule.

Whilst the above typology and findings give an overview of the wide range of possible ways in which change requests can affect projects, three specific area of concern are addressed in more detail below.

2.7.1 Scope Creep

Alessandri et al. (2004) stated that scope changes are defined as any activities or events that propagate the modification of the initial plans and time limits, as well as cost estimations. Before projects are commenced, these three aspects are normally outlined in minute detail in order to ensure that all parties are aware of their roles and responsibilities.

Scope creep may occur for several reasons. Some of the most common are identified by Turk (2010) who notes that a project manager may be intimidated and afraid to refuse a request by the client who is paying for the project, or agree because they want to be seen as cooperative and capable. Lack of a formal review and approval process can also lead to scope creep through the haphazard ad hoc acceptance of requests, without critical scrutiny in relation to clear criteria. It is especially dangerous if people other than the PM or project team, that is, people who are not involved in and do not understand the work, accept changes and then impose them on the project team. Scope creep can also result from the project manager's egotistical pride and self-confidence, urging him to suggest or accept changes that may be possible and impressive, but at the cost of financial or other problems. Turk (2010) concludes by warning against the belief that a single small change will not matter, because an apparently small change may open the door to, or even force more frequent or greater changes.

Fischer and Kunz (2004) observed that, regardless of the cause, scope creep has widespread effects on the outcome of a project, with the most prominent impact visible in the budgets, duration and quality of the project. The outcome of such a

scenario is the inculcation of novel functionalities in the project, designed to bridge the gaps between outcomes and expectations.

2.7.2 Uncertainty and risk

A key issue in project management is handling uncertainty and risk. As indicated previously, change requests may occur in response to uncertainties, change and risk in the project environment. Equally, change requests may be sources of uncertainty and risk, due to their effects on project cost and timing, and on relations between professionals. It is not possible to discuss change requests fully, therefore, without considering uncertainty.

There are relationships between uncertainty, change request, complexity, delay and disruption, and risk. According to Williams (1999), complexity can arise with high uncertainty, which leads to high risks. So, if there is more uncertainty in objectives, changes throughout the project may occur which significantly increase structural complexity. A major source of uncertainty is temporal complexity, which refers to unpredictable environmental considerations such as changes in government legislation, or changes in technology, which are out of the control of stakeholders. This complexity appears as a result of uncertainty, which leads to change requests (Remington & Pollack, 2007).

Williams (2004) indicated that one of the two features of high-ranking management's role of significance in project management is attitude to variation orders or change orders. If there is acceptance to change orders, there will be disruption of complex projects, and if the project is already disrupted and complex, more change orders can cause serious and complex effects. In this case it is difficult to estimate the cost and time of change orders. However, the problem increases dramatically when there are several change orders, while engineers try to estimate the effects of previous change. This will definitely lead to delay and disruption (Williams, 2004). According to Eden et al. (2000) delay and disruption would usually be regarded as a type of a risk and added to the estimate.

Figure 9 Relationships between Uncertainty, Complexity, Disruption and Risk

2.7.3 Estimation of project parameters

According to Migilinskas and Ustinovicius (2008), uncertainties and risks are closely linked to change orders. Most project plans as contained in the schedules and structures are linked to estimated values. In most cases, costs, timelines and even quality are based on estimations and projections. As a result, the ability of the project planners and design team to model and simulate the outcomes based on expectation is all based on estimates. The design process is one aimed at ensuring that the estimates are as realistic and attainable as possible. Actually, it has become prudent practice for the design team to include allowances for variability in all activities in a project and make similar provisions for the whole project. A similar scenario is duplicated with regard to costs (Abdul-Rahman et al., 2009). Quality aspects are based on a trade-off between duration and cost, and these are sometimes left out of the equation. Basically, cost let-ups cannot be included in the project, since no one is willing to participate in a project which is flawed from the start (Luu et al., 2009).

According to Chapman and Ward (2003), a clear area of uncertainty is in the measure of project parameters such as cost, time and quality associated with special

activities. For example, we may not know the effort or the time it will take to finish a particular activity. Uncertainty may have many causes, as follows:

- Lack of clear specification on the requirements of the project.
- Lack of experience in a particular activity.
- Complexity regarding the extent of interdependencies, and influencing factors.
- Lack of analysis in the process of the activity.
- Possibility of particular conditions or events, which could affect some activities.

Changes in the duration of the project due to change requests are influential on the total project costs. The primary reasons for changes in duration are based on delays in acquisition of inputs and completion of certain phases (Assaf & Al-Hejji, 2006). These delays sometimes involve no cost factors, since they simply represent change in the timing of activities. However, since contractors use scarce resources, changes in the timing may result in additional costs (Ismail et al., 2012).

2.8 Normal Handling of Change Requests

Since change requests can have so many adverse consequences, contractors and owners may have an interest in attempting, through contract provisions or otherwise, to mitigate their impact.

Mohammed et al. (2010) indicated that handling change requests is sometimes beset with costs and limitations, especially if responsibility is not assigned accordingly. Some change requests occur due to human error, acts of God, or unforeseeable outcomes (Alsuliman et al., 2012). Syan and Menon (2012) indicated that "there is an increasing emphasis on tight contracts, using prime contractorship to pass time-risk on to the contractor, frequently with heavily liquidated damages for lateness. As projects become shorter in duration, this enforces parallelism and concurrency, which by definition increases project complexity further". According to Nahod (2012), contractors are sometimes least concerned about the impact of change orders, since it is the project owner who is responsible for the supply of resources. Unless contractual obligations confer responsibility on the contractors, their roles are limited to implementation of the changes. However, this black and white alignment of the

scenario is not what happens in actual practice (Arain & Pheng, 2007). Contractors stand to lose or gain from the success of a project. Their reputation is normally on the line with each project. It is their responsibility to ensure that the completion of the project contributes to enhancement in their reputation. Similarly, owners are rarely kind-hearted when it comes to forbearance of liability for changes in projects. Most contracts set tight controls through clauses aimed at deterrence and assignment of responsibility in order to avoid ambiguity for each expected outcome (Sun & Meng, 2009).

- Scheduling of Change/ Variation Orders

Alsuliman et al. (2012) indicated that the timing of the change order influences the outcome of the whole process. When change orders may be slated during the early or initial stages of a project, it is easier for such requests to be honoured. During the design stage, it is easy for parties to the project to implement changes, which are least influential. Even when such changes are influential, it becomes easy to incorporate such changes into the whole process, without adversely affecting the timing, cost and quality of the whole project. The nature of construction projects makes back and forth changes highly unviable. Intangible and non-physical projects can be altered with ease, unlike physical projects. Arain and Pheng (2007) reiterated that change orders at the design stage are preferred since they do not involve the need for reworking or demolition.

- Minimize costs

Sunday (2010) indicated that it is beneficial to both parties that the change orders involve minimal costs. Numerous writers have proposed the scheduling of change orders in the design stage. However, the precipitating factors for such changes cannot be restricted to this stage, for logical reasons. The range of factors necessitating the change orders could occur at any point in the project. Ndihokubwayo (2007) proposed that if a cost-benefit analysis places the change request as a crucial aspect of the completion of the project, regardless of the phase at which it is recognised, the project has no option but to institute the change. Under such circumstances, it becomes necessary for both parties to establish the best approaches to minimize costs and maximise savings. Optimisation of costs and savings does not, however, rank higher than achievement of the objectives of the project.

- Strict Adherence to Schedules, Costs and Plans

Strict adherence to plans promotes the iterative aspects of the project (Molly, 2007). In case there is need for change, roll-backs will be possible, as long as the stipulated procedures were adhered to. However, if the schedules were implemented in an alternating approach, it becomes hard to peel back the layers. Although novel approaches over and above the assigned steps may result in faster and cheaper completion of the project, it is important that the designs play the role of communicating plans. This ensures that the design team is able to conceptualize progress even without being on the ground during completion.

- Timely Communication through the Various Tools

Nilsson (2012) indicated that periodic meetings and period reports are commonplace aspects of project management. In addition to the direct supervision, this documentation provides the management with reliable communication about the progress of the project. The period reports provide a check-list and basis for comparison of expectations and outcomes. Variations in these two dimensions are cause for investigation. Communication is a primary aspect in any form of management, especially project management. From a certain perspective, project management is all about communication. The ability of the various parties to translate plans into realities is closely linked to communication (Sun & Meng, 2009). The fact that a large proportion of the individuals involved in a project are professionals makes communication a primary tool in normalising and harmonising their ability to apply their proficiencies. Ultimately, it is the role of the contract to transform plans into realities. As a result, any challenges in this aspect must be communicated to all parties in order to ensure that there is unity in direction and parity in sufficiency of information. The importance of decision-making under perfect information is highly imperative in project management (Long et al., 2004).

Table 5 shows several steps to handle change requests. Some of these steps to protect the project from change requests are usually in the contract. Other steps are taken during the change request.

Table 5 Handling Change Requests

Before change request	During change request
Define the project scope.	Identify the change.
Determine who will perform the work.	Notify parties of the change.
Plan and schedule the defined work.	Document the change request.
Estimate resources and authorize budgets.	Prepare the change request (Molly, 2007).
Record costs (Cleland, 2004).	

2.9 Reducing the Likelihood of Change Requests

In view of the many uncertainties, costs, delays and other adverse consequences arising from change requests, it is preferable if the likelihood of their occurrence can be minimized. This section therefore, revisits the project elements identified previously, in order to demonstrate how project management of each element can reduce problems that give rise to change requests.

2.9.1 Optimum handling of the tendering process

As indicated in an earlier section, the prevalent open competitive tendering system suffers a number of weaknesses. It can encourage exploitative pressure from clients to drive down prices, forcing contractors to submit low bids against their best interests; it can produce inaccurate cost estimates, due to the lack of knowledge or experience in identifying and pricing risk factors; and it can lead to the selection, solely on cost grounds, of contractors who may lack the ability to perform satisfactorily in time and quality terms. All these situations have the potential to give rise to change requests. However, the literature contains a number of suggestions as to how weaknesses in the tendering process can be alleviated.

The first point, made by Gazula and Vadali (2012), is the importance of having a fair and transparent procurement policy. Based on comparison of procurement policy in India and Sweden, they note the lack of transparency in some of the former's procurement rules and regulations, and assert the need for policy to comply with

WTO GPA, enabling suppliers to participate in procurements on a clear and fair basis.

As for the difficulty of pre-tender pricing, Chan et al. (2007), with reference to the Hong Kong construction industry, presented a design for an e-tendering system using Web services. Their system can help tenderers retrieve relevant rates from their cost database, reducing pricing and time, and thereby enabling the incorporation of more up to date prices; cost estimations can be left or amended almost up to the last minute, for greater accuracy.

With regard to the third problem, the danger of choosing the lowest bidder, who may not necessarily be the best contractor, Xu and Greenwood (2006), discussing the context of design-and-build contracts in China, noted that projects were not necessarily awarded to the lowest tender, but that tenders from pre-qualified contractors, including preliminary designs and cost estimates, were evaluated against the client's requirements. Holt et al. (1995) advocated the incorporation of pre-qualification in the selection procedure, and evaluation of bids based on broader criteria, including contractors' capability to deliver a product and service meeting quality criteria, within the required time-frame, as well as on budget. In such a process, the contract would not necessarily be awarded to the lowest bidder, but to the contractor able to provide the best overall value for money. Perng et al. (2006) make the same point, advocating the economically most advantageous tender (EMAT), replacing traditional cost competition with differentiation competition. They devised a business game simulating the EMAT bidding situation, which provides participants with an opportunity to make bidding decisions and formulate strategies for construction procurement projects. In contrast to the time-consuming, costly and risky process of gaining experience in real bidding situations, the game offers a quick and efficient way of learning, which can help contractors acquire differentiation strategies and effective know-how for bidding in EMAT projects. Although in its initial, non-computerized form, the game simplifies the bidding situation, omitting the influence of subcontractors, implementation with 24 participants revealed that it nevertheless produced useful learning for contractors, Moreover, the authors envisaged a computerized vision which would more fully capture the complexities of bidding situations, enabling would-be tenderers to

constantly practise and test their bidding approaches and strategies, in order to be able to produce more effective bids in authentic EMAT situations.

2.9.2 Contractual remedies to reduce change requests

As indicated previously, problems in construction projects can arise as a result of ambiguities, errors and omissions in the contract itself, which require correction by change requests, or other factors (which may or may not be recognized in the contract), giving rise to inability to perform as envisaged, delay, cost overruns, waste and possible claims. However, the literature suggests a variety of ways in which such risks may be alleviated.

An important consideration is the right type of contract to suit the project, according to the types and levels of risk entailed. The use of alternative contract types has been successful in the USA and Europe. In't Veld and Peeters (1989) and other authors favour specific alternative contracts to the traditional fixed-price lump sum contract. Chan et al. (2011a), based on analysis of 45 questionnaires from an industry-wide survey in Hong Kong, found that the GMP contract has the benefits of early settlement of the final project account, improved working relationship between parties, and the potential for integrating constructor expertise before construction commences. Meanwhile Corts (2011), in the context of public procurement, advocates an explicit cost-plus contract, coupled with an implicit agreement (supported by repeated interaction between the parties) that continued contracting will be dependent on the effort and performance of the contractor. This "puts surplus on the table for the agent in every period" (p.1) rather than only when an explicit lump-sum contract is re-negotiated, and so, Corts (2011) argues, enhances the value of the relationship between the parties. However, various types of contract have different strengths and limitations; accordingly the choice should be made based on the fullest possible advance knowledge of the likelihood of occurrence and severity of consequences of risks, such as complex specifications, the project deadline, budget, acceptance and the like, which may give rise to change orders, with resulting delays, cost and possibility of claims. This knowledge will enable the use of risk management methods, depending on the type of contract. Indeed, in an earlier study,

In't Veld and Peeters (1989) proposed a decision model to facilitate objective selection of the appropriate contract type in each instance.

Once the type of contract has been decided, careful drafting is important, to avoid error Mendis et al. (2013) asserted the need for the contract documents to be free of "errors, deficiencies, ambiguity and unfair risk transfers" (p.1063). In order to remove ambiguity, they recommend that projects be written in crisp technical language, and that the criteria for the acceptance or rejection of completed work are clearly set out. A clear, unambiguous exposition in the contract of how the intended work will be performed will reduce the likelihood of disputes, which may arise when a party to the contract demands changes, or completed work is rejected by the consultant or project owner. Lee et al. (2010) similarly identified the clarification of vague contract provisions as one of the measures needed in order to avoid or reduce construction change order claims. One solution to avoid unfair or ambiguous contract provisions might be to use one of the model contracts provided by organisations such as FIDIC. Guo et al. (2014), for example, find the FIDIC standard contract to be clear in specifying the rights of all stakeholders, and useful in alleviating and balancing risk.

In their proposals for improved management of change order claims in the Egyptian construction industry, Amr and Elnemr (2007) advocated not simply clarity of contract provisions, but the establishment of unified general contract conditions, to be applicable across the whole industrial sector. Such a recommendation, however, could result in contracts being excessively rigid, or failure to take account of the unique features of each project. This would depend, of course, on the extent to which any adopted standard conditions recognize and provide for variations, given that some risk of conditions giving rise to change requests seems to be inherent in the nature of the industry, and widely documented (Van Der Veen & Korthals Altes, 2012). Indeed, Van Der Veen and Korthals Altes (2012) argue with regard to complex urban projects, that contracts should allow for learning that takes place during the course of the project in order better to meet developing societal needs.

As a final point, it may be suggested that, whatever type of contract is adopted, and whatever care is taken in the drafting, there is a need for a clear system and set of

procedures for handling any change to the original terms of the contract. The PMI (2013) describes a "contract change control system", which defines the process required for project modification. Such a system includes the necessity for authorizing changes, and provides procedures for the resolution of any dispute arising relative to the proposed change. Such a system has the potential to remove many potential ambiguities and conflicts in relation to change requests and associated contractual claims, thereby reducing the risk of damaging consequences.

2.9.3 Managing stakeholders in construction projects

According to Al-Sedairy (1994), although the situation of multiple stakeholders with diverse interests is inherently conflictual, it may nevertheless be possible to remove conflict before it need occur, and this is an important role of project management. Indeed, in his Saudi study, he found the least conflictual relationships reported were those involving the project manager, and that, from a preliminary investigation using linear regression analysis, conflict in the construction period was inversely related to the presence of project management elements. This points to the role of effective project management in handling or even averting potentially disruptive disputes among stakeholders.

If there are several conflicts between stakeholders, searching for a compromise solution to resolve these conflicts is essential for project managers (Freeman, 2010). This is because successful and effective relationships between the project management team and stakeholders are essential for the successful implementation of projects, and for fulfilling stakeholders' expectations (Cleland, 1986). Such relationships depend upon trust and commitment among stakeholders. In other words a good relationship might be developed and obtained by effective relationship management (Bourne & Walker, 2005). The 'Stakeholder' model specifies the importance of clarifying roles and duties in the regular communication between stakeholders. It is important to specify the stakeholders who have an interest in project achievement, and to identify which elements can perform a good role in project achievement. This would lead to an accurate understanding of project achievement factors that might be measured to enable a shared stakeholder opinion of project success, as a successful project encourages ambition, develops

communication, enhances group or team working and improves productivity. (Davis, 2014). Bearing in mind Nash et al's. (2010) evidence on the dynamic nature of power relations in projects, it is also important to track stakeholders to determine when power shifts occur, so that they can relate to each other proactively, rather than in a reactive way.

A key role in managing stakeholders in construction projects, in order to minimize conflict, is played by effective communication. Regarding stakeholders in the construction sector, contractors need to be able to set a precise timetable, and establish a standard which supports reporting, progress monitoring and controlling in order to achieve the objectives of the project (Doloi, 2013). Effective communication is needed between all parties to determine, clarify and indicate the client's demands. Yu et al. (2007) noted that the essential fundamental success element of the briefing was direct and useful communication. Successful, regular and planned communication between all members of the project is essential for a successful project (Cleland, 1986). Direct analysis of the project's systems environment is an ordered procedure for determining and controlling the potential stakeholders within that environment. This management procedure needs to be able to identify how potential stakeholders would react to project decisions, what would affect their response, and how the stakeholders are likely to deal with each other and the professionals and project managers, to influence the opportunities for the success of a suggested project strategy (Cleland, 1986). McLeod et al. (2012) indicated that estimating project results can be done for a single or group of stakeholder expectations, showing how the project and its product will serve their interests and needs.

According to the PMBOK(2013), managing stakeholders involves a number of tasks, as follows:

- **Control stakeholder engagement** is the procedure of observing total project stakeholder connections or relationships and modifying techniques and plans for involving stakeholders.

- **Project stakeholder management** consists of procedures which are necessary for specifying all the people or institutions affected by the project, analysing stakeholder goals and expectations which affect the project, and

creating suitable management approaches for efficiently involving stakeholders in project decisions and execution.

- **Control communications** is the procedure of observing and managing communications during the project life cycle to ensure that the information needs of the project stakeholders are fulfilled.

- **Manage communications** is **"**The process of creating, collecting, distributing, storing, retrieving, and the ultimate disposition of project information in accordance with the communications management plan" (p.287).

- **Manage stakeholder engagement** is the procedure of communication and working together with stakeholders to deal with their expectations/needs, describing issues as they happen, and building suitable stakeholder engagement in project actions during the project life cycle.

The project manager needs to have ability to identify the reasons for conflict. After that, he can positively control the conflict, and then reduce the possibility of negative effects. The project members will then be ready to provide better solutions, which will strengthen the chances of the project's success (PMI, 2013).

As noted earlier, however, good relationships among project stakeholders depend primarily on trust, although this may mean different things to different people. Hartman (2000) identified different dimensions or sources of trust, including competence and integrity. Competence is the expectation of the other party's knowledge, skill and ability to perform reliably and satisfactorily in delivering the desired service. Integrity is belief in the other party's honesty in the relationship. Pinto et al. (2009) drew on this conceptualization of trust in their investigation of the impact of trust between project managers and contractors in large construction projects in Canada. They found that trust was considered important, although differences in perceptions of its impact on the PM-contractor relationship suggested it was conceptualized differently. Terje Karlsen et al. (2008), in the context of a large Norwegian public construction sector, investigated how trust can be built between a project and its stakeholders. Based on in-depth interviews, they concluded that trust can be built through good communication, reliability, demonstrating commitment,

being sincere, competence, acting with integrity and establishing common goals.

2.9.4 Avoiding design-related problems

As indicated in an earlier section, there are a number of ways in which design-related issues occurring in the pre-design, design and construction stages of a project may give rise to unsuitable design, errors, ambiguities and construction difficulties, necessitating change requests for amendment and rework. This implies that correct handling of project design has the potential to reduce the need for change requests, and the consequent disruption of the project (Motawa, 2012). Kuprenas (2007) finds an inverse association between the amount of change requests and the time and money invested in design: more time and money spent on design results in fewer change requests. It makes sense to focus on the design area in efforts to reduce change requests, because of the high percentage of such requests that originate in design issues (Arain et al., 2006). Moreover if problems are identified in the design stage, they are comparatively easy to manage, as they do not require rework or demolition (Arain & Pheng, 2007). Greenwood et al. (2001), based on their preliminary analysis of causes of delay in hospital building, suggest the importance of preparing complete and adequate plans, to minimize the likelihood of client-initiated design changes when implementation is underway.

It is important in the pre-design phase that sufficient time is allowed for appropriate design development, and also that sufficient information is collected about the client's requirements, the site and other relevant issues (Arain et al., 2004). Such preliminary data gathering can also include the designer's familiarity with local designs and cultural preferences (Wang, 2000), and knowledge of available materials and equipment (Arain et al., 2006). Such knowledge contributes to the development of a clear and accurate design, which is more easily understood and implemented by the contractor (O'Brien, 1998). Moreover, a clear and well-developed design creates a clear and unambiguous foundation for the project contract, which can avert potential claims and disputes later in the project (Chan & Yeong, 1995). Assaf and Al-Hejji (2006) advocate the use of advanced engineering design software, to increase design accuracy and quality. However, the real key to achieving the

requirements discussed above is good communication between the designer and other stakeholders. Arain et al. (2004) draw attention to the important role of effective coordination between the designers and contractor, especially in the design phase, for project success. In this respect, several authors attest the value of involving the contractor in the design conceptual phase (Tam, 2007) and the design development phase (Adrian, 1983), as well as ongoing communication between the designer and contractor throughout the construction phase (Puddicombe, 1997) in order to reduce confusion and discrepancies, and to overcome problems.

To facilitate communication within the project, Stocks and Singh (1999) developed a technique called functional analysis concept design (FACD), allied to functional analysis system technique (FAST). This is an approach to partnership between owners and designers, characterized by teamwork among all engineering disciplines, and guided by a set of regulations and specifications. The increased input into project planning and design, compared with projects without FACD is expected to reduce design errors and the consequent generation of change requests. Stocks and Singh (1999) report the viability of the method and its potential to reduce construction costs. Other tools for handling design issues include value engineering and constructability reviews (Stocks & Singh, 1999). Value management, which encompasses value engineering, is discussed below.

2.9.5 Value Management in the design stage

Value Management (VM) is a practical approach to maximizing project value by specifying and evaluating the functional benefits in accordance with the values determined by stakeholders (Kelly et al., 2014). It takes account of time, cost and quality issues, and the interrelationships between them, with a view to obtaining the best value for money (Nawi et al., 2015). As such, it is potentially useful in identifying and reducing many of the problems discussed in earlier sections.

The origins of VM can be traced to US manufacturing in the post-war era. Subsequently, under the name, Value Engineering (VE), the term most commonly used in the US today, it was adopted by the U.S. Department of Defense. Since the

1980s, it has been widely adopted in a number of countries, as an approach to obtaining value for money in the construction industry (Kelly et al., 2014).

A number of related terms are used to denote the approach, including Value Analysis (VA), Value Engineering and Value Methodology (Alalshikh, 2015). However, the relationship between these terms is a matter of controversy. Some practitioners, such as Younker (2003), view them as synonymous, while others make a distinction between them. Zimmerman and Hart (1982), for example, described VE as a value study on a project at the design stage, while VA is an evaluation of a project that has already been designed or built, in order to assess the potential for improvement. Both are part of VM, which is an umbrella term for all value optimisation techniques. Alalshikh (2015) takes the same approach. To some extent, confusion of terminology reflects a difference of usage between Europe and the USA. In what follows, the terms VM and VE are used interchangeably, depending on the terminology used by the authors cited. It should be understood, however, that in this thesis, the interest in VM is mainly in its use at the design stage, as an approach to managing issues that might otherwise give rise to change requests, rather than at the post-construction stage. The idea is to use a multi-disciplinary set of procedures, knowledge and experience (Bínová, 2014) in order to provide the necessary functions to meet the required performance at the lowest overall cost (Rane & Attarde, 2016).

The VE procedure is structured around the 'job plan' (Green, 1994). According to Kelly et al. (2014), a variety of types of job plan exist, two of the most common being the Charette and the SAVE (Society of American Value Engineers) 40-hour plan. The Charette plan focuses primarily on functional analysis of space requirements, although if time permits, it can be broadened to cover other issues. It is a relatively quick and inexpensive way of briefing designers at an early stage, reducing the likelihood of wasted design work. More common, however, is the SAVE plan, usually described in terms of the following phases (Green, 1994; Ansari et al., 2013; Kelly et al., 2014):

Information: Defining and understanding the problem by collecting information on clients' requirements, design standards, specifications and costs.

Speculation/creativity: Generating alternative ways of providing the required functionality.

Analysis/evaluation: Setting evaluation criteria and using cost and other models to evaluate and select among the alternatives.

Development/proposal: Deeper development and testing of the ideas selected as most suitable in the analysis phase, including detailed technical and economic evaluation, and consideration of the likelihood of successful implementation.

Presentation/recommendation: Quantification and preparation of a detailed proposal.

Implementation: Including follow-up, problem-solving and evaluation of outcomes.

A number of studies have attested to the benefits of adopting such a systematic, structured approach to analysing client requirements at an early stage in the project. Finch et al. (2005) assert the benefits of VM input into construction project briefing, to clarify client requirements, representing them precisely and explicitly and so facilitating the design process. Involvement of stakeholders in design decisions facilitates the development of a common understanding of the design problems, and consensus on courses of action (Green, 1994; Leung & Liu, 1998), and leads to commitment to the project and a spirit of ownership (Leung & Liu, 1998). In particular, involvement of the contractor, with his knowledge of construction technology, can enhance the opportunity for cost optimisation (Leung & Liu, 1998; Fan & Shen, 2011). Not only is a VM approach beneficial for setting and monitoring the project schedule and costs (Bínová, 2014), but it also involves an overview of the whole project life-cycle, and can hence identify and reduce, or eliminate potential risks during construction and subsequent use of the building. Wang et al. (2012), for instance, reported use of VM in the design of energy-saving residences, to increase the overall value of the building from a whole life-cycle perspective. Similarly, Nawi et al. (2015), in the context of the Malaysian construction industry, showed how VM can contribute to sustainable design performance by avoiding errors at the conceptualization and design stages, which could otherwise result in problems and costs associated with the maintenance of the finished building.

Despite its potential benefits, however, VM is not without difficulty. Hiley and

Gopsill (2000) found that the potential of VM had not been realized in the UK construction industry, due to barriers ranging from lack of education to the nature of the industry. Rane and Attarde (2016) concluded that it is not possible to apply VE to every project. In their view, VE can be more successfully achieved in large, complex projects, which are better able to recoup the cost of investment in the VE process. They suggest that VE performs best when conducted with the purpose of increasing value (including design standards and buildability), rather than merely reducing costs, and that it is important for all participants to embrace and contribute fully to the VE process.

Value Management in the Saudi Public Sector

VM based on the American SAVE model was introduced into the Saudi Public Sector in the 1980s (Alalshikh & Male, 2009; Alalshikh & Male, 2010), and the Ministry of Finance launched a resolution encouraging public sector organisations to apply VM to projects with budgets greater than SR 20 million (Alalshikh & Male, 2011). Nevertheless, most of these organisations did not adopt VM, and when it was used, a number of problems were encountered that constituted barriers to its wider acceptance (Alalshikh & Male, 2009). The SAVE methodology was adopted without contextualisation to the Saudi public sector. It was normally employed by bringing in an outside, independent VM team, which tended to create an adversarial situation and conflict with the design team. Generally, VM was not introduced until the later stages of the project, so the VM team's recommendations often resulted in change to already completed design and construction work. This inhibited the VM team from recommending radical changes, because of the cost of redesign and rework. Nevertheless, their proposals were often resisted by the designers, and/or rejected by clients (Alalshikh & Male, 2009).

Against this background, Alalshikh set out to develop a VM approach more appropriate to the Saudi public sector context, and with the potential for application at various stages in the project. He suggested (Alalshikh & Male, 2010) that VM could be used at the pre-concept stage, to guide the strategic decision on whether to proceed with the project, and to reconcile stakeholders' perspectives on the project

objectives at the briefing stage, to structure requirements, the design stage, realign client and contractor values and address buildability issues. Key features of the proposed system were inclusion of the design team within the VM team, improved communication between stakeholders and an emphasis on conducting VM at an early stage, to help to derive feasible proposals and mitigate resistance (Alalshikh & Male, 2009). The proposed system was validated at the project level by questionnaires sent to 11 experts, and at the organisational and institutional levels by interviews with experts from three organisations that used VM, and two senior managers from the Ministry of Finance (MOE) (Alalshikh, 2012). Participants supported the proposal of a hybrid design/VM team, and favoured applying VM at least twice in the project: to review and structure briefs and address soft issues, and to optimize design and deal with hard issues. As a result of Alalshikh's research, several requirements were identified for successful use of VM in the Saudi public sector:

- Support for VM use and monitoring by the MOF
- Establishment of a VM policy at organisation level
- Allocation of sufficient resources for VM
- Support of senior management
- Training to promote VM culture, in order to overcome resistance.

2.9.6 Specifying with care

In an earlier section, it was shown that unsuitable, poorly written, or ambiguous technical specifications can give rise to the need for change requests to upgrade or substitute products, resulting in cost to the project and delay in the schedule - and even to legal disputes between the project parties. It follows, therefore, that carefully considered and well-written specifications can go some way toward reducing the need for change requests. This section is concerned with ways in which the problems noted in section 2.6.1.5. can be alleviated.

One of the sources of specification problems identified earlier was the proposal of unsuitable projects, bearing in mind the nature of a project, prevailing conditions,

and features of the material in question. An important first step towards avoiding such problems is adequate product information from suppliers. Ibbs Jr (1985) found that when product suppliers worked closely with the designer and provided adequate technical data about their products, disputes related to product specification were less likely to occur. They also recommended specifying clearly-defined performance standards for each product, rather than relying on proprietary brand names to reference a standard. In this regard, Luo et al. (2010) described a case-based reasoning system designed to facilitate the use of function performance specification, a structured requirement analysis process in which requirements are defined in terms of functions and relevant evaluation criteria. Their experimental testing of the system suggested good potential to facilitate the briefing of building projects.

In order to ensure that specifications are suited to the specific nature of the project in question and the environmental conditions in which it is to be built, it is also important that architects have a good understanding of the appropriate parameters for building materials and their behaviour under different climatic conditions (Folorunso & Ahmad, 2013). This, again, highlights the importance of product information; Folorunso and Ahmad (2013) recommended that building materials should carry information about their life-cycle, performance and rate of degradation under a variety of conditions, which would assist designers in making appropriate decisions when specifying the choice and use of materials. On a related point, it has also been suggested (Erdis & Ozdemir, 2013) that proposed specifications be reviewed in relation to the region's natural environmental, production situation and evolving technical conditions.

Since it was established earlier that misunderstanding and dissatisfaction, leading to change requests in projects, can occur due to ambiguities in the specification documents, it is obviously important to avoid ambiguities, both by having specifications prepared by sufficiently knowledgeable technical personnel (Erdis & Ozdemir, 2013), and by care in the writing (Kululanga et al., 2001; Lam et al., 2004; Kululanga & Price, 2005). This means incorporating up-to-date and relevant information, as well as clarity and communication efficiency in language and format (Lam et al., 2004). In order to provide a comprehensible guide to project implementation, the specifications should conform to the following criteria:

- Competence, that is, the preparer's knowledge and understanding of construction processes and techniques;
- Precision in wording, with no redundancy or ambiguity;
- A systems approach to reflect interrelationship among project components and procedures;
- Consistency in the way terms are used and concepts expressed throughout the documents;
- Up-to-date, reflecting current developments in services, products and processes;
- Fair, in order to reduce the likelihood of disputes between parties;
- Realistic, that is, achievable and practical in the prevailing conditions;
- Logically structured, to facilitate easy reading, referencing and retrieval of information;
- Results-focused, facilitating the preparation of tenders and creation of a contract;
- Right first time, eliminating time-and-money-wasting changes.

As a final note, it is worth mentioning that value engineering (see section 2.9.5) is a useful tool in improving project specifications and achieving better value for money, because it involves expert evaluation of various aspects of the project, including costs and functionality (Kelly & Male, 2003).

2.10 Previous Studies

A number of previous studies have been conducted to investigate issues related to change requests in a variety of national contexts. As indicated in previous sections, past work in the project management field reveals a variety of understandings of change requests, reflected in inconsistent terminology (see section 2.5.1). Different accounts exist of the process and parties involved (2.5.3). Researchers have identified various causes of change requests at different stages of a project, including financial problems, design issues and stakeholder conflicts, to name but a few. They have also identified effects of change requests on the project, including delayed progress, staff changes, project degradation network, and financial damage to the

owner and/or contractor. Not surprisingly, then, change requests are a matter of concern in various industries. A concise summary of the subject matter, scope, methods and findings of a variety of studies on this is provided in Table 6. A few of these studies have been cited in earlier sections, but many are mentioned here for the first time, in an attempt to capture a variety of contexts, emphases and methodological approaches. The aim of so doing is to provide an overview of the scope and nature of previous research. The "Comments" column highlights studies' emphases and omissions, as a step towards identifying the research gaps (and, hence, the areas to which this study can contribute. The gaps are identified more fully in the next section. However, discussion of the contributions of this research is left to Chapter six, the conclusion.

Table 6 Previous Studies

Author	Year	Subject	Scope	Methodology	Findings	Comments
(Hanna et al.)	1999	Impact of change orders on labour efficiency for electrical construction	The research sought to quantify the effects of change orders on work efficiency	Quantitative data were collected from two electrical contractors and linear regression was used to model the impact of various independent variables on loss of efficiency resulting from change orders	Provide a means to estimate the impact of a change order under certain project conditions. This research also identifies factors, which, when understood and effectively managed, may be used to mitigate the impact of a change order on project costs and efficiency. These factors are, effects of the amount of change, schedule extension, timing of changes and management experiences in handling change orders	Focused on the impact of change orders and appropriate handling strategies confined to contractors. Did not consider conceptualization, process or causes
(Hanna et al.)	2002	Statistical-fuzzy approach to quantify cumulative impact of change orders	This paper investigates the effects of change orders on the electrical and mechanical sectors of the construction industry.	Statistical-fuzzy approach	This paper provides a new methodology using the statistical-fuzzy approach to quantify the cumulative impact of change order	Did not study causes, effects, and handling of change requests
(Charoenngam et al.)	2003	Web-based application for managing change orders in construction projects	This paper discusses a web-based project management system, called the change order management system (COMS), to manage change orders using the Internet.	In this study, object-oriented methodology is used to conduct a detailed study of system analysis	The proposed system facilitates handling of change orders by 1) standardisation of forms used; 2) timely receipt of documents by the relevant parties; 3) confirmation that documents are received and read; 4) a centralized database ensuring equal access to information; 5) avoidance of document mismanagement	Focused on the process and handling of change orders with no attention to concept, causes and effects
(Arain & Pheng)	2005	The potential effects of variation orders on institutional building projects	A rebuilding programme initiated by the government of Singapore, through a government agency.	Questionnaire survey and interviews with developers	This paper presented the developers' view of the effects of variation orders for institutional building projects in Singapore. The results suggest that the most frequent effects of variations were related to the increase in project cost, additional payment for the contractor, effects on progress but without any delay, completion delayed, increase in overhead expenses	Focused solely on the effects of variation orders, with no attention to conceptualization, process, handling or causes

					and rework and demolition	
(Ibbs)	2005	Impact of change's timing on labour productivity	The data reported in this study were collected over 9 years, beginning with the original Ibbs and Allen CII study (1995)	A total of 162 disputed and non-disputed projects were selected from 93 contractor, CM, design, and owner organisations. The data were analysed using conventional regression analysis	The implications and benefits of this research are clear: if changes are necessary, they should be recognized and incorporated as early as possible	The study focused solely on timing effects - not causes
(Moselhi et al.)	2005	Change orders impact on labour productivity	The study investigates the impact of change orders on construction productivity and quantifies it by means of a new neural network model. The study focuses on construction projects conducted in the USA and Canada	Based on data collected from selected projects, change order factors that affect labour productivity were identified, the impact of change timing modelled, and a neural network model developed	The neural network model is found to compare favourably with others in accuracy of productivity impact estimators	The research is confined to impact on productivity and neglects other possible impacts; it does not address causes or handling
(Arain & Pheng)	2007	Modelling for management of variations in building projects	A theoretical model is developed to guide management of change requests in construction	A theoretical framework was developed and a structured model created for handling variation orders	The proposed approach enables the project team to benefit from favourable variations, while minimizing negative consequences	The research is confined to handling and is purely theoretical, so does not reflect stakeholders' views

(Oladapo)	2007	A quantitative assessment of the cost and time impact of variation orders on construction projects	The research evaluates the degree of cost and time impact caused by change orders	Quantitative data were collected from 50 project participants, by means of questioner survey	Variation orders accounted for 79% of cost and 68% of time overruns, irrespective of project type and size. The main causes of variation orders were changes in specifications and scope, originating from project owners and consultants	Focuses on the causes and effects of change orders in terms of time and cost, but neglects handling
(Jawad et al.)	2009	Variation orders in construction projects	The study examines the causes, effects and control of variation orders on large building projects in 34 companies.	A survey questionnaire was distributed to all building contractors, grade A and B as well as building consultants in Malaysia	Change of plans and material substitution are the main causes of variation orders in large buildings	Focuses on the causes and effects of change orders, with no attention to handling. Owners' perspective is missing
(Alnuaimi et al.)	2009	Causes, effects, benefits and remedies of change orders on public construction projects in Oman	Four types of project in Oman 1-Water transmission project 2-Building project. 3-Road project. 4-Port project	Four case studies and a field survey via a questionnaire. The questionnaires were distributed to 30 clients, 25 contractors and 20 consultants who were involved in similar types and sizes of projects presented in the above case studies	The variations resulted in delays, disputes and cost overruns. The study indicated that the contractor benefits the most from change orders, followed by the consultant and then the client. Some general remedial recommendations	Did not focus on a specific subject
(Rashid et al.)	2012	The impact of change orders on construction projects; sports facilities case study	The context is construction of sports facilities in Egypt. The research focuses on the factors influencing project time and cost	Quantitative data were collected by means of questionnaire listing factors assumed to influence change orders. The questionnaire was distributed to 65 construction practitioners in Egypt, of whom 33 responded. Data was analysed statically	Changes by owners had the most impacts on the projects. The main reasons for change orders affecting projects were: owner making additional requests, contractor's financial difficulty, design| consultant requesting new work during execution and design revisions during the execution stage	Focuses on the causes and impact of change orders

(Nahod)	2012	Scope control through managing changes in construction projects	Dynamic planning and control methodology (“DPM”) is used to examine time and cost issues and derive implications for managing change	Data were collected by means of questionnaire and interview. Using the customized DPM method, a model was created to assist change approval/ rejection decisions	The model facilitates evaluation of the impact of proposed changes on the project and provides an objective, comprehensive tool for controlling scope creep	Focuses on the impact of change orders and managing the scope of the project
(Memon et al.)	2014	Significant causes and effects of variation orders in construction projects	The research seeks to identify the significant causes, effects and control methods for projects in the Malaysian public works department	Data collection involved a survey with a structured questionnaire consisting of 18 causes and 9 effects of variation orders identified through a comprehensive literature review	Major causes of variation orders are unavailability of equipment, poor work quality and complex design. Major impacts are increased cost, late competition and logistics bottlenecks. Early involvement of professionals and better design can mitigate problems of changes	No investigation of the conceptualization and process of change orders

(Alsuliman)	2014	Effective stakeholder engagement in variation order management at the design stage of public sector construction projects in Saudi Arabia	Saudi public construction projects	The methodology combined several methods. Interviews investigated the current practice of variation order management. Then, a questionnaire survey measured the level of power and interest of the different stakeholders. Finally, focus group sessions validated the performance and concept of the developed model	Develop a model that better manages variation orders in Saudi public construction projects in the design stage.	Just focus on the design stage
(Memon et al.)	2014	Severity of variation order factors in affecting construction project performance	The research investigates various causes of variation orders and assesses their impacts on time and cost	Comprehensive quantitative data were collected through a questionnaire, distributed to clients, consultants and contractors involved in the construction industry. Identified factors were grouped by means of factor analysis	Project timing is mainly affected by schedule change, scope change and design change, financial difficulty and lack of strategic planning. Cost impacts were mainly due to schedule change, financial difficulty, insufficient detailed working drawings and specification change	This study focused on the effects of variation orders, confined to time and cost
(Kolawole et al.)	2015	Change order management factors in building projects in Northern Nigeria	This paper explores how change order management strategies affect building projects in Nigeria	Statistical analysis was used using average index, Spearman correlation coefficient, factor analysis and multiple regressions, to analyse data from a survey questionnaire	Change orders can be minimized by care at the design stage, including clear, detailed briefing, careful planning and sufficient detailing of design. Allocation of adequate requests is also essential	Focuses on the strategies to handle change order without focusing on the concept, process, causes and effects

(Oloo)	2015	Modified variation order management model for civil engineering construction projects	Investigated the factors contributing to variation orders and their effects on civil engineering construction projects in Kenya	The study was conducted through survey method. Data was collected using a total of 95 questionnaires. The survey achieved a 78% rate of return. The data was analysed using percentages	The causes of variation orders were: delay in land; differing site conditions; change of plans or scope by client; change of schedule by the client; and lack of coordination between overseas and local designers. In addition, the three most important effects of variation orders were found to be: cost and time overruns, contractual claims and disputes. There is no existing variation management system and development of an effective model that if adopted, would help reduce the occurrence of variations and ensure that those that are inevitable do occur in a controlled manner	Did not study the conceptualization and process of change requests

The table shows that previous studies have looked at change requests from both theoretical and practical perspectives. Several of the studies were conducted in the construction industry. There is evidence of attention to various aspects of change requests, particularly causes, effects and handling. Some studies have addressed owners' (clients') concerns, others (more commonly) those of contractors, and very few have included consultants. It could be argued that, while each of the cited studies provides insight into some aspects of change requests, each in its own national, sectoral and project context, none gives a comprehensive account of change requests, and none addresses the problems reported in Saudi Arabia (discussed in section 2.2). In the next section, therefore, gaps in the existing body of change management literature are identified, and the need for studies that fill the identified gaps is highlighted, in order to introduce and justify the aims of this study.

2.11 Research Gaps

Reviewing the literature can enable identification of gaps in research. In this regard, this chapter started with an overview of Saudi Arabia, particularly Riyadh and its projects, to identify the nature of the projects and their problems. Change requests have emerged as one of the most significant problems in construction projects in Saudi Arabia. It has been shown that there are potential relationships between project management and national culture, which could affect projects in Saudi Arabia. Then, a discussion was presented of the elements of projects, as significant aspects related to change requests. Following that, the conceptualization, importance and process of change requests were reviewed, to provide a detailed understanding of the main subject. The discussion then turned to causes, effects, normal handling and reducing the likelihood of change requests, to see how they occur, their effects and ways of handling them, from several perspectives.

In the previous section, some studies related to change requests have been summarized. However, these studies leave many critical gaps which this study seeks to fill, and which motivated the development of the research questions. The identified gaps and their implications for this study are as follows:

- Limitation of study context: the previous studies were conducted in Europe, USA, Africa and Asia. However, no study has been applied in Saudi Arabia. This is an important limitation, given the potential influence of culture on PM (see section 2.3). Clear understanding and effective practice of PM require understanding of how cultural and other context –specific factors operate. Therefore, there is a need for research to fill the gap by looking at change requests in Saudi Arabia, a location with a unique culture, and where change requests are reportedly problematic.
- Type of project: most studies focused on several types of projects and did not focus specifically on change requests in large building projects. The only study that focused on such projects was the one by Jawad et al. (2009), who focused on large building projects, but these buildings were classified in two grades, A and B. There is a gap with respect to change requests in massive buildings projects (which in Saudi Arabia, are classified as grade one), which have more impacts on the economy of the country.
- Type of samples: no study takes all stakeholders as a sample. Some are confined to a single stakeholder group. In view of the previously identified issue of stakeholder conflict, there is a need to consider the perspectives of all stakeholders, such as owners, contractors, project managers and consultants as sources of primary data, as these groups may be expected to play different roles in relation to change requests, and be influenced by them in different ways.

- Aspects of change request: each of the previous studies focused on one, two or even three aspects of change requests; for example Moselhi et al. (2005) limited their study to one aspect, which was the impact of change orders on labour productivity. However, there is a need for comprehensive investigation of all aspects of change requests, from conceptualization, through process, causes, and effects, to handling change requests, in order to study the problem from scratch. No previous study, for example, has addressed the prevalent issue (explored in section 2.5.1) of inconsistences in terminology and definition of change requests. A clear and consistent conceptualization of change request, shared by all parties concerned could be

seen as a necessary starting point for understanding how such requests are generated and handled, and their implications. Investigating the prevailing conceptualization(s) of change requests in the research context was therefore considered essential in this study, leading to the following research question:

a) How do stakeholders in Saudi Arabia conceptualize change requests?

Some literature describes or proposes specific procedures for raising and approving change requests, but few of the empirical studies reviewed addressed this aspect. It would be useful to investigate the parties and procedures involved in making and approving change requests in the research context, in order to understand their impact on projects. This gap motivates the second research question:

b) How do change requests occur in large building projects in Saudi Arabia?

A number of previous studies, as indicated in Table 6, have investigated causes of change requests. However, these may differ according to context (e.g. sector, country). In order to gain a better understanding of the reported prevalence of change requests in large Saudi construction projects, it is important to examine the causes of such requests in that context. This in turn may enable identification of ways of reducing the number of such requests affecting projects. This concern informed the development of research question c, namely:

c) How are change requests caused in large building projects in Saudi Arabia?

Similarly, while a number of previous studies have investigated the effects of change requests, they have not done so in the Saudi construction context. Moreover, studies that included only one or two stakeholder groups are unlikely to have captured the full range of possible effects, since each stakeholder group will be affected in different ways, depending on their relationship with the project. Given the general effects of change requests reported in the literature (see section 2.7) it seems that such requests may contribute to the reported problems facing Saudi construction projects

(section 2.2.5). This concern leads to development of the fourth research question:

d) How do change requests affect large building projects in Saudi Arabia?

The majority of the studies reviewed did not discuss strategies for handling change requests. The few that did so were conducted in sectors or cultural contexts different from the one of interest in this study. Moreover, they did not link ways of handling change requests to issues of conceptualization, procedure, causes and effects, in a holistic view. In order to provide holistic insights for the Saudi construction sector, the following question was formulated:

e) What methods do stakeholders currently use or envisage to handle change requests in Saudi Arabia, and how effective do they find them?

The result of all the aforementioned gaps in previous research is that no previous study has provided a holistic framework or structure for the whole phenomena of change requests, from conceptualization to handling. Such a framework could be potential benefit as an aid to analysing change request issues, diagnosing related problems and finding solutions in a variety of contexts. Thus, a sixth research question is proposed, as follows:

f) How can our analysis of change request issues provide assistance in understanding, analysis and diagnosis of change request issues in practice?

- Methods used: most studies used quantitative methods such as questionnaire surveys or statistical modelling. These provide general overviews and trends, but fail to provide context, or to capture the real experience of those parties involved in raising, processing and implementing change requests. There would be value in gathering qualitative data from stakeholders and company documents, in order to gain deeper insight into the different perspectives and issues involved.

The methods adopted in order to answer the research questions are explained and justified in the next chapter.

Chapter 3: Methodology

3.1 Introduction

The foregoing chapters have provided a rationale for this study, and identified the research questions, which were:

a) How do stakeholders in Saudi Arabia conceptualize change requests?

b) How do change requests occur in large building projects in Saudi Arabia?

c) How are change requests caused in large building projects in Saudi Arabia?

d) How do change requests affect large building projects in Saudi Arabia?

e) What methods do stakeholders currently use or envisage to handle change requests in Saudi Arabia, and how effective do they find them?

The questions therefore concern the experiences of project stakeholders in a specific, naturally occurring context. This chapter provides an explanation of the methodological decisions taken and procedures employed in order to address these questions empirically. The chapter begins with a consideration of the philosophical assumptions underpinning the research. Aspects of the research design are then discussed, including the nature of the research purpose, the research logic, strategy and choice of a multi-method sequential qualitative design, and development of an interviews schedule. Implementation of the research procedures is then described, including the sampling strategy, pilot study, and data collection and analysis procedures. After a discussion of validity and reliability issues, the chapter ends by addressing ethical considerations arising in the conduct of this research.

3.2 Research Philosophy

Research philosophy can be defined as the principles of how to collect, analyse and use data about a phenomenon (Chia, 2002). These depend on the research paradigm, a perspective formed from a set of shared values, assumptions, practices and concepts (Johnson & Christensen, 2007), which generally defines the way in which a researcher views the development of knowledge (Sekaran, 2003). This section begins

by considering assumptions about anthology and epistemology, then turns to the selection among alternative research paradigms.

3.2.1 Ontology and epistemology

Ontology and epistemology are concerned with, respectively, views on the nature of the social world and how it can be understood. These issues have important implications for the strategies and methods adopted.

Ontology

Ontology refers to the view of the researcher concerning the nature of reality, whether the researcher views reality to be an objective entity that actually exists, or a subjective entity that is only created within our minds (Blaikie, 2007). In this research, one of the fundamental assumptions made is that reality is subjective and may depend on the particular environment and circumstances under which the social actors operate. The researcher has assumed that the manner in which project managers handle change requests and the effects of such requests on project completion in Saudi Arabia will depend on the way in which stakeholders view such changes. In other words, the change request is viewed not as an objective entity with a single, unchanging nature, but as a social phenomenon, open to subjective interpretation. The research questions aim to uncover potentially multiple and even conflicting conceptualizations and experiences of change requests, their causes and impacts, in order to build up a rich picture and detailed understanding of the range and complexity of this phenomenon.

Epistemology

Epistemology refers to how reality can be known and the extent to which that reality can be known (Chia, 2002). It focuses on the standards and methods of producing, representing, and describing verifiable and reliable knowledge. This research is based on the assumption that knowledge is gained through experience. Hence, those who have adequate experience of a phenomenon are best placed to provide knowledge about it (Denzin & Lincoln, 2000). This assumption was made because effective management of change requests in a unique environment such as Saudi Arabia goes beyond project management theories and principles, and borrows from a

deep understanding of the environment, an understanding that can best be gained through experience. Based on this assumption, the researcher opted to seek information from project managers, owners, consultants and contractors, whom the researcher assumed have gathered a great wealth of information on the ways in which change requests occur, and their effects on construction projects in Saudi Arabia. This stance, which is consistent with the researcher's subjectivist ontology, implies that access to participants' experience requires exploring the exploring of their perceptions in their own terms, and in the light of contextual factors in the Saudi environment.

3.2.2 Research paradigms

There are various research paradigms that could be used to guide a research work. Such paradigms include realism, positivism, interpretivism, phenomenology and pragmatism among others (Moran, 2002). Given the constraints on the length of this chapter, only a few paradigms commonly used in management research will be discussed, with the aim of revealing their fundamental differences. This section highlights why the researcher settled on a particular paradigm as opposed to other paradigms.

To begin with, some researchers may take a positivist approach. Positivism involves testing of hypotheses derived from various existing theories by measuring observable social realities, based on the assumption that the social world exists externally and objectively (Saunders et al., 2012). This method would therefore only be suitable when the research is based on the assumption that reality is absolute and measurable. This is not the case in this research, which explores the complex phenomenon of change requests, with varying manifestations, some aspects of which (for example change request effects) may be intangible. Positivism was therefore not suitable for this research, as it would have called for the measurement of the external realities, which would not have been the most appropriate approach. The effects of change requests on a project are not easily measured, given that a project is affected by many factors other than the change request. As such, positivism would be an inappropriate approach for this study. It would be more appropriate to assume that knowledge of

the causes and impacts of change requests, and ways of handling them, is gained through experience of social actors who have actually implemented, or been affected by change requests.

In contrast to positivism, constructionism argues that it is people who 'construct' the world and that such constructions should serve as the driving force to be investigated in research conducted in social science. The paradigm argues that the reality constructed by each person has such a great influence on their behaviour that external realities are less important. It is not possible, according to this paradigm, to compare the various realities constructed by different people (Bazely, 2002). The social constructionist paradigm was not considered suitable for this research either, since the manner in which stakeholders manage change requests does not entirely depend on the stakeholders' social selves, but also depends on some factors that are inherent to the projects and the environment within which the projects are conducted. What was needed, therefore, was a paradigm that would employ the experience gained by stakeholders to assess the effects of change requests in Saudi Arabia, while acknowledging the factors underlying such requests.

Pragmatism is another paradigm that could be used in social science research. This paradigm does not rely on any single philosophical system or any clear definition of reality (Mertens, 2009). Pragmatism was not used in this research either, mainly because its unrestrictive nature would offer no proper guidelines on the best approach to the research processes. As such, it would be difficult for a different researcher to repeat the same research and come up with similar results.

3.2.2.1 Researcher's paradigm

This research applied an integration of interpretivism and critical realism. Interpretivism assumes that knowledge is acquired through memories, individual experiences and expectations (Denzin & Lincoln, 2000). Critical realism, on the other hand, assumes the existence of a real structure independent from the consciousness of individuals, but that knowledge is socially constructed (Denzin & Lincoln, 2000), for example by historical, economic and cultural forces.

While some of the structures and concepts involved in project management are real and measurable, some concepts in this field are clearly socially constructed (Morris, 1994). Therefore, conducting an effective study in this field calls for a paradigm which spans critical realism and interpretivism, rather than choosing a single paradigm. A blend of the two paradigms was used for this research, as they are the most appropriate for studying the subject at hand. The researcher selected the two paradigms after deep consideration of the study objectives and the research questions. Since the research aimed to explore stakeholders' conceptualizations of change requests, their experience of the procedures involved and their perceptions of the causes and effects of change requests and evaluations of ways of handling them, which are subjective experiences and understanding, to uncover them, interpretivism is appropriate. There are various social factors underlying the effects of change requests; hence the need to incorporate critical realism to account for these factors. As indicated in Chapter Two, section 2.2, Saudi Arabia has a unique culture which affects the workplace setting and hence the conduct of projects in the country. This made it necessary to conduct a contextualized research on change requests.

3.2.2.2 Implications for research methodology

The research paradigms have implications for the choice of the data collection strategy and techniques. Interpretivism emphasizes the understanding of people's experiences, feelings and thoughts, as well as their understanding of their social situation. This is reflected in the research questions. Such a stance is associated with qualitative data collection and analysis (Smith et al., 2003). This will facilitate understanding of interviewees' interpretations of the reality and formation of conclusions on the impact of change requests on the execution of projects in Saudi Arabia.

The blending of interpretivism with critical realism has further implications for the way in which data can most appropriately be interpreted. It points to the necessity to take account of the political, economic and socio-cultural background of Saudi

Arabia, to create an understanding of the factors underlying the occurrence of change requests in the country, their effects, and how the project owners, project managers, contractors and consultants deal with such requests. It also suggests the value of considering the background of the stakeholders, in order to uncover any possible connection between their perceptions of the change requests and their professional, academic and social background.

3.3 Research Design

The purpose of this section is to give an outline of the overall methodology for this study. It begins by explaining the purposes of study. Then, it clarifies how the research strategy and research techniques were chosen to achieve the desired outcomes. The design of the research instrument is also discussed.

3.3.1 Research purpose

According to Keslinger (1986), research may have explanatory, exploratory, or descriptive purposes (see Table 7). The purpose of explanatory research is to discover the relationships between variables driven by theory or expectations. The aim of exploratory research is to familiarize the researcher with a subject. The purpose of descriptive research is to give a description of a phenomenon or a case situation. However, these aims are not totally separate, so a single piece of research may have more than one aim (Kerlinger, 1986). This research has a predominantly exploratory purpose, since it addresses an under-researched context of which little is known.

Table 7 Descriptions of Research Purposes

	Exploratory	**Explanatory**	**Descriptive**
Objective	Discovery of ideas and insights.	Determine cause and effect relationships.	Describe market characteristics or functions.
Focus of the study	Relatively unknown subject.	Relatively known subject, to study the relationship between variables.	To describe the actual situation of the phenomena by using averages, counts and frequencies.
Methods	Expert surveys. Pilot surveys. Case studies. Secondary data (qualitative). Qualitative research.	Experiments.	Secondary data (quantitative). Surveys. Panels. Observational and other data.
Characteristics	Flexible. Versatile. Often the front end of total research design.	Manipulation of one or more independent variables. Control of other mediating variables.	Marked by the prior formulation of specific hypotheses. Pre-planned and structured design.
Questions	Mainly how, or why.	Mainly why, or how.	Who, what, where and hen

Source Adapted from De Jager (2002).

The principal aim of this research is to explore the current method of handling change requests and how effective they are, during big building construction projects in the capital city of Saudi Arabia. This will be revealed at the end of the research after a thorough data analysis and interpretation. The outcome will be in the form of recommendations to project managers in Saudi Arabia as to what they should do when change requests are triggered by their clients or due to legal actions concerning building construction. The study will also be of instrumental significance for property clients in Saudi Arabia to understand the consequences of their change requests, which might be detrimental to Saudi Arabian contractors. The government, suppliers and other stakeholders will also learn the consequences of change requests

resulting from the role they play and their adverse effects to the contractors. In this way, they can devise ways to avoid activities that can lead to change requests, which may also have a negative effect on the development of Saudi Arabian economy.

3.3.2 Research method

According to Young (2007), if the researcher wishes to choose a suitable technique, he/she must consider the kind of paradigm which will be used in the research then, understand the effect of this paradigm on the data which will be collected (inductive vs. deductive, subjective vs. objective, and qualitative vs. quantitative). This will guide the researcher to suitable methods (techniques). Figure 10 illustrates the process of selecting research methods.

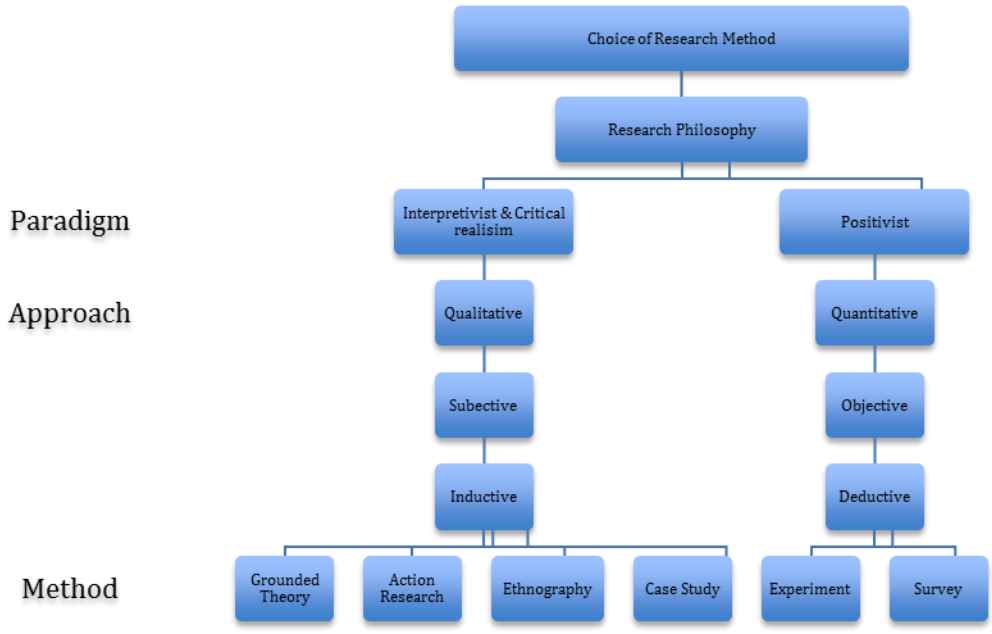


Figure 10 Choosing Research Methods

Source: Young (2007).

As mentioned earlier, the paradigms adopted in this research were interpretivism and critical realism. In light of these paradigms, and the research intention to explore the conceptualization, occurrence, causes, effects and way of handling change requests in large construction projects in Saudi Arabia, the following sections explain the choice of research approach and method.

3.3.2.1 Qualitative approach

There are several advantages and drawbacks to qualitative approach. According to Hakim(2000), one of the main benefits of qualitative research is its validity, as data are normally collected in enough detail for the outcome to be correct, complete, true, believable and convincing reports of participants' experiences and views.

Despite the fact that qualitative research has a major drawback in terms of the sample representing only a small number of participants (Hakim, 2000), it has an advantage in the depth of information gleaned rather than simply the size of data (Miles Jr, 1979). Table 8 shows the advantages and drawbacks of qualitative and quantitative approaches.

Table 8 Qualitative vs. Quantitative Approches

	Qualitative Approach	**Quantitative Approach**
Types of question	Probing	Limited probing
Sample size	Small	Large
Amount of information	Substantial	Varies
Requirements for administration	Interviewer with special skills	Interviewer with fewer skills
Type of analysis	Subjective, interpretive	Statistical, summation
Hardware	Audio recorders, projection devices, video recorders, pictures, discussion guides	Questionnaires, computers, printouts
Degree of reliability	Low	High

Source: McDaniel and Gates (2002).

This project used a qualitative approach due to the nature of the data needed. A quantitative approach would have interfered with the validity of the project due to

the tendency to manipulate information into statistical figures for generalisation purposes (Argyrous, 2011). Thus, through the use of qualitative data analysis, generalisation about the causes and effects of change requests in Saudi Arabia was avoided. In this research, qualitative methods were used, because of the type of information needed for this research. The researcher needed detailed information on the causes, effects and handling of change requests in big projects in Saudi Arabia, and to see whether culture affected change requests or not. This type of information would only be derived from the experiences and opinions of social actors, which was best captured by a qualitative approach.

3.3.2.2 Research logic

In management and business research there are two obvious types of logic: deductive, and inductive logic (Saunders et al., 2012) . Deductive logic is associated with positivist paradigm studies (Collis & Hussey, 2013). In this type of logic, a hypothesis is deduced from existing theory, then empirically tested (Bryman & Bell, 2015). However, inductive logic is associated with interpretivist paradigm research, which develops theory after the observation of empirical reality (Collis & Hussey, 2013).

Table 9 Differences between Deductive and Inductive Logics

Deduction emphases	Induction emphases
Scientific principles.	Gaining an understanding of the meanings humans attach to events.
Moving from theory to data.	A close understanding of research context.
The need to explain causal relationships between variables.	The collection of qualitative data.
The collection of quantitative data.	A more flexible structure to permit changes of research emphasis as the research progresses.
The application of controls ensures validity of data.	A realisation that the researcher is part of the research process.
The operationalisation of concepts to ensure clarity of definition.	Less concern with the need to generalise.
A highly structured approach.	
Researcher independence from what is being researched.	
The necessity to select samples of sufficient size in order to generalise conclusions.	

Source: Adapted from Saunders et al. (2012)

Therefore, based on these differences between deductive and inductive logic, the logic of this study was inductive, because the researcher could not assume in advance

the understandings, processes, causes and effects of change requests and ways of handling them in Saudi Arabia. The research was designed to gain insights into these issues. Hence, the process and aim of the research were directed towards developing theory, not testing existing theory.

3.3.2.3 Research method (Case Study)

The research questions were designed to explore in detail multiple dimensions (conceptualization, process, causes effects and handling) of a phenomenon (change requests) as experienced by construction companies in a specific cultural context (Saudi Arabia). For this purpose, a case study strategy seemed appropriate. A case study is chosen due to its tendency to reveal the facts behind a phenomenon from different facets of the situation (Yin, 2009). Easterby-Smith et al. (2008) stated that the case study approach focuses on depth of information on individuals, events, or a small number of organisations over time. Yin (2009) described case study as a type of empirical study that investigates a current phenomenon in its real life context, which is especially suitable when the boundaries between context and phenomenon are not very clear. However, Stake (1995) disagrees that case study is a methodological choice. In his view, it is just a selection of what would be studied.

Yin (2009) categorizes the significant data sources which can be used in case studies as archival records, documentation, interviews, participant observation, direct observation and physical objects. Table 10 shows the weaknesses and strengths of these data sources, which should be considered by researchers.

Table 10 Weaknesses and Strengths of Sources of Evidence

Source of Evidence	Strengths	Weaknesses
Documentation	Stable– can be reviewed repeatedly. Unobtrusive– not carried out as a result of the case study. Exact– contains exact names, references and details of an event. Broad coverage– long time span covers many events and many settings.	Retrievability– can be low. Biased selectivity, if collection is incomplete. Reporting bias– reflects (unknown) bias of an author Access– may be deliberately blocked. Danger of false or unreliable documents.
Archival Records	(As above for documentation). Precise and quantitative.	(As above for documentation). Accessibility for reasons of confidentiality.
Interviews	Targeted – focuses directly on case study topic. Insightful– provides perceived casual inferences.	Response bias. Inaccuracies due to poor recall. Reflexivity– interviewee says what interviewer wants to hear.
Direct Observation	Reality– covers events in real time. Contextual– covers context of event.	Time-consuming. Selectivity– unless broad coverage. Reflexivity– event may proceed differently because it is being observed. Cost– hours needed by human observers.
Participant Observation	(As above for direct observation). Insightful into interpersonal behaviour and motives.	(As above for direct observation). Bias due to investigator's manipulation of events.
Physical Artefacts	Insightful into cultural features Insightful into technical operations.	Selectivity. Availability.

Source: Adapted from Yin (2009).

There are four case study designs: single and multiple designs in terms of investigation, or holistic and embedded designs in terms of viewing (Yin, 2009). A multiple case study design was used in this research, the cases selected being big construction companies, and a holistic design was applied because each company was viewed as a whole. The researcher focused on projects in those companies where

change requests had occurred, and, by examination of documents (project records) and interviews with project managers, contractors and consultants in each company, explored each company's experiences of the causes and effects of change requests, and how they could be handled.

Justification for using the case study method

Case study as a research method can provide knowledge about group, individual, social, and organisational phenomena. Investigators can obtain a holistic and meaningful picture of real-life events, for example, small group behaviour, individual life cycles, organisational managerial processes, international relations and the maturation of industries (Yin, 2009). This research used a case study method for several reasons, as follows:

1. Case study enables more understanding of the process, context and the nature of change requests from the point of view of stakeholders.
2. Case study is suitable for cultural, social and organisational situations, and in this study the researcher needed to define the dimensions of the research problem, as perceived and experienced by stakeholders of specific projects.
3. Case study method focuses on the depth of information.
4. Interesting and new issues can emerge from the discussion with the research participants.

3.3.3 Research phases

A multi-method, sequential design was adopted in this study, with the data collected in two phases, as follows:

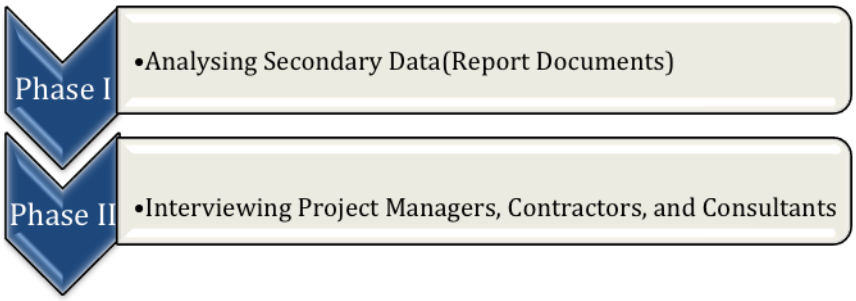


Figure 11 Phases of Study

- In Phase one, secondary data were collected by reviewing reports of companies that had faced change requests in the past. This phase was designed to identify the stakeholders involved in change requests, to inform selection of a sample for the next phase, and to see the timescale of change requests and the causes of any delay in handling them.

This phase provided detailed information and a wide perspective on the problem of the research. Through Phase one, the researcher was guided to formulate suitable questions for participants in the second phase (interview). For example, if the documents indicated that most change requests were made by the project manager, the researcher would pose suitable questions to him to investigate the problem. However, the researcher did not depend on the information from these documents as undisputed facts.

- Phase two involved semi-structured interviews with project managers, contractors and consultants in three big construction companies in the capital city of the Kingdom of Saudi Arabia. This phase was designed to capture stakeholders' understanding and experience in relation to the nature, procedure, causes, effects and handling of change requests.

Semi structured interviews were used to understand the current practices of stakeholders in the selected companies and the effects of culture.

3.3.4 Preparation of interview schedule

The literature review reported in Chapter Two had led to the identification of gaps in the PM literature with regard to change requests, and the formulation of research questions to be explored through the empirical research. These questions, and prior

literature, served as a guide in the preparation of an initial set of open questions to be used in interviews with project stakeholders. The majority of these were directly related to the research questions, such as to inquire into the causes and effects of change requests in large building projects. In addition, an initial set of questions was designed to elicit information about respondents' background (e.g. their experience and responsibilities). There was also a question asking about perceptions on the impact of cultural factors on change requests, and an invitation for participants to offer suggestions for any changes they thought would enable more effective management of change requests (a copy of this preliminary schedule can be found in Appendix 1).

The overall research design in summarized in Table 11

Table 11 Research Design

Phases	Phase 1	Phase 2
Research Paradigm	Interpretivism	Critical Realism
Purpose of the Research	Exploratory	
Research Approach	Qualitative, Subjective and Inductive	Qualitative, Subjective and Inductive
Strategy Method	Case Study	Case Study
Sampling Methods	Judgement Sampling	Judgement Sampling
Data Type	Secondary	Primary
Target	Company's Annual Report	Owners-Contractors-Consultants
Data Collection Techniques	Document analysis	Semi-Structure Interviews
Type of Questions	-	Open –Ended

The next four sections describe the way in which the design was implemented in the field.

3.4 Research Description

Since this was an exploratory study, there were several aspects that could not be planned definitively in advance; a preparatory period in the field was needed in order

to locate suitable organisations commissioning or involved in large construction projects, identify projects with a history of change requests and determine (in the light of project documents) the stakeholders involved with those projects. This section describes the procedures involved in identifying and recruiting research participants, piloting the interview schedule, and collecting and analysing data.

3.4.1 Sampling

It is possible to define sampling as a process of describing a limited collection of a statistical population, which represents the complete population, in order to test clear theories, observations or hypotheses (Kent, 2007). In most cases, it would be impossible to involve the whole population to prove or test hypotheses. Basically, there are two common means of sampling. Probability sampling is where the samples are selected randomly, and each member of the population has a known, equal chance of being selected. On the other hand, non-probability sampling is where the samples are collected by intentionally approaching specific individuals. Probability sampling allows a fair chance selection of the sample without being subjective, whereas non-probability sampling inhibits fair selection of the sample, and therefore the methods are subjective, which affects the reliability and validity of the research. There are no wrong or no right methods for sampling; it depends on the research and its nature (Kent, 2007). This study applied judgemental or non-probability sampling for the following reasons:

- Research cost and time limitation.
- Difficulty of accessing companies' databases (as sampling frames) due to concerns about confidentiality and competition. Non-probability sampling does not require a sampling frame.
- It is more useful when the population is not usually spread. As there is a shortage of research in Saudi Arabia, the researcher is not usually completely aware of the population and its distribution.
- More appropriate for hypothesis development (exploratory study), as it

focuses on selecting those people with relevant experience and knowledge. For non-probability sampling, there are five strategies, i.e. purposive, quota, self- selecting, snowball and convenience sampling (Millmore, 2007).

The recruitment of participants involved gaining access to relevant project-commissioning organisations (representing clients and their project consultants), and construction companies responsible for building the projects. In addition to selecting interviewees, the researcher also collected a sample of project documents. The samples were as follows:

1. Organisations:

The government of Saudi Arabia has established several organisations, each of which commissions construction projects for its own use, or to provide public facilities. In each organisation there is a project management department responsible for projects. The researcher visited four government organisations and met four representatives of clients in the Department of Project Management. These representatives were chosen instead of clients, because they were involved in change requests and they knew the process very well. For confidentiality the researcher will name these organisations A, B, C, D. Every client had consultants and the researcher chose two consultants for every organisation except organisation B, where the researcher chose nine consultants, because this organisation faced many problems and many change requests in its projects.

2. Construction Companies:

Three big companies classified as grade1 were chosen from the top 10 companies in the capital city of Saudi Arabia, Riyadh. The reason for choosing three big companies was to increase reliability, by obtaining a wider range of perspectives and to fulfil the replication logic of multiple case studies suggested by Yin (2009). The researcher went to these companies and met the head managers who represented the contractors, to arrange access to them. They were very kind and helpful, and they gave the researcher permission to start the interviews with project managers and department managers. To preserve anonymity, the companies are denoted as X, Y and Z.

3. Projects:

The research is limited to change requests in four large building construction projects (one each for companies X and Z, two for company Y) costing over 600,000000 Saudi Riyals, (about £100,000,000). These were very important projects in the capital city, Riyadh. A very interesting issue for this study is that all projects between the companies and organisations were delayed and suffered from change requests. The researcher visited the sites of these projects and observed how the work was progressing.

4. Documents:

The researcher obtained documents from these companies for nine change orders and seven change requests, and also saw more than 20 other change requests without taking them out. This step was extremely difficult because it is not easy to obtain confidential documents, especially if they are related to delay of projects, which is a sensitive issue. Obtaining them necessitated many requests to the head managers of these companies. However, one company refused to provide its documents.

It could be argued that it would have been better to also interview design consultants in this study. However, they were not included for several reasons. First and foremost, they do not work on the ground of the projects, like other stakeholders; thus they do not understand precisely the aspects of change requests, such as process, causes, effect and handling of change requests, the topics of the research questions. Secondly, based on the destination and time barriers, it was not possible to meet them, because design consultants were foreign designers working outside of Saudi Arabia, who attended at the beginning of the projects and then returned to their own countries, such as the USA. The researcher limited the interviewees to 44 stakeholders, of whom four were involved in a pilot study (see section 3.4.2). All of the selected participants were engineers with no less than 10 years of experience in dealing with change requests in several projects. Thus their opinions would be helpful to understand the problems of frequent change requests and the handling of them. All of them were male, because there are no women working in this field in Saudi Arabia. The composition of the research sample is shown in Table 12.

Table 12 Descriptions of Participants

	Owner	Consultant	Contractor		Total
			Project Manager	Department Manager	
Project A	1	9	1	3	14
Project B	1	2	1	6	10
Project C	1	2	1	5	9
Project D	1	2	1	3	7
Total	4	15	4	17	40

3.4.2 Pilot study

A pilot study is a study that is conducted to test the accuracy and precision of the instruments of data collection prior to the actual study (Kent, 2007). For the purpose of this study, a pre-test of the instrument of data collection, a semi-structured interview schedule, was conducted in order to assess the anticipated time needed for each respondent, and to enable the questions to be reviewed, and if necessary modified, to enhance their clarity and appropriateness to the research purpose, context and participants.

The pilot research involved three major steps:

- The first step was to test the schedule using the researcher's colleagues as the respondents. This helped to make time estimations for each respondent.
- The second step was to make a pre-visit to the respondents' premises to book interviews. Meanwhile, the researcher was able to make informed decisions concerning the cost and distance to be travelled during the actual interviews, and hence to prepare an accurate budget.
- The last step was to conduct four pilot interviews to ensure that the respondents understood the questions clearly.

Following the first two pilot study interviews, it was found necessary to change some questions and add others. For example, the following question was added:

- What is the difference between change order and change request?

This question was added because the initial interviewees did not distinguish between change requests, and change orders.

Also, question number 8 was changed. The original question was:

- What type of project management system do you apply in your project? American system? If so, is it suitable to the culture of Saudi Arabia? How? Is this system a cause of change requests? If so in what way?

The researcher changed this question, because it was found that project management was sometimes not applied, or applied, but not as a complete process. Therefore, he divided the question into two questions as follows:

- Do you apply the standard of the Project Management Institute PMI or similar in your project? If so, is it suitable to the culture of Saudi Arabia? How?
- Do you think that not fully applying PMI or similar in Saudi Arabia is one of the causes of change requests?

This question was asked to explore other causes of change requests.

Another two pilot interviews were then conducted to check the effect of the change. After these four pilot interviews, the interview questions were clear, and satisfactory. The revised interview schedule can be seen in Appendix 2.

3.4.3 Data collection

Interviews were conducted in the participating companies between 21/01/2014 to 22/04/2014, as arranged in the preliminary visits. However, the process was not without difficulties. A problem faced at this stage was that some interviewees were worried about the researcher's position as a colonel in the Ministry of the Interior, and they were concerned that the information they gave would be disclosed. However, before starting each interview the researcher tried to reassure the participants by explaining about the confidentiality of their information and showing them some papers as evidence of that. Also, the experience of the researcher as an investigator helped him to manage the meetings with participants and obtain the information smoothly. For example, difficulties were experienced in arranging to meet the representatives of clients, because all of them were very busy. However, the researcher managed the situation by maintaining contact with them. Also he was

lucky in some situations. For example, the representative of organisation A asked for his interview just 30 minutes before the meeting at 11:30 am, and said this was the only time he had to do the interview. In order to be well prepared, the researcher carried the interview questions with him everywhere. Also, it was fortunate that he was very near to the representative by chance; if the researcher had been at home, he would have needed at least two hours to reach the destination, because in some areas of Riyadh, the traffic is very congested in the morning. A similar problem arose when the representative of organisation B asked to have his interview at 12 noon and sent the message at 11:15, with only 45 minutes' notice before the meeting. However, luckily the researcher lived not far away from this organisation, so he was able to conduct the interview on time. Interviews were not recorded, because interviewees would not give permission, so written notes were taken during each interview.

3.4.4 Data analysis

After transcribing all interviews, the researcher translated them into English, and they were translated into Arabic by another professional Arabic translator, to ensure the validity of the translation. All the documents and interviews employed for this study were recorded and encoded in a documented written report for easier analysis of the data. As Auerbach and Silverstein (2003) point out, there is no 'one right way' to analyse and interpret qualitative data. In this research, a thematic analysis approach was employed, drawing insights from a variety of research methods writers.

The process of analysis began in the field, at the time the data were being collected from interviews and documents, in the sense that this was an opportunity to reflect on the data as it emerged and identify concepts that appeared helpful for understanding how the selected companies perceived and experienced change requests. One outcome of this process was to confirm that the topics expressed in the research questions did indeed capture important aspects of participants' experiences.

On return from the field the transcripts and documents were reviewed frequently in order to develop what Saldaña (2015) calls intimate familiarity with the data. Marginal notes were made to identify important quotations and preliminary codes for

data (Engel & Schutt, 2016). In this process, initially a set of a italics codes were derived from the literature and captured in the research questions (Miles & Huberman, 1994): conceptualization, process, causes, effects and handling, and was used to create a set of categories. These provided direction in searching the data (Taylor-Powell & Renner, 2003), or what Saunders et al. (2012) call an emergent structure. The computer software programme, NVivo, was used to assist in managing the data by collecting relevant data segments (ranging from a phrase to a whole paragraph). NVivo generated a number of codes within each category, which the researcher then ground into themes. To take an example, one of the categories (corresponding to RQ3) was causes of change requests. NVivo generated a variety of codes within this category. The researcher's inspection of these codes indicated that they reflected various aspects of change request causes, such as the motivation for them. Moreover, it was apparent that certain motivation factors were linked to a common source - the owner. Therefor the researcher created the theme, 'owner', to collect together related codes. On a similar basis, other codes were grouped under the themes, consultant and contractor. In this way, hierarchies of vertically related codes were created (Ekka, 2014).

Whilst the data is presented in predominantly narrative form, a table (4.2) was also created to display all the categories used, with their themes and codes. Moreover, a Figure (Fig 24) in the form of a network diagram was created to summarize themes and categories (see Chapter Four).

3.5 Validity, Reliability and Alternative Quality Criteria

Validity of results is a term used in research methods to mean the accuracy of results (Babbie, 2012). The validity of this research was achieved by ensuring that the tool of data collection was properly designed to gather responses from constructors in Saudi Arabia that would be helpful in data analysis, and recommending how to handle the adverse effects of change requests. The researcher tried as much as possible to avoid constructing interview questions that were meant for personal curiosity, and concentrated on formulating questions that would be used in data

analysis for the benefit of advising project managers in large companies in Saudi Arabia on how to avoid detrimental effects of change requests.

Reliability of results is a term used in research methods to mean that the same results would be obtained by other researchers when using the same tools of data collection and sampling methods (Kent, 2007). For the purpose of this project, sticking to the universal techniques of the basic requirements of an interview, which in this case was the tool of data collection, enhanced reliability.

Given the small number of projects investigated, and the non-probability sample, this research will not be generalized. However, the results of the research could be useful for other countries with a similar culture, which suffer from frequent change requests in construction projects.

There is, however, considerable debate among researchers as to the relevance of traditional notions of validity and reliability in qualitative research. While some authors, such as Mason (1994), use the terms similarly to the way they are used in quantitative research, where the terms were developed, others argue that these concepts are problematic and need to be re-defined when applied to qualitative research. For example, the notion of internal validity, in the sense of accuracy and matching reality, is problematic in research that rejects a realist ontology. The main concern is how well the research reflects the experience and perceptions of participants (Miles & Huberman, 1994). External validity or generalizability is similarly problematic in research that is context-specific (Bryman & Bell, 2015), such as that which employs a case study strategy, as this research does. As for reliability, which, as noted above, is traditionally concerned with stability and consistency, either over time, or within a measure, neither of these interpretations is appropriate in qualitative research. Stenbacka (2001) argues that reliability concerns measurement, and so is irrelevant in qualitative research. Moreover, social settings, by nature, do not remain stable (Bryman & Bell, 2015), and participants' experience and perceptions will inevitably change over time.

In view of these difficulties, researchers have adopted alternative criteria by which to evaluate qualitative research, namely credibility, as an alternative to internal validity;

transferability, as an alternative to generalizability; dependability, to replace reliability; and confirmability, instead of the positivist criteria of objectivity. In the following paragraphs, these criteria are explained, and their application in this research is discussed.

To begin with credibility, this criterion is not concerned with capturing some absolute 'truth', which is not possible in research that recognizes the possibility of multiple subjective 'realities'. Rather, it is the persuasiveness and feasibility of the interpretation offered which allows it to be accepted as a valid account of participants' experiences (Creswell, 2014; Bryman & Bell, 2015). In this research, credibility was pursued through engagement between the researcher and the participants, building rapport and trust, and therefore minimizing the likelihood that they would attempt to hide or misrepresent their views. This process of trust-building included, for example, careful explanation of the research purpose, assurances of anonymity, and respecting of participants' preferences not to have the interviews audio-recoded, as explained earlier in this chapter, and in the section on ethics. Another strategy was the triangulation of data sources, as recommended by Fellows and Liu (2008). In this research, triangulation was achieved by two means: the complementary use of interviews and document analysis, and the involvement of a variety of stakeholders, giving a wide range of perspectives on the experience of change requests in Saudi Arabian construction companies.

The second criterion, transferability, is an alternative to generalizability. Rather than the onus being on the researcher to demonstrate the typicality or representativeness of the research setting and sample, transferability refers to judgement by the reader of the appropriateness of transfer to another research context (Creswell, 2014). Such judgement is based on an evaluation of the degree of similarity between the original research context and the one to which transfer is being contemplated. The role of the researcher is to facilitate such an evaluation by providing sufficient information about the research context. This purpose was achieved in Chapter Two of this thesis, which described the Saudi context with specific reference to the challenges facing the construction sector. Moreover, attention was drawn to Saudi Arabia's scores on Hofstede (2016) cultural dimensions, enabling comparison with the same cultural dimensions in many other countries worldwide. From this information, readers will

be able to compare the research context with their own setting in order to make an informed decision as to whether or how far the research conclusions may be applicable in their own settings.

The third criterion, dependability, substitutes for the traditional notion of reliability, in the sense of stability and consistency. It involves demonstrating trustworthiness by means of clear evidence of how the research conclusions were derived (Sandberg, 2005). As recommended by Miles and Huberman (1994), all research materials have been retained in retrievable form in hard copy and on computer. All stages of the research were scrutinized by the research supervisors. Moreover, the researcher was open about his experience and role.

A related concept to dependability is confirmability, which concerns the level of 'objectivity' in the research (Creswell, 2014), and the extent to which the researcher has acted in good faith and not allowed his conduct or reporting of the research to be distorted by personal considerations, prior assumptions, or theoretical inclinations (Bryman & Bell, 2015). This was achieved partly by the auditing technique described above in relation to dependability and also as advised by Remenyi and Williams (1998) by an evaluation of the various aspects of the research in relation to the literature. It has already been shown in Chapter Two how the components of projects definitions of change requests and issues surrounding such request were explored through previous theoretical and empirical literature, and in Chapter Five, the research outcomes will be discussed in light of the literature.

From the above, it can be seen that careful consideration has been given to a variety of criteria in order to support the research process and demonstrate the trustworthiness of its outcomes. Further details of some of the strategies employed to this end are provided in the following section, on ethical considerations.

3.6 Research Ethical Implications

Ethics is the moral philosophy that systematizes, recommends and defends the concepts that determine right conduct from wrong. To aid a deeper understanding, ethics can be categorized into four major study areas: meta-ethics, normative ethics, descriptive ethics and applied ethics, as described below.

Meta-ethics deals with the provision of theoretical moral propositions and the determination of their truth values. Normative ethics on the other hand is the practical determination of the moral course of proceedings. Descriptive ethics analyses peoples' beliefs on morality, whereas applied ethics emphasizes the attainment of moral outcomes in specific situations (Philpot, 2004).

In this research, normative ethics was mainly applicable. This is appropriate for the consideration of moral factors and conducts that aid the achievement of accurate information and hence fulfilment of the intended study objectives, in addition to appreciation of the individual participants' contributions. Research ethics is a requisite backbone and determinant of efficiency and accuracy in every study, and thus dictates the fulfilment of the research objectives and goals (Chow & Drummond, 2010).

Basically, ethical implementation in research is of critical significance, in the sense that it offers a smooth and accommodating platform between the researcher and the study participants, which is vital for the provision of accurate feedback by those respondents. Any standard research/study has to observe and implement all the various ethical considerations necessary. These include consent/permission seeking, and provision of adequate information to the participants on the nature of the study, in addition to ensuring the confidentiality of the data sources and the privacy of the participants.

3.6.1 Consent seeking

In essence, consent involves making decisions and being committed to the decision made. It is an act of information evaluation, decision-making and the signification of the decision (Haman & Hollon, 2009). The entire research programme depends on the active cooperation of the participants in answering questions, and thus implies consent is necessary.

Prior to the fieldwork, the researcher took steps to obtain permission from the relevant authorities, the Arabian companies. The researcher therefore conducted a reconnaissance to understand and seek all recommended consent to legitimize the study in the chosen organisations. It was necessary to write a formal request letter to the top authorities of the chosen organisations, and then wait for their feedback before executing the study. A follow-up call was necessary in cases of a delayed feedback or just to remind the management of the study request. The follow-up call enabled the researcher to get immediate feedback on what to do next, in comparison to 'letter feedback', which would have taken days, or even weeks via the post office. However, the initial request had to be made through a formal letter. Upon the request of the management, the researcher faced the organisation's authority in person for a face-to-face discussion, which was vital for explanation of the significance of the area/organisation to the study.

After obtaining the consent of the top management of the chosen organisations, the researcher sought consent from the individual employees, by asking them to sign a consent form. This was vital in that, despite the acceptance of the top management of the organisation to be used for the study, the researcher still required the contributions of individual employees (the management could only guarantee access to the organisation; however, the actual data were obtained from the employees through their opinions). The researcher therefore strove to seek informed consent from the employees, either through an individual or a group approach. A similar situation occurred with the top three construction companies. That is to say, individual targeted participants (within Saudi Arabia) had to give consent before being included in the study.

3.6.2 Prior information to participants

The decision of participants whether or not to take part in the study was on the basis of their understanding of the study itself. Every participant had the right to fully understand the study before giving or refusing consent. Accordingly the researcher explained in detail the nature of the study, and possible risks to participants during their involvement in the study. The targeted participants had the opportunity to weigh and consider all the possible dangers, before choosing to accept or refuse the invitation to participate.

3.6.3 Reporting concerns

Contact information (telephone numbers) were provided on the consent form to enable the participants to easily report and seek clarification on any issue, or ask any question that they found necessary during or even after the study. In this way, any concerns on the part of the participants were effectively addressed to their satisfaction (Lawrence, 2011).

3.6.4 Confidentiality and privacy concerns

All the data sources were kept as confidential as possible, and were not disclosed or used for any reasons other than for the intended study. In addition, the privacy of participants, i.e. the project managers, department managers and consultants of the Saudi Arabian companies, were carefully safeguarded. Any information relating to the private lives of the participants was kept in secrecy and not disclosed to any unauthorized persons.

3.6.5 Reaction of the Saudi Arabian Project Managers

Given the sensitivity of the subject of reasons for the failure of projects in Saudi Arabia, there was a possibility that managers, department managers and consultants would be uneasy and unwilling to tackle questions on the subject, and among those

who answered, there was a possibility that they might give false information. The researcher was therefore careful in asking such questions. These questions were asked in different ways to obtain all the necessary information and to test the accuracy of the information given. In addition, the researcher compared the information given by different stakeholders, so as to verify their accuracy.

In cases of refusal of the managers to answer questions, the researcher strove to understand the reason behind the refusal (which was likely to be fear of being associated with failure). The researcher therefore assured the managers, where necessary, of the confidentiality of the information and the respect for their privacy. The researcher also explained to the respondents the significance of their answers to the success of the study. However, in cases of complete refusal, the researcher respected the right of voluntary participation and withdrawal.

In conclusion, ethical implications are crucial for any researcher intending to perform a successful study. Effective ethical consideration ensures that the research is legal and has the consent of both the management of the study area and individual study participants. Besides, it ensures the confidentiality of the study participants. In addition, respect for the participants is further shown by making provision for the reporting of concerns during and/or after the study.

3.7 Summary

This chapter has explained the methodological decision and procedures involved in seeking answers to the research questions. A combination of interpretive and critical realist perspectives was adopted, on the assumption that change requests are subjectively perceived and experienced in different ways by social actors, whose experiences, nevertheless, are influenced by historical, cultural and other factors. A multi-method, inductive, qualitative study was designed, involving a case study strategy. Data were collected by means of document analysis and semi-structured interviews with stakeholders (owners, consultants and contractors) of large building projects in Riyadh. The next chapter presents the research findings.

Chapter 4: Presentation of Findings and Analyses

4.1 Introduction:

The objective of this chapter is to explore the answers to the research questions based on the findings from interviews with stakeholders and supporting documents that were collected from the four projects. Therefore, the chapter is divided into five main sections based on the research questions:

1. How do stakeholders in Saudi Arabia conceptualize change requests?
2. How do change requests occur in large building projects in Saudi Arabia?
3. How are change requests caused in large building projects in Saudi Arabia?
4. How do change requests affect large building projects in Saudi Arabia?
5. What methods do stakeholders currently use to handle change requests in Saudi Arabia, and how effective do they find them?

This chapter presents, analyses and compares the findings, drawing on the codes, themes and categories that resulted from analysing the responses (see Table 14).

All the interviews were conducted in the Arabic language, and subsequently translated into English by the researcher. 40 people from the three contracting companies and four government organisations were identified, and relevant stakeholders chosen for interviews. In order to preserve respondents' anonymity while also providing contextual information as to their relationship to the project, respondents are referred to by codes (see Table 13)

All related stakeholders in the four organisations were interviewed. Interviews were conducted during on-site visits, times varying in length from an hour to two and a half hours. Table 13 shows the abbreviation or description of interviewees in the four projects and organisations.

Table 13 Descriptions of Interviewees in 4 Projects & Organisations

Description	Referred to as
Owner	O
Consultant	Cons
Contractor	Cont
Project A	PA
Project B	PB
Project C	PC
Project D	PD

Table 14 Presentations of the Categories, Themes, and Codes

4.2Conceptulization of change request 4.2.1 Conceptualization of owners 4.2.1.1 Design 4.2.1.2 Improving project 4.2.1.3 Project scope 4.2.1.4 Specification 4.2.1.4 Contract 4.2.2 Conceptualization of consultants: 4.2.2.1 Design 4.2.2.2 Request 4.2.2.3 Project scope 4.2.2.4 Specification 4.2.2.5 Contract 4.2.3 Conceptualization of contractors: 4.2.3.1 Design 4.2.3.2 Improving project 4.2.3.3 Project scope 4.2.3.4 Specification 4.2.3.5 Request 4.2.3.6 Contract
4.3 Process of change request 4.3.1Process Originating From Owner 4.3.1.1 Roles of Owner 4.3.1.2 Roles of Consultant 4.3.1.3 Roles of Contractor 4.3.1.4 Roles of Technical Team 4.3.1.5 Roles of Commercial Team 4.3.2 Process Originating From Contractor 4. 3.2.1 Roles of Technical Team 4. 3.2.2 Roles of the Contractor 4.3.2.3 Roles of the Consultant 4.3.2.4 Roles of the Commercial Team 4.3.2.5 Roles of the Owner
4.4 Causes of change request 4.4.1Internal causes 4.4.1.1 Change by owner 4.4.1.1.1 Change of schedule 4.4.1.1.2 Change in design 4.4.1.1.3 Change in specifications 4.4.1.1.4 Tendering and contract-related change 4.4.1.2 Change by consultant 4.4.1.2.1 Change in design 4.4.1.2.2 Change in specifications 4.4.1.3 Change by contractor 4.4.1.3.1 No project management 4.4.1.3.2 Change in design 4.4.1.3.3 Change in specifications 4.4.2 External causes 4.4.2.1 Supply problems 4.4.2.2 Technological development 4.4.2.3 Logistical reasons

4.4.2.4 Government regulation
4.4.2.5 Conflict with some government departments
4.4.2.6 Weather conditions

4.5 Effect of change request

4.5.1Direct effect
4.5.1.1Positive effects
4.5.1.1.1Saving time
4.5.1.1.2Financial
4.5.1.1.3Owner need
4.5.2.1.4Quality of project
4.5.1.2Negative effects
4.5.1.2.1 Time overrun
4.5.1.2.2 Cost overrun
4.5.2 Potential effects
4.5.2.1Positive effect
4.5.2.1.1Good reputation
4.5.2.1.2 Reduce maintenance
4.5.2.1.3 Experience
4.5.2.1.4 Good relationship
4.5.2.2Negative effects
4.5.2.2.1 Slow productivity
4.5.2.2.2 Excess work
4.5.2.2.3 Indirect cost
4.5.2.2.4 Bad reputation
4.5.2.2.5 Bad relationship

4.6 Handling frequent change requests

4.6.1 Restriction of handling- Cultural practices
4.6.1.1 Uncertainty avoidance
4.6.1.2 Centralisation

4.6.2Handling change requests before they occur
4.6.2.1 Study the project
4.6.2.2 Value engineering
4.6.2.3 Sufficient time for bidding
4.6.2.4 Contract
4.6.2.5 Training course
4.6.2.6 Administration for change request
4.6.2.7 Applying project management

4.6.3Handling change requests during the process
4.6.3.1 Clear information
4.6.3.2 Good communication
4.6.3.3 Delegation a decisions

4.6.4Handling change requests after they occur
4.6.4.1By the owner
4.6.4.1.1 Fast decision
4.6.4.1.2 Financial
4.6.4.1.3 Help the contractor
4.6.4.2 By the contractor
4.6.4.2.1 No waiting
4.6.4.2.2 Well prepared

4.2 Conceptualization of Change Request

In Chapter 2 (section 2.5.1) it was noted that a variety of terms are used in the literature to refer to change in a project: change request, change order, and variation order, and attention was drawn to the potential confusion resulting from inconsistent definitions. As noted in that section, this thesis adopts the term change request since this is the only term defined by the PMI (2008) and adopted the broad definition (again adopted from the PMI (2008)) of change in any project document, deliverable or baseline. Insights as to what such change might encompass can be derived from a more detailed explanation given by the PMI (2008:428) as a "request to expand or reduce the project scope, modify policies, processes, plans, or procedures, modify costs or budgets, or revise schedules". However, given the variety of terms and definitions found in the literature, and the failure of previous studies to address this issue, it could not be assumed that Saudi stakeholders had a shared, consistent understanding of the concept of change request, or how their conceptualization(s) might influence their approach to raising and handling such requests.

So, how do stakeholders in Saudi Arabia conceptualize change requests?

The researcher preferred to start with this category and analyse it, because one of the aims of the research is to explore whether or not stakeholders understand the meaning of the change request, because it is important to understand a problem before trying to solve it. The researcher compared all opinions of stakeholders, and based on the findings from interviews conducted in the three companies, explored the conceptualizations of owners, consultants and contractors, which were completely different, with no agreement on one clear definition. It is noticeable that some codes were common to owners, consultants and contractors. However, they differed in other aspects.

4.2.1 Conceptualization of owners

The owners under study reported different opinions related to the meaning of change request. There were several owner interviews, and the researcher took all their

opinions and recorded them as codes. Even though some opinions were expressed in just one code, they are still important to the research, because every owner was a stakeholder and sponsor of one project. The related codes underpinning this theme are examined below.

4.2.1.1 Design

One opinion described the change request as something wrong in the design when the contractor prepared it, which led to the change request. For instance, this owner described his opinion in this regard by stating:

"*It could be an error in design by the contractor*" (*Interviewee, O-PB).*

In this case, the owner blamed the contractor as the cause of change requests, because he did not do the design in the right way. This issue may indicate a possibility of conflict between the owner and contractor.

4.2.1.2 Improving project

A change request can be described as a request by the owner to make some change in the project, in order to improve it and to make it of good quality in order to get benefit in the future. So, this perspective focuses on developing the project by owner. In this regard, one owner said: *"The owner would like to improve the project to make it in a good condition" (Interviewee, O-PB).*

Similarly, another owner agreed that a change request means making some change in order to improve the project. However, he added more detail, indicating that the change request should be done within the budget and time limit:

"A change request is a change in order to raise the level of performance of the project in line with the allocated budget and time limit" (Interviewee, O-PC).

4.2.1.3 Project scope

One of the owners revealed that a change request is a request by the stakeholders when they want to add or reduce some work, which will affect the project scope. He

stated: *"change order is a request to add or reduce a part of work from the project scope" (Interviewee, O-PA).*

However, change requests can be viewed as producing a new different function in the contractor's business, which contributes to expand the range of the project. Therefore, in this view, a change request affects the project scope only by expanding it, not reducing. For instance, one owner stated in this regard:

"A change request leads to an increase in the scope of the project" (Interviewee, O-PD).

4.2.1.4 Specification

The meaning of change request may sometimes relate to the specification. From one owner's perspective, a change request is not just change in the project scope; it is also a change in the specifications by stakeholders, whether this is a change in the quality, or an attractive shape. He said: "*A change request is any change in the technical specifications by the owner or contractor or consultant" (Interviewee, O-PD).*

4.2.1.5 Contract

One view of an owner described a change request as the addition of new work to the contractual obligations, which will affect the scope of the project. In this definition, the owner did not clarify whether this work would be added to the contract or not. Also, he did not say by whom and why such work was added to the project. In this regard, he said: *"A change request is a new work in the contractor's work" (Interviewee, O-PD).*

Summary:

The researcher interviewed four owners from four projects. One broad theme that emerged from the analysis was the opinion of the owner regarding change requests. A number of issues were identified by the interviewees, which were recorded as codes: design, improving project, project scope, specification and contract. These

codes indicate that there were different opinions of the owners regarding change requests. First of all, owners thought that a change request is a request to solve a problem in the design, caused by the contractor. This indicates that there is a possibility of conflict between them. Secondly, two owners considered that a change request is not just a request; it is an important request to improve the project. Finally, another owner said it is a request that affects the project scope by adding or cancelling some work. Also, he added that a change request is a change to the specifications and contract. Different opinions in terms of the meaning of change request may increase the number of change requests, because everyone has his special justification to make a new change request, or to blame the stakeholders when they ask for one. Moreover, deficiency in the definition of change request may lead to frequent change requests, because there will not be enough understanding of the causes and effects of change requests.

4.2.2 Conceptulization of consultants

Several consultants highlighted different perspectives related to the meaning of change requests. The codes that emerged from the responses include design, project scope, specification and contract, which were also raised by owners. However, there were differences in some respects, as follows:

4.2.2.1 Design

Sometimes a change request is understood as modifying a number of the elements or terms of the contract, to be working with requirements, and which might result from a problem in design. This order comes from the owner of the project to the contractor.

One consultant described the situation regarding his thinking about change requests as follows:

"A request from the owner of the project, directed to the contractor to change some of the items or descriptions of the contract, to be fitted with functional requirements that may be caused by a failure in design" (Interviewee, Cons3-PA).

It is clear that one of the owners and a consultant both raised the issue of design when they expressed their understanding of the change request. However, there are differences between the meanings in some respects. For example, the consultant specified that the change request came from the owner, whereas the owner did not mention that. Also, the consultant did not indicate who was responsible for the error in the design, whereas the owner said that the error could have been made by a contractor. This means that there are differences in the meaning of design in change requests between the owner and consultants, even though they talked about the same issue.

From another perspective, a change request was explained as the demand to modify the work with regard to design. One consultant stated strongly: *"Change request is a request to change the nature of the work in terms of design" (Interviewee, Cons9-PA).* This definition is shorter than the previous definitions by the consultant and the owner, and does not indicate who asks for the change and what the problem is in the design: is it an error in the design, or just a desire to change the design?

4.2.2.2 Request

From one consultant's point of view, a change request is just an issued and agreed application by stakeholders. He stated: *"A variation order is a request by any party and accepted by them" (Interviewee, Cons2-PB).*

4.2.2.3 Project scope

Several consultants expressed their ideas relating to the meaning of the change request. A change request could be known as an increase or decrease in the scope of the project and function to meet specific requirements for the client. To illustrate the significance of these ideas, one of the consultants made the following remark: *"A change request is a particular need for the customer, which increases or decreases in the scope of the project and work to achieve his needs" (Interviewee, Cons2-PA)*

Furthermore, other opinions went further by describing the change request as not just working outside the scope of the project; it is also an increase or decrease in the cost of the project. Talking about this issue, one consultant said:

"A change request is a request to act outside the scope of the project that entails adding sums of money, or reducing the total value of the project." ***(****Interviewee, Cons1-PA).*

Moreover, one view gave more explanation about understanding of the change request. It is not just changing the project scope; it is also a request to resolve a problem, which occurs during the implementation of the project, different from what has been agreed in the contract. For instance, one consultant said:

"A change request is a request to change a problem that occurs during execution contrary to what has been agreed at the establishment, which increases or decreases the project scope" (Interviewee, Cons8-PA).

However, another consultant limited his opinion regarding a change request by saying that a change request means expanding the project scope, without giving any details. On this issue, he said:

"Any increase in the quantities of work in the scope of the project" ***(****Interviewee, Cons5-PA).*

4.2.2.4 Specification

One contractor thought that a change request is an order by the owner to improve the specification of the project by replacing the quality of the old specification. Thus, in this regard, he said:

"A change request is changing the quality of specifications, which were not mentioned in the charts by the customer" (Interviewee, Cons2-PC).

To compare this definition with the previous definition by an owner in 4.2.1.4, this definition mentioned that the change in specification is by the owner, whereas the owner saw the change in specifications as coming from any of the stakeholders.

4.2.2.5 Contract

The final code identified in the conceptualization of consultants regarding change requests was the contract. Several consultants addressed this issue in regard to the meaning of change request. However, these views were different from those of owners regarding the meaning of the change request, even though they used the same

term, ‘contract’. It is worth noting at this point that the researcher was not allowed to see actual project contracts for confidentiality reasons; the implications of this restriction for the research are discussed later (see section 6.4). However, from discussion with project stakeholders, it was possible to ascertain that none of the contracts were FIDIC or similar standard, internationally recognized contracts, which might have a bearing on the openness of the contracts used to different interpretations and requests for change. At this point, however, the concern is not so much with the actual terms of the contract, as with participants’ reference to the contract when explaining their understanding of the meaning of change request. For example, one consultant mentioned that a change request is additional, different work added to the contract by the stakeholders, stating:

“A change request is the addition of a new item to the contract by the contractor, owner, or consultant” (Interviewee, Cons9 -PA).

However, another consultant described the change request as an order not by all the stakeholders, but only by the owner, to make some change to the contract. Also, this change entailed implications for the contractor, such as raising questions about his commercial role. In this regard, he said:

“A change request is an order directly from the owner who asks for a change or anything else not in the contract documents, which makes the contractor ask about the effect of the change” (Interviewee, Cons7-PA).

Another perspective defined a change request as replacement of specifications or adding different items to the contract. Basically, it is something different about the project. In this case, the opinion gave some detail about what might be new in the contract, such as specifications, and new items, the respondent stating:

“A change request is anything new on the project, whether to change specifications or insert new items in the contract” (Interviewee, Cons6-PA).

However, one interviewee thought that a change request is simply a change in the contract, without giving any more information. He just mentioned that this change came from ‘someone’, but it seems he meant any of the stakeholders: *“Someone requires some change to the contract” (Interviewee, Cons1-PB).*

Similarly, another consultant described the situation as some change to the contract. Nevertheless, he did not mention who makes the change or offered any more information. He simply said:

"Any work beyond the contract documents" (Interviewee, Cons4-PA).

Here, one consultant talked about change requests and clarified that, based on the needs of the project; it may be necessary to modify a current contract by adding new items or replace one item with another:

"Change an existing item to another item, or add a new item that is not in the contract, according to the needs of the project" (Interviewee, Cons1-PC).

Another consultant reported his opinion in terms of change requests as possibly modifying the work or time. Basically, it means performing a different process that was not in the previous plan and contract. On this, he stated:

"To do something different from the contract and the original plan activity; it could be to change the task, time or the way of doing the task" (Interviewee, Cons1-PD).

Finally, the last consultant described the change request as a change in the contract. It is clear that there is an ambiguity in this definition, because he did not provide any description in terms of, by whom and why that change is applied. In this respect, he said:

" Change request is something that changes from the contract" (Interviewee, Cons2-PD).

Summary:

The researcher met 15 consultants from the four projects. The main codes emerging from the views of consultants regarding the meaning of change request were the design, request, project scope, specification and contract. These codes are similar to those raised by the owners, but with some differences regarding who asks for the change and why. One consultant mentioned that a change request is just a request, accepted by stakeholders. Also, consultants focused on the contract more than the owners, because one of their responsibilities is fulfilling the contract. In terms of project scope, four consultants from one project made different points regarding the impact of change requests on project scope. It is obvious that there are differences of

opinion and a lack of clear definition of change request, which may lead to frequent change requests.

4.2.3 Conceptualization of contractors:

The contractors in this study also gave their views relating to the meaning of change request. The related codes which formed the theme were found mainly to include the design, improving project, project scope, specification, request and contract. These codes are similar to those emerging from owners and consultants, but differ from them in some respects as follows:

4.2.3.1 Design

Sometimes, change requests were described by contractors as agreement by stakeholders on changing the design, as requested by the owner.

To compare the concepts of design between contractor and stakeholders, it is obvious that contractors had different concepts in this regard. Sometimes, they added more information, and at other times gave less. The first contractor added new information, which is that change in the design usually comes from the stakeholders. Also, he did not suggest that change in the design was due to a fault or problem in the design, whereas the previous stakeholders expressed this view.

He pointed out: *"Change request is any change from the owner on the designs agreed upon by the stakeholders" (Interviewee, Cont5-PB).*

Another contractor remarked that a change request is a mistake in the project if the contractor is at fault in the accuracy of the design, or when he fails to apply it properly, which will give rise to a need for some changes to the project. In this situation, the contractor acknowledged that the fault came from the contractors, either in preparing the design or performing it on the ground. He mentioned problems of the design, but in a different way, confirming that the problem was not caused by the owner, but by the contractor:

"A change request is a fault in the project when the contractor is a fault in the implementation of the project design or does not have the required accuracy, which leads to changes" (Interviewee, Cont3-PB).

Furthermore, a change request can be seen as any new work, which is not the same as the original design. The end-user may contribute to making change requests, if the design is not suitable for him. So, in this regard, one contractor added a new view about the change request, which is that it could occur through the end-user in the design, commenting:

"A change request is anything requested by the owner and the end-user different from the basic design" (Interviewee, Cont3-PA).

Also, some contractors defined a change request as modification to the design by the owner and his consultant. The difference here is that sometimes the request is made by the owner and the end-user; however, at other times the request is by the owner and his consultant. In this regard one contractor stated:

"A change request is changing the design by the owner or consultant" (Interviewee, Cont1-PC).

Another contractor reported that a change request is performed when stakeholders agree to modify the design. This opinion is different compared with the previous ones, because the contractor asserted that stakeholders should agree on the change request. So, the difference here is the agreement of all stakeholders to the change request, whereas the previous view was that the request was one-sided, coming from consultants or the end-user. In this perception he pointed out:

"A change request is a change in anything agreed in design or different quantities by the contractor or from the owner and consultant" (Interviewee, Cont3-PC).

In addition, another contractor commented that a change request is a new need for the owner if there is a problem in design, which leads him to expand or reduce the project. In this case, the contractor gave more information, saying the change may expand or reduce the project, and that the decision is usually made by the owner. He specified:

"A change request is an increases or decrease or error in design and usually there are new requirements for the owner" (Interviewee, Cont4-PD).

Also, one contractor defined a change request as the existence of defects in the design, which led the owner to ask for change. He understood that a change request is simply a change by the owner when the design has deficiencies, declaring:

"Change request is a request from the owner due to the presence of deficiencies in the design" (*Interviewee, Cont3-PD).*

It is obvious that there are both similarities and differences between the opinions regarding the code 'design' in some respects.

4.2.3.2 Improving project

One contractor highlighted several opinions relating to the meaning of change requests. He thought a change request could be understood in two ways:

Firstly: If the change request is made by the contractor, it will definitely be to improve the functionality of the project, because otherwise he applies contracts and plans as they are.

Secondly: If a change request is made by the owner and his consultants, it may make the project more efficient. However, in some situations the contractor may lose his financial right, if the request is not reasonable and not official. To illustrate the significance of these meanings, he pointed out, *"If a change request is by the owner and his consultants, it will be a required increase to make the project more efficient. However, it may prejudice the right of the contractor if the request is not justified and not official. If a change request is by the contractor, it will be to raise the efficiency of the project after studying the plans and contracts" (Interviewee, Cont1-PA).*

4.2.3.3 Project scope

Various contractors highlighted several views related to the meaning of the change request. In some situations there is a similarity between the stakeholders' expressions, regarding the meaning of change request. However, they differ in some respects. On the one hand, contractors described change requests as additional work, which affects the project scope based on the owner's decision. In this case the owner makes the decision, and the cause of change is based on his changing his mind. As one of the contractors stated:

"A change request is extra work in the project scope when the landlord changes his opinion and asks for additional work to the project." (Interviewee, Cont3-PB).

On the other hand, project scope may be expanded or reduced by the owner in other ways. In such situations, the owner did not explain the decision; he just asked stakeholders without clarifying the reason. One contractor commented that:

"Change request is any request by the owner when he asks to implement something outside the scope of the original project" (Interviewee, Cont2-PB).

From another perceptive, a change request is just related to the scope of the project, when it is expanded or reduced, regardless of who asks for it or any more detail. One contractor said:

"A change request is when there is an increase in the scope of the project or the lack of it" (Interviewee, Cont7-PB).

In addition, the meaning of change request may be viewed as an increase or decrease in the project scope, based on a change in some types of materials, without any detail. One contractor asserted:

"A change request is modifying the scope of work either in the specification or adding or shortening business" (Interviewee, Cont4-PC).

Similarly, another contractor mentioned that a change request simply modifyies the scope of the project. He said:

"Change request is a change in the scope of the project" (Interviewee, Cont4-PD).

4.2.3.4 Specification

Several contractors highlighted the meaning of change request in terms of specifications. However, these expressions were different in a several ways. For instance, who makes the change in specifications? To illustrate one of these significant differences, one of the contractors pointed out that a change in the specification could come from the owner, or consultants, without giving more detail: *"A change request is changing the specification, and quantities by the owner or consultant" (Interviewee, Cont1-PC).*

In another definition, a contractor defined a change request as a request by the owner, consultant, or supplier. Thus, in this view, the supplier can also ask for a change. *"A change request, is a changed in the specification by the owner or consultant or supplier" (Interviewee, Cont2-PC).*

However, another contractor, while mentioning that a change request had been agreed, did not mention who agreed to make that change in specification:

"A change request is a change in anything agreed in specifications" (Interviewee, Cont3-PC).

Moreover, one of the contractors viewed a change request as the result of any modifications in scope. However, the contractor did not mention who asked for this change:

"A change request is modifying the scope of work either in the specification or adding or shortening business" (Interviewee, Cont4-PC).

4.2.3.5 Request

Various opinions related to the meaning of change request were integrated into the code, 'request'. There are similarities and differences between these views. One opinion defines a change request as just a request for new work, without giving more detail about the real meaning of the change request. So, one contractor said:

"A change request is a request for change" (Interviewee, Cont2-PC).

Another opinion mentioned that the change request is the starting point for the change, which needs approval by the engineer. This opinion was given by one contractor when he said: *"A change request is the beginning of change, which requires agreement by the engineer" (Interviewee, Cont1-PD).*

Moreover, one contractor agreed that a change request is a request, but added that this request, which is made by the owner, may be approved or rejected:

"A change request is a request from the owner under study, which may be implemented or rejected" (Interviewee, Cont2-PD).

The final opinion about change request described the owner and questioned his motives in asking for some changes and updating of the project. The respondent

indicated that such requests occur due to the owner's mood and fancy, as a way of revealing his brilliance and enhancing his self-esteem. So, the contractor indicated not only that this request is by the owner but also that it is unjustified and is just based on his whim. He said: *"A change request is modifications desired by the owner, usually due to his moods and desire, as a type of showing off in excellence and self-esteem." (Interviewee, Cont3-PD).*

4.2.3.6 Contract

Several conceptualizations focused on the contractual implications of the change request. For example, one of the contractors pointed out that a change request is an application by the owner or anyone delegated by him, to the contractor. It is clear that the contractor attributed change to the owner and implied that the request was made without giving a justification for this change:

"A change request is a request from the owner or his representative directed to the contractor outside the boundaries of what has been contracted" (Interviewee, Cont4-PA).

Another perspective was that a change request that may affect the contract might derive from the owner and his consultants, whereas the previous contractor only referred to the origin of the request without identifying its impacts. In this situation, he said:

"Change request is something that does not exist in the contract, it happens by the owner or his consultants whether or not this change increases or decreases in the contract" (Interviewee, Cont2-PA).

However, another contractor declared that a change request is the addition of more work to the contract, not by the owner, his representative, or consultants, but by the contractor, if the project needs some changes. So, the contractor has control over change requests, if there is a need to make a change. The contractor said:

"A change request is anything extra out of contractual provisions introduced by the contractor according to the need of work" (Interviewee, Cont5-PC).

Another contractor was less specific than the others in his description, when he defined a change request as just a need for change, which affects the contract. In this respect, he said,

"A change request is anything required outside the contract, which was contracted" (Interviewee, Cont6-PB).

However, another opinion gives a more detailed perspective relating to who asks and agrees to make the change, which affects the contract. So, in this concept the owner asks about some change related to his needs, and stakeholders must agree to this change. This change may be in design, or in a part of work and, will result in some increase in the contract:

"A change request is a notice from the owner to change the type, section, design or layout of the main contract to make increases, which he needs. Briefly, it is anything new in the contract agreed by the stakeholders." (Interviewee, Cont5-PC).

Another view gave more description, indicating that a change request is a modification that may influence cost and time, expanding or reducing the contract agreed among the contracting members. Sometimes, this modification may affect the cost or time and sometimes it may not:

"A change request is an increase or decrease in the contract agreed between the contracting parties. This change may affect the cost or time or not" (Interviewee, Cont6-PC).

Most importantly, the last opinion associated change request with a request for compensation for an incorrect or unfair contract. In some projects, the contractor would seek to win the bidding by accepting the contract without sufficient study. As a result of this, sometimes the contract contains some mistakes, or is unfair and against the interests of the contractor, which can cause him to incur substantial financial losses. In this situation the contractor tries to make several change requests to minimize his losses. In this consideration, one contractor said:

"A change request is a claim for mistakes in the contract" (Interviewee, Cont1-PA).

Summary:

The researcher interviewed 21 contractors from four projects, including four project managers, in this way obtaining the opinions of the contractors regarding change requests. A number of issues were explored by the interviewees, which were recorded as codes such as design, improving project, project scope, specification, request and contract. The related codes underpinning this theme were further examined, and it was revealed that there were different opinions among the contractors regarding change requests. Contractors focused on contract and design rather than other codes. They mentioned the contract several times, because they were concerned about their financial rights, which may be infringed by owners, so they focused on the contract to protect themselves. In some situations, contractors were not convinced about some changes requested by owners, so they mentioned that a change request is just a request by the owner, without clear justification. This situation indicated that there is a conflict and bad relationship between some contractors and owners. Also, inadequate understanding of change requests may contribute to more change requests, because of incomplete understanding of their causes and effects. Interviewees did not distinguish between a change request and a change order; basically, they called it a variation order.

Table 14 shows the disagreements and differences of opinions of stakeholders concerning the definition of change request. The codes generated by the interviews reveal inconsistences of interpretation both within and between stakeholder groups, suggesting a need both for better communication among the parties to a project and also a greater degree of consistency and standardization in application of PM terms and definitions. These issues contribute to the development of a model of change request-related practice derived from the overall findings (see Fig 24, p.233) and are further discussed in Chapter Five. Given the frequency with which research participants mentioned the project contract when articulating their understanding of change requests, it is important to restate here that the researcher was not given access to project contracts, but was informed by interviewees that the contracts were not standard contracts. Thus, perceptions of participants regarding contractual issues could not be objectivity verified. However, the preliminary insight obtained into the potential salience of project contracts led the researcher to attempt to obtain and

synthesize as much information about the four projects as possible through interviews and observation, and this is reflected in subsequent sections of the findings and discussion.

Table 15 Differences among the Definitions

	Design	Improving project	Project scope	Specification	Just Request	Contract
O-PA	-	-	Request to add or reduce.	-	-	-
O-PB	Error by contractor.	Owner hopes to improve.	-	-	-	-
O-PC	-	Change with located budget and time limit.	-	-	-	-
O-PD	-	-	New work that increases the scope.	Change in specification by stakeholders.	-	A new task in the contractor's work.
Cons 1-PA	-	-	Request outside the scope, increases or reduces the cost.	-	-	-
Cons 2-PA	-	-	Needs from owner, to increase project scope.	-	-	-
Cons 3-PA	Request by owner to correct design.	-	-	-	-	-
Cons 4-PA						Any work.
Cons 5-PA	-	-	Any increase in the quantity of work.	-	-	-
Cons 6-PA	-	-	-	-	-	New specification or items.
Cons 7-PA	-	-	-	-	-	By owner and the contractor asking about the cost.
Cons 8-PA	-	-	Request to solve a problem that affects project scope.	-	-	-
Cons9 -PA	Request to change the nature of work.	-	-	-	-	Additional new item by stakeholders.

Cons 1-PB	-	-	-	-	-	Someone requires.
Cons2 -PB	-	-	-	-	Request accepted by stakeholders.	-
Cons 1-PC	-	-	-	-	-	Change or add item according the needs.
Cons2 -PC			-	Changing quality of specifications.	-	-
Cons 1-PD	-	-	-	-	-	Change task or time.
Cons 2-PD	-	-	-	-	-	Change from contract.
Cont1-PA	-	Change by stakeholders to make the project more efficient. It may prejudice the right of the contractor if the request is not justified.	-	-	-	Claims for the mistakes in the contracts.
Cont2-PA	-	-	-	-	-	Request by the owner or consultants may increase or decrease contract.
Cont3-PA	Request variation from the basic design, by owner and end-user.	-	-	-	-	-
Cont4-PA	-	-	-	-	-	Request by owner or his representative to contractor.

Cont1-PB	-	-	-	-	Beginning of change order, agreed by engineer.	-
Cont2-PB	-	-	Any request the owner asks to implement outside the scope of project.	-	-	-
Cont3-PB	Fault in preparing or implementation of design by contractor.	-	Extra work when the owner changes his mind.	-	-	-
Cont4-PB	Error in design	-	-	-	Request for change.	-
Cont5-PB	Any change by owner on the designs agreed by stakeholders.	-	-	-	-	-
Cont6-PB	-	-	-	-	-	Anything required outside the contract.
Cont7-PB	-	-	Increase or decrease in the project scope.	-	-	-
Cont1-PC	Change request is change the design by owner.	-	-	Changing specification, and quantities by owner or consultant.	-	-
Cont2-PC	-	-	-	Change in the specifications by owner, consultant or supplier.	-	-
Cont3-PC	Change design by stakeholders.	-	-	Change in anything agreed in specifications.	-	-

Cont4-PC	-	-	Modifying the scope of project in increasing or decreasing some work.	Modifying the scope of project in specification.	-	-
Cont5-PC	-	-	-	-	-	Notice from owner to do something new in the contract agreed by the stakeholders.
Cont6-PC	-	-	-	-	-	Increase or decrease in the contract that agreed between stakeholders, may affect the cost or time or not.
Cont1-PD	-	-	-	-	-	Extra work by contractor for the needs of work.
Cont2PD	-	-	-	-	Request by owner, which may be accepted or rejected.	-
Cont3-PD	Request by owner due to deficiencies in the design.	-	-	-	Modifications by owner based on his mood, desire, showing off, excellence and self-esteem.	-
Cont4-PD	-	-	Change in the scope of project.	-	-	-

4.3 Process of Change Request

The second category is the process of change request, which answers the second question of the research. How do change requests occur in large building projects in Saudi Arabia? One of the aims of the research was to look for the process of change request in the four projects, analysing and comparing them, to explore in detail the processes of the change request from the beginning to the end. What are the similarities and differences between the processes in all projects? Is there a formal and known process for change requests?

There was no written process in all four projects. Everyone thought they knew the process, but in practice no one did, which is why the process took longer. The researcher had to infer the process and represent it in figures (see Figures 12-19) to show the result. There are two different starting points for the process of change requests. Some requests originate from the owner, others from the contractor. The researcher compared the two starting points of the processes to find out the possibility of causes, effects and handling of change requests. Also, he tracked the processes to identify the causes of delay.

As mentioned before in the first category, the interviewees did not distinguish between change request and change order. However, the researcher distinguished between them in the process, because it was important to do so to differentiate between the request and order. For example, sometimes the owner asks for a change request and at other times he gives the orders to change directly.

4.3.1 Process Originating From Owner

This section examines the roles of various parties in the change request process, when the request is first raised by the owner, in order to identify similarities and differences across projects.

4.3.1.1 Roles of Owner

Two roles were common to the owner across all four projects: sending the change request to the consultant, and making the finally approved decision. Taking project D

as an example, it was stated that the process begins when *"... the owner would like to make some amendments, add items, and make some change. These changes may be due to some error in the design, and the specifications. Therefore, he begins by notifying the consultant ... and asking for an estimation of these changes" (Interviewee, O-PD).*

After the other parties have performed their roles (as described in subsequent sub-sections) the process ends when *"the owner gives his order to perform the change" (Interviewee, Cont2-PD).*

There were, however, certain differences in the way in which these roles were performed. Whereas in projects A, C and D, the owner would raise a change request on his sole authority, in project B he involved the consultant in the decision: "*he sends an order to the consultant asking for his opinion regarding this change" (Interviewee, O-PB).* Another difference was found in project C, where it was stated that the owner might change his mind and cancel the request if feedback on the implications of the request shows that "*it is not suitable" (Interviewee, Cons2-PC).*

The biggest difference in the role of the owner, however, was identified in project A, where the owner was involved in three steps rather than in two, as in the other projects. This was because, following his initial requests, he would receive an interim report with preliminary costing, and would give provisional approval, pending a second, more detailed report: *"The owner gives the first agreement, then sends it to the consultant asking about the final study" (Interviewee, Cons4-PA).*

It was reported that in any project, the owner could cause delay if he took excessive time in evaluating the report on the implication of the change request, even in those projects where there is only one report for him to consider.

4.3.1.2 Roles of Consultant

In all projects, the consultant was involved in receiving the initial request from the owner and sending it to the contractor for technical and financial information. There were, however, crucial differences. In project B, the consultant was involved in negotiation with the owner before communicating with the contractor: *"The [owner's] letter is reviewed by the consultants to recommend making the change or decline. If the owner and consultant agree to make the change there will be a site work instruction, which is sent to the contractor"* ***(****Interviewee, Cons1-PB).*

Moreover, in project C, the consultant has authority to amend or refuse a change request from the owner, if he considers it inappropriate: *"The consultant reviews the letter from the owner and he may add some information if necessary, or reject the request. After that, he sends the request to the contractor"* ***(****Interviewee, Cont4-PC).*

Compared to his counterparts in projects B, C and D, the consultant in project A had additional tasks since, as indicated in 4.3.1.1 the owner commissioned two reports - a preliminary report and a final, detailed report - on the proposed change, so the consultant had to review and discuss the preliminary report, and deal with the owner's requests for clarification, which could be a source of delay: *"If the change request is not clear by the contractor, it will take a long time with the owner, because he will ask for clarifications" (Interviewee, Cons7-PA).*

Despite these variations in the consultant's early involvement in the change request in all four projects, the final step for which he has responsibility is the same: *"The consultant reviews the change, and sends it to the owner to approve" (Interviewee, Cont6-PB).*

Further information on the nature of the consultant's review was provided by an interviewee from project A: he checks whether the detailed proposal submitted by the contractor contains *"the same item as in the contract"* and the cost of the change: *"In all cases the estimated cost of change must be no more than 10% higher or 20% lower [than the original]" (Interviewee, Cons7-PA).*

4.3.1.3 Roles of Contractor

The role of the consultant in the change request process in the four projects was essentially to organise the preparation of technical and financial information about the project, usually with the assistance of relevant teams. In each case, therefore, his first step was to recover the request from the owner and *"send it to the technical and commercial teams to assess the change" (Interviewee, Cons2-PB), that is, "to determine the cost and time" (Interviewee, Cont3-PD).* In project B, however, the contractor did not always have to pass on the request to his team; it depended on the nature of the change: *"... checks whether or not this change is within the project budget and materials are available locally. If yes, he will not ask about the claim. However, if the request will affect the design, specification, and cost, the contractor sends it to the technical and commercial team to estimate the change" (Interviewee, Cons2-PB).*

In project A, the contractor actually had to arrange for two reports, because the first was only an "*initial technical and commercial study" (Interviewee Cont2-PA),* which after initial approval, was followed by "*a precise study with three prices" (Interviewee, O-PA).* In other cases, the contractor was involved in compiling only one report.

In all four projects, when the contractor had obtained the necessary information, he sent the full study of the changes to the consultant for review. In most cases, this was a formality, for the sake of amending project costings, but in project C, the contractor would not simply pass on the change proposal but would *"negotiate with the consultant" (Interviewee, Cont5-PC),* which could lead to cancellation of the change request if the owner did not accept the technical and financial implications of the change.

4.3.1.4 Roles of Technical Team

In project A, the technical team were involved in two stages: first to prepare an initial study and send it to the contractor *(Interviewee, Cont3-PA),* and subsequently to

prepare the final study containing more precise information about the change and its effects, and send it to the contractor *(Interviewee, Cons7-PA).* In all other projects, the team prepared only one study, which would identify *" the effect of this change" (Interviewee, Cons3-PD),* outlining "*the new work in terms of the design and specifications" (Interviewee, Cont5-PB).*

4.3.1.5 Roles of Commercial Team

As in the case of the technical team, the role of the commercial team was to provide information requested by the contractor, to enable him to compile his report for the consultant. The commercial team focused on the financial implications of the project- *"the direct cost … and indirect costs such as the salary of the main managers…" (Interviewee, Cont2-PC).* As with the technical team, in project A, the commercial team had to report twice, once with preliminary cost estimates, and later with final costings.

Summary:

The researcher compared the processes of the change requests, which originated from the owner in the four projects. A process emanating from the owner is a clear theme, which emerged after analysing the interviewees' answers regarding the second question of the research. Several codes emerged from the views of stakeholders, such as the responsibilities of owners, consultants, contractors, technical team and commercial team. There are similarities between the names and some functions of the codes in the four projects. For example, the functions of the commercial teams are the same in projects B, C and D, because all of them are responsible for preparing a full study of the change request. However, there are important differences between the codes in other situations, because the procedures are not the same in all projects. The process of change request may take a long time in some situations. Firstly, if the owner adds initial and final studies to the change request, and take a long time to assess them. Secondly, if the contractor sends his report regarding change requests with misunderstandings or vague information to the owner, the owner will send it back to the contractor with more questions. Based on these delays, a bad relationship may occur.

For easier comparison, see below the summary of the processes in all projects, which are initiated by the owners as follows:

a) **Process in Project A with the request originating by the owner**

1. The owner seeks to make a new change for his own reasons.
2. The consultant executes the request and sends a message to the contactor seeking a preliminary technical and commercial study.
3. The contractor sends an order to his technical and commercial team to make the initial study.
4. The technical team executes the order, and then sends the result back to the contractor.
5. Also, the commercial team executes the order, and sends it back to the contractor.
6. The contractor evaluates the initial study, and then sends it to the consultant.
7. The consultant assesses it. If he discovers some deficiency, he sends it back to the contractor. However, if there is no notice, he sends it to the owner.
8. The owner sends the initial agreement, and requests the consultant to prepare the final study.
9. The consultant sends a request to the contractor asking for a final report.
10. The contractor executes the request and sends the report to the technical and commercial team.
11. The technical team makes the final technical report.
12. The commercial team makes the final commercial report, and sends it to the contractor.
13. The contractor re-writes the changed technical and commercial proposal and sends it to the consultant.
14. The consultant assesses it. If he certifies that the change is appropriate, he sends it to the owner. If the change causes extra change, he sends it back to the contractor. If the new change does not involve the same items in the contract, the consultant sends it to a team to estimate the price and then sends it to the owner.
15. The owner signs the change order.

Figure 12 shows the process of a change request, which originated from the owner in project A.

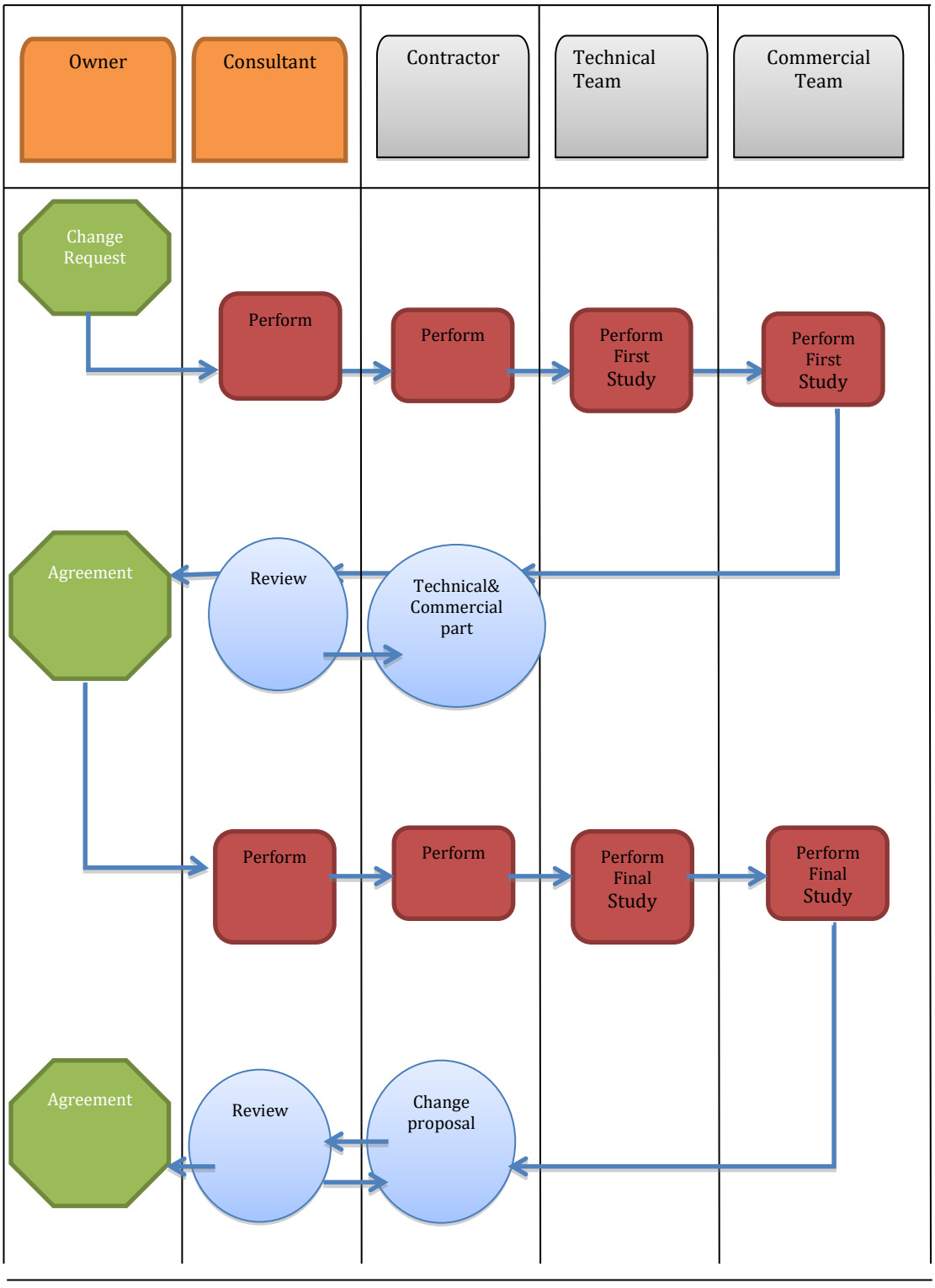


Figure 12 Process in Project A initiated by Owner

b) **Process in Project B with the order originating from the owner**

1. The process is initiated by the owner, based on his wish for a change or any other reasons reported by his technical team. He sends the proposed order to the consultant for his opinion.
2. On reviewing the owner's letter, the consultants recommend or reject the change. If the owner and consultant agree on the change, a site work instruction will be sent to the contractor.
3. The contractor checks whether or not the requested change is within the project materials and budget. If yes, he will not question the order. However, if the request has implications for the design, specification, or cost, the contractor refers it to the technical and commercial teams for an estimation of the impact.
4. The technical team assesses the new work in terms of the specifications and design.
5. The commercial team assesses the prices and sends their report back to the contractor to review.
6. After that, the contractor reviews the teams' reports on the change and sends a unified report to the consultant for review.
7. The consultant assesses the change, and sends it to the owner for approval.
8. The owner gives final agreement on the prices and changes.

Figure 13 shows the process of a change order, which originated from the owner in project B.

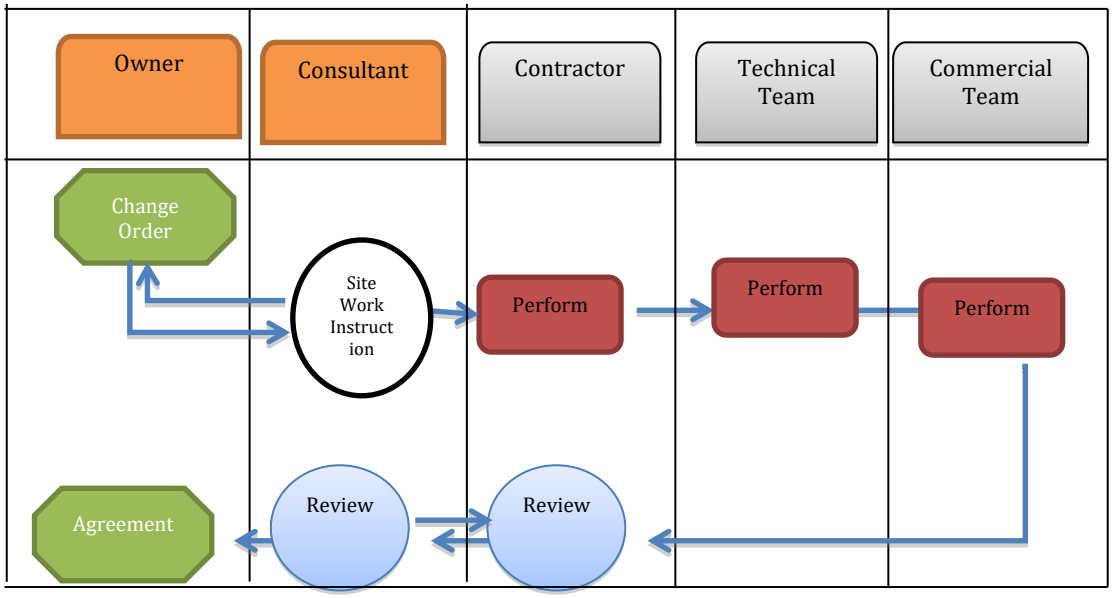


Figure 13 Process of project B initiated by Owner

c) **Process in Project C with the request originating from the owner**

1. The process is initiated by the owner's desire for changes in the specifications or design. He makes the relevant request to the consultant, but the latter may reject it if it is not feasible**.**

2. The consultant assesses the owner's request and he may accept and add some information if necessary, or reject the request. Following this, he sends the request to the contractor**.**

3. The contractor considers the request and sends it to the technical and commercial team for evaluation**.**

4. The technical team determines what new work will be needed**.**

5. The commercial team calculates the direct cost of the change request and estimates indirect costs. They then report back to the contractor**.**

6. The contractor estimates the change, including the costs, and confers with the consultant**.**

7. The consultant assesses the change, and discusses the time and cost implications with the contractor. If he agrees, he sends it to the owner for approval**.**

8. The owner may accept or reject the request based on the prices**.**

Figure 14 shows the process of a change request, which originated from the owner in project C.

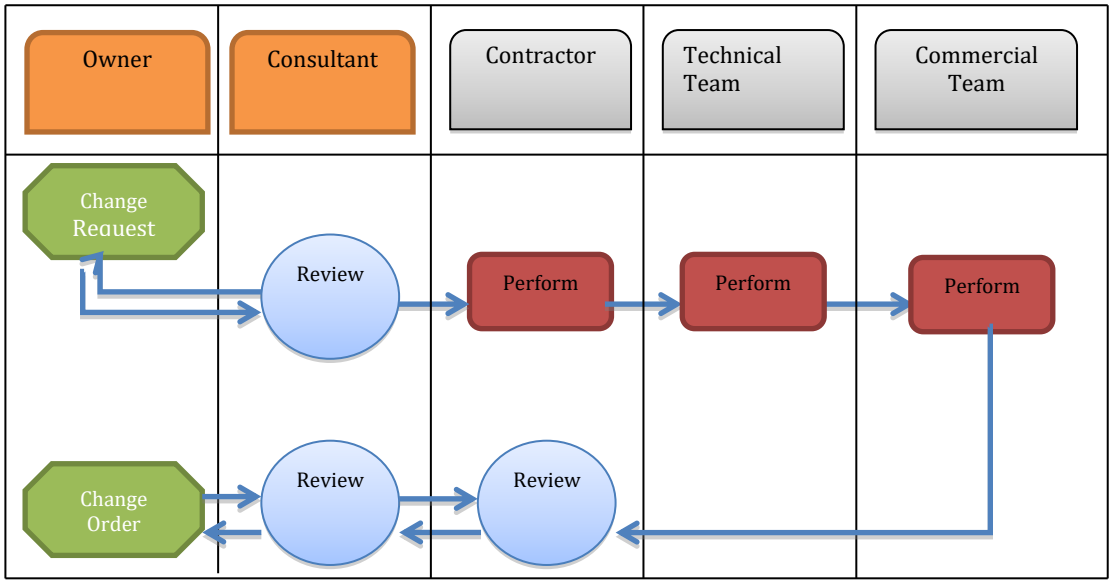


Figure 14 Process of Project C initiated by Owner

d) **Process in Project D with the order originating from the owner**

1. The owner may decide that he wants to make some amendments or additions, due to some error in the design and the specifications. Therefore, he notifies the consultant of his wishes.
2. The consultant receives the order and passes it to the contractor to be performed.
3. The contractor executes the order, and passes it to the project manager, technical and commercial team, with a request for a full study about the proposed changes, including the cost and time implications.
4. The technical team investigates the effect of the change technically.
5. The commercial team estimates the financial implications of this change. Then, they report back to the contractor.
6. The contractor reviews the full report of the technical and commercial teams, then sends the combined report to the consultant for review.
7. The consultant assesses the change, and passes it to the owner.
8. The owner gives his order for the change to be implemented.

Figure 15 shows the process of a change order, which originated from the owner in project D.

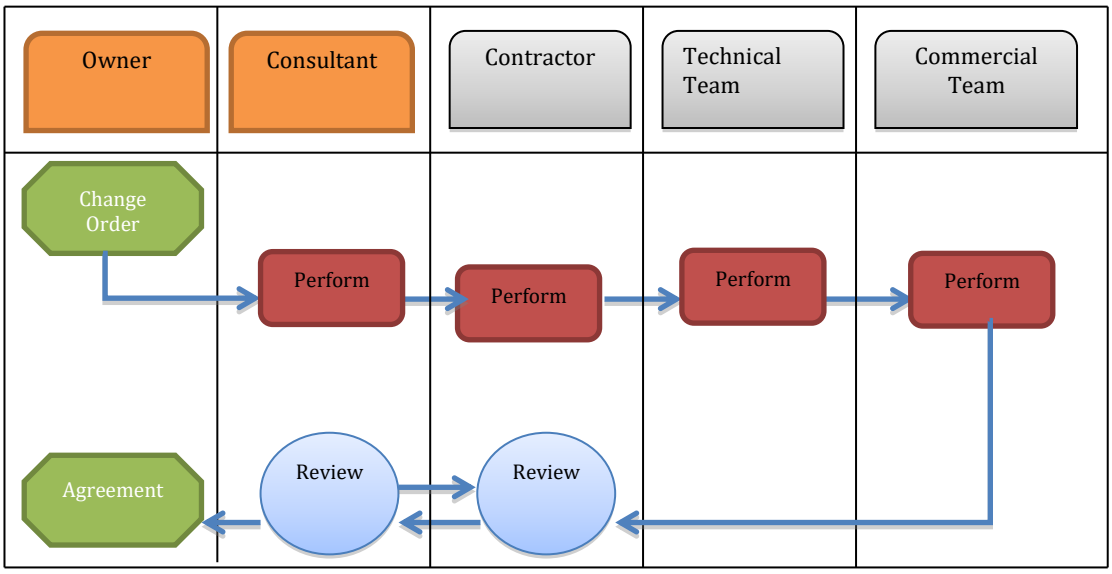


Figure 15 Process of Project D initiated by Owner

4.3.2 Process Originating from Contractor

In some cases, requests for change were raised by the contractor, when problems with the project came to his attention. In this section, the roles played by project stakeholders in such projects are analysed.

4.3.2.1 Roles of Technical Team

In practice, change requests originating from the contractors were made in response to difficulties observed and reported to him by the technical team. In this respect, the roles of the team were the same in all four projects, and began with notifying the contractor of a problem. Problems giving rise to such a notification could be of several types, for example, "*The technical team notifies the contractor if there is inconsistency between the design, requested by the owner and conditions on the ground" (Interviewee, Cons4-PA),* difficulties raised by the contractor's department *(Interviewee, Conts1-PC), or* "*error in the work site" (Interviewee, Cont1-PD).* The team were then involved, when the change request come back to them from the contractor, in preparing a detailed report about the changes required, and sending it to the contractor. Again, the process is the same for all four companies, for example, *"The technical team prepares a final study in more detail and sends it to the contractor" (Interviewee, Cont4-PC).*

4.3.2.2 Roles of the Contractor

The change request process really starts when the contractor, having been alerted to a technical problem, sends a change request to the consultant - although in project C, this took place only after the contractor had reviewed the technical team's notes: *"The contractor reviews the note and sends it to the consultant"(Interviewee, Cont6-PC).* The initial communication sent by the contractor to the consultant was described in project B as a 'proposal' *(Interviewee, Cont6-PB)* and took the form of an outline of the identified problem, its expected effects, and the proposed solution.

Compared to his counterparts in projects B, C and D, the contractor then had two additional responsibilities: to request and submit the initial financial study to the

consultant: *"The contractor performs the order by asking the commercial team to prepare the initial commercial study"(Interviewee Cont1-PA),* then*"…sends the initial commercial study to the consultants for review" (Interviewee, Cont3-PA).*

In all four projects, the contractor requested full technical and commercial studies of the change, in order to compile his report. For example, *"The contractor is directed to prepare a final study, technically and financially" (Interviewee Cont6-PB); "… he asks the technical and commercial team for more detail" (Interviewee, Cont3-PD).*

The final step of the contractor in project C was to prepare a detailed change request: *"The contractor reviews the final study, and prepares the change request with all the requirements. After that he sends it to the consultant" (Interviewee, Cont4-PD).* In contrast to projects A, B and D, where the contractors had been described as preparing a change request following the initial notification of a problem, the final step was a last round of review, before sending the final report to the consultant, for example, *"The contractor reviews the final study, then prepares the change proposal with technical and commercial parts" (Interviewee, Cons6-PA).*

4.3.2.3 Roles of the Consultant

The role of the consultant involved five steps in project A, and three steps in all the other projects. In all four projects the first step was to review the initial request by the contractor. For example, *"The consultant reviews the proposal, and if he finds notes, he will send it back to the contractor. However, if he does not find any notes, he will send it to the owner" (Interviewee, Cont6-PB).*

An interviewee in project D similarly suggested a process of clarification between consultant and contractor before the consultant forwards the proposal to the project owner. In project C, however, such negotiation was not mentioned: *"The consultant reviews the note, and sends it to the owner …" (Interviewee, O-PC).*

In project A, the consultant then had two additional roles, not required of any of his counterparts in other projects: to request an initial commercial study, then review it and forward it to the owner: *"If the request is technically feasible, the consultant asks the contractor to initiate the preliminary commercial study"* ***(****Interviewee, Cont1-PA).*

"The consultant reviews the initial study and he may return it again to the contractor asking for clarification on some points. However, if there are no notes the consultant sends it to the owner to get the initial decision" (Interviewee, Cont4-PA).

He would the ask for, receive, check and forward the final study, whereas the consultant in projects B, C and D proceeded straight to these stages without a preliminary study. The process was similar in all four projects. For example, *"The consultant reviews the details, then sends it to the owner for approval" (Interviewee, Cont4-PD).*

The only difference noticed was that in project C, it was reported that the review of the final study was discussed with the owner before possible referral back to the contractor, whereas in projects A, B and D, the consultant discussed the final report with the contractor only, then forwarded it to the owner for approval.

4.3.2.4 Roles of the Commercial Team

The role of the commercial team differed between project A and the other three projects. In project A, the commercial team was involved at an early stage, as it *"prepares the initial commercial study, and sends it to the contractor for review" (Interviewee, Cont3-PA).* None of the other three projects required such a step. However, in all four projects, the commercial team "*prepares a final financial study"* ***(****Interviewee, Cont7-PB)* showing the detailed cost of the change, and sends it to the contractor.

4.3.2.5 Roles of the Owner

When the change request was initiated by the contractor, the owner's role was essentially to give approval. In project A, this meant first approving the initial study, before the next stage of the process: *"The owner decides [on whether to go ahead with the change request based on the initial study]" (Interviewee, Cons9-PA).* If he decided to continue the process, he would ask for *"an accurate final study with three prices" (Interviewee, Cons9-PA).* In other projects, the owner proceeded straight to the final study, without a preliminary report, for example in project B, "*If [the owner] agrees [with the change request], he will ask for a full report on the change request with details on the effect in time, cost, and technically" (Interviewee, Cont6-PB).*

Whereas, in project C, the owner gave the consultant the chance, based on the final report, to create the change order which *"the owner may approve or refuse" (Interviewee, Cons1-PC),* in general, the final step of the process was for the owner to give the final agreement to the change request, which would then become a change order: *"The owner accepts and issues a change order" (Interviewee, Cons4-PA).*

Summary:

Another broad theme that emerged from the analysis is a process of change request that begins with the contractor. A number of codes were found, such as the responsibilities of the technical team, contractors, consultants, commercial team and owner. These codes, underpinning the theme, revealed that there is a similarity between some codes. For instance, all functions of technical teams are similar, because all of them are responsible for issuing the notice of change request and preparing a complete study of the change request technically. However, there are important differences between them in other situations. Also, there are differences between this process and the previous process, which originates from the owner.

These differences indicate that there was no one who could track the process and know how it was going. Also, there was no one who knew how much time the process would take, which may cause conflict in terms of who is responsible for

delay.

a) Process in Project A with the order originating from the contractor

1. The technical team informs the contractor of any inconsistency between the conditions on the ground and the design.
2. The contractor submits a change request to the consultant based on the comments of the technical team.
3. The consultant scrutinizes the request from a technical perspective.
4. The consultant requests the contractor to make the initial commercial study, if the request is technically reasonable.
5. The contractor executes the order and asks the commercial team to execute it.
6. Following completion of the initial commercial study, the team forwards it to the contractor for review.
7. The contractor then passes the initial commercial study to the consultants for their opinion.
8. Having reviewed the initial study, the consultant may refer it back to the contractor with a request for clarification on some issues. However, if there are no queries, the consultant passes it to the owner for the initial decision.
9. The owner makes his decision and requests a precise study with three prices.
10. The consultant requests the contractor for a clear change, and an accurate study with three prices.
11. The contractor conveys the order to the technical and commercial teams.
12. The technical team makes the final study and conveys it to the contractor.
13. The commercial team makes the final study and conveys it to the contractor.
14. Having reviewed the final study, the contractor prepares the change proposal, combining technical and commercial aspects**.**
15. The consultant reviews the request. If he finds that implementing the request may cause further cost, he returns it to the contractor unapproved. However, if not, he ensures that the change is consistent with the contract and submits it to the owner for the final decision. If the change does not contain the same items as in the contract, the consultant sends it to a committee for the prices to be scrutinized to reach a final estimate for submission.
16. The owner accepts and issues the change order**.**

Figure 16 shows the process of a change request, which originated from the contractor in project A.

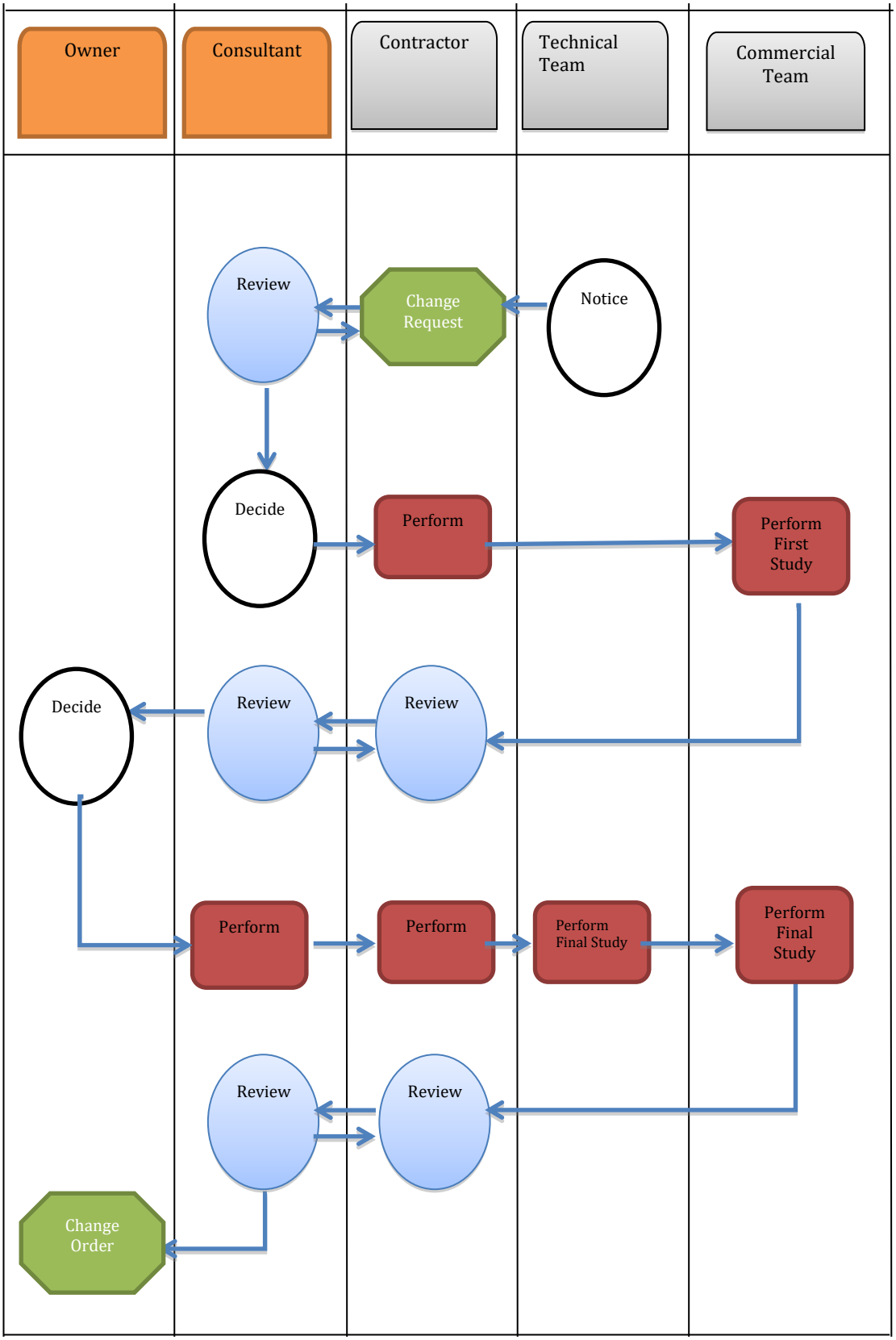


Figure 16 Process of Project A initiated by Contractor

b) Process in Project B with the request originating from the contractor

1. Occasionally, the contractor perceives the necessity for changes due to potential problems in the implementation of the design identified by the technical team, and reviewed by the contracts manager. If the request is outside the project scope, the latter sends a notice to the contractor.
2. The contractor makes a proposal.
3. The consultant assesses the proposal, and if he has queries, he will return it to the contractor. Otherwise, he will forward it to the owner.
4. The owner may reject the proposal and send it back the consultant. However, he may give provisional approval subject to a full report on the change request with details of its implications in time, cost and technically.
5. The consultant assesses the order.
6. The contractor is ordered to make a final technical and financial report.
7. The technical team makes the final technical report.
8. The commercial team makes the final financial report.
9. The contractor reviews the final report, and forwards it to the consultant.
10. The consultant assesses the report. If he has further queries, he will send it to the owner for approval.
11. The owner gives formal approval.

Figure 17 shows the process of a change request, which originated from the contractor in project B.

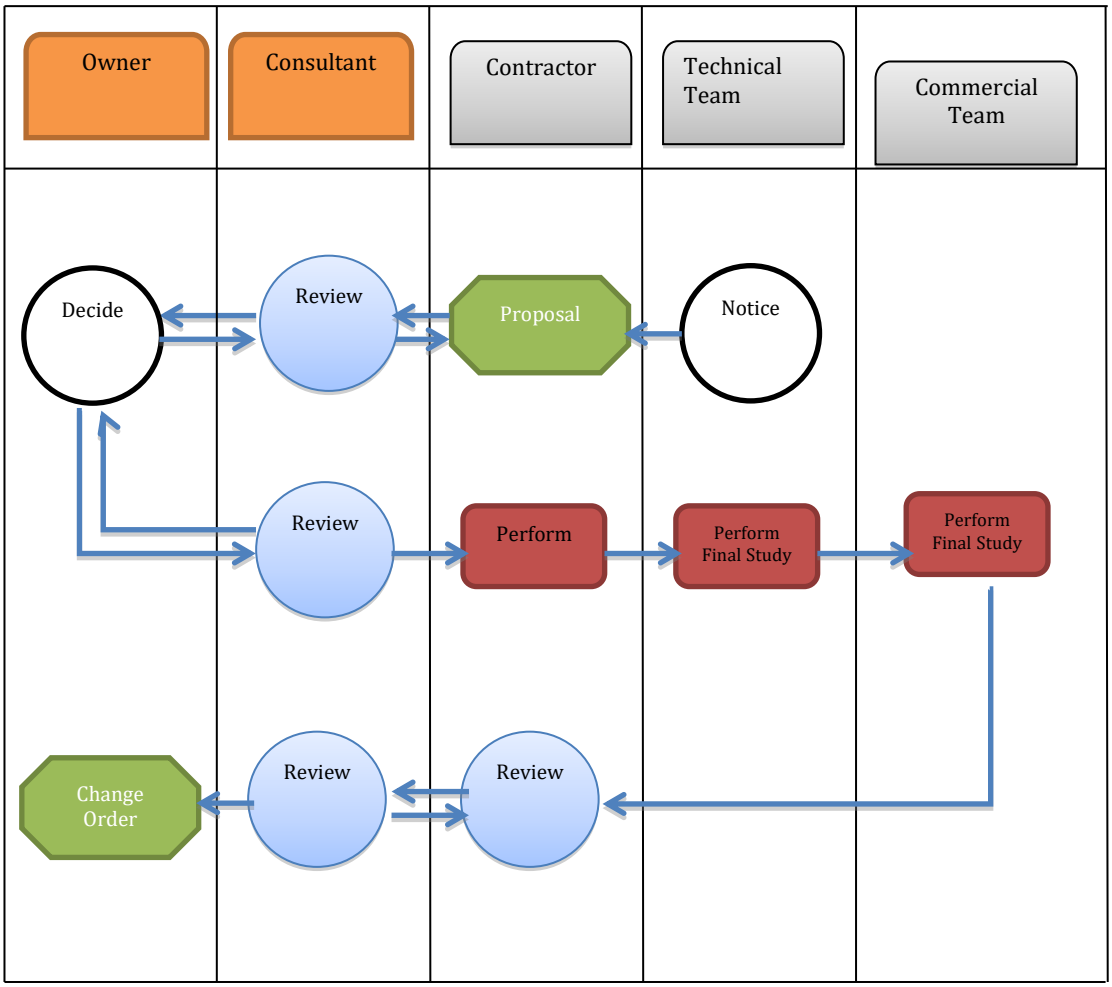


Figure 17 Process of Project B initiated by Contractor

c) Process in Project C with the request originating from the contractor

1. A change request may be prompted by notes from the technical team, particularly the contract department, which they send to the contractor.
2. The contractor assesses the note and passes it on to the consultant.
3. Following review, the contractor forwards his note to the owner, explaining the need for change.
4. The owner agrees, and requests further detail as to technical, time and cost issues, and includes them in the change request.
5. The consultant prepares the order, and passes it to the contractor to obtain the details of the change request.

6. The contractor executes the order. Then he passes it to the technical and commercial teams to make the final report, technically and financially.

7. The technical team makes a detailed final technical report and passes it to the contractor.

8. The commercial team prepares the final financial report, and passes it to the contractor.

9. The contractor reviews the combined report, and makes the change request accordingly, then passes it on to the consultant.

10. The consultant assesses the final report and confers with the contractor. If the latter has any concerns, he will send it back to the consultant. Otherwise, he will send the report to the owner for approval.

11. The owner may approve or reject the request.

Figure 18 shows the process of a change request, which originated from the contractor in project C.

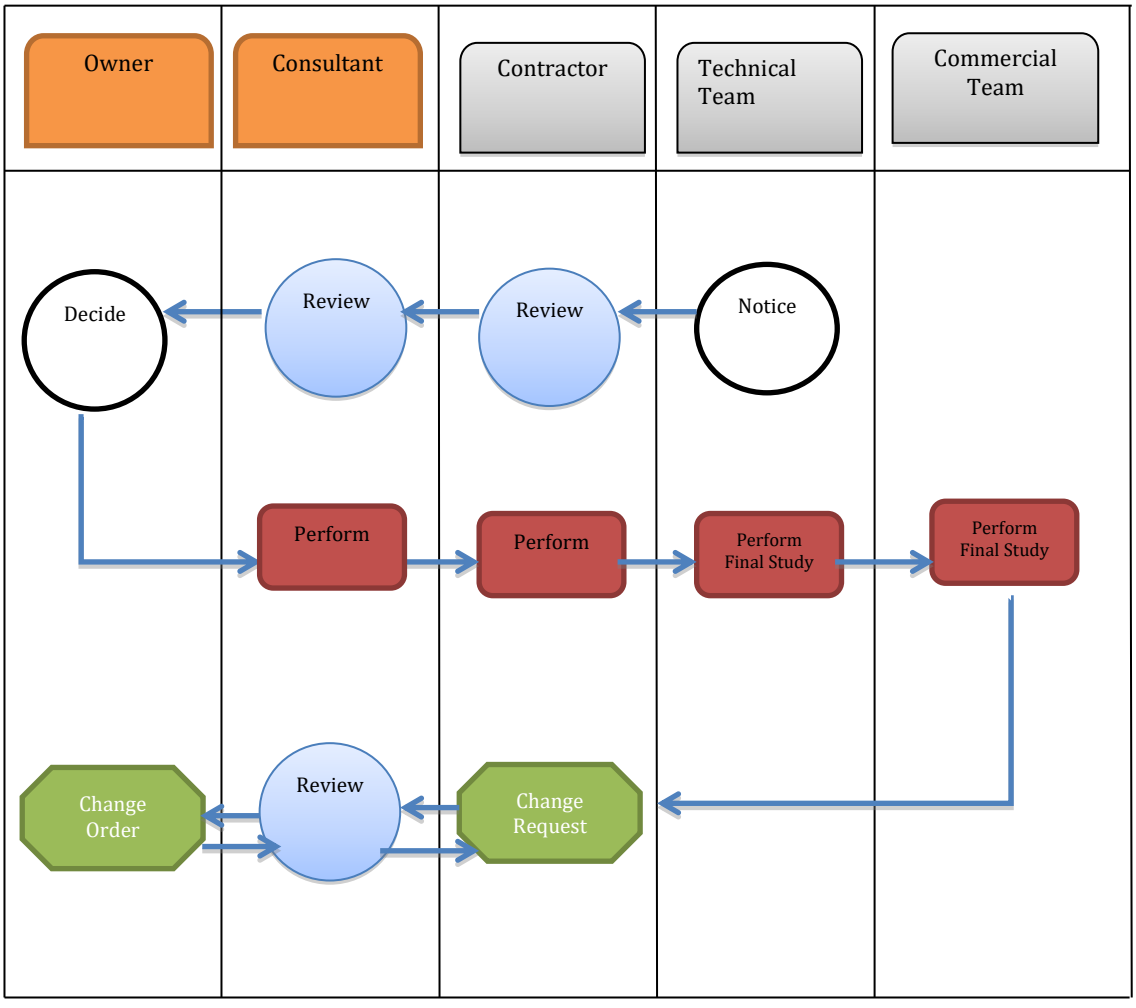


Figure 18 Process of Project C initiated by Contractor.

d) Process in Project D with the request originating from the contractor

1. The technical team discovers errors in the work site, such as errors in the design, and notifies the contractor accordingly.
2. The notes are reviewed by the contractor, and then a change request is prepared with a preliminary technical and commercial study, which is sent to the consultant.
3. The consultant reviews the request and confers with the contractor as to the nature of the reported errors. If the consultant is persuaded that change is necessary, he sends the request to the owner and discusses it with him to get his agreement.
4. Following discussion with the consultant, the owner may express initial agreement, subject to further information, such as time and cost.
5. The consultant asks the contractor for further details of the change request.
6. The contractor questions the technical and commercial team for more details.
7. The technical team prepares a technical feasibility report on the change, and sends it to the contractor.
8. The commercial team estimates the cost of the change, and reports it to the contractor.
9. The contractor reviews these reports, and prepares a detailed change request, incorporating all the requirements, which he forwards to the consultant.
10. The consultant reviews the details, then sends the report to the owner to obtain final approval.
11. The owner authorises implementation of the request.

Figure 19 shows the process of a change request, which originated from the contractor in project D.

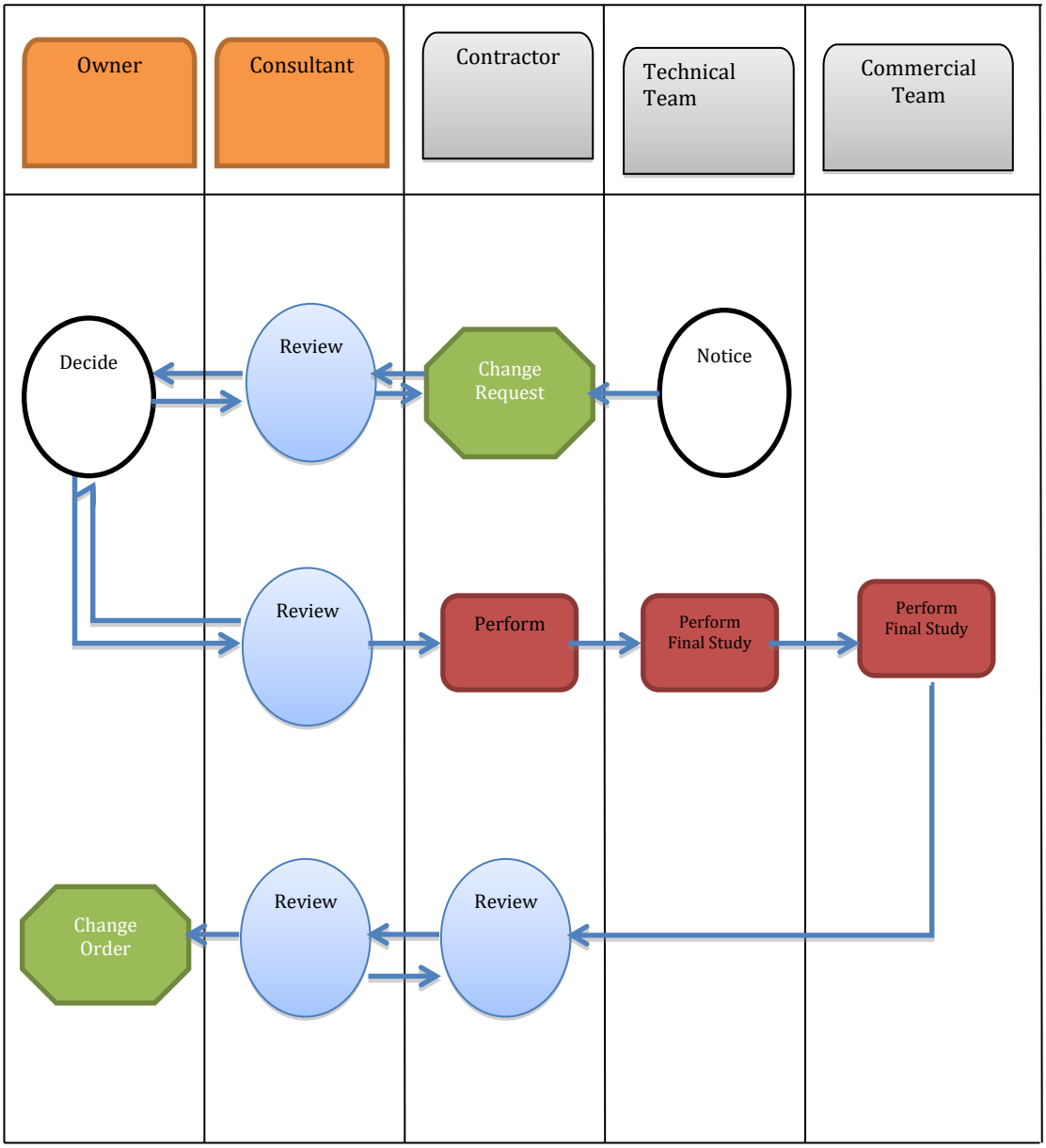


Figure 19 Process of Project D initiated by Contractor.

4.4 Causes of Change Requests

After analysing the concepts and the process of change requests, the research aims to explore the third category, which is the cause of the change requests, by analysing the answers of the interviewees to the third question of the research: how are change requests caused in large building projects in Saudi Arabia? The causes of change requests are classified into internal and external causes.

4.4.1 Internal causes

Internal causes of change request mean that the cause of the change request occurs internally from one of the stakeholders in the project, such as the owner, consultant, or contractor.

4.4.1.1 Change by owner

A change request may arise from the owner in several ways:

4.4.1.1.1 Change of schedule

It is known that every project has a limited timescale. However, the owner has the authority to ask for the project to be accelerated or delayed by a change request. In project B, the owner accelerated the project for the sake of profit. In this situation, one consultant said, *"Sometimes the client asks about change to improve or accelerate the project. In this project the client gave an order to accelerate the project because he wanted to get the benefit from the project as soon as possible" (Interviewee, Cons2-PB).*

4.4.1.1.2 Change in design

Various stakeholders pointed out that the owner may seek some amendment to the design to make it more comfortable for him and his managers; it is a sort of lack in value engineering. For instance, the owner in project C asked for the rooms intended for the managers to be widened, which caused several change requests. In this regard, one contractor said," *The owner sent a change request to expand some rooms*

especially for the head managers of his organisation." ***(****Interviewee, Cont3-PC).*

Other stakeholders explained that in some projects, the owner uses an old design to reduce the cost of the project. However, applying these designs may cause several change requests, or a complete change in the design. One of the consultants stated, "*Sometimes the owner chooses old designs to avoid spending more money. However, these designs may not fit with modern life. In this project, the previous representative of the owner had chosen an old design, which caused several problems during application*" (*Interviewee, Cons2-PA).*

In another situation, as several stakeholders highlighted, the end-user, who will use the project, is one of the owner's team. However, some owners do not study the project with the end-user. Therefore, the end-user asks for several change requests to achieve his goals. In this regard one contractor said, "*The most common problem in design occurs if the end-user is uninvolved from the beginning of the project. For example, the end user in this project asked us to widen some rooms and asked to have a special room for monitoring the building after we had completed the building*." *(Interviewee, Cont3-PA).*

4.4.1.1.3 Change in specifications

Various interviewees said that the owner sometimes makes a change order to improve the project by changing some specifications. Reflecting on such situations, one consultant said, "*The client would like to improve the project; for example, he asked us to change the original paint to a higher quality of paint*" ***(****Interviewee, Cons1-PB).*

Another situation mentioned by several stakeholders is when the owner seeks to reduce the cost, if he finds it too high. Therefore, he may ask for a change request to avoid spending more money. On this issue, one consultant mentioned, *"The client sometimes needs to change material to save money"* ***(****Interviewee, Cons2-PD).*

4.4.1.1.4 Tendering and Contract-related change

Several participants indicated that the short period allowed for tendering by the

owner may cause some change requests, because the contractor will rush to win the contract, and discover later that he is not be able to fulfil it properly, which pushes him to ask for change requests. In this regard one consultant said, "*Therefore, most contractors try to win and get the project as soon as possible. However, during the application some contractors find it is difficult to apply the design on the ground, and so they ask for change requests" (Interviewee, Cons1-PD).*

Several stakeholders indicated that omissions or ambiguities in the contract lead to change requests in the project. For example, in one project the owner had a contract which asked the contractor to provide the project with the latest technology, such as communication and security devices. However the contractor did not know at what specific time to renew the technology, especially as the project took a long time. Explaining situation, the contractor said, *"This contract has a condition in terms of updating technology in the project. However, the conflict was in the ambiguity of the meaning of up-to-date the technology. Did it mean taking the newest technology from the signing of the contract, or at the time of delivering the project, because this project took a long time and the technology had already changed?" (Interviewee, Cont5-PB).*

An unfair contract may lead to change requests as a form of corruption. Some stakeholders pointed out that change requests may be made by the contractor to gain more time and money, because he discovers that the contract will be costly to him and bring no benefit. In this regard, one consultant said, "*The contractor sometimes asked for a genuine change request in the design, and other times he asked for an unnecessary unreal change request to obtain more time and money because he felt that the contract was against him, so he wanted to compensate his loss*" *(Interviewee, Cons8-PA).*

4.4.1.2 Change by consultant

The consultant may ask for a change request in some situations as follows:

4.4.1.2.1 Change in design

The consultant is described as the person who is responsible for overseeing the work

to ensure that the project is moving in the right way. Occasionally, he finds it is desirable to make some changes to improve the project. In this case, one of the consultants said, *"The consultant works with the client to improve the design, such as changing the shape of some buildings in this project."* ***(****Interviewee, Cons1-PD).*

In another situation, the consultant may find an error in the design during its execution. In this regard, one of the owners said, " *The consultant may find an error in the design. For example, in this project the consultant found the pavements of some buildings were too wide and needed to be narrowed*" *(Interviewee, O-PB).*

Several owners and contractors reported that corruption may occur on the part of consultants when they ask for frequent changes in the design to extend the project, in order to earn more salary during the time of the project. For instance, one of the contractors said, "*In this project the consultant provided the owner with some information in terms of the need to make some changes in the design to get more salary, and most of the time the owner supports him, because he is one of his team.*" *(Interviewee, Cont4-PC).*

4.4.1.2.2 Change in specifications

On the one hand, the consultant is described as honest when he asks for a change request in the specifications to improve the project, because some specifications are of inferior quality or are more expensive. In this regard, one of the consultants said, "*The consultant asked the owner to change the door locks because they were not in a good condition*." ***(****Interviewee, Cons6-PA).*

On the other hand, some owners and contractors indicated that some consultants exploit changes in specifications to extend the time of the project, because as long as the project continues, the consultant will draw his salary. Regarding this situation, one owner said, "*The consultant obtains his salary as long as the project exists. For example, the consultant asked to change the marble from local to foreign, which will take a long time to import.*" (*Interviewee, O-PB).*

4.4.1.3 Change by contractor

The contractor is one of the stakeholders involved in the causes of change requests as follows:

4.4.1.3.1 No project management

Project management is "*the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements*." OPMBK Guide (PMI, 2013: p.5)**.** The majority of stakeholders indicated that frequent change requests may occur and a project may be delayed, if the stakeholders do not apply the process of project management. Nevertheless, they asserted that there is a lack of application of the process of project management. In this regard, one of the contractors said, "*The application of project management reduces the amount of change requests and the delay in the project, because in project management the process of the project is clear and all stakeholders apply the contract on time, with quality. However, in this project we applied 30% of project management.*" (*Interviewee, Cont2-PC).*

4.4.1.3.2 Change in design

Various stakeholders indicated that the contractor may ask for a change request in the design to improve the project, even if there is no error in the design. In this regard, one contractor said, *"The contractor suggested changing the cover of columns from wood to steel for the quality." (Interviewee, Cont3-PA).*

Also, stakeholders mentioned that the contractor might ask to make a change request based on some error in the design. One of the contractors pointed out, "*The contractor asked for a change request to provide every building with an electric meter, because the designer made an error by providing one electric meter for all the buildings.*" *(Interviewee, Cont2-PB).*

4.4.1.3.3 Change in specifications

Several stakeholders specified that a change request in specification may occur when the contractor wishes to improve the project. One consultant commented that, *"Contractors sometimes seek to improve the project. For example, he may like to change the lift from a Chinese lift to a Finnish Lift."* (*Interviewee, Cons2-PB).*

Other stakeholders indicated that the contractor may ask for a change request in specifications if some materials are unavailable locally. One contractor stated in this regard, " *The contractor asked for a change in the type of stone, because it [the one specified] was not available locally*" (*Interviewee, Cont5-PB).*

Also, several stakeholders mentioned that an honest contractor tries to reduce the cost of the project, to help the owners, without affecting the quality. In this regard, one of the consultants said, *"The contractor would like to do value engineering in the specifications."* ***(****Interviewee, Cons1-PD).*

However, various stakeholders indicated that corruption may occur in specifications by the contractor. In some situations, the contractor may earn more money from the supplier if he takes more materials as a result of frequent change requests. In this consideration, one contractor said, "*The contractor sometimes gets the specifications from a specific supplier, because he can get a profit from him if there is a good relationship."* ***(****Interviewee, Cont3-PD).*

Summary:

From the 40 interviewees, one of the themes that emerged was internal causes of change requests. A number of sub-themes were raised: change by owner, consultant and contractor. Every sub-theme has several codes, and these codes reveal that there are several causes of change requests. The owner can initiate change requests in several situations, for example, when he changes the schedule to accelerate the project, or modifies the design to make the project more convenient, or reduce the cost, or because the owner did not involve the end-user in the design. Change in specifications may be made to improve the project or to reduce the cost. Finally, hasty tendering and an ambiguous or incomplete contract may create more change requests by the stakeholders. Also, an unfair contract may push the contractor towards corruption to compensate his losses from the contract. The consultant can be a cause of change requests when he asks to change the design to improve the project, due to error in the design, or for his own interests. Similarly, he may ask to change the specifications to improve the project or for corruption purposes. The contractor could be one of the causes of the change request when he does not carry out proper project management. Otherwise, he may ask to change the design to improve the project, or due to an error in the design, or as a type of corruption. In addition, the contractor may ask to change the specifications to improve the project, due to unavailability of the specified materials, or to reduce the cost.

4.4.2 External causes

A change request may occur from external causes. External causes mean that the causes arise externally, and not from one of the stakeholders in the project. Nevertheless, external causes sometimes affect the most important internal causes of change requests. Examples of external causes include: supply problems, technological development, logistical reasons, government regulation, environmental conditions, conflict with some government departments and weather conditions.

4.4.2.1 Supply problems

Several stakeholders mentioned that a change request may caused by external causes, which are outside their control. For example, in project B, a change request was made to change the supplier of some materials, because the previous supplier had already left, so changing the supplier resulted in changing the specifications. In this regard, one consultant stated, *"The project faced a problem in terms of supply problems. Some suppliers now have closed down, such as the supplier of air conditioning. Therefore, we have to change some materials."* ***(****Interviewee, Cons2-PB).*

4.4.2.2 Technological development

Several stakeholders highlighted that technology is changing every year, which may cause a change request to keep up to date with these technologies, such as computers. Therefore, projects which take more than four years to be executed need new technology. Hence the development of technology affected the situation, due to new specifications of new computers or other technological materials in the project. In this consideration, one contractor pointed out, "*Change of technology pushed us to change the security and communication system in this project, because providing the project with new technology was one of the contract conditions*" *(Interviewee, Cons5-PB).*

4.4.2.3 Logistical reasons

Various stakeholders specified that change requests are sometimes made for logistics reasons. For example, if the stakeholders see that bringing in foreign materials will

take a long time, they will ask to change them for local materials. Thus, the specifications would be affected by this change. As an example, one contractor said, *"We changed the foreign marble to a local one, because we were told that our request would take 6 months to come to Riyadh because of customs reasons*." (*Interviewee, Cont3-PC).*

4.4.2.4 Government regulation

The majority of stakeholders believed that most companies prefer to employ foreign labour who are not under their sponsorship, because it is cheaper and easier. However, the government of Saudi Arabia has issued sanctions and compulsory instructions against this practice. As a consequence of these instructions, most labourers left their work, and a shortage of workers appeared in these companies, which affected the plan, schedule and cost of the projects. Therefore, several change requests were made in some projects to cancel some parts of the plan in terms of the design and specifications. In this regard, one contractor said, *"The new labour laws, which indicate that every worker should work for a sponsor, led us to cancel part of the plan area in our project, because it needed special labour to maintain it." (Interviewee, Cont3-PC).*

4.4.2.5 Conflict with some government departments

Several stakeholders indicated that conflict with government departments may cause a change request. Therefore, such conflict may affect the design of the project. In this regard, one contractor mentioned that, "*The aviation department asked us to reduce the height of the minaret for the sake of safety for planes*" *(Interviewee, Cont5-PC).*

4.4.2.6 Weather conditions

Saudi Arabia is characterised by desert areas and the weather is sometimes cold, and sometimes hot and dusty. Some stakeholders reported that weather conditions affect their work. Sometimes the stakeholders discover that a type of specification does not fit with the weather in Saudi Arabia. Thus they change it to another type, which is strong enough to face such conditions. For instance, one of the contractors said, "*We*

did our painting one month ago, and changed the type of paint because there was a sand storm" ***(****Interviewee, Cont2-PD).*

Summary:

External causes of change requests are an obvious theme that emerged after analysing the interviewees' responses. Several codes were derived from the opinions of stakeholders, which reflected the causes of change requests that came from outside the ability of stakeholders, such as supply problems, technological development, logistical reasons, government regulation, conflict with some government departments and weather conditions. However, there is a relationship between external and some internal causes of change requests in some respects. For example, conflict with some government departments may end in changing the design or specifications when some parts of the project are not consistent with safety or when it has any problem, such as reducing a minaret's height due to plane routes. Also, government regulation in the previous projects affected the design and the specifications when the government changed the labour law. This affected the plans for some projects because most projects depended on workers who were not under their sponsorship. However, technological development, supply problems, logistical reasons and weather conditions only affected the specifications, because no compulsory reasons were offered by the government asking for change in the design, the only changes being in the specifications to be adapted to every single situation, such as changing the specification of paint, to withstand the sand storms prevalent in Saudi Arabia.

Figure 20 shows the internal and external causes of change requests.

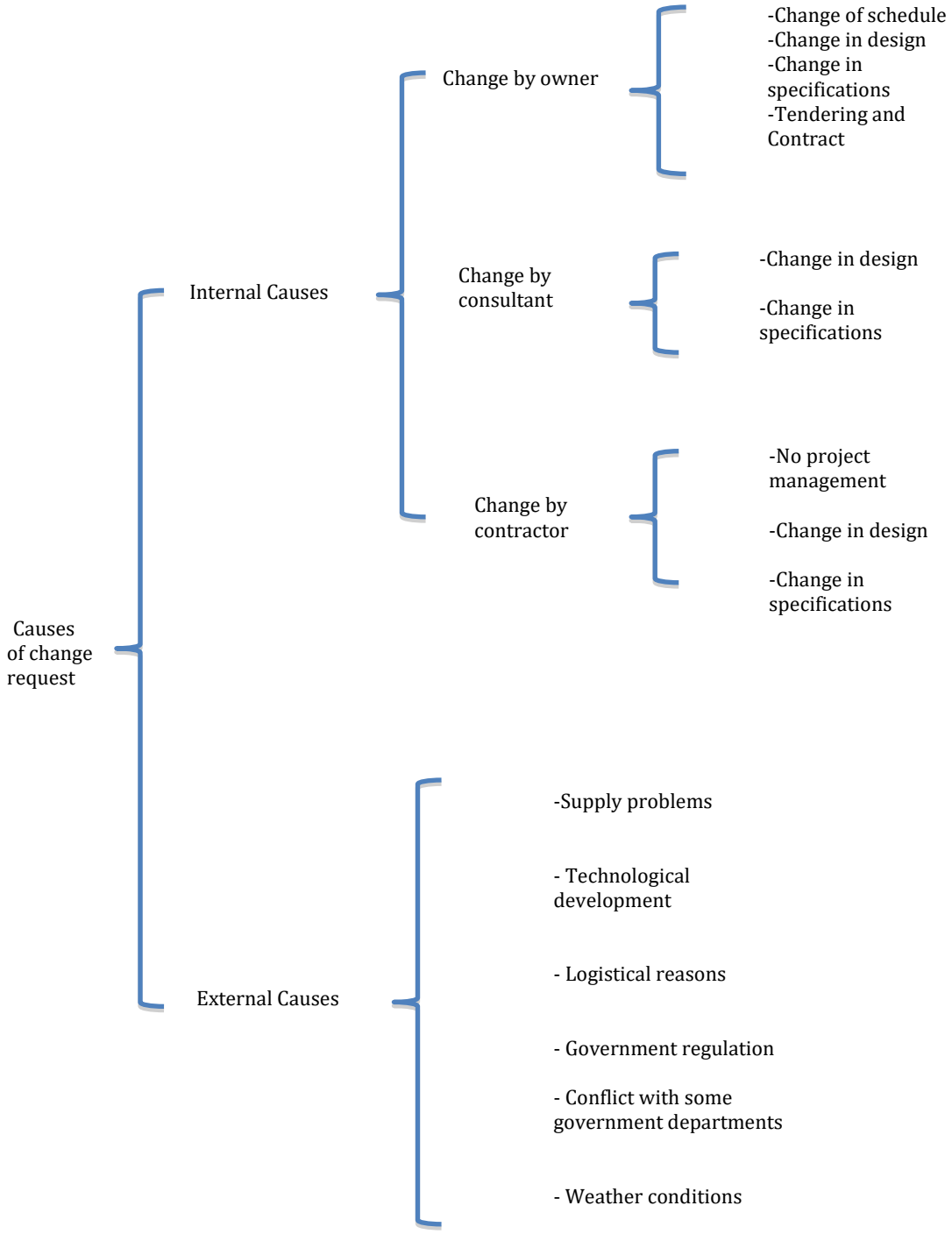


Figure 20 Causes of Change Request

Figure 21 shows the relationship between external causes of change request and some codes in the internal causes.

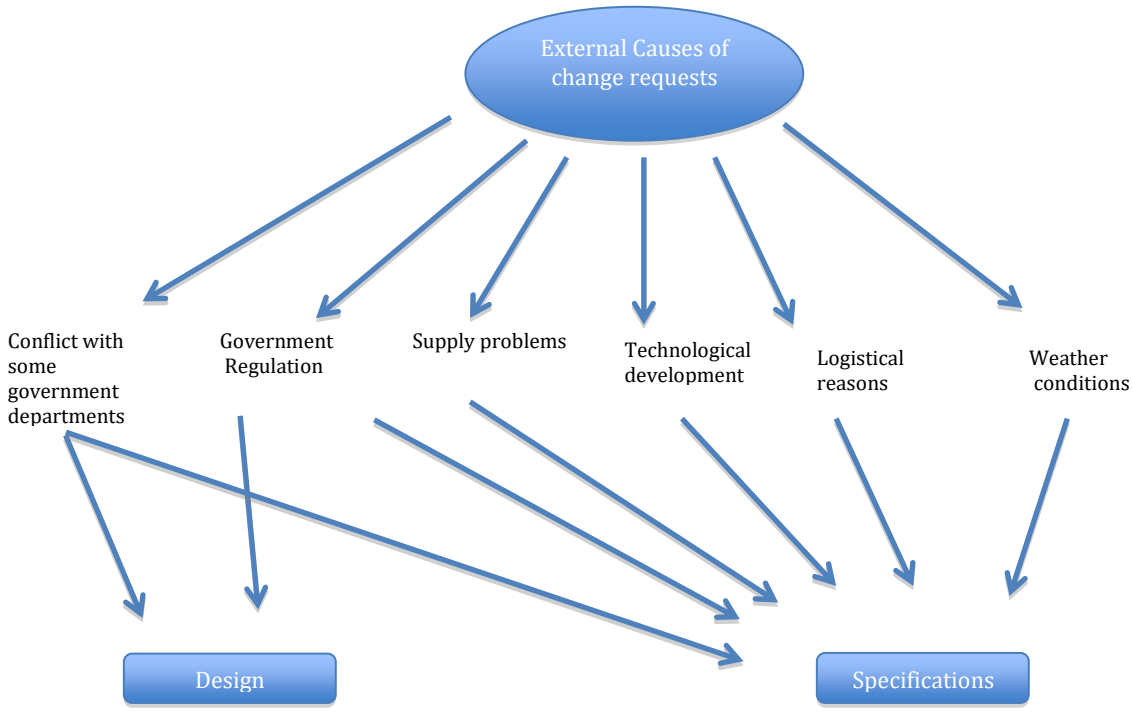


Figure 21 Relationship between External and Internal Causes of Change Requests

4.5 Effect of Change Requests

In the fourth category, the researcher will explore the effect of change requests by analysing the fourth question in the research, which is: "How do change requests affect large building projects in Saudi Arabia?"

Understanding the effect of a change request will help the researcher to estimate the positive and negative effects of change requests, which may help him to solve this problem. Also, this step will provide stakeholders and the reader with a clear perspective and more understanding of this problem in Saudi Arabia.

This section consists of some answers, which described the situation in the specific projects examined. However, other answers were provided by the expectations and opinions of stakeholders from their experience of other projects.

There are two main themes in this category, which are direct and potential (indirect)

effects of change requests.

4.5.1 Direct effect

A direct effect is an effect that occurs on the project or stakeholders directly as a result of the change request. There are positive and negative effects of change requests.

4.5.1.1 Positive effects

The effect of a change request could be beneficial for one of the stakeholders, in terms of time, finance, need, or quality.

4.5.1.1.1 Saving time

Various stakeholders indicated that the owner may make a change request or change order to expedite the work, because owners usually hope to acquire their projects as soon as possible, in order to achieve the benefit from them. However, these projects were already delayed due to frequent change requests.

In this regard, one contractor indicated, *"The owner asked us to accelerate some sections in the project. Therefore, we are going to change the concrete corners of the rooms to metal, to save time."* ***(****Interviewee, Cont1-PC).*

In other situations the change request may help the contractor to save time, because some contractors would like to complete the project as soon as possible in order to be free to make other bids and obtain further projects. Contractors succeeded in saving time in some parts of projects. Nevertheless, all projects were delayed due to the negative impacts of other negative change requests. Regarding this situation, one consultant said, "*Also, a change request can save time for the contractors. For example, narrowing the wide pavements of some buildings will sometimes save time for the contractor and the project*" ***(****Interviewee, Cons1-PD).*

4.5.1.1.2 Financial

Some stakeholders claimed that a change request may reduce the cost of the project for the owner, whether this is a change in the design or in the specifications. However, the positive financial effects were limited, because although success occurred in some cases of change request, the majority of them suffered from cost overrun. In this situation, one consultant mentioned, *"Change requests save some costs by reducing some units from the project"* ***(****Interviewee, Cons2-PA).*

4.5.1.1.3 Owner need

Several stakeholders highlighted that one of the benefits of a change request is to achieve the needs of the owner and the end-user, because in some situations the design is not suitable for them, based on lack of study or the end-user being uninvolved in the design before starting the project, or any other causes of change request in this regard. Thus, the owner makes a change order to achieve his goals. In this situation, one owner stated, "*By the change order the client and the end-user get what they need regarding the design and materials*" (*Interviewee, Cons1-PB).*

4.5.1.1.4 Quality of project

Various participants revealed that the aim of change requests is to improve the project and make it of good quality. Sometimes, stakeholders discover that the quality of the specification is not adequate or needs to be updated, which will make the project of better good quality and reduce the need for maintenance. For instance, one owner said, "*The change request is very important for the quality of the project. For example, changing the flagstone to marble will give the project more quality*." (*Interviewee, O-PD).*

4.5.1.2 Negative effects

The effect of a change request could be detrimental to stakeholders in terms of time or cost, as follows:

4.5.1.2.1 Time overrun

Several interviewees mentioned that frequent change requests would affect the delivery time of the project negatively, because there would be new work which needs more time. Also, some change requests may create a new change request, which may extend the delivery time of the project. Regarding this point, one of the contractors said, "*This project was delayed for two years because of the frequent change requests, and it will take a long time to be delivered to the owner as long as there are frequent change requests*" *(Interviewee, Cont3-PB).*

4.5.1.2.2 Cost overrun

Various respondents pointed out that change requests could cause cost overruns to the owner, because some change requests need new materials and specifications, or more time, resulting in higher salary bills. In this respect, one of the stakeholders asserted that, "*Frequent change requests in this project have cost the owner 100 million so far, because the project needed new materials, consultants' salaries, and contractors' rights*" ***(****Interviewee, Cont6-PC).*

Other respondents indicated that a change request could also cause cost overrun to the contractor if the owner does not compensate him financially in terms of the new materials and salary for the labour or any other expense caused by the new change request. On this issue one consultant commented, "*Change requests affect the cost overrun to the contractor, especially if he didn't get his profit from the change request*." ***(****Interviewee, Cons2-PB).*

Summary:

A single theme that emerged from the analysis is the direct effect of the change request. Also, a number of sub-themes were identified by the interviewees, such as the positive and negative effects of the change request. The positive sub-theme includes different codes, which demonstrated that there were some benefits from the change requests. These codes were: saving time, financial, owner's need and quality of the project. Regarding saving time in the project, it was not completely successful every time and in every change request. The successes were in a few change

requests, which accelerated some parts of the projects. However, in general all the projects were already delayed. Also, the positive financial effects did not always occur, or in the expected manner. In some cases, the stakeholders succeeded in saving costs by making some changes in the design and specifications. However, all projects had cost overrun. In terms of owners' needs and quality of projects, the effects were successful, because the owners and end-users achieved their expectations from changes, whether these changes were right or wrong. Also, the quality generally improved, regardless of cost.

The negative effect codes under the negative sub-theme include time and cost overrun, which affect the project negatively. These codes reflect the reality of these projects, because all of them were delayed and had cost overrun, based on frequent change requests.

4.5.2 Potential effects

A potential effect is an effect that occurs indirectly or in the future, to the project or stakeholders, as a result of the change request. There are positive and negative potential effects of change requests.

4.5.2.1 Positive effect

Positive effects are advantages which may be derived from the change request for the stakeholders, in terms of good reputation, reduced maintenance, experience, good relationship, time for the contractor and commission for the contractor.

4.5.2.1.1 Good reputation

Several interviewees described how a successful project could affect the consultants and contractors positively by enhancing their reputation, which is very important for them to attract new projects and a higher salary. However, all projects under the study were delayed. In this respect, one contractor mentioned, *"The consultant and contractor will achieve a good reputation and more work in the future, if the project succeeds. However, this project has been delayed more than two years." (Interviewee, Cont6-PC).*

4.5.2.1.2 Reduce maintenance

Various stakeholders reported that change requests and change of some materials to a better quality may reduce maintenance in the future. As long as the materials and specifications are of good quality, the maintenance would be less than expected. To clarify this information, one consultant indicated that, *"We have changed the elevator from a Chinese to a Germen one by a change request and from my experience, this will reduce the maintenance of the elevator in the future." (Interviewee, Cons2-PA).*

4.5.2.1.3 Experience

Several interviewees expressed their opinion that the contractors may gain experience in terms of the ability to address problems in projects by change requests. In this situation, one consultant said, **"***Now, I think the contractor has the best experience of how to estimate and solve any dilemma in the next projects and he can decide whether or not he will benefit from the change request." (Interviewee, Cons4-PA).*

Other stakeholders stated that the consultant may also gain experience from frequent change requests, as one consultant mentioned, "*The consultants obtain the best experience by frequent change requests in the construction projects. For instance, in this project I have good experience, especially in the design and the specifications, because I have dealt with a lot of change requests.*" (*Interviewee, Cons5-PA).*

It is expected that frequent change requests in all projects may support the experience of contractors and consultants; because a change request means that there is a dilemma, which needs to be resolved. Therefore, solving problems from time to time will provide stakeholders, especially contractors and consultants, with good experience, because they usually work in the field.

4.5.2.1.4 Good relationship

Some stakeholders stated that a successful change request for the project is important to improve the relationship between the stakeholders. For example, if the change request improves the quality of the project, all stakeholders will be delighted and

respect each other. In some situations the relationship became good based on the success change request. As one consultant indicated that, "*In some situations the client can maintain a good relationship between stakeholders by change requests, especially positive ones. For instance, the right change requests in the specification affect our relationship positively.* " ***(****Interviewee, Cons1-PD).*

However, most of the time the relationship was harmed in these projects, because most change requests caused delay and had negative effects.

4.5.2.2 Negative effects

The potential effect of change requests may be detrimental to the project and stakeholders in terms of productivity, excess work, bad reputation, bad relationships and indirect costs.

4.5.2.2.1 Slow productivity

Several respondents revealed that frequent change requests may affect the enthusiasm and productivity of contractors, consultants and workers, which may cause some delay in the project. If there are unjustified change requests, or if there is a delay in some of them, the worker will not be happy to accept this type of change request. Moreover if someone is not convinced about doing something, his productivity will decline. In this situation, one contractor indicated that, " *Our delay in this project is due to the frequent change requests, which have made us more pessimistic. Also, we expect more change requests in the future from the owner, which I think will affect our productivity"* ***(****Interviewee, Cont3-PB).*

4.5.2.2.2 Excess work

Some stakeholders pointed out that a change request may affect the project by adding more work which was not in the plan or contract. This new work will affect the contractor negatively if he cannot find the materials or workers for it. In this regard, one consultant contended, "*As a result of change requests in this project, the contractor will face more administrative work in looking for another supplier for the new materials"* ***(****Interviewee, Cont3-PA).*

Other stakeholders revealed that change requests may affect the consultant's work by adding to the previous work: "*Several change requests mean that the consultant has more complicated work to follow*" ***(****Interviewee, Cont2-PB).*

4.5.2.2.3 Indirect cost

Some consultants and contractors indicated that a change request may not always be worthwhile for the contractor, especially when the project is delayed, because he may lose other contracts and projects. In this regard, one contractor mentioned that, " *Also, the contractor lost the opportunity to obtain another project, because he spent a long time on the current project, due to frequent change requests*" (*Interviewee, Cont2-PA).*

4.5.2.2.4 Bad reputation

Several respondents highlighted that delay or failure of projects as a result of frequent change requests will affect the reputation of the contractor in the future, regardless of who is the cause of this delay or failure. Therefore, other owners will be wary of dealing with him. In this situation, a contractor pointed out, *"I think the reputation of the contractor is affected by the change requests and delay of this project*" *(Interviewee, Cont6-PC).*

Also, some stakeholders indicated that the reputation of consultants may be affected by change requests, if the project is delayed. Therefore, in this regard, one consultant said, "*Frequent change requests and project delay will affect the reputation of consultants in any place. Therefore, we are worried about our reputation from this project because it has been delayed more than two years*." *(Interviewee, Cons1-PC).*

4.5.2.2.5 Bad relationship

Some respondents asserted that change requests are usually damaging to relationships, if there are time and cost overruns or any mistake in the design and specifications, or if there is an unacceptable change request. In this respect one contractor said, "*There is more and more tension between the owner and the contractor, because the owner did not accept the contractor's opinion relation to any unsuitable change orders*." (*Interviewee, Cont2-PB).*

Summary:

The potential effect of the change request is the second obvious theme, which emerged after analysing the participants' answers. There are two sub-themes, which were labelled as positive and negative potential effects of the change request. On the one hand, the positive effects incorporate several codes identified from the answers of stakeholders, such as good reputation, reduced maintenance, experience and good relationship. These codes denoted possible helpful effects indirectly occurring to stakeholders as a result of change requests. Regarding a good reputation, it is unlikely that the reputation of contractors and consultants of these projects would be high, because all the projects were delayed. Also, a good relationship was not found every time in these projects, because they were all delayed, which could affect the relationship negatively.

On the other hand, there are negative potential effects that are harmful to the stakeholders and the project, indirectly. This sub-theme has several codes, such as slow productivity, excess work, indirect cost, bad reputation and bad relationship. All of these effects may occur, because all projects had cost and time overrun.

Figure 22 shows the direct and potential effects of change requests.

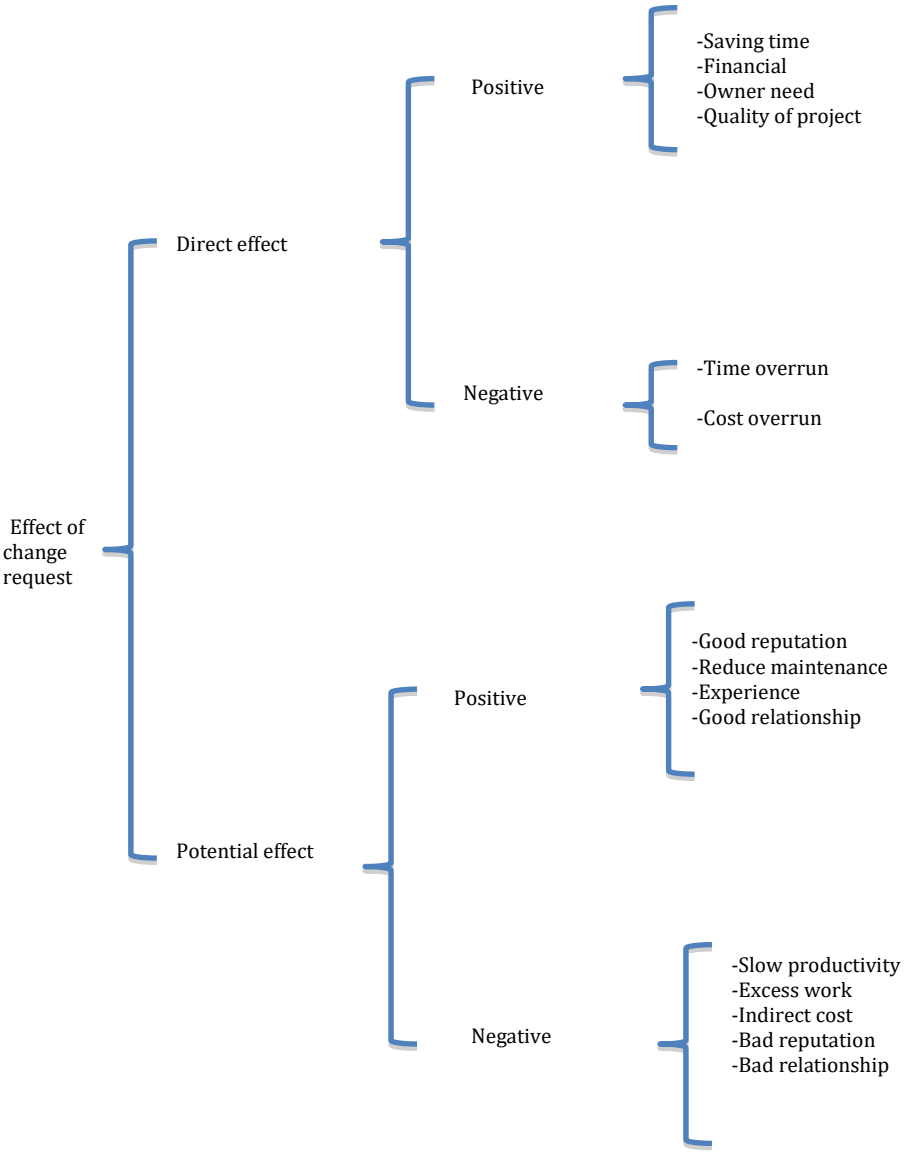


Figure 22 Effects of Change Request

4.6 Handling Change Requests

In this category, the researcher aimed to find out how detrimental or frequent change requests are handled before they occur, during the process, and after they have occurred by answering the last question, “What methods do stakeholders currently use or envisage to handle change requests in Saudi Arabia, and how effective do they find them?” Through the data from all stakeholders in the four projects, the researcher explored the ways of handling change requests by analysing the fifth question in the research, and tried to divide the strategies into three steps. First of all, handling change requests before they occur by answers the first minor question “What elements do you believe would avoid or reduce change requests before executing the process of a project? How?”

Secondly, handling change requests during the process answers the minor question, “When creating the change request, what can you do to speed up decision-making for its approval and adoption? Why do you adopt this approach? How effective do you think it is?

Thirdly, handling change requests after they occur answers the minor question “After the authorisation of the change request, what can you do to speed up its implementation?”

When the researcher asked the interviewees the minor question, “Are there any changes you would like to see that would enable you to manage change requests more effectively? How?” their answers indicated that there were several steps before change requests occur, during the process and after they occur.

Handling change requests effectively before they occur was not applied in these projects, but suggestions and opinions were expressed by stakeholders who had worked on some previous projects in Saudi Arabia, the Arabian Gulf, or in Arabian countries which have the same culture. Handling change requests during the process and after they occur can accelerate the process of change requests. Participants considered their strategies as effective because they had tried some of them in a few cases and found them to be a good solution. All these steps became three main themes with related codes. Also, an important theme that emerged was that culture

has negative effects on the way of handling change requests. Therefore, the researcher will start with this theme.

4.6.1 Restriction of handling - Cultural practices:

4.6.1.1 Uncertainty avoidance

Several stakeholders indicated that stakeholders are not normally happy with any new change. Therefore, they need time and more training to accept change. For example, the stakeholders did not apply project management completely. According to one consultant, *"It was difficult for project management to be applied completely in this project by stakeholders, especially the owner, due to cultural reasons. However, it will be possible to apply it in the future by training and qualifying all stakeholders." (Interviewee, Cons2-PA).*

4.6.1.2 Centralisation

Various interviewees revealed that the centralisation in the approval of change requests by the owner affected the time for completion of any change. Speaking on this issue one contractor said, *"There is a centralisation of decision-making by the owner regarding change requests. If there were no authorisation powers in the decision, there would be no delays in change requests." (Interviewee, Cont5-PC).*

4.6.2 Handling change request before it occurs

The first and foremost way to handle change requests is by handling them before starting the project and before requests occur, because after they occur, all that can be done is to accelerate the process. The stakeholders did not use any method to handle change requests before they occurred. However, they suggested several ways to handle change requests before they occur as follows:

4.6.2.1 Study the project

Various stakeholders described that it is important to specify what a client and his

end-users need in the project and to have it in writing, to be reviewed by the consultant before the bidding stage. After that, they should send it to the designer to make the design based on their needs. One owner indicated that,*" It is important to study the project very well by clients, consultants, and end-user before the bidding. Then, introduce the project requirements in a "Project Brief" describing their needs briefly and clearly to the designer."* ***(****Interviewee, O-PA).*

4.6.2.2 Value engineering

Some stakeholders mentioned that value engineering is very important to solve any dilemma in the design and specification before executing the contract and the work. Value engineering always focuses on the quality and the function of the project, with no cost overruns. One of the consultants said, *"It is necessary to use value engineering for the quality of the project. Choosing a good and functional design and specifications will reduce the frequent requests for the project before starting the work" (Interviewee, Cons1-PC).*

4.6.2.3 Sufficient time for bidding

Some respondents highlighted that the majority of owners do not give the contractors enough time for the bidding, to decide whether or not they have the ability to take on the project and control it, which can give rise to some change requests in the future. Therefore, they recommended giving enough time to think and decide. In this regard, one consultant pointed out: *"It is important that the owners give enough time for bidding to enable the contractors to make sure that they are able to take the project and do it properly or not. Therefore, most contractors try to win and get the project as soon as possible. However, during the application some contractors find it is difficult to apply the design on the ground, and so they ask for change requests"* ***(****Interviewee, Cons1-PD).*

4.6.2.4 Contract

Several stakeholders asserted that it is crucial to apply the FIDIC contract in all projects in the Kingdom of Saudi Arabia, for many reasons, firstly, to achieve the

project in the specified time. Secondly, stakeholders will receive their dues, and avoid cost overrun, because everything is written in the contract. In this respect, one consultant indicated that, *"The FIDIC contract should be applied in the projects in Saudi Arabia. Also, FIDIC contract should not be changed or amended because this will make many mistakes. FIDIC contracts will save the rights of all stakeholders and will save the timescale of the project"* ***(****Interviewee, Cons1-PB).*

All stakeholders indicated that there is no formal process or time limit for change requests and processes. Therefore, these processes can take a long time to be approved, some taking more than three years. For this reason, it is important to apply a formal process with a time limit in the contract. Regarding this point one consultant described that, *"There should be a formal process for the change request in the contract, with clear steps and timescale." (Interviewee, Cons2-PA).*

4.6.2.5 Training course

Some respondents explained that it is important to prepare some courses and meetings between the stakeholders to go deeper into the nature of the project and discuss any misunderstandings regarding the design and specifications, in order to start the project with a clear vision about the future. On this point, one consultant said, *"It is really important to have a regular training course between the stakeholders before starting the work to specify the final decision regarding the decision and specifications"* ***(****Interviewee, Cons6-PA).*

4.6.2.6 Administration for change requests

Several interviewees asserted that there is no specific committee or administration responsible for the acceptance of change requests and detecting responsibility for delay. Therefore, they indicated that they wanted an administration of their own to control change requests from initiation to approval. In this regard, one consultant said, *"We need a special dependent administration consisting of representatives of the client, contractor, and consultant. This administration would be responsible for change requests in terms of technical and commercial aspects and monitoring the process and the timescale for every change request. Also, it should have the authority and the decision to give the approval without going back to the client. In*

this situation, change requests would be under control" (Interviewee, Cons2-PD).

4.6.2.7 Applying project management

Various stakeholders revealed that project management is one of the ways that could help them to minimize the frequent change requests and control them. They indicated that applying project management means all stakeholders are willing to apply the experience and skills to achieve the project goals in clearly controlled, informed steps, which will help to manage cost, time, scope, risk and procurement. In this regard, one of the consultants said, *"Handling change requests needs application of project management in all the project's steps by all parties of the project. As long as we apply project management on the projects, we can reduce the amount of change requests and control them, because project management focuses on scope, time, cost, procurement, quality, and risk management." (Interviewee, Cons2-PA).*

Summary:

Two themes emerged from the analysis, which were the effect of culture on the handling of change requests, and handling change requests before they occur. The effect of culture includes two codes: uncertainty avoidance, and centralisation by the owner. These codes explained that there are two cultural factors that do not help stakeholders to handle change requests. The theme of handling change requests before they occur has several codes: study the project, value engineering, sufficient time for the bidding, contract, training course, administration for change requests and applying project management. These codes illustrated that stakeholders could reduce the frequency of change requests, if they applied the previous steps.

4.6.3 Handling change requests during the process

Handling change requests during the process is the second method. However, in this situation, the handling is just to accelerate the process, while the stakeholders work on their project. Three ways were indicated by the stakeholders to handle change requests at this stage as follows:

4.6.3.1 Clear information

Various respondents reported that vague and unclear information about change requests affects the time of completion and makes the process longer, because there will be several questions to be asked for clarification. Therefore, it is important to clarify all information in the application of the change request. In this consideration, one consultant said, *"Sometimes the information from the contractor team is not clear regarding the cost and type of change request, which leads the owner to ask for clarifications. Therefore, all information must be clear and available for all parties, because if is it not clear the process will take a long time between the stakeholders asking for clarifications" (Interviewee, Cons2-PB).*

4.6.3.2 Good communication

Some participants revealed that, as long as there is no administration responsible for change requests, it is important to have meetings between stakeholders regularly and at any time they are needed. This would facilitate clarification of any misunderstanding and make the process faster. In this situation, one contractor mentioned, *"We need regular and emergency meetings to sort out any problem in change request and this will help us to accelerate the process at the same time" (Interviewee, Cont1-PB).*

4.6.3.3 Delegation of decisions

Some respondents described that delegation of decisions by owners is important for accelerating the process of change requests. This delegation would be to the project manager in the case of minor changes, and to the representative of the owner for major changes. On this point, one contractor said, *"It is helpful if the project manager has the authority to make small changes on the project if the situation needs them, without going back to the owner and consultant. Also, it is worthwhile if the representative of the owner has the authorisation to take a decision instead of the owner with big changes, because most of our change requests take a long time to be approved." (Interviewee, Cont4-PA).*

Summary:

Handling change requests during the process was a theme that emerged from the analysis. This theme includes three codes, which explained that there is a possibility to accelerate the process of change requests. These codes are: clear information, good communication and delegation of decisions by the owner. The stakeholders asked for these steps because they were unable to prevent frequent change requests before they occurred. Therefore, participants wanted to accelerate the process of change requests by these recommendations.

4.6.4 Handling change requests after they occur

The last way of handling change requests is after they occur, when the concern is to accelerate completion. There were some recommendations from the stakeholders to the owner and contractor to handle change requests, as follows:

4.6.4.1 By the owner

There are three ways in which the owner can handle change requests after they occur: fast decision-making, financing and helping the contractor.

4.6.4.1.1 Fast decision

Several consultants and contractors revealed that most of the delay in the process of change requests is caused by the owner's bureaucracy. Therefore, they asked owners to accelerate their approval or refusal in making decisions. Also, they asked for the decision to be conveyed to them faster, by email or by telephone. In this consideration, one contractor said, *"The owner should give a fast decision, because we are already waiting for his decision to accelerate the process. Therefore, it is better to send the decision by email or by phone before the formal letter reaches us, because sending a decision in writing will take a long time."* ***(****Interviewee, Cont7-PB).*

4.6.4.1.2 Financial

Various stakeholders indicated that the funding for change orders can take as long as six months, because there is a standard procedure when the owner requests the funds from the Ministry of Finance. In this situation, sometimes the contractor is unable to execute the changes, because he needs more resources and more salary for the workers. In this regard, one contractor said, *"It is mandatory that the owner has the ability to pay for approval change order, because we need to pay new salaries and for new materials for some changes. However, the usual process of payment takes 6 months when the owner asks the Ministry of Finance to pay for the changes " (Interviewee, Cont5-PC).*

4.6.4.1.3 Help the contractor

Several consultants and contractors asserted that stakeholders should work as one team to push the project forward. For example, the contractor is sometimes stuck, due to waiting for some new resources required from abroad by the owner. If there is no help by the owner to bring them, the project will be delayed. In this consideration, one consultant pointed out, *"In this project, some change orders need foreign materials, which take a long time due to the process of customs. Therefore, the contractor needs some help from the owner's power and authority to bring these materials" (Interviewee, Cons2-PC).*

4.6.4.2 By the contractor

There are two ways the contractor can handle change requests after they occur; not waiting for approval of change requests, and being well prepared to take action immediately if a request is approved.

4.6.4.2.1 No waiting

Various stakeholders pointed out that the contractor should not stall the project while he waits for approval of change request from the owner. He must do other work on the project to save time. Otherwise the project will be delayed. As one contractor said, *"I did not waste time waiting the approval from the owner. Any*

contractor should continue with the project and execute other work until the approval of the change request, because if he waits longer the project will be delayed." (Interviewee, Cont1-PC).

4.6.4.2.2 Well prepared

Some stakeholders pointed out that contractors should be ready to make the new change by preparing procurements and workers when the owner sends his agreement. However, if he is not well prepared, the project will be delayed. As one contractor indicated, *"The contractor should be ready at any moment to start making any change, when the owner gives the approval. Thus, the worker and procurement should be ready" (Interviewee, Cont2-PB).*

Summary:

One theme that emerged from the analysis is handling change requests after they occur. This theme includes two sub-themes, which are handling change requests by the owner, and by the contractor. The first sub-theme includes three codes, which illustrated that it is possible for owners to help stakeholders to accelerate the process of a change request after it occurs. These codes include: fast decisions, financing and helping the contractor if he needs it. The second sub-theme is ways of handling a change request after it occurs, by the contractor. This sub-theme includes two codes: not waiting for approval of the change request, and being well prepared. It means that the contractor should not wait for the approval of the change request by the owner, but he must work on other parts of the project until the owner agrees to the change request. Also, he must prepare his workers and materials so that he is ready to execute the change order as soon as the owner approves it.

Figure 23 shows the constraints on handling of change requests, as well as the three ways of handling change requests, which are before they occur, during the process and after they occur.

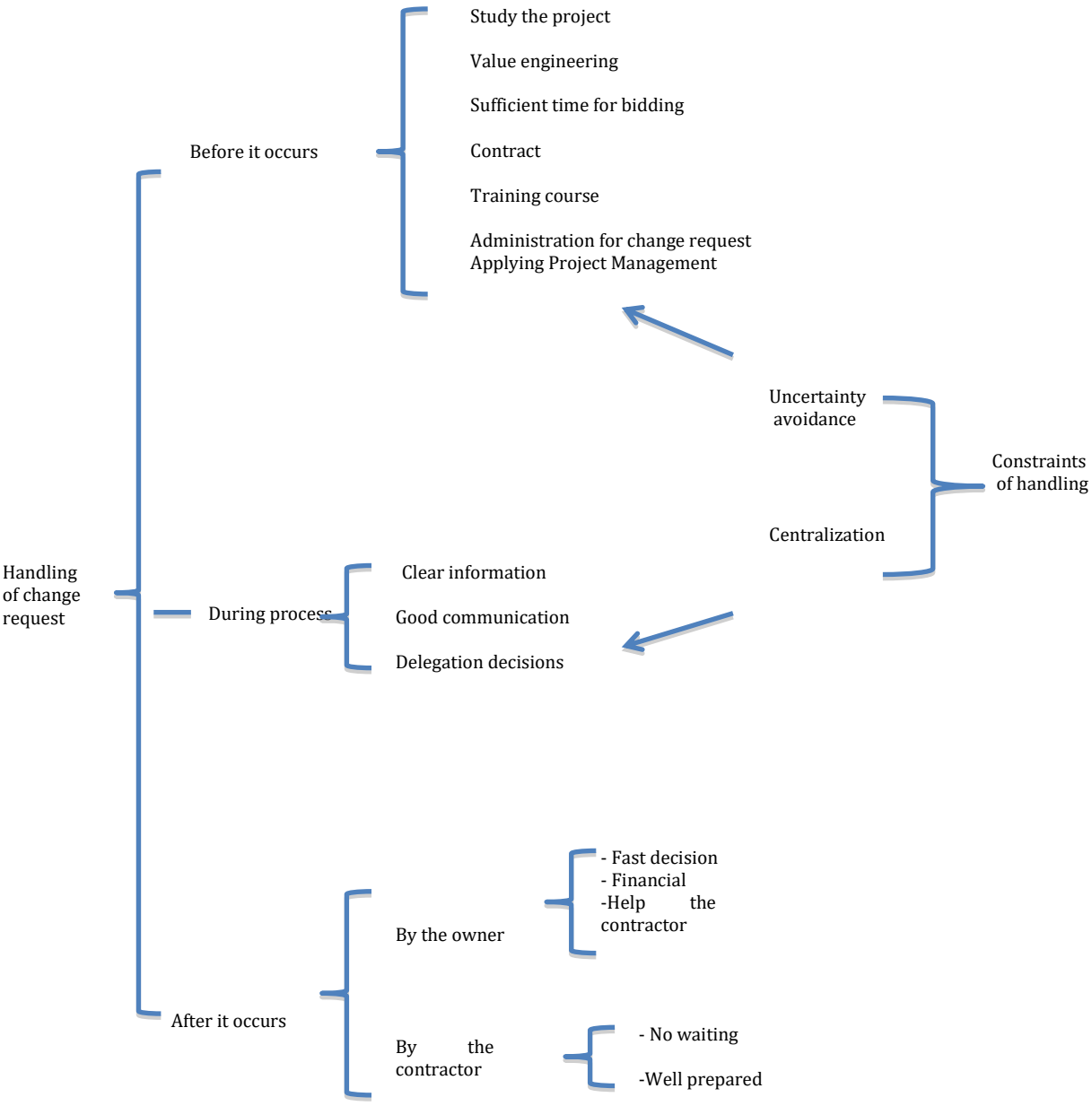


Figure 23 Handling of Change Requests

4.7 Overall results:

In this section a summary is presented of the main results in relation to each of the data categories, each category reflecting one of the research questions. The whole analysis is then depicted diagrammatically.

a) Conceptualization of change request:

The analysed data from various sources yielded the following results:

Interviews

1. The researcher compared all opinions of stakeholders to find out if there was one clear definition of the change request. However, he found disagreement and different perceptions of stakeholders in this regard, which led to important results describing some situations of change requests as follows:

a) Different opinions about change requests may lead to bad relationships and conflict among stakeholders. For example, some owners thought that a change request is a fault in the design when it was being prepared by the contractor (see conceptualization of owners) (4.2.1.1 Design, Interviewee O-PB). However, some contractors thought that change requests could be made by owners without justifications (see conceptualization of contractors) (4.2.3.5 Request, Interviewee Cont3-PD).

b) There are different concepts of the meaning of change requests among stakeholders. Some stakeholders gave definitions reflecting their needs or situation. This may lead to internal causes of change request, because everyone has his own justification for change requests (for example, see conceptualization of owners) (4.2.1.2 Improving project, Interviewee O-PB).

c) No one gave a complete definition of change requests, even if they talked about the same meaning. This could lead to causes of change requests because there was no general concept of the change request reflecting the real problem and its effects. Therefore, not understanding a problem will lead to repetition of the same problem, (for example, see conceptualization of contractors) (4.2.3.3 Project scope, Interviewee Cont4-PD).

2. All stakeholders used variation orders instead of change request.

Documents:

From the documents, it is clear that stakeholders used the terms change order or variation order, instead of change request, so there was no distinction between change request and change order. Therefore, when the researcher read the documents, he could not understand whether or not the document referred to a change request before it was approved, or a change order after it was approved. For example, in the introduction of the change request in document 1 the stakeholders said, *"The subject: Change order to add two lifts to every site" (Document 1)***.** Hence, the reader did not know if it was a request or an order.

b) Process of change request:

Interviews

1. The researcher studied the processes in all projects, and compared them to clarify similarities or differences and other aspects, which could help him to explore direct or indirect causes, effects, delay and handling of change requests. The researcher discovered that there was no written process for change requests in any of the projects, and no one knew the rules of the process; therefore, the process took longer. For this reason the researcher had to infer the processes to enable him to describe the similarities and differences among them.
2. The process of change request may emanate from the owner himself, or sometimes he gets a notice from his consultant or end-user, (see Process originated from owner) (4.3.1.1 Roles of Owner, Interviewee O-PD) Alternatively, the process may come from the technical team of the contractor, or the contractor himself, (see process originating from contractor (4.3.2.1 Roles of Technical Team, Interviewee Cons4-PA).
3. There was a difference between the processes of change request from one project to another. For example, there were different processes between project A and project C, even though the contractor was the same. These

differences indicated that there were no clear processes to enable stakeholders to track them. In addition, there was no time limit to complete these processes, which could have led to conflict between stakeholders regarding who was responsible for delay.

4. Sometimes, there was similarity between the functions of the stakeholders. For instance, the commercial team played the same role in projects B, C and D. Hence all of them were responsible for calculating the entire cost of the change. However, the function of stakeholders could change from one project to another.
5. If the owner asked for an initial and final study on the change request, the process could take longer (see the process of project A initiated by owner).
6. Delay could occur in the process of change request, if the owner spends a long time considering the report of the contractor (see process originated from owner) (4.3.1.1 Roles of Owner, Interviewee O-PD). However, delay in the process of change requests could emanate from the contractor, if he sends an unclear report to the owner, which could raise some questions and lead to a long process (see process originating from owner) (4.3.1.2 Roles of Consultant, Interviewee Cons7-PA). As a consequence of these delays and long process with more questions between them, the relationship could be badly affected.

Documents:

1. There were no committees responsible for tracking change requests; thus there were no sanctions for any delay in the process.

   The process could often cause delays of one or two years, and sometimes more than three years. For example, one change request in project C took more than two years (Document 4).

2. Some delays were based on errors by the contractor and his team in the reports on the change request, which resulted in the report being sent back to the contractor for clarification. For example, one construction manager asked the representative of the contractor for some clarifications in project C, thus, *" The list of materials for light fittings is approved and has already been*

released for procurement, while another with remarks needs clarification." (Document 9).

3. From the documents of all projects, it is clear that none of the projects used a special application form for change requests, except company B, which showed the researcher an application form as an example of their documents. However, this application was blank and without any information. Hence, the researcher was not able to consider it as an actual application for a change request.

   There were no regular meetings, and, in some projects, no attendance by the representative of the owner (Document 13).

c) Causes of change requests

a) Internal causes of the change request: -

<u>Interviews</u>

1. **By Owner**

a) Change of schedule:

The owner could accelerate the project to obtain its advantages as soon as possible (see internal causes-change by owner) (4.4.1.1.1 Change of schedule, Interviewee Cons2-PB).

b) Change in design:

- The owner requested some change in the design to improve the project and make it more suitable for him, and for his executives (see internal causes - change by owner) (4.4.1.1.2 Change in design, Interviewee Cons3-PC).
- The owner applied an out-of-date design to reduce the cost of the project (see internal causes - change by owner) (4.4.1.1.2 Change in design, Interviewee Cons2-PA).
- As long as the owners did not involve the end-user in the design, some

change requests will be raised by the end-user. Also, if the end-user is changed, the new end-user may ask for some new changes (see internal causes - change by owner) (4.4.1.1.2 Change in design, Interviewee Cont3-PA).

c) Change in specifications:

- The owner occasionally tended to make a change order to upgrade the project by replacing some specifications (see internal causes - change by owner) (4.4.1.1.3 Change in specification, Interviewee Cons1-PB).
- Sometimes the owner aimed to reduce the cost by changing the specifications, if the project was too expensive (see internal causes - change by owner) (4.4.1.1.3 Change in specification, Interviewee Cons2-PD).

d) Contract-related change:

- Incompleteness and ambiguity in the contract could increase change requests and manipulation by any of the stakeholders (see internal causes - change by owner) (4.4.1.1.4 Contract-related change, Interviewee Cont5-PB).
- Contractors could seek a change request in the design to expand the duration of the project and to earn more money, as a corrupt way of compensating themselves for loss in the contract (see internal causes - change by owner) (4.4.1.1.4 Contract-related change, Interviewee Cons8-PA).

2. By consultant

a) Change in design

- The consultant sometimes suggested creating a change request to improve the project (see internal causes - change by consultant) (4.4.1.2.1 Change in the design, Interviewee Cons1-PD).
- The consultant might also request change when he discovered an error in the design (see internal causes - change by consultant) (4.4.1.2.1 Change in the design, Interviewee O-PB).
- Some consultants asked for a change request to extend the project time to obtain a higher salary (see internal causes - change by consultant) (4.4.1.2.1 Change in the design, Interviewee Cont4-PC).

b) Change in specifications:

- A number of consultants required a change request in the specifications to improve the project (see internal causes - change by consultant) (4.4.1.2.2 Change in specification, Interviewee Cons6-PA).
- Some consultants made unnecessary requests to expand the duration of the project and to earn a higher salary (see internal causes - change by consultant) (4.4.1.2.2 Change in specification, Interviewee O-PB).

3. By contractor

a) **No project management**

A change request could occur if there is a failure to apply proper project management (see internal causes - change by contractor) (4.4.1.3.1 No project management, Interviewee Cont2-PC).

b) **Change in design:**

- The contractor may seek a change request in the design to improve the project.(see internal causes - change by contractor) (4.4.1.3.2 Change in design, Interviewee Cont3-PA).
- The contractor might demand a change request because of some deficiency in the design (see internal causes - change by contractor) (4.4.1.3.2 Change in design, Interviewee Cont2-PC).

c) Change in specifications:

- Change request in the specification could emerge when the contractor wants to improve the project (see internal causes - change by contractor) (4.4.1.3.3 Change in specifications, Interviewee Cons2-PB).
- The contractor might seek a change request in specifications if certain resources are unavailable locally (see internal causes - change by contractor) (4.4.1.3.3 Change in specifications, Interviewee Cont5-PB).
- Some contractors tried to make changes in the specifications to reduce the cost of the project, to help the owners (see internal causes - change by contractor) (4.4.1.3.3 Change in specifications, Interviewee Cons1-PD).

- Corruption might occur in specifications as a way for the contractor to compensate his loss in the contract (see internal causes - change by contractor) (4.4.1.3.3 Change in specifications, Interviewee Cont3-PD).

b) External causes of the change request: -

1. **Supply problems:**

If the supplier is changed, the specification may change (see external causes) (4.4.2.1 Supply problems, Interviewee Cons2-PB).

2. **Technological development:**

Change in the technology of daily life will change the specifications of technology required in the project, if it is a condition of the contract (see external causes) (4.4.2.2 Technological development, Interviewee Cons5-PB).

3. **Logistical reasons:**

Logistical delay might lead to a request for a change in the specifications from foreign to local supplies (see external causes) (4.4.2.3 Logistical reasons, Interviewee Cont3-PC).

4. **Government regulation:**

Strict regulation from the government might reduce illegal workers on the project, which might affect the ability to realise the plan, resulting in several change requests in the design and specifications (see external causes) (4.4.2.4 Government regulation, Interviewee Cont3-PC).

5. **Conflict with some government departments:**

Some government departments asked for changes, for example for compliance with safety requirements, which could affect the design and specification (for example, the Civil Aviation department asked to reduce the height of a minaret (see external causes) (4.4.2.5 Conflict with some government departments, Interviewee Cont5-PC).

6. **Weather conditions:**

Bad weather may affect a project. For instance, dust in Saudi Arabia may change the specification of paint used in a project (see external causes) (4.4.2.6 Weather conditions, Interviewee Cont2-PD).

Documents:

1. Change requests may occur due to a change of end-user. For instance, in project A the new end-user asked for changes in the design, such as cancelling four rooms and making them into a hall (Document 10).

2. If the owner is changed, he may ask for new change requests. For example, the new owner in project C asked for the offices of all managers to be made larger (Document 12)

d) The effects of change requests:

Interviews

Direct effects:

a) Direct effects of change requests could be positive, as follows:

1. Sometimes change requests may save time for the owner and the contractor by making changes in the design or specifications. However, most of the time, change requests caused delay (see the effects of change request - Direct effects – Positive) (4.5.1.1.1 saving time, Interviewee Cont1-PC).
2. Financially, change requests can reduce the cost for the owner. However, change requests in these projects caused cost overrun (see the effects of change request - Direct effects – Positive) (4.5.1.1.2 Financial, Interviewee Cons2-PA).
3. The owner and the end-user can get what they need (see the effects of change request - Direct effects – Positive) (4.4.1.1.3 Owner need, Interviewee Cons1-PB)
4. The project will be of good quality (see the effect of change request - Direct effects – Positive) (4.5.1.1.4 Quality of project, Interviewee O-PD).

b) The negative direct effects of change requests are as follows:

1. Time overrun for the project delivery, because there is more work in the project.(see the effect of change request - Direct effects – Negative) (4.5.1.2.1 Time overrun, Interviewee Cont3-PB).
2. Cost overrun for the owner, because there are more materials, change in specifications, and higher salaries for the workers. Also, a change request may cause overrun to the contractor if he does not get funds for the change request from the owner (see the effects of change request - Direct effects – Negative) (4.5.1.2.2 Cost overrun, Interviewee Cons2-PB).

Potential effects:

1. The suggested positive potential effects of change requests are as follows:

a) A good reputation for the consultants and contractor if the project succeeds due to the change request (see the effects of change requests - Potential effects –Positive) (4.5.2.1.1 Good reputation, Interviewee Cont6-PC).
b) Reducing maintenance if the change request exchanges poor specifications and materials for better quality (see the effects of change requests - Potential effects – Positive) (4.5.2.1.2 Reduce maintenance, Interviewee Cons2-PC).
c) Good experience for the contractor and consultant, because change requests are usually for solving dilemmas (see the effects of change requests - Potential effects – Positive) (4.5.2.1.3 Experience, Interviewee Cons4-PA).
d) A good relationship between the stakeholders, because their changes can progress the project (see the effects of change requests - Potential effects – Positive) (4.4.5.1.4 Good relationship, Interviewee Cons1-PD).

2. The negative potential effects of change request are as follows:

a) Slowness in the productivity of the stakeholders based on frequent change requests, because some changes are not logical (see the effects of change requests - Potential effects – Negative) (4.5.2.2.1 Slow productivity, Interviewee. Cont3-PB).
b) Excess administrative work for the contractor and consultant, because sometimes the new work needs new workers, materials and time (see the

effect of change requests - Potential effects – Negative) (4.5.2.2.2 Excess work, Interviewee Cont3-PA).

c) Indirect cost to the contractor when he loses opportunities to take on other contracts and projects, because of delay in completing the current project (see the effect of change requests - Potential effect – Negative) (4.5.2.2.3 Indirect cost, Interviewee Cont2-PA).

d) If the project is delayed by frequent change requests, the reputation of the contractor and consultants will be affected (see the effects of change requests -Potential effects – Negative) (4.5.2.2.4 Bad reputation, Interviewee Cont6-PC).

e) An unsuitable change order will affect the project negatively, which will have an impact on the relationship between the stakeholders, especially if the owner does not accept others' opinions on his change order (see the effects of change requests - Potential effects – Negative) (4.5.2.2.5 Bad relationship, Interviewee Cont2-PB).

Documents:

1. Delay will occur, because a change order may affect other work on the project. For example, when the owner asked for widening of the managers' offices in project C, the contractor indicated, *" This order will affect the project negatively in terms of the delay, because we will stop working in the electrical and mechanical work and we will change our plan." (Document 12).*

2. Extra cost on site. For instance, when project C added CCTV to the project, it had to change the electrical system (Document 13).

e) Handling frequent change requests

Constraints on handling - Cultural practices:
Interviews

Handling of change requests in Saudi Arabia is restricted and affected negatively by several cultural factors, as follows:

- **Uncertainty avoidance**

The environment of work in Saudi Arabia does not accept any new change in the work. For example, there was no complete application to project management on all projects in the study (see cultural practices) (4.6.1.1, Interviewee Cons2-PA).

- **Centralisation of decision-making by the owner**

There is no authority for approval of change requests by the contractor, consultant, or the representative of the owner, whether or not the request is for a minor or major change. Centralisation will lengthen the time of the change request and is not helpful (see cultural practices) (4.6.1.2 Centralisation, Interviewee Cont5-PC)

Handling change requests:

Interviews

1. Giving a clear and complete meaning of change requests may contribute to understanding the causes of change requests and handling them.
2. It is important to distinguish between change request and change order or variation order, to track and understand the application easily, because there is a difference between an order and a request.
3. A formal process, with limited time, will help stakeholders to accelerate the process and reduce the conflict.
4. The ways of handling change request can be before they occur, during the process, and after they occur.
5. Handling change requests before they occur is the best option, because it reduces their frequency. The stakeholders did not apply any method to the handling of this situation. However, they suggested several steps from their previous experience within the same culture, to reduce the frequency of change requests as follows:

a) It is very important to give sufficient time for tendering to give the contractors a chance to decide whether or not they will be able to execute the project properly. Some contractors try to win the instant bidding. However, they are shocked that there are problems in the design and specifications on the ground, which prompt them to seek for change requests (see Handling change request - before it occurs) (4.6.2.3 Sufficient time for bidding, Interviewee Cons1-PD).

b) A strict contract, such as FIDIC should be applied in Saudi Arabia with conditions set for change requests to avoid time and cost overrun and to safeguard the rights of stakeholders (see Handling change request - before it occurs) (4.6.2.4 Contract, Interviewee Cons1-PB).
c) Specify a designated administration consisting of representatives of the owner, contractor, and consultant to determine and accept useful change requests and to control them from the beginning to the end, with the authority to approve (see Handling change request - before it occurs) (4.6.2.6 Administration for change request. Interviewee Cons2-PD).
d) Careful study of the project by the owner, end-user, and consultant with requirements specified in a written paper and sent to the designer. See Handling change request- before it occurs (4.5.2.1 Study the project, Interviewee O-PA).
e) Following that, all stakeholders should have a training course to discuss the project in several aspects, such as design specifications, and clarify misunderstanding for a good start (see Handling change request - before it occurs) (4.6.2.5 Training course, Interviewee Cons6-PA).
f) Then, value management will help stakeholders to reduce the amount of change requests, because value management focuses on choosing the best design and specifications with a good quality and function (see Handling change request - before it occurs) (4.6.2.2 Value engineering, Interviewee Cons1-PC).
g) Applying project management to all projects will help to save time and achieve the target within the timescale. Also, applying project management is helpful to manage the cost, quality, procurement and risk. All project management processes are helpful to reduce the frequent change requests (see Handling change request - before it occurs) (4.6.2.7 Applying project management, Interviewee Cons2-PA).

6. The second method to handle change requests is handling it during the process. This method is to accelerate the process, not to reduce the quantity. They found this way of handling requests suitable and effective, because they had tried some of these solutions in some change requests for these projects. There are three

recommendations that will help to accelerate the process of change requests, as follows:

a) All stakeholders should clarify the information and the details of change requests, especially the contractor team, in terms of the cost and type of change. If there is any vagueness in the information in the change request, several replays between the owner and contractor will take a long time until the information becomes clear (see Handling change request - during the process) (4.6.3.1 Clear information, Interviewee Cons2-PB).
b) Centralisation in the decision-making delays the process of change request; thus it is important that the owner gives the authority to the contractor to make the small changes, if needed, without affecting the design or the quality of the specification (see Handling change request - during the process) (4.6.3.2 Good communication, Interviewee Cont1-PB).
c) Also, it is important to give the representative authority to approve any change request, because the owner is usually busy (see Handling change request - during the process) (4.6.3.3 Delegation the decision, Interviewee Cont4-PA).

6. The third way of handling change requests is to handle them after they occur. Again, the aim of this type of handling is to accelerate the process on the part of the owner and contractor. Also, some stakeholders decided that this way of handling change requests was effective because they succeeded with some change requests in these projects. However, they did not apply these solutions in all change requests as a general rule.

By the owner:

a) Instant decision: When the consultant studies the change request and sends it to the owner, the owner should decide instantly and send the decision by phone or email pending the formal written approval (see Handling change request - after it occurs - by owner) (4.6.4.1 Fast decision, Interviewee Cont7-PB).
b) Financial: If the owner approves the request, it is important to provide the contractor with the means for the change, because sometimes the contractor is

unable to perform the work without funds, and the project will be delayed (see Handling change request - after it occurs - by owner) (4.6.4.2 Financial, Interviewee Cont5-PC).

c) Help the contractor: The contractor may need some help from the owner, especially if the owner is a member of the government. For example, if the request needs materials to be imported, the contractor may need support to accelerate the process of customs and bring them from the airport (see Handling change request - after it occurs - by owner) (4.6.4.3 Help the contractor, Interviewee Cons2-PC).

By the contractor:

a) No waiting: The contractor should not wait for approval of the change request by the owner, and he must work on other steps of the project until he gets the agreement. Otherwise the project will be delayed (see Handling change request - after it occurs - by contractor) (4.6.4.2.1 No waiting, Interviewee Cont1-PC).

b) Well prepared: The contractor should prepare himself and his workers and procurement to be ready to act if he gets approval of change requests (see Handling change request - after it occurs - by contractor) (4.6.4.2.2 Well prepared, Interviewee Cont2-PB).

The following diagram, Figure 24, shows at a glance the whole analysis, which facilitates a comprehensive view of the issues surrounding change requests in the Saudi context, as uncovered and interpreted in this research. The interpretation includes such project documents as were made available, but not project contracts, which were withheld for confidentiality reasons. The main source of the interpretation, therefore, is the perceptions of the various stakeholder groups for the four projects. The five ellipses depict the five main data categories addressed in this research, each one being related to one of the research questions. For the ellipse representing the causes, effects and handling of change requests, the text branching from the ellipse shows the relevant themes (e.g. internal and external causes, direct and indirect effects, and handling before, during and after). These can be further classified into sub-themes (e.g. effects are classified into positive and negative) and codes. Arrows indicate relationships between elements, whether within or between

categories. For example, it can be seen that ‘misunderstanding of change requests’ contributes to both internal causes of change requests and negative effects, such as a bad relationship between the parties. The diagram enables the complexities of change request issues to be grasped more simply; not only are individual elements identified, but they can be located within the web of interacting factors.

In the next chapter, the outcomes of the research will be discussed in light of the literature reviewed earlier in the thesis.

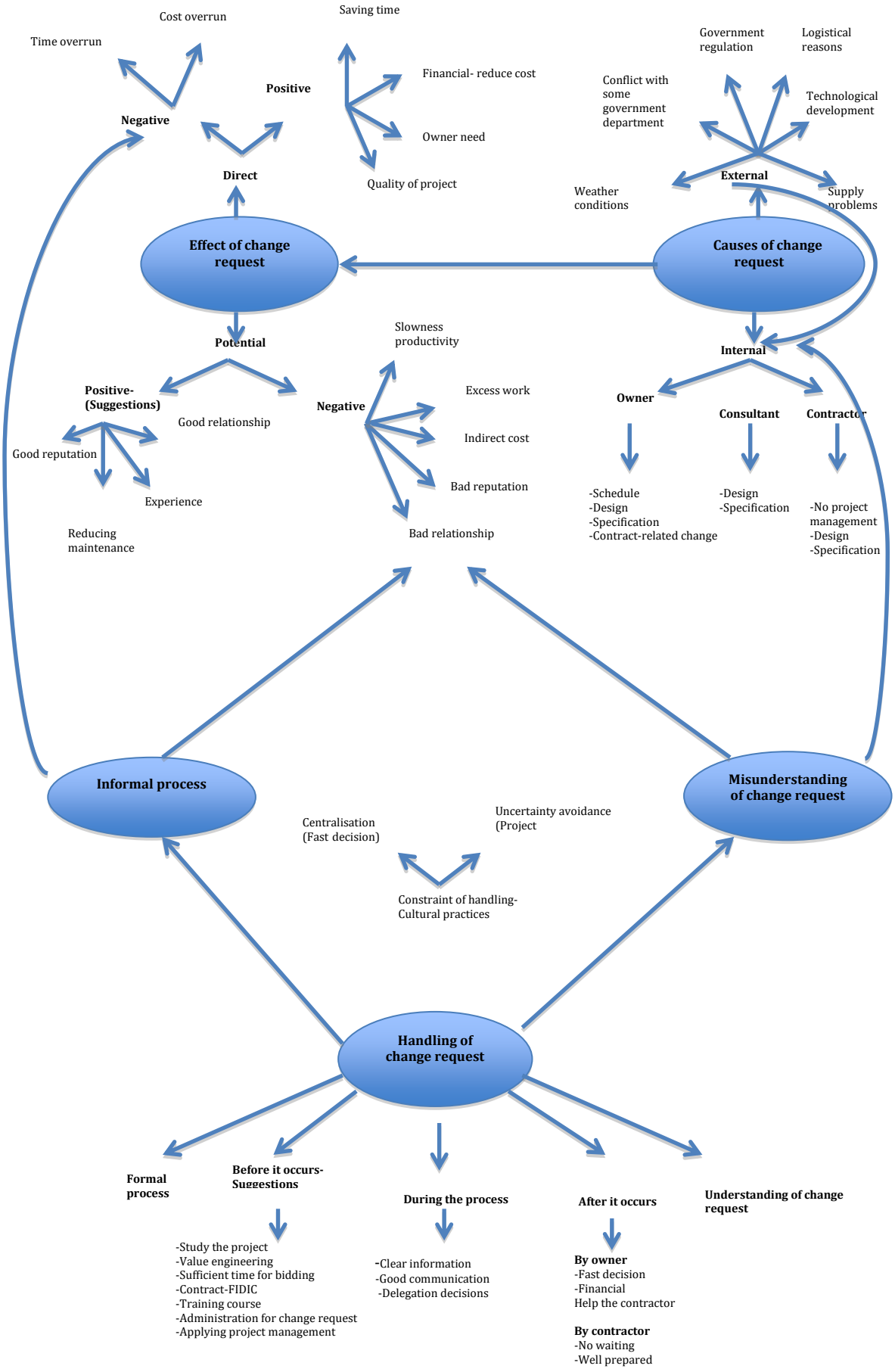


Figure 24 Model of the Analysis

Chapter 5: Discussion

5.1 Introduction

This chapter presents a discussion of the findings from Chapter Four, obtained from a critical analysis of interviews and the secondary data (documents) provided by the companies participating in the study. The discussion is guided by the research questions that were set out in Chapter One and further structured, based on the previous model of findings and analysis. This chapter also presents a suggested model of the handling of change requests.

5.2 Research Question I: How do stakeholders in Saudi Arabia conceptualize change requests?

To solve any problem, it is important to understand it properly. Therefore the researcher started from scratch and investigated how change requests were understood by stakeholders.

Stakeholders' conceptualizations of change requests showed inconsistency and lack of clarity, so it was not possible to identify agreement among the interviewees on one definition of change request. For example, some participants considered change requests as just new work that increases the scope of the project. As O-PD said, "A change request leads to an increase in the scope of the project". However, this limited description of the change request is inconsistent with indications in the literature of other kinds of change. For example, Ndihokubwayo (2008) notes that "variation orders involve adding, removing, changes". O-PA agreed with this opinion that a change request is "a request to add or reduce", but this perspective still falls short of the full meaning. When any project is executed by stakeholders, they need to understand any change, but if that change is understood as just a change by the owner to improve the project (as suggested, for example, by O-PB) the perspective is still not clear, despite being consistent with Chan and Kumaraswamy's (1997) comment that 'change orders' may arise from "client-initiated variations or

necessary variations for the works". This does not help workers, who need to understand what type of changes the client wants, and why and so on. The most general description of change requests in the findings was as a modification of the project's time and cost (e.g. Interviewee Cont-PC in section 4.2.3.6). Similarly, Rashid et al. (2012) defined it as a change in the "date or a change in the cost of work". However, it is important to answer other questions, such as, does it increase or decrease the time or cost? Who is responsible for this change? Is it agreed by stakeholders? It is evident that there is no complete and clear definition of the change request among the stakeholders. Different concepts and opinions in this regard have important implications; three main themes emerging from the findings are discussed in turn, below: the tendency of conceptual confusion to encourage proliferation of change requests; the conflict among stakeholders due to their different understanding with regard to change requests, and the potential for misunderstanding (for example as to whether or not a request has been approved) caused by terminological confusion and inconsistency.

5.2.1 Frequency of change requests

One interesting finding concerned the frequency of change requests. The figures provided by participants were astonishingly high. For example, one of the interviewees said, "In the beginning of the project, I dealt with 5-6 change requests a day" (Cont3-PB). Moreover, a review of project documents revealed that in project A, the number of change orders was 2,160, even though the project was not completed, so more change requests might be expected. These changes occurred for several reasons, but one factor in the frequency of change requests appears to be different understandings of the meaning of change requests (Section 4.2). When a change request is understood as just a change, as was believed by some owners and contractors (e.g. Cont2-PC), it becomes easy to do it several times. If any stakeholders think that a change request is just a request for any change, the likelihood of frequent change will increase, because there were no strict criteria for all dimensions of these changes. Such an informal approach is in contrast to the detailed written instruction referred to in literature, e.g. Oladapo (2007) Even with such a description however, over-simplification may still lead to excessive frequency of such requests; moreover, as such a simplistic definition still leaves unanswered questions such as the type of change, the necessity for it, whether there is a

justification and whether the person proposing the change is authorized to do so. In this respect it is notable that participants disagreed as to which party or parties made the change requests. This is in contrast to the principles set out in the literature, which assume clearly defined roles, accountabilities and procedures (for example,Charoenngam et al., 2003; Gardner & Block, 2004).

Therefore, change requests may occur frequently, based on differences in conceptualization and understanding among stakeholders, which the literature does little to clarify. If stakeholders believed that a change request is just " the beginning of the change"c (Cont1-PD in section 4.2.3.5) and when everyone has his own justification for making the change, changes may occur many times, as misunderstanding of any problem will lead to the repetition of the same problem.

5.2.2 Conflict among stakeholders

Another important finding is that conflict between stakeholders may occur based on misunderstanding of the change request (Section 4.2). If there is no definition with full information regarding responsibility and legitimate reasons for change requests, it may lead to frequent change requests and conflict between stakeholders, because there is no convincing reason to apply the change. The findings showed that stakeholders' understanding of change requests reflected their different interests, so that some parties saw other parties as mainly responsible for causing change requests, and cast doubt on their motives. For example, contractors might attribute owners' requests for change to caprice or self- aggrandisement (e.g.Cont3-PD, section 4.2.3.5)- Conversely, owners may attribute the need for change to the unsatisfactory work of contractors (e.g. O-PB, section 4.2.1.1). A similar view is expressed by Arain and Pheng (2005).

As the above examples illustrate, stakeholders often define change requests as a problem caused by another party. Oladapo (2007) said such requests arise from the 'architect'. In another situation the request may be seen as a sense of achievement, as an owner believes that he is trying to 'improve the project' (e.g. O-PB in 4.2.1.2). However, others suspect him of trying to make the change based on his 'desire' (Cont3-PD). Given their different needs and motivations, the likelihood of frequent change requests may continue between stakeholders, and conflict may appear between them, especially when change order is informal and perceived as

unjustified, and if it is seen to prejudice the rights of other parties. As one contractor said, “It may prejudice the right of the contractor if the request is not justified and not official. If a change request is made by the contractor, it will be to raise the efficiency of the project after studying the plans and contracts”. (Interviewee, Cont1-PA). Such conflicts of perceptions and interests are consistent with stakeholder theory (section 2.6.1.3) have been highlighted by a number of authors (Rantanen et al., 2007; Freeman, 2011) conflicts between owner and contractor are especially common in the Saudi context.

Based on the differences in the definition of change request, which contribute to bad feeling between stakeholders in the findings and based on the hundreds of claims mentioned in the project documents, it appears that misunderstanding of change requests may lead to conflicts and deteriorating relationships between stakeholders, disruption of project achievement (Olander & Landin, 2008) and even costly litigation (Lee et al., 2010).

5.2.3 Potential for misunderstanding

The most obvious finding to emerge from the analysis of conceptualization of change request and the literature review, is the frequent, indiscriminate use of the words ‘change order’, ‘variation order’ and ‘change request’. This terminological confusion may lead to vagueness for workers and researchers, as well as general readers.

Before starting to look at this in detail, it is important to understand the difference between an order and a request. An order means “a confirmed request by one party to another” (BusinessDictionary, 2016). However, a request is "an act of asking politely or formally for something"(Balci, 2009). These definitions are consistent with Stasis et al. (2013), who note that “a change request denotes the request for a variation, while the order characterizes the employer- authorized instruction for it” (p.178).

The evidence, however, was that stakeholders did not differentiate between these terms and there is no rule to govern this situation. This confusion is illustrated by one owner’s view that “a change order is a request to add or reduce a part of work from

the project scope" (Interviewee, O-PA). This opinion seems consistent with that of Desai et al. (2015) who used the word 'orders' to cover alteration to the scope of work. Similarly in the secondary data (project documents), the words 'change order' are used in both senses, of request and order. For instance, one document stated: "The subject: Change order to add two lifts to every site" (Document, 17). In this case, it is not clear whether this is a request for change, or an order to make the change after approval.

Conversely, other definitions used the term 'request' instead of order, as when one owner said, "A change request leads to an increase in the scope of the project" (Interviewee, O-PD). Again, the problem is the usage of one word (in this case 'request') in both senses, when stakeholders ask for a change and when it is approved. This reflects confused use of the terms 'order' and 'request' in the literature (Cleland, 2004), despite some effort to specify the formal instrument and stakeholder agreement involved in an order (AIA, 2007).

Other stakeholders used the word 'variation' instead of change order or change request and this appeared in the documents of project D, which mentioned: "Regarding the subject variation to implement the change of lighting fixtures, we hereby attach contractor's confirmation of receipt of your variation instruction" (Document 9). Although consistent with the usage of some authors, such as Arain and Pheng (2005) this is confusing, because the word 'variation' means the change, but it is unclear whether the change is approved or not.

Moreover, other stakeholders used the term 'variation order', which has the same meaning of making changes in the project, (for example Cons2-PB, section 4.2.2.2). This usage is consistent with some authors cited in Chapter Two, as when Ndihokubwayo's (2008) use of 'variation orders' in his previous definition, meant addition or removal of some project items. In fact the words, variation and change are often used interchangeably in the literature (e.g.Charoenngam et al., 2003; Keane et al., 2010), while Arain and Pheng (2005) use 'variation', but define it in the same way that Stevens (2002) defines 'change'. In the example cited above, when the expression was used by one of the consultants, he said, "A variation order is a request by any party and accepted by them". (Interviewee, Cons2-PB). Although the interviewee says the 'request' is 'accepted', it is not clear whether or not this is a

request or a formally approved order. Both in interviewees' definitions and in documents, there was no distinction between the request and the order. Therefore, it is important to use clear and consistent terminology, to clarify whether a change is a request or an order. The Project Management Institute tries to avoid terminological confusion by using the term 'approved change request' (PMI, 2008) while Stasis et al. (2013) distinguish between a request and an order. Nevertheless, stakeholders and authors still use a variety of terms: change order, variation order and change request, and often confuse them.

In view of the evident need to resolve this confusion, the researcher contributes by suggesting a clarification of the difference between these terms by choosing just two terms, 'change request' and 'change order'. Change request is used to mean the request for change by any of the stakeholders, such as owner, contractor, consultant, architect and project manager; it is not confined to one party. When the request is approved by owner, it becomes a change order. Such definitions would be consistent with the PMI's (2013) concern to distinguish whether a request has been approved or not; however, the use of order to mean an approved request is more in line with the dominant usage in the literature (see the summary Table 2 in section 2.5.1. for example) .However, this general definition does not accord with some aspects of current practice in the Saudi context. In Saudi Arabia, change requests are approved only by the owner. Also, in Saudi Arabia, sometimes the owner makes a direct decision by issuing change orders without change requests, because, as the owner of the project, he believes he has the authority to make such decisions unilaterally. This practice may be one of the factors that has contributed to the current confusion. In the concluding chapter, the researcher will suggest a new definition to describe change requests in detail and their potential impact (positive or negative) on the project.

5.3 Research Question II: How do change requests occur in large building projects in Saudi Arabia?

A review of project documents revealed that change request procedures may cause delay of between one or two years, and in some cases more than three years (as noted

in document 4). These figures were astonishingly high and may cause failure of the projects. It was noticed that none of the projects in this study followed standardized, systematic application procedures, and there was confusion between the definitions of 'change order', 'change request', 'variation order' and 'variation' used in letters, which could cause delay in these processes. This inconsistency of practice is in sharp contrast to theoretical prescriptions and empirical reports in the literature. For example, Charoenngam et al. (2003), whilst acknowledging that procedures may differ according to the nature and circumstance of the project, nevertheless, advocate the use of an application diagram, that is, a flow chart or similar, clearly setting out the procedures to be followed in raising, evaluating, approving and implementing change requests, with the personnel responsible for each activity specified; they provide an example of such a diagram, which was reproduced in Chapter Two, section 2.5.3

It was noted by participants that change requests may be initiated by the contractor, architect, consultant or project manager (section 4.3). The findings showed that the process is sometimes initiated by the owner as a direct order to make the change, because he is convinced of his idea and determined to make the change, as mentioned in PA. Such a situation departs from the assumption, inferred in section 2.5.1., that a change order is preceded by a request and an approved process (e.g.Stackpole, 2013). The finding also differ from previous literature, which shows change requests as being initiated by contractor and engineer, not by the owner (Charoenngam et al., 2003; Lee et al., 2010). This may to some extent be explained by the high power distance (Hofstede, 2016) in Saudi culture, whereby it is accepted that certain individuals, by virtue of their position, connections and influence, are able to exert autocratic control and command. However, in other situations, the owner suggests a change as an idea, not as an order, asking other stakeholders whether or not the change is acceptable. Thus, if they recommend him to do so, he will approve the change, as noted in PB. This reflects more of a consultative procedure, and may reflect stronger adherence to collectivist values, in Hofestede's terms.

Both interviews and project documents indicated that there were no clear tasks or functions to be followed by every participant from one project to another. This was

apparent in the differences observed in the project process mapped in section 4.3 in the researcher's diagrams, Figures 12-19. Therefore, in some projects, it is possible that the contractor can initiate a change request if it is required. However, he may not have the same authority in another project. This may lead to confusion and damaged relationships, because there is no description for every task which may affect the timescale of the process. The evidence showed that confusion over roles and responsibilities can cause or exacerbate stakeholder conflicts related to different perceptions and priorities (consistant with the warning of Cleland, 1986), and the resulting delays can interfere with project closure, as previously reported by Al-Sedairy (1994). One way of managing such conflicts, therefore, would be to have clear definition of roles, authority and procedures. The need for clear description of every task has been highlighted by a number of authors, e.g. Gardner and Block (2004); Lee et al. (2010); and Charoenngam et al. (2003) who offered a variety of charts and protocols exemplifying formal procedures and lines of communication. As a contribution of this research, the author developed diagrams of the processes followed in the examined projects (see Figures 12-19 in Chapters Four, section 4.3.1), which illustrate the procedures and stakeholder functions involved in each case. These enable comparison of similarities and difference among the projects, and also make it easier to analyse, discuss and answer the second question. In this regard, the processes of change requests observed in the projects examined have important implications, as follows:

5.3.1 Informal process

It is noticeable that all participants used ordinary letters instead of illustrated figures or special pro formas when making change requests. Therefore, there were no rules for change requests in any projects, and no clear processes to enable stakeholders to track them. Basically, it was extremely difficult to even understand these processes before the researcher suggested the diagrams referred to above. Also, sometimes the participants dealt with oral requests, which led to conflict and troubled relationships, because no one was willing to take the responsibility for these changes at the end of the project. This is contrary to the practice highlighted by a number of authors, such as Charoenngam et al.(2003), who illustrated the change request process in a diagram (see Figure 5 in Chapter Two). It also contravenes the principle highlighted by Lee et

al. (2010) that it is important to document all steps in written form, especially for public projects. Although, sometimes, authors accept the possibility of oral requests in special cases, which need acceleration, nevertheless, they still argued that an oral request should be confirmed formally in writing, as depicted in Figure 6 (Charoenngam et al., 2003). Moreover, they acknowledged that it is unlikely that all processes associated with a project can be documented (Lee et al., 2010). Despite these limitations, a formal process is important to build a picture of the change request from the beginning to the end, whether in a table or other form, to show the stakeholders all the steps of the new changes. Lee et al (2010) suggested a way to tabulate the process, as shown in Table 3. Lack of a clear, documented approval process and formal review may lead to scope creep, due to ad hoc acceptance of requests without critical examination and clear criteria (Turk, 2010).

Both interviews and project documents revealed that a change request starts with a letter from one of the stakeholders, without more detail. The process takes a long time because of negotiations and referrals between the architect, contractor and consultant before a proposal is sent to the owner for initial agreement. Then, the owner asks about the details of cost and time of this change, if he is satisfied with the idea (see PA initiated by the contractor, section 4.3.1). The ad hoc nature of these negotiations contradicts accounts and recommendations in PM literature. For example, Yayla and Tas (2010) suggest that, before a change order is prepared, it is important to identify the problem as a first step, because understanding the problem is a part of the solution; then to determine the requirement and causes and solutions. After that, the cost of the change and its likely impact should be determined between the architect/engineer and contractor; otherwise, delay may occur in any project. In other words, they advocate a systematic sequence. Therefore, the research contributes by identifying a reliance on informal procedures, contrary to descriptions in the literature, and showing that a delay in the process of change requests may occur as a consequence of the reliance on informal processes, which leads to delay in the approval of change requests and delay to the project in general.

5.3.2 Delay in the process

The findings revealed that delay in the process may be caused by stakeholders, in

several ways. For example, when the contractor sends an unclear report on a change request to the owner, it will raise questions from the owner and lead to a long process of inquiry and response (see Interviewee, Cons7-PA). There is no doubt that the process needs some input from the stakeholders; however, the unregulated nature of these inputs in the examined projects contrasts with the literature, which makes clear that these inputs should be within acceptable parameters and useful for the project, with a clear time-frame, without mistakes and ambiguities that waste time and raise costs. For example, in this regard, Hammer et al. (1993) define a process as a sequence of actions, initiated with some inputs and clear processes, leading to a significant outcome for the client, until the time and cost implications and so on are approved and formally issued as a change order.

Also, the process may be delayed, because the owner's approval of change requests sometimes takes a long time when he asks for both initial and final studies on the change request, and spends time considering the reports by the contractor (see Interviewee, O-PD). This may lead to conflict between the owner and contractor, based on the lengthy negotiations between them. This supports Kasen and Oblas's (1996) contention that often, change requests raise difficulties related to timing issues between the time of identification of the change and the scheduled date for starting the work. However they did not specify the problems occurring between these periods.

Another problem mentioned in the findings is centralisation of authority with the owner, which affects the timing of the process (e.g. Cont5-PC, section 4.6.1.2). It is noticeable in owners making decisions and approving delay change requests, as one consultant indicated (Cons2-PA). Hofstede's high score for Saudi Arabia's high Power Distance implies acceptance of the tendency towards centralisation and autocratic decision-making (Hofstede, 2016). Therefore, the owner has the authority to initiate a change request or change order directly. This is in contrast to the literature, in which owners in general are not responsible for initiating change requests. Also, according to the participants, the owner is the only one who has the authority to approve the change request. It was observed during visits to the companies that owners, who are usually government ministers, are often not available, due to their other duties, causing delay in approval of change requests. Without a timescale for change requests, the owner may take the opportunity to

delay decisions, which may affect the relationship between stakeholders.

In addition, both in interviews and project documents (e.g. Cons2-PD, in section 4.6.2.6; document1-PA), it appeared that the process may be delayed because there is no committee or authorized body responsible for tracking change requests. Delay in change requests may be caused by the owner (O-PD). However, consultants thought that delay in change requests may occur due to the contractor (Cons7-PA, section 4.3.1.2). In the absence of a tracking procedure, no one can determine the absolute responsibility for delay. This is in contrast to the PMI's advice that a committee be constituted which is responsible not only for tracking change requests, but also for taking the authority to accept or reject change requests. They call this a Change Control Board, which is defined as a "formally chartered group responsible for reviewing, evaluating, approving, delaying, or rejecting changes to the project, and for recording and communicating such decisions" (PMI, 2013).

The research contributes by suggesting that conflict among stakeholders may occur when projects are delayed for several reasons: delays caused by the owner when asking for clarification or based on his centralisation of decision- making to approve a change request; delay caused by contractors sending vague or misunderstanding information, and absence of a committee responsible for tracking and reviewing change requests.

5.4 Research Question III: How are change requests caused in large building projects in Saudi Arabia?

A review of the findings indicates that there are several reasons for change requests, divided into two main categories, internal causes and external causes.

5.4.1 Internal causes of change requests

Internal causes may be introduced by one of the stakeholders of the project.

5.4.1.1 By Owner

A number of interviewees indicated that the short time allowed for tendering is one of the causes of change requests by the owner, because contractors trying to win the contract will submit hasty, ill-considered tenders, which prove impossible to fulfil satisfactorily (see, for example, Cons1-PD in section 4.4.1.1.4). This problem is consistent with concerns expressed in the literature. Holt et al. (1995) pointed out the problem of owners choosing the lowest bidder, which may not be the best contract. When the contractor tries to win the contract hastily, he may only later find problems in the design, leading to mistakes and the need for corrective change requests during the execution stage. The Saudi practice of open competitive tendering is common worldwide (Holt et al., 1995; Adedokun et al., 2013). Nevertheless, a number of authors (e.g.Perng et al., 2006) make the point that the lowest tender is not necessarily the most advantageous overall, while Xu and Greenwood (2006) note that in the Chinese context, tenders from pre-qualified contractors are evaluated against client requirements, rather than simply awarding contracts to the lowest bidders, which would potentially avoid some of the problems caused by the usual Saudi practice.

Participants also indicated that change requests occur frequently if there is a problem in the design, at an important stage in the project. For example, three interviewees quoted in section 4.4.1.1.2. referred to changes to enhance the suitability of the design (Cont3-PC), to overcome problems caused by re-using an old design, rather than one tailor-made for the project (Cons2-PA), or change caused because the designer did not ascertain end-users' needs (Cont3-PA). This evidence of the role of design flaws in precipitating change requests is consistent with the comments of previous authors. Al-Khalil and Al-Ghafly (1999) agreed that problems in design are a major source of change requests and failure, which affect time and cost targets. Howick and Eden (2001) mentioned that amendments may occur at different stages of the industrial and engineering phases, for example if there is an internal error, or the client wishes to make a change in the design. Sometimes, the owner initiates a change request to accelerate the process of the project to obtain advantages, as mentioned in section 4.4.1.1.1, Cons2-PB. However, unjustified haste in the design stage may lead to errors in design (Motawa, 2012). One of the

significant causes of change requests is when the owner changes his plan based on his new needs and requirements (Nadia et al., 2006:5; Reddi & Moon, 2012). Interviews also indicated that change requests can occur to remove some project features or change materials to save money (4.5.1.1.2, Cons2-PA, 4.4.1.1.3, Cons2-PD). Mohammad et al. (2010) similarly indicated that sometimes owners make change requests based on financial problems, which force them to reduce the project scope. Moreover, as noted above, some participants indicated that the owner's use of an out-of-date design or copying of previous designs, to reduce the cost of the project, can result in problems leading to change requests. The evidence supports the argument made by Thomas and Priyanka (2015) that the design can not be executed in a proper way if there is insufficient time for the design process.

Also, the owner may seek to improve the project by making some changes in the design to make it more suitable for him (4.4.1.1.2), but this improvement may not suitable for the overall design, and cause problems, since, as Koskela et al. (2002) indicated, changes in design have implications for construction and procurement; therefore, problems at the design stage cause complexities that can damage the whole project.

Also, based on both interviewees and document 10, other problems may occur in the design stages, such as the owner not allowing the end-user to be involved in the design stage (Cont3-PA), so that he finds his requirements are not met when the project is delivered. This is an addition to the literature, which reports problems due to non-involvement of the owners (Jawad et al., 2009). Another finding is that if the end-user is changed for any reason, the new end-user may ask for changes because the previous requirements, made to suit the previous end-user, are not acceptable to him. For example, in project A, the end-user was changed based on a new government regulation, which led the new end-user to request changes, to make the project more convenient for him. Similarly, if the government changes the owner, the new owner may ask for new change requests. For instance, the new owner in project C asked for the offices of all managers to be enlarged, in order to provide more comfortable conditions for them to do their work properly (Document 12).

Sometimes the owner makes a change order by changing the specifications to improve the project as he sees it (4.4.1.1.3, Cons1-PB). Also, sometimes he aims to reduce the cost by making several changes, if the project is too expensive (Cons2-PD. Regarding such problems with technical specifications, Erdis and Ozdemir (2013) indicated that a hasty cut-and-paste approach to their preparation can lead to project deficiencies and failure to keep up to date with new product and technical developments.

There were reports in the present study of owners manipulating the contractor in the contract, by requiring him to provide the project with the latest technology, such as security devices (4.4.1.1, Cont5-PB). The problem is that after the contractor signs the contract, the technology will change, especially if the project takes a long time. Therefore, the contractor will not be sure which technology he should provide in the project and the owner will ask him to update the technology. In this case, several change requests may occur and when the project is completed, some problems may occur between the contractor and the owner. The findings of change requests caused by contractual ambiguity is consistent with the literature. Davison and Sebastian (2009a) found that change orders and delays were significant problems derived from construction contracts, which they identified as the most problematic contracts. Ambiguity and incompleteness in the contract may increase the likelihood of change requests in the projects by any of the stakeholders. In this respect, Mendis et al. (2013) mentioned that ambiguity and errors in contracts will lead to changes in the project and the contractor may be not be protected by clauses enabling him to claim compensation for any losses. Change requests may occur due to error, negligence and omissions (Fayek & Nkuah, 2002; Oladapo, 2007; Ndihokubwayo, 2008). Contractors may manipulate the contract if it is not clear and rigid. Nahod (2012) indicated that if the contract is strict and rigid, the contractor will have to accomplish the terms of the contract without alteration or omission, and there will be no more change requests. Therefore, contracts should be clear, without errors and ambiguities.

While the above are examples of changes initiated by the owner as one of the stakeholders, change requests may arise from other stakeholders, such as the consultant, in terms of major issues, such as design, or specifications.

5.4.1.2 By Consultant

Some participants indicated that the consultant, who works with the owner, may seek a change request in the design to improve the project and fulfil the owner's needs (for example.4.4.1.2.1, Cons1-PD). This finding is consistent with Arain et al's. (2004) warning that if the designer depends on his own experience to make the design, with insufficient or poor quality communication with the owner, he may produce a design that does not meet the owner's expectation, which may lead to more change requests. Also, Assaf and Al-Hejji (2006) agreed that a project may not meet requirements if there is insufficient data before the beginning of the design stage. In such a case, change requests are made to improve the project. However, change requests in the design may occur due to errors in the design, as in the example given by one project owner, when "The consultant found the pavements of some buildings were too wide and needed to be narrowed" (Interviewee, O-PB). Errors may come from the designer's lack of knowledge of equipment or materials, which may result in an unsuitable design (Adrian, 1983). A designer unfamiliar with the local construction methods may produce a design lacking in "buildability". Employment of foreign designers may increase such problems, due to lack of knowledge about local conditions, or cultural and social factors. For example, foreign designers in Saudi Arabia often produce unsatisfactory or unworkable designs, resulting in more change requests to amend the design (Assaf & Al-Hammad, 1988).

Some participants indicated that the consultant may seek to change specifications to improve the project (4.4.1.2.2,Cons6-PA). Whilst the example quoted concerned a quality problem, the literature suggests other reasons why consultants may change specifications, such as lack of materials and equipment (Fayek & Nkuah, 2002).

5.4.1.3 By Contractor

Instances were also found where the contractor seeks to improve the project by making some change in the design, to enhance quality or style (4.4.1.3.2, Cont3-PA). The contractor and his team experience the details of the project on the ground directly, so they know the necessity for making some changes to improve the project.

Similarly, Mohammad et al. (2010) found that improvement as a result of a design review accounts for more than half of changes in construction projects. Also, some stakeholders indicated that the contractor may make a request for change if the design has some deficiency or error (4.4.1.3.2, Cont2-PB). Similarly, Stevens (2002) mentioned that the project manager may seek to amend the design if needed. Inconsistencies between design and construction are a result of insufficiently detailed working drawings and ambiguity in design details, which cause the need for reworking (Arain et al., 2004-2006; Assaf & Al-Hejji, 2006). Some interviewees indicated that owners often ask for several change requests (Cont5PC, section 4.2.3.6). However scope creep may occur if the project manager accepts any change request from the owner, because he is wary of him as the one paying for the project, or because he wants to demonstrate that he is a cooperative manager (Turk, 2010).

Product specifications are considered to be one of the principal causes of disputes and delay in any type and size of construction projects (Ibbs Jr, 1985). In this respect, stakeholders indicated that change in specifications is important for projects, and some contractors seek to improve projects by making such changes, for example changing the make of lift installed (Cons2-PB, section 4.4.1.3.3). Stakeholders also indicated that contractors suggest changes to reduce the cost of the project (Cons1-PD) by making some changes in the specifications or if the specified resources are unavailable locally (Cnt5-PB). These reasons are additional to those cited in the literature, which shows that change in specifications are not necessarily improvements. Erdis and Ozdemir (2013) indicated that the problem comes from the usage of poor quality materials and trying to increase the profits under competitive conditions, while Fayek and Nkuah (2002) accepted that incomplete specifications may cause variation orders, while Nadia et al. (2006) and Al Duaij et al. (2007) noted that unclear specifications are the reason for variation orders.

Several participants indicated that they did not fully apply project management in their projects. Most stakeholders were not yet ready to apply a complete project management process. One contractor, for example, commented on the low level of his application of project management on the current project, although he acknowledged that PM could reduce change requests and delays (Cont2-PC, see 4.4.1.3.1). This failure to accept a new idea (in the Saudi context) could be because

society is concerned about ambiguity and uncertainty, and tries to avoid it (Hofstede, 2016). Based on his cultural dimensions, Hofstede said that Saudi Arabia is classified as high in uncertainty avoidance (Hofstede, 2016). Several stakeholders in the four projects worked without full project management (Cont2-PC). The evidence in the projects investigated was that, as a result, many problems appeared, such as poor communication, cost and time overrun, change in scope, quality, and frequent change requests. The finding is consistent with the warning of Arain et al. (2004) that changes in design may come from poor communication and the different perspectives of stakeholders of different nationalities in the project. Nevertheless, this study contributes a new finding by explicitly connecting the lack of application of project management with the proliferation of change requests in the projects. The application of project management cannot avoid all change requests, because some of them are beneficial; however, it may reduce harmful or frivolous ones.

Overall, it was evident from the findings that whether the change request was initiated by the owner, consultant, or contractor, the most problematic areas leading to frequent change requests were design and specifications. These findings demonstrate the salience of previous findings regarding the importance of proper data gathering, planning and clarity in the design stage, in order to ensure that the design meets the owner's/user's needs, is prepared to realistic cost and time parameters, is buildable under local employment, environmental and material availability conditions, and is culturally appropriate (Assaf & Al-Hammad, 1988; Wang, 2000; Greenwood et al., 2001; Assaf & Al-Hejji, 2006).

5.4.2 External causes of change requests

External causes of change requests are causes which occur that are out of the control of the stakeholders. They have been categorized based on the reports of project stakeholders, presented as follows:

1. **Supply problems**

Several participants indicated that the contractor is responsible for supplying materials for the project. However, Nahod (2012) mentioned that as long as the

owner is responsible for the supply of materials, contractors would sometimes be concerned about the impact of change orders. The main problem of supply is unavailable resources and materials for the project, as in the case of project B, where the type of stone originally specified was unavailable. Similarly, Arain et al. (2004) indicated that sometimes stakeholders are forced to change the design of a project based on short supply or unavailable materials, which necessitates substation of materials and hence, a modified design. However, a new finding in this research, not previously mentioned, is that, if the supplier is changed, the specification may change, which forces stakeholders to make some change requests to the design to fit the new materials. As one consultant indicated, "Some suppliers now have closed down, such as the supplier of air conditioning. Therefore, we have to change some materials." (Interviewee, Cons2-PB).

2. Technological development

Daily life is constantly changing, including changes in technology. Some participants indicated that changes in the technology may lead to requests to change the specifications of technology, especially if a project take a long time to be completed (Cons5-PB). Similarly, Remington and Pollack (2007) indicated that new technologies are one of the unanticipated causes of disruption to the project, as a temporal complexity. Project technologies can include several items, such as computers, security cameras, fire extinguisher and so on.

3. Logistical reasons

A number of stakeholders indicated that delays in logistics may necessitate change from the usage of foreign materials and products to local ones (Cont3-PC). The issue of foreign versus local suppliers, particularly salient in Saudi projects, adds a new dimension to previous comments on logistics in the literature for example, Fisk and Reynolds (2013) agreed that logistics delays in transportation of the materials to the site is one of the causes of variations in construction projects. The need to provide materials is very important to enable the smooth and uninterrupted flow of works, otherwise stakeholders are forced to make change requests to obtain the materials from any available source.

4. Government regulation

A number of comments concerned the impact of new government regulations in giving rise to several change requests. For example, in 2012 the Saudi Arabian government initiated a new strict regulation to reduce the number of illegal workers on projects. Accordingly, every worker had to work under a company's supervision. Since a high percentage of workers were employed in Saudi Arabia illegally and deported following the new law, companies were forced to change the design and specification of their projects by change requests to fit the labour available (Cont3-PC, in 4.4.2.4). The Saudi labour indigenisation policy is a unique local circumstance not specifically reflected in the literature. However, Chan et al. (2010:2011) indicated that unforeseen conditions on the ground can be riskier than any problem related to the contract itself. Moreover, Yayla and Tas (2010) mentioned the effect of other government legislation, such as building regulations. Changes of this kind after the completion of work are one of the causes of change requests. Changes mode by the government could be for various reasons, such as economic conditions, which force stakeholders to change the original plan after starting work (Sunday, 2010).

5. Weather conditions

Sometimes, unexpected circumstances and problems may occur in the workplace (Al Duaij et al., 2007), such as delay through acts of God on the environment (Fayek & Nkuah, 2002). Several participants indicated that bad weather in Saudi Arabia may lead to change requests, such as the effect of dust on paint (Cont2-PD). This finding supports Mohammad et al's. (2010) claim that weather conditions may cause serious damage to projects. Similarly, Ndihokubwayo (2008) reported that variation orders may occur due to inclement weather, when damage comes from accidents. In this situation, stakeholders are forced to make changes to specifications to adapt to climatic conditions. Whilst accidents are outside the control of project stakeholders, it could be argued, however, that some climate-related product failures reflect a lack of sufficient product information and understanding of the behaviour of materials under different climatic conditions (Folorunso & Ahmad, 2013). Participants' reports of change requests caused by weather conditions may, therefore, be seen as further evidence of insufficient attention to such matters, highlighting the need for cooperation between designers and suppliers (Ibbs Jr, 1985), and careful

consideration of local conditions (Erdis & Ozdemir, 2013) when drawing up initial design and specifications.

5.5 Research Question IV: How do change requests affect large building projects in Saudi Arabia?

If there is an action there will be an effect, whether positive or negative. Williams (2004) indicated that acceptance of change orders leads to disruption of complex projects, which in turn can cause serious time and cost effects, although these may be difficult to estimate. Moreover, delay and disruption will increase dramatically if there are several change orders (Williams, 2004). Different effects may appear as a consequence of several change orders. However, scope creep is possibly the major effect in this situation (Turk, 2010), which in turn brings other problems. Fischer and Kunz (2004) observed that scope creep has extensive effects on the result of the project, most noticeably on quality, duration and the budget of the project. A review of the findings indicates several effects of change requests on Saudi construction projects, which can be divided into direct and potential effects.

5.5.1 Direct effects

The evidence from participants indicated that time overrun is the most common effect of change orders, which affects project delivery negatively (e.g. Cont3-PB, in section 4.5.1.2.1). This was confirmed by a review of project documents, which revealed that a new change order may affect other work in the project, resulting in delay in the delivery of the project. For example, change orders affected project C negatively by stopping electrical and mechanical work and changing the plan completely (Document 12). Such delays have been highlighted by a number of authors, such as Fayek and Nkuah (2002), who mentioned that several changes affect the progress and flow of work. Also, Oladapo (2007) indicated that variation orders affect time overrun. However, a new finding in this research was that change requests may sometimes save time in certain stages of the project, by making some changes to simplify the design or amend specifications (see Cont1-PC and Cons1-PD in section 4.5.1.1.1). Nevertheless, the sheer number of change requests caused delay in the projects.

Also, several stakeholders indicated that change orders may cause cost overrun for both owner and contractor. The owner has to pay for more in materials and salaries of the workers on the new work, and the contractor suffers financially when he does not receive the funds for the new work and changes (Cons2-PB). Such cost overruns have been highlighted by a number of authors, such as Oladapo (2007), who indicated that cost overruns are a result of variation orders. However, Fayek and Nkuah (2002) indicated that it is difficult to estimate the cost and time of frequent changes. Frequent small changes affect a project negatively, because they extend the project without compensation. A review of project documents revealed that there are also extra costs on site. For example, in project C the electrical system had to be changed when CCTV was added to the project, because it needed a special location and conditions that had not been considered in the plan previously (Document 13). Hanna et al. (1998) indicated that there is difficulty in estimating the cost of frequent change orders and determining the appropriate compensation for the workers involved in the project. However, this research contributes to the theory that, in some parts of the project, change requests that reduce project scope may reduce the cost of the project for the owner. Nevertheless, in general, change orders in these projects caused cost overrun.

Another outcome of change orders referred to by participants is that the end-user may get what he needs (Cons1-PB, in 4.5.1.1.3). This is consistent with the claim by Al Duaij et al. (2007) that variation orders can be beneficial when they amend inadequate specifications, plans, or previously approved proposals introduced by the engineer. However, others argue that client needs may be affected badly by negative variation orders (Arain & Pheng, 2005). In some situations, project quality will be improved by variation orders, as some participants indicted. However, Fisk and Reynolds (2013) indicated that quality of work may be negatively affected by frequent change orders, and Arain and Pheng (2005) agreed that quality of work often suffers if there are frequent variations.

5.5.2 Potential effects

Other effects of change orders may arise indirectly for the project and stakeholders. According to Migilinskas and Ustinovicius (2008), uncertainties and risks are associated with variation orders. Eden et al. (2000) asserted that a significant cause of disruption in large projects is acceptance of change orders, even in the case of logical and justified change orders. However, in this study, several participants complained of illogical change requests, resulting in decline in the productivity of stakeholders, because they were not convinced about making changes (Cont3-PB in 4.5.2.2.1). Therefore, a new finding of this research is that unjustified change requests affect the morale of those working on the project and lead to slowness in the work. This is an addition to previous literature, which views loss of productivity as a direct consequence of logistics, material and workload issues, and does not identify loss of motivation as a factor. For example, it is acknowledged that it is usual for disruption to occur, due to lack of materials and information (Thomas & Napolitan, 1995). However, it is hard to prevent disruptive effects in same situations (Arain & Pheng, 2005). Hanna et al. (1998) mentioned several negative impacts of change orders, which affected labour productivity, resulting in impacts on quality, time and cost. Productivity may be lost as a result of changing a project's scope, unavailable labour, materials, and interruptions and interference.

In this study, some stakeholders (e.g. Cont3-PA; Cont2-PB in 4.5.2.2.2) also indicated that change orders lead to excessive administrative work for the contractor and consultant, because most of the time the new work needs new materials, workers and time. This is consistent with Fisk and Reynolds' (2013) comment that technological and complex projects in particular need professional workers and manpower, although they did not comment on the associated administrative burden. Arain and Pheng (2005), moreover, noted that those new professionals in the project may request some changes to the project. Therefore, it is anticipated that projects would be affected by making some change, because appropriate professionals are not available.

Another potential effect is the indirect cost to the contractor if he delays completion of the project due to frequent change orders, because he will lose opportunities to win other contracts and projects (Cont2-PA). This is a different perspective on cost implications of change requests from the more common focus in the literature, which highlights the direct costs involved and the financial strain this causes. According to O'Brien (1998), additional payment for contractors as a result of additional works is one of the potential effects of variation orders. In this situation, the contractor may actively seek more change orders to boost the additional payment (Arain & Pheng, 2005). Also, Arain and Pheng (2005) found that delay in payment to the contractor may be affected by several change orders. In this situation, the owner delays in paying the contractor, and the contractor is then forced to delay paying the subcontractor, and finally the work and the project may not be delivered on time, unless the owner pays them first. In general, in the Seychelles, Sunday (2010) found that if there are many change orders on the project, there will be differences between the initial contract budget and final costs of the project.

However, even if the contractor loses some additional payments, he may benefit from experience gained through reworking. In this regard, several participants indicated that the contractors and consultants may gain good experience, because the core of variation orders is trying to solve problems, so this will give them good experience to deal with problems in the future (Cons4-PA; Cons-PA, in 4.5.2.1.3). This is a new perspective not reported in previous literature.

This research also found that damage to the reputation of the contractor and consultants is another potential effect of frequent change requests (Cont6; Cons1-PC). If the contractor and consultant delay in delivering the project due to several change requests, they may lose both their reputation and other potential contracts and projects. This is an addition to the literature, although previous research makes the related point that variations are a major cause of construction claims and disputes (Yogeswaran et al., 1998; Fisk & Reynolds, 2013). These may lead to collapse and affect stakeholders' reputation negatively. Conversely, a good reputation may be earned if a project succeeds due to the change request (Cons1-PD). Also, a change request may reduce maintenance when it replaces poor

specifications and materials with those of better quality (Cons2-PA), which will enhance the contractor's reputation and relationship with the owner. Regarding relationships, several participants indicated that change orders may affect projects negatively, especially in the relationship between the stakeholders. For example, if the owner does not accept the contractor's and consultant's opinions on his change order, conflict and antagonism may occur (Cont2-PB). This is consistent with, Arain and Pheng's (2005) general point that change orders may affect the relationship of professionals, which may lead to disputes. Such problems are noted by Syal and Bora (2016), who indicated that cost-related disputes are significant disputes, caused by change orders when the contractor and consultant feel that change orders do not reflect real costs and reduce their profit. Such disputes highlight the risk inherent in the situation noted previously, that in Saudi Arabia, change requests are often made orally and not confirmed by proper documentation. Amr and Elnemr (2007) similarly found that change orders are the main cause of claims in the construction sector, especially in the case of oral change orders, which they found accounted for 76% of claims, leading to loss of rights, as a consequence of the lack of appropriate documentation and contract awareness. However, conversely, this research maintains that in some cases, change orders may enhance the relationship between the workers and stakeholders, if the changes are beneficial and facilitate the progress of the project (Cons1-PD).

5.6 Research Question V: What methods do stakeholders currently use or envisage to handle change requests in Saudi Arabia, and how effective do they find them?

Based on discussion of the first research question about conceptualization of change requests, it is important to give a clear and complete meaning of change request, because this may lead to better understanding of the causes of change requests and how to handle them. Misunderstanding of any problem will lead to repeated mistakes. Also, because there is a difference between a request and an order, it is

important to distinguish between change request and variation order or change order to understand the application and track it easily.

Also, based on discussion of the second research question regarding the process of change requests, it is very important to adapt a formal process with a limited time frame, because this may help stakeholders to accelerate the process and reduce conflict. Conflict occurred in these projects due to lack of a clear and formal process, or any means of identifying responsibility for delay.

According to participants, there are three ways of handling change requests: handling change requests before they occur, during the process, and after the request occurs.

5.6.1 Handling change requests before they occur

Handling change requests before they occur is the best way for handling the frequency of changes. However, this does not mean eradicating all change requests, because some are beneficial. Basically, it means reducing harmful change requests in projects. In the projects examined for this research, the participants did not apply the following ways of handling change requests, mentioned in this section. However, they had been applied in previous projects and were found to be effective methods that may help to reduce change requests in other projects within a similar culture. According to Cleland (2004), before handling a change request, it is important to define the project scope, and then determine who will execute the work; following that, it is crucial to plan and schedule the defined work, estimate resources, authorize budgets and record costs.

Several participants indicated that giving sufficient time for tendering is very important for the contractor, because it gives him sufficient time to decide whether or not he will be able to perform the project properly. As one consultant said, *"It is important that the owners give enough time for bidding" (Interviewee, Cons1-PD).* Most contractors try to win the tender without thinking of their ability to execute it. However, they are shocked when they find that they may not be able to do the project properly, which may force them to request changes to amend the design.

Identification of this problem in the projects investigated is consistent with previous studies. According to Towner and Baccarini (2012), the pre-tender cost estimations need a high level of expertise and knowledge to make them more accurate. Holt et al. (1995) support the integration of eligibility (pre-qualification) in the selection procedure, and assessment of bids based on wider standards, including the contractor's ability to provide a product and service according to quality criteria, within budget and time-frame. In this situation, the lowest bidder would not automatically win the contract. According to Towner and Baccarini (2012), tender prices must take into account several issues, such as weather conditions, buildability, risks of resource availability and design errors. Pricing these requires taking into account project factors such as the contractor's workload, completeness of documentation, project complexity and type of contract. Therefore, this research recommends that it is important to give the contractor a chance to think about this ability to perform the project, and to minimize change requests.

After the tendering stage, the contract is an important step in the project. Several participants suggested the desirability of applying a model contract such as FIDIC in Saudi Arabia to control change requests, avoid cost and time overrun and protect the rights of stakeholders (Cons1-PB; Cons2-PA). This is in line with the recommendations of previous authors. According to Charoenngam et al. (2003), the FIDIC contract offers several forms such as "additions, omissions, substitutions, alterations, changes in quality, form, character, kind, position, dimension, level or line and changes in any specified sequence or method or timing of construction required by the contract". This type of contract includes assessment of change orders, and safeguards the right of the engineer in relation to the contractor when he seeks to make change requests and ultimately protects his claims. In't Veld and Peeters (1989) stated that it is important to bear in mind that the right type of contract should be applied to suit the project in terms of the levels of risk entailed. Corts (2011) asserted that there are several types of contracts, each with their limitations and strengths. Therefore, it is important to select the appropriate type for every project, with full knowledge about the possibilities of risk, such as cost and time overrun, complex specifications, acceptance and the like, which may raise the likelihood of change orders and claims. It will require a well-defined system to establish a process for handling any change to the original contract. The PMI (2013) outlines a "contract

change control system", which describes the necessary process for project modification. Such a system has the ability to remove many potential ambiguities and conflicts associated with change requests and in relation to contractual claims, thus reducing the risk of harmful consequences. Such a system involves the necessity to approve changes, and offers procedures for resolving any problem or dispute related to the change. In terms of managing change requests and claims, this research contributes by introducing one method, which may help in this situation. Several participants indicated that it is important to select a committee consisting of representatives of the contractor, owner and consultant responsible for controlling change requests by assessing their usefulness and tracking them from beginning to end. Such a committee would have the authority to approve or review change requests without going back to the owner himself (Cons2-PD).

Following the contract stage, the design stage is an essential process before executing the project. It is easy to manage and control problems in the design stage, because it does not need demolition or rework (Arain & Pheng, 2007). Kuprenas (2007) indicated that there is an inverse relationship between the time and cost spent on design and the amount of change requests. The more money and time spent on the design stage, the fewer the occurrences of change requests. Given the high percentage of such requests arising during the design stage, it is logical to concentrate on design with extra effort to reduce change requests (Arain et al., 2006). This research contributes by suggesting value management as a tool to handle design in the early stages, which may reduce the need for change requests (Cons1-PB). In this regard, several participants indicated that value management is a good way to reduce change requests, because it concentrates on the best design and materials with a good function and quality, particularly in the design stage. In this respect, it is noteworthy that Alalshikh and Male (2009) reported use of VM, specifically the SAVE methodology, imported from the USA. However, its implementation and usefulness were weakened by failure to contextualize it to Saudi conditions, use of external VM teams, causing conflict with designers, and implementing it only in the later stage of projects, rather than during pre-design and design, where many of the problems leading to change requests originate.

Sunday (2010) indicated that is important to have change requests with minimal costs. Several writers indicated that it is beneficial to schedule change requests in the design stage. However, change requests may occur at any time of the project due to the necessity for change. Several participants indicated that it is important to make provision in order to reduce the need for subsequent changes, that careful study of the project be performed by the owner, consultant and end-user, with all requirements identified in writing and sent to the designer (O-PA in 4.6.2.1). This suggestion is consistent with previous work highlighting the importance of adequate data gathering in the planning stages. For example, Arain et al. (2004) agreed on the importance of giving sufficient time to the pre-design phase, with appropriate information gathered about the client's requirements, the site and other subjects relevant for appropriate design development. These initial data may include the familiarity of the designer with local designs and culture (Wang, 2000), and information about available equipment and materials (Arain et al., 2006). Such information and knowledge contribute to an accurate and clear design, which assists the contractor in understanding and implementing the plan more accurately (O'Brien, 1998). Value management or value engineering can be useful in this situation. SAVE (Society of American Value Engineers) is commonly described in terms of several phases (Green, 1994; Ansari et al., 2013; Kelly et al., 2014), such as explaining and understanding the problem by obtaining information on client's needs and circumstances, specifications, design standards, and costs, then creating additional ways of offering the required functionality. Next come the setting of assessment criteria, using cost and other models to assess and select among the options. Then, for deeper development and evaluation of the recommendations specified as most appropriate in the analysis phase, including economic evaluation and detailed technical consideration of the possibility of successful execution, there follows the quantifying and preparing of a detailed proposal. The final phase is implementation, which includes tracking/problem-solving, and assessment of the final results.

Participation of stakeholders in the design stage is important, but this often appears to be lacking in Saudi projects, as in the situation described previously with regards to end-users. This runs contrary to the literature stating that such stakeholder involvement enables the development of common understanding of the design issues, and general agreement on courses of action (Green, 1994; Leung & Liu, 1998). Finch

et al. (2005) indicated that the benefits of a VM input into construction projects can clarify client needs, representing them accurately and clearly, and supporting the design process. Value engineering involves experts in evaluating several aspects of the project, such as costs and functionality, which leads to value for money and improving the project specification (Kelly & Male, 2003). The benefits of a VM approach are not just for controlling schedules and costs, but also in focusing on the whole project life-cycle, to reduce risks during building construction, and subsequent use of the building (Bínová, 2014). Such a broad view seems not to be generally applied in Saudi projects, although Cons1-PC (section 4.6.2.2), for example, acknowledged the potential value of using it to address quality issues in the design stage. Failure to adopt a more complete form of VM can lead to errors and omissions that give rise to change requests.

Several participants, moreover, indicated that applying project management processes may reduce the frequency of change requests (Cons2-PA). Applying project management helps to achieve the goals within the timescale, saving time and cost, ensuring quality, aiding procurements and managing risks. However, projects in Saudi Arabia do not apply project management in a proper way as noted, for example, in section 4.4.1.3.1, which contributes to increase the number of change requests. According to PMI (2013), in project management, change requests scheduled during the early stage, specifically at the planning stage, can save time, Alsuliman et al. (2012) indicating that spending time on change orders affects the result of the whole process. Therefore, when a change order is suggested in the earlier stages, it is easier to control it later. For instance, a change request during the design stage is easier to deal with than after the construction stage, when changes may involve demolition. Even if these changes are influential, it is easy to embody them in all processes without affecting the quality, time and cost of the project. Also, it is important that stakeholders understand all aspects of the project before the execution process. In this regard, several participants asserted the need for training to discuss the main aspects of projects, such as design and specification, to remove any vagueness and ensure a good start (4.6.2.5 Cons6-PA). Nilsson (2012), in addition, asserted that periodic reports and meetings are important tools of project management, improving the communication between stakeholders and helping to solve several problems.

5.6.2 Handling change requests during the process

As mentioned earlier, the first way to address change requests is to reduce the likelihood of change requests before they occur. However, the second method is to accelerate the process, rather than to reduce the number of orders. According to Molly (2007), handling change requests when they occur should include identification of the change request, notifying parties about it, documenting the change request and preparing it. Several participants indicated that their way of handling change requests was simply to accelerate the process, and that they found this method effective and suitable in some areas of projects. However, in general, all the projects in the study were delayed, because potential causes of change requests were not handled before they occurred, and once requests were made, they were not handled according to a consistent, systematic process.

As indicated in the findings, there are some recommendations that may help to accelerate the process of change requests. For example, information on any change request should be clear and detailed in terms of the cost and type of change during the process, especially when it involves the contractor team, because any vagueness in this information may lead to several exchanges between the owner and contractor seeking clarification, which takes a long time (Cons2-PB). Consistent with this view, Thomas and Napolitan (1995) asserted that lack of information is the most significant kind of disruption. Stackpole (2013) described a standard change request format, which contains specific information, such as the name of the initiator of the request, change number, change category, description of change, the rationale and justification for the proposed change, together with the implications of the suggested change, in terms of, for example, quality, project scope, schedule, cost and impact on project documents.

Based on the earlier discussion on the centralisation of authority with the owner as one of the causes of delay in the process of handling change requests, it is important to mitigate this type of bureaucracy, as suggested by, for example, Cont4-PA. Therefore, this research contributes by suggesting two ways to handle centralisation. Firstly, it is important to provide the contractor with a degree of authority to make

small changes if necessary, without affecting the quality of the specification or the design. Secondly, if the owner is busy most of the time, it is important for him to give authority to his representative to approve change requests on his behalf. Simply waiting for approval of change requests may take several months, which affects the process and delays the project.

5.6.3 Handling change requests after they occur

Several participants indicated that handling change requests after they occur is simply to accelerate the process. They mentioned that this method had succeeded and been effective when applied in some change requests. However, they did not apply and use it as a general rule for all change requests. The owner and contractor are responsible for accelerating the process of change requests as follows:

By the owner:

Several participants indicated that it is important that, after studying the change request, the owner that should decide and send his decision instantly by phone or email, to enable continuation of the project, pending formal written approval (Cont7-PB). Assaf et al. (1995) agreed that from architects' and engineers' perspectives, slowness in the decision process of the owner was one of the main reasons for delay. Charoenngam et al. (2003) indicated that there are several advantages for the usage of Internet technology in the process of change requests in construction projects, such as standardisation of procedures, providing the information speedily between the stakeholders, confirmation that all participants have read the document, and keeping documents safe, with avoidance of mismanagement.

Several participants indicated that it is important that the owner supports the contractor with funds if he approves a change request, because sometimes the contractor needs the cost of the change to proceed with the project, otherwise he may have to stop working and the project in this case will be delayed (Cont5-PC). However, the owner may face financial difficulties, which do not allow him to fund the contractor, and he may ask for reduction in the project cost or scope. Assaf et al. (1995) asserted that financing problems are most important causes of delay in

projects. Also, Mohammad et al. (2010) mentioned that financial difficulties of the contractor are often one of the problems in projects.

Several stakeholders indicated that it is better for the owner to help the contractor when he needs it, especially if the owner is a member of government (4.6.4.1: Cons2-PC). For example, sometimes the change request requires a new foreign product, which needs acceleration of the import process. As long as the stakeholders are concerned to complete the project on time, they should work as a team. PMBOK (2013) has a tool to manage stakeholder engagement, which aims to build appropriate stakeholder engagement during the project life cycle by its procedure of communication and working together with stakeholders to deal with their expectations and needs.

By the contractor:

The contractor can help other stakeholders to mitigate the effects of change requests, especially regarding time issues. As mentioned earlier, the process of a change request takes a long time until it is approved and becomes a change order. However, several participants indicated that the contractor can avoid delay by working on the other steps of the project, pending approval of the change request (Cont1-PC). At the same time, he must be ready and well prepared in terms of workers and procurement to deal with change requests when the owner approves them (Cont2-PB). However this view departs from Nahod (2012), who indicated that contractors are occasionally complacent about the effects of change orders, because it is the project owner who is responsible for the supply of materials.

The suggestions of the research participants, reported and discussed in section 5.6.1-5.6.3 and supported by the researcher's analysis of project information, can provide the basis of a framework model for handling change requests in a systematic, consistent manner. Such a model would provide a reference point for practitioners or facilitate avoidance of frivolous or harmful change requests and expedite the processing of changes that are necessary and beneficial for the project. Such a model is offered as a practical contribution of the thesis, in the next chapter (see figure 26, section 6.3.2).

5.7 Assessment of the trustworthiness of the results

In Chapter 3 it was noted that quantitative research is often evaluated by the criteria of credibility, transferability, dependability and confirmability. The purpose of this section is to discuss the extent to which these criteria, which together form the composite criterion of trustworthiness, are met by the findings of this research.

To begin with credibility, this was defined as being concerned with the persuasiveness and feasibility of the interpretations offered (Bryman & Bell, 2015) In other words, it addresses the question, how likely is it that the findings presented constitute a fair and accurate representation of the views and experience of the participants (bearing in mind that the research does not pursue a single, ultimate "truth")? As explained in Chapter 3, this criterion was pursued through engagement with the participants, and through two kinds of triangulation: of methods and of participant groups. In practice, both of these approaches have limitations. With regards to engagement, for example, the researcher was able to spend considerable time in each of the case study companies, interacting formally and informally with various parties involved with the project. Access was afforded to project sites, and participants were open about their roles and concerns. Nevertheless, there were certain areas of reservation, notably the refusal to disclose actual contracts, on the grounds of confidentiality. The opportunity to scrutinize these documents may have revealed errors and omissions in planning the project or drawing up the contract, or may have revealed causes and responsibilities for delays and other problems, beyond or different from those acknowledged by the participants.

As for the second approach to credibility, namely, triangulation, a limitation here is that it is not possible within a bounded research effort such as a PhD, to include all the parties who might at some stage affect or be affected by a project: In this study, for example, it was not possible to include suppliers or project designers, many of whom were from overseas and who were not necessarily available locally or directly involved in the projects at the time of the research. Other potential stakeholders, such as end-users and the general public, might not be identifiable, or their experience of the project known, until after project completion. For example, a change in the specifications of an office might affect the comfort and convenience of its eventual

occupants, or have impacts on the maintenance and useful life of the building, but these might not become apparent for some years.

Given these limitations, it cannot be claimed that the findings of this study provide a comprehensive account of all possible issues pertaining to change requests and their impact on the selected projects. Nevertheless, given the substantial access afforded to the main project stakeholders (owners, contractors, and consultants) and project sites, the detailed level of analysis (informed by the researcher's professional knowledge and experience) and the fact the all interpretations stem directly from the research data (as evidenced by, for example, abundant quotation), it can be suggested that the findings presented provide a plausible and feasible account of the "realities" of the projects, as experienced at the time of the research.

The second criterion, transferability, refers to a judgement as to whether the research conclusions are applicable in other contexts. As noted in Chapter 3, such a judgement is not made by the researcher, but by the person who might at some point be contemplating transfer (Creswell, 2014). It is envisaged that the findings of study may be of interest to and have implications for stakeholders of other projects in Saudi Arabia, and project managers in other developing countries, particularly those that may be using non-standard, ad hoc contracts and change request procedures. However, their judgement as to the appropriateness of transferring the present findings to other contexts will depend on the ability to compare their contexts with the situation reported in this thesis. To aid such a judgement, detailed information on the research context, including relevant cultural considerations, has been given in Chapter 2. Future readers can refer to this qualitative description, as well as assess their own cultural contexts in Hofstede (1984) terms using the definitions and references provided, in order to judge the equivalence of national and sectorial contexts. Given the inability of this research to provide precise contractual details, as noted above, there would be a limitation on deciding transferability at the project level. Nevertheless, the detailed analysis of change requests routes and procedures (sections 4.3, 5.3) and the many examples provided of change request motivations, causes and impacts in the selected projects, can be taken as a basis by future project managers, for analysing issues in their own projects. In particular, the framework referred to in section 5.6 and presented in Chapter 6 (section 6.3) will provide a

useful benchmark for comparison. Thus, although the research findings are context-specific, a substantial body of contextual, theoretical and practical information is provided in relation to the research and the resulting interrelations, which will inform future decisions on potential transfer.

The third criterion of trustworthiness in qualitative research is dependability, which concerns evidence of how the research conclusions were reached (Sandberg, 2005). In this research, the dependability of the findings is supported both by evidence provided within the thesis, and by an "audit trail" (Miles & Huberman, 1994) of documentation maintained outside the thesis but verified by the research supervisors and producible of required. In the former (in-thesis) category, attention is drawn to the abundant use of quotation throughout the findings chapter. Thus, the researcher's interpretations can be linked to the verbatim expressions of research participants on every theme, sub-theme and substantive point. Moreover, in the absence of formal documentation of change request procedures, the procedures followed were analysed by the researcher and procedural diagrams inferred, which were subsequently verified by participants. A further source of dependability is the photographic evidence of the researcher's engagement with participants and review of project plans in the Appendix. As for the audit trail of evidence accumulated during the research but not contained within the thesis, it has already been explained in Chapter 3, section 3.5, how field notes, interview recordings and transcripts and the like were maintained. Thus, the researcher can demonstrate how all aspects of the research were conducted, and clearly link the conclusions drawn to identified sources of evidence, whether the oral testimony of a specific participant from a particular project, or a written or pictorial project document.

Lastly, there is the criterion of confirmability, concerned with the researcher's integrity and open-mindedness in carrying out the research and, hence the "objectivity" of its outcomes (Creswell, 2014). This criterion is to some extent met by the same "audit trail" referred to above with regard to dependability, in line with Miles and Huberman (1994). The second approach to achieving cofirmability has been applied throughout this chapter, in the form of a comparison of the findings with relevant literature, as advised by Remenyi and Williams (1998). In this respect, all the findings emerging from this study have been shown to be related to themes

and issues found in the literature, albeit with nuances and emphases that reflect the scope and distinctive context of the study. For example, in relation to conceptualization of change requests, terms and definitions differed among participants, but were consistent with the range found in the literature (e.g.Charoenngam et al., 2003; Stackpole, 2013). Similarly the evidence that conceptualization may differ among stakeholders is in line with theory (Rantanen et al., 2007; Freeman, 2011). With regard to the way change requests occur, practice was found to depart from theory, as reflected in the lack of formal procedures, application diagrams and documentation (Charoenngam et al., 2003) for example. Nevertheless, the problems identified as a result, and participants' recognition of the need for clear information, better communication and formal accountability are all in line with theory (Lee et al., 2010). Causes of change requests, while taking context-specific forms, fell within broad areas highlighted in theory, such as tendering issues (e.g.Perng et al., 2006), technical specifications (Erdis & Ozdemir, 2013), contractual ambiguity Davison and Sebastian (2009a) and design issues (Stevens, 2002). Identified effects of change requests were compatible with themes discussed by previous authors, including time and cost (Oladapo, 2007), disruption(Eden et al., 2005), and relationships among stakeholders Arain and Pheng (2005). Lastly, with regard to the handling of change requests, although observed and reported practice in many ways departed from theory, especially with regard to anticipatory | preventive measures, which were generally neglected, participants were aware of such ideas. Thus, the findings reflect discrepancies in execution, not a challenge to PM principles as such. Contextual differences of this kind are consistent with the acknowledged principle that PM is influenced by culture (Pagell et al., 2005; PMI, 2013). It can be seen, therefore, that the research findings are within the realm of what is theoretically feasible in the PM context, and as such possess adequate confirmability.

As the above discussion has demonstrated, despite certain caveats related to sampling limitations and the unavailability of project contracts, the research findings meet the criteria of credibility, transferability, dependability and confirmability. It can thus be suggested that they demonstrate satisfactory trustworthiness. On this basis, the research contributions and implications will be highlighted in the next chapter.

Chapter 6 Conclusion

6.1 Introduction

Construction projects in Saudi Arabia have suffered from frequent change requests. There have been reports of delay in projects, which have sometimes failed due to the occurrence of frequent change requests (Alshahrany, 2012). Therefore, the purpose of the current study was to investigate the conceptualization, process, causes and effects of change requests as perceived by various stakeholders in such projects, in order to achieve the main objective, which was to find out what methods stakeholders currently use or envisage to handle change requests in Saudi Arabia, and how effective they find them. Ultimately, the goal was to suggest ways to reduce the frequency of change requests in the Saudi context.

This chapter presents the research conclusion, which is divided into four main sections. Firstly, the research findings are summarized, addressing the five research questions in turn. Then, the research contributions from theoretical, practical and methodological perspectives are highlighted. In addition, the research limitations are discussed. After that, suggestions are made for future research regarding change requests.

6.2 Summary of the Research Findings:

The main aim of this research was to explore the handling of change requests in large building projects in the Saudi Arabian context. The findings of the research were reported in Chapter Four, depicted in Figure 24 and discussed in Chapter Five with reference to the literature in Chapter Two. The summary of the research findings will be organised according to the research questions as follows:

6.2.1 Research Question I: How do stakeholders in Saudi Arabia conceptualize change requests?

In terms of the conceptualization of change requests, this study has identified that there were different opinions regarding the meaning of change requests among the

participants of the research, as well as among previous authors. It was found that none of the stakeholders participating in the study had a clear definition of change requests. Differences of opinion and incomplete understanding of the meaning of change requests resulted in several major findings. The first major finding in this regard was that misunderstanding of change requests may lead to frequent change requests, because everyone had his own justification to seek new change requests, and that misunderstanding of any problems leads to repetition of the same faults. The second major finding relating to this question was that different opinions and misunderstanding of change requests may lead to conflict among stakeholders, causing bad relationships, because everyone is convinced of his own opinion and justification for seeking change requests. The third major finding was that there is prevalent confusion caused by failure to distinguish between a change request and change order or variation order. It was suggested that, for clarity a change request should be defined as an initial request that is not yet approved, whereas the terms, change order or variation order would refer to an approved change request.

6.2.2 Research Question II: How do change requests occur in large building projects in Saudi Arabia?

This study has shown that there was no formal application procedure for change requests in any of the four projects examined. Stakeholders used normal letters and replies between parties without detail; therefore, the researcher had to infer the processes to enable him to understand the functions and rules prevailing, and the similarities and differences between them. This study has identified that there was no consistency in the change request process, no clear function for each participant and no rules to control them. For example, the owner may ask for feedback about a change request in order to approve or reject it; however, in other situations he has the authority to ask for a change order directly, without the agreement of other stakeholders. This may lead to conflict and bad relationships between them, because some of these orders were detrimental to the cost or timescale of the project. The research has also shown that the delay process may sometimes occur based on the shortage of or mistaken information on the change requests by the contractor, necessitating time spent on requests for clarification. Also, delay may be caused by the owner requesting initial and final studies of change requests and the

centralisation of approval authority, which may take a long time. Moreover, without a timescale and procedure for tracking change requests, stakeholders cannot determine precisely who is responsible for delay. All these types of delay may cause conflict and badly affect the relationships between stakeholders.

6.2.3 Research Question III: How are change requests caused in large building projects in Saudi Arabia?

Regarding the causes of change requests, this study has identified that there were internal and external causes. Internal causes may originate from the owner when he not only accepts the lower bidder, but also rushes the tendering process so that contractors do not have time to assess their capabilities and submit a realistic bid. These practices encourage contractors to try to win the contract by hastily submitting low, badly thought-out tenders; then they later find they cannot apply some part of the design on the ground, which needs more change requests. Also, the owner may ask for changes in the design for various reasons, such as to speed up the project in order to benefit from the advantages of the project, or because of changes in his needs and requirements, or to make the design more convenient for him, including reducing the cost of the project, sometimes by using an out-of-date design. Moreover, change may occur when the owner does not allow the end-user to be involved in the design stage, or due to a change in the owner or the end-user, who may not be happy with the previous design and request change requests to make the project fit for them. Also, the owner may change the specification to improve the project. Moreover, change requests may occur due to ambiguity and incompleteness in the contract.

Also, this study has shown that change requests may be initiated by the consultant when he seeks to make some change in the design and specifications to improve the project to achieve the owner's needs, or due to some errors in the design by the owner or contractor.

The research has also shown that change requests may be raised by the contractor due to some design error or to improve the project. Moreover, he may make some change in the specifications to improve the project, if the original specifications are

not available locally, or to reduce the cost by changing the specifications, to help the owner in this regard. The major finding was that not applying project management fully may lead to more frequent change requests.

External causes of change requests may occur for several reasons. These are factors outside the owner's and contractor's control, which may require them to modify the project. The failure of a supplier's business, or delay in materials availability may necessitate a change of specifications. In a lengthy project, technology development may render the initial design and specification outmoded before the project is complete, resulting in a need for updating. The use of products imported from abroad may cause logistical bottlenecks. Government regulations, such as labour law may change, forcing change in the project. Weather events may cause change or reveal inadequacies in design and specification. All such situations can give rise to a need to change one or more aspects of the project.

6.2.4 Research Question IV: How do change requests affect large building projects in Saudi Arabia?

In terms of the effects of change requests, this study has identified that there are direct and potential effects. Direct effects could be positive, such as saving cost and time in some parts of the project by reducing the design or changing the type of specifications. Also, the owner and the end-user can get what they need and obtain the best quality. However, direct effects could be negative, such as time and cost overrun due to extra work, which may lead to scope creep.

This study has also shown that potential effects could be positive, such as a good reputation for the contractor and consultant if they succeed in delivering the project on time and within budget. Moreover, subsequent maintenance can be reduced if the change request involves improving the quality of specifications. It can also be suggested that problem–solving gives the contractor and consultant good experience. Moreover, good relationships may result when change requests are beneficial to the progress of the project. Conversely, it has been shown that potential effects could be negative, such as slow-down in productivity if a stakeholder is not convinced about an illogical change request. Also, excessive administrative work may be caused for

the contractor and consultant due to the new work, which sometimes needs new workers, materials and time. There are also indirect costs, because the contractor may lose the chance to get other contracts due to the delay. Also, damage to relationships and reputations may occur due to unacceptable change requests.

6.2.5 Research Question V: What methods do stakeholders currently use or envisage to handle change requests in Saudi Arabia, and how effective do they find them?

Regarding handling change requests, this study has identified that, before starting to handle change requests, it is important to have a clear and comprehensive understanding of the meaning of the change request, which may help to understand the problem and handle it. After that, it is important to distinguish between the meaning of change requests and change order or variation order, which may help to track requests simply and clearly. A formal process with specified timescale is also important to accelerate the process and mitigate the conflict between stakeholders.

Following that, this study has shown that there are several ways of handling change requests - handling them before they occur, during the process and after they occur. Handling change requests before they occur is preferable, because it reduces the number of change requests. Ways of handling change requests before they occur were suggested by stakeholders based on their previous experience in other countries with a similar environment and culture. The first suggestion in this regard is allowing sufficient time for tendering, to give the contractor the opportunity to think whether or not he could perform the work without too many mistakes and change requests. Then, it is important to apply a suitable contract, such as FIDIC, to control the scope, cost and time of the project. Participants favoured specifying a committee consisting of representatives of the owner, contractor and consultant to manage change requests and authorize them without having to go back to all stakeholders separately. Doing so may reduce the time and frequency of change requests. After that, it is important for the stakeholders, including the end-users, to study the project carefully, and have all requirements and needs set out in writing, to be sent to the designer. A training course could be held to discuss all aspects of the project and clarify any

misunderstanding. Value management could be applied in the design stage of the project, because value management focuses on the quality and function of design and specifications, especially in the early stage. Also, it is important to apply project management as a tool to reduce change requests. It is known that project management depends on project scope management, integration management, time and cost management, quality management, human resource management, communication management, risk and procurement management, which may reduce change requests (PMI, 2013).

The second method is handling change requests during the process to accelerate it, not to reduce the amount of requests. Stakeholders thought that handling change requests during the process was effective and suitable for some parts of the projects, based on their experience, although all projects were delayed due to frequent change requests. The first suggestion to handle change requests during the process is related to the availability of sufficient information, which should be clear and detailed to avoid time being wasted in requests for clarification. Also, it is important for the owner to delegate to the contractor a degree of authority to handle minor change requests and give the representative of the owner the authority to approve major change requests to avoid the delays caused by bureaucracy and centralisation.

The third method of handling change requests is handling them after they occur, to accelerate the process. Firstly, when the owner agrees and approves a change request, he should send the decision immediately, without delay, by email. Also, if he approves the change request, he should provide the contractor with funds to cover the cost of change, to support him, because sometimes the contractor is unable to execute the work without funds. Moreover, it is better if the owner can help the contractor if he needs it, especially by facilitating import of any materials needed from abroad. At the same time, the contractor should continue to perform other work without waiting for a decision from the owner on the change request, to save time on the project. Also, he should be ready with his workers and procurement, pending the decision from the owner, so that when the approval arrives, he can immediately perform the request, to save time.

6.3 Research Contributions

This research has contributed to theoretical, practical and methodological perspectives.

6.3.1 Theoretical contribution

As noted in Chapter 2, the research questions guiding this study stemmed from identification of a number of gaps in extant literature, with regard to the theoretical understanding of change requests in general, and in the distinctive cultural context of Saudi Arabia. As a result of the work undertaken, a more detailed and holistic view of change requests emerges, which confirms some aspects of previous findings and adds additional elements as incremental contributions, including context-specific evidence of the impact of culture on project management.

Contributions to knowledge theoretically will be summarized here, as they were indicated in the previous chapter. This is followed by Figure 25, abstracted from Fig 24 in Chapter 4, which summarizes the contributions listed here in the form of a model that can be used as a reference point for understanding the nature, causes and impacts of change requests.

1. The study contributes to debate on the definition and conceptualization of change requests, by highlighting current terminological confusion in the literature and demonstrating, with evidence from the Saudi context, how such confusion permeates and influences practice.

   As observed in Chapter Two, previous theoretical literature and reports of empirical studies use the terms, change request, change order and variation order in a variety of ways, without drawing attention to this confusion. Moreover, in reports of empirical studies, each author has employed his or her chosen terminology, without discussing or apparently considering whether participants in their research understood the terms used in the same way. This study in Saudi construction companies revealed incomplete and inconsistent conceptualizations from one project or company to another, and even among parties in the same projects, a confusion which theory needs to address because of its implications for project management.

It was found that different conceptualizations among stakeholders contribute to proliferation of change requests without consideration of their implication. This study has highlighted the repercussions of this confusion, both for the project process and for relations between stakeholders. Therefore, this research contributes by suggesting a clarification and distinguishing between a request and an order, such that a change request means the requests for a new change, and once it is approved it becomes a change order. It is important to distinguish between them, in order to track and understand the application and the process of change requests more easily.

Moreover, the research has demonstrated a need to suggest or develop the definition of the change request to clarify it in detail, as this may help to track the process and reduce the need for change requests. As mentioned in Chapter Two, the PMI (2008: p.428) defines change requests as "requests to expand or reduce the project scope, modify policies, processes, plans, or procedures, modify costs or budgets, or revise schedules". However, based on the findings from the Saudi context, the researcher suggests adding, "Once a change request is approved, it becomes a change order", which may help to track change requests in the process. Also, adding that "a change request could be beneficial or harmful to projects" may help in understanding the impact of change requests, which may in turn help to encourage critical evaluation of such requests and reduce harmful consequences of ill-advised, unreasonable, or impractical requests.

2. The study contributes to a more nuanced, balanced and comprehensive understanding of the complexities surrounding change requests, as demonstrated in the Saudi context, including the identification of causes, effects and handling not previously reported. As noted in Chapter 2, previous studies have often addressed only one of these dimensions, and from limited stakeholder perspectives. By looking at all three dimensions, as they affect and are affected by three different stakeholder groups, this study adds to the existing understanding of the issues involved.

With regards to causes of change requests, previous researchers have

mentioned several causes of change requests, for example Rashid et al. (2012) indicated that the causes of change requests may be due to the owner making additional requests, or when the contractor suffers from financial difficulty. However, this study finds other causes of change requests not previously reported, such as rushing the tendering stage, and government choosing the lowest tender, when the cheapest contractor wins the contract with a hastily prepared bid and discovers that he is not able to execute the project appropriately. In this situation, frequent change requests may occur during the performance stage, due to discovery of a large number of mistakes.

The research confirms previous reports that some of the major issues giving rise to change requests originate in the design stage. In this respect, some researchers indicated that change requests could be caused by a complex design (Memon et al., 2014a), or by an insufficiently detailed design (Kolawole et al., 2015). However, from evidence in the Saudi contexts, this research contributes by identifying the role played by lack of involvement by the end-user in the design stage. It also identifies that change of end-user, or change of owner by the government, may give rise to design-related change requests, because they will seek to tailor the project to their own requirements.

Some studies indicated that change in specification is the main cause of variation orders (Oladapo, 2007; Memon et al., 2014b). This study confirms that specifications are a major source of problems leading to change requests. However, this research contributes more detailed understanding of the repercussions of changes in specification by showing that, if the supplier of specifications is changed for any reason, change requests may arise, seeking another specification, which may not fit with some parts of the design, and forces stakeholders to amend the design to suit the new materials.

With regards to the effects of change requests, previous research has tended to focus on negative effects of change requests, such as scope creep, delay and cost overruns. This study, while acknowledging and expanding on such risks, offers a more balanced picture by identifying ways in which change requests may also benefit the project. Most researchers indicated that the

major direct impacts of change order are cost and time overrun (Alnuaimi et al., 2009). However, this research conversely suggests that in some cases, a change request may save time and cost when it reduces and amends some parts of the design or specifications of the project.

The cost, also, could be considered as a potential effect when a change results in additional payment to the contractor (Arain & Pheng, 2005). However, this research added another potential effect for the contractor, when he loses opportunities to win other contracts due to the delay of his current project by frequent change requests. In terms of reputation, several researchers mentioned that change requests may result in a bad reputation based on project delay and cost overrun (Yogeswaran et al., 1998; Fisk & Reynolds, 2013). However, this research provides an additional perspective by indicating that a change request may enhance the reputation of stakeholders, if the project is achieved before its timescale and under budget.

Arain and Pheng (2005) indicated that change orders may lead to disputes and affect stakeholder relationships. This research confirms such a view, but also uncovers an alternative position, showing that in some cases, positive change orders may improve the project and make progress in the delivery time, which may contribute to building good relationships between the stakeholders.

The researcher also adds to understanding on handling change requests. Several authors have proposed handling change requests in several ways. For example, Hanna et al. (1999) focused on the impact of change orders and how to handle the contract. Another study by Charoenngam et al. (2003) concentrated on the process and handling of change orders without focusing on the concept, causes, and effects of the change requests. Others, such as Kolawole et al. (2015) offered accounts of and prescriptions for the handling of change orders without addressing the concept, process, causes and effects. However, this research based on insights from several Saudi projects, contributes by suggesting a comprehensive process for handling change requests, starting with understanding the concept and the meaning of the

change request, then using a formal standardised, documented application process with timescale and specified responsibility authority; after that, the causes of change requests are specified, followed by determining the direct and potential effects of the change requests. Finally, change requests can be handled based on the previous steps. Moreover, the researcher has supported this broader process-related understanding with an illustrative model (Figure 24). The model encapsulates, in the form of network diagram, the whole analysis of this thesis, showing the themes and codes associated with each data category and the relationships between elements across categories.

The model is, of course, context-specific, depicting the issues and relationships found to be salient in the context of Saudi construction projects. There can be no universal model, as each project has its own environment and faces its own set of influencing factors. Nevertheless, by mapping in detail the issues in one particular context, the model demonstrates the complex, multi-faceted nature of change requests and could provide a starting point for the analysis of change requests in other contexts. This depiction contributes to a more holistic perspective and better understanding of the ramifications of change requests.

3. The study contributes to stakeholder theory by applying it in the new context of large construction projects in Saudi Arabia. It identifies the relevant stakeholders for such projects, their roles and relationships, and the various ways in which they can impact each other, and the project, through the initiation, processing, approval and execution of change requests. This is an issue that has been given insufficient consideration in previous studies on change requests. This was apparent in Chapter Two, for example, where an analysis of gaps in previous research showed that studies have generally focused on one stakeholder group, or perhaps two, but few if any have drawn on the insights of a range of stakeholders with different roles and interests in the project, as this research has done. In this way, the research demonstrates the value of considering multiple stakeholders' perspectives when evaluating the implications of change requests, and when designing procedures for handling change requests in a given project.

4. The research makes an incremental contribution by applying Hofstede's (1984; 2016) theory of cultural dimensions to shed light on how aspects of Saudi culture influence project management, with specific reference to change requests. In previous literature, Hofstede's dimensions have been applied to analysis of project management issues in other cultural contexts, such as China and Singapore. Moreover, Hofstede's dimensions have been used to describe the characteristics of Saudi culture. However, this is the first study to use Hofstede's dimensions to interpret project management issues, as represented by change requests, in the construction industry in Saudi Arabia.

   In particular, this research has demonstrated the impact of Saudi Arabia's high Power Distance, manifested in the centralisation of authority with the owner, which not only causes bureaucratic delays in project processes, but can also result in the owner's autocratic imposition of capricious change requests to inflate the project and, hence, his own status. It was also suggested, based on the evidence of project consultants and contractors, that project management is applied only in a piecemeal and incomplete manner, and a factor in this was shown to be Saudi society's tendency towards uncertainty avoidance, Saudi values contributing to a preference for perpetuating entrenched habits rather than risk a foreign and (in the Saudi context) relatively 'untried' methodology. These examples show that project management is not a universal concept or standard artefact, but is context-dependent and negotiable. Thus, there can be no 'one size fits all' prescriptions, but a need for culturally-relevant solutions and ways of 'selling' them.

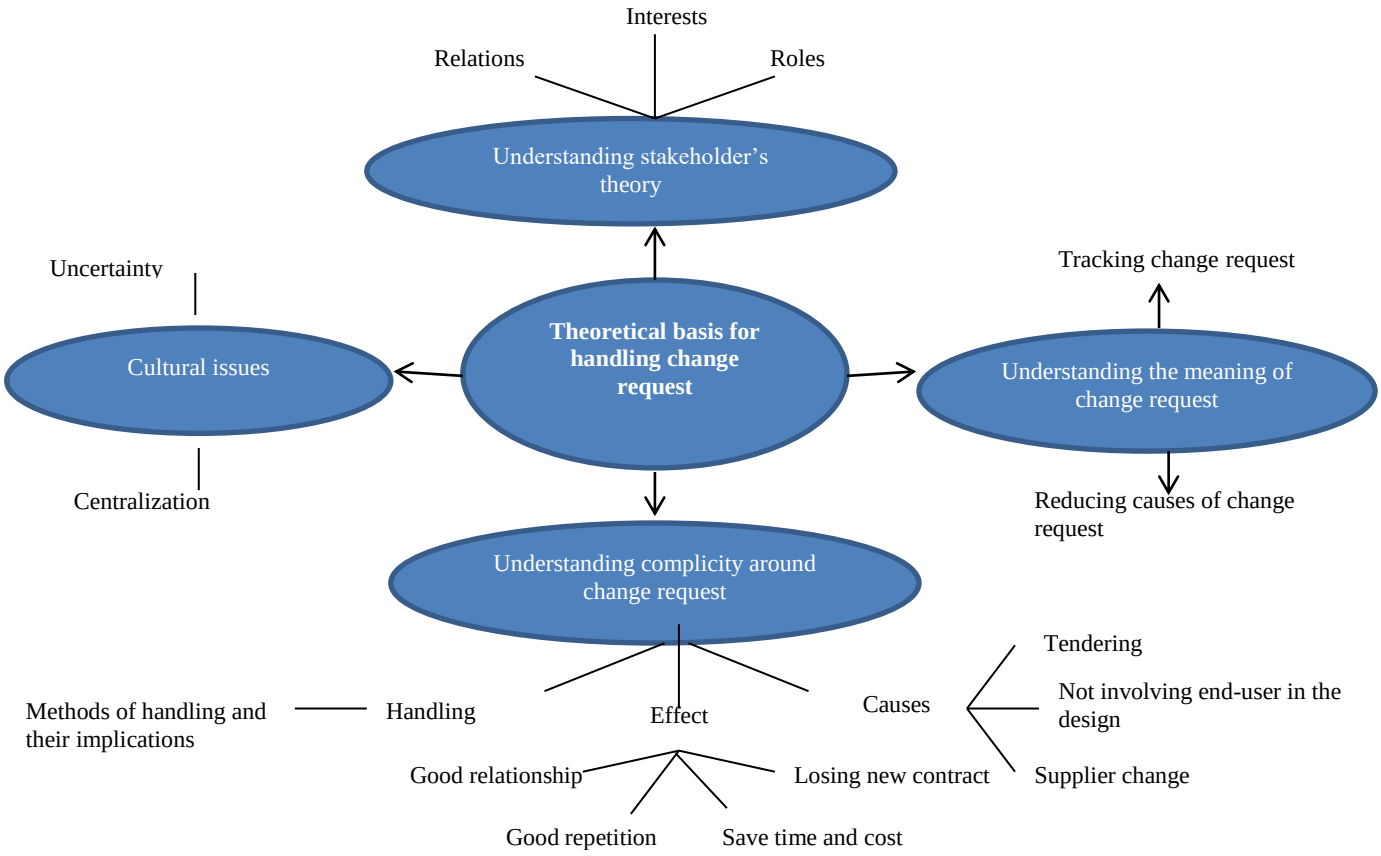


Figure 25 Improving management of handling change request theoretically

Figure 25, abstracted from the earlier Fig 24, summarizes the contributions detailed above and offers a theoretical framework for understanding the concept, occurrence and impacts of change requests, as a necessary starting-point for understanding how management of change requests in large projects can be improved. The core of the model is the process-based view of change requests detailed as the first and second contributions, above. This is informed by a clear and consistent understanding of the meaning of the term, change request, and of the distinction between a request and an order. Such an understanding can encourage and assist the tracking of change requests from the initial proposal to approval (giving them order status). The model highlights the importance of understanding the causes and effects of change requests (examples specific to this study are indicated), as a basis for anticipating and addressing avoidable causes and deterring frivolous or harmful requests. Practical ways of acting on this understanding are addressed in the next section. Ancillary to the change request process itself, but of importance to understanding the issues raised, are two other bodies of theory to which the thesis has contributed. As noted in contribution 3, above, managing change effectively necessitates identifying the key stakeholders and

understanding their interests, roles and relationships. This study has provided evidence from multiple stakeholders' perspectives in the Saudi construction sector context, which can confirm such an understanding. Finally, the model shows the contribution of cultural understanding as a requirement for a contextualized understanding of change request issues, necessary for producing culturally feasible and desirable improvement strategies. Thus, the model contributes to a balanced, holistic, context-sensitive understanding of change requests, which moves beyond the limited perspectives that predominate in the literature, enabling the change request to be viewed within a macro-perspective. Such an understanding provides an expanded basis for theorizing change requests, and a foundation for the practical proposal in the next section.

6.3.2 Practical contribution

The findings of this study give rise to a number of evidence-based practical contributions, some of which had been experienced by participants, albeit not used in the projects studied, and others proposed by the researcher based on analysis of the situation in the participating companies. Following enumeration of these suggestions, they are summarized in a framework model, Figure 26 as a guide to practitioners on a systematic approach to reducing and optimally handling change requests, for more effective of management of change requests, before and following the occurrence of change requests.

A number of strategies were suggested by research participants, based on their past experience in other, similar contexts, which they thought could usefully be applied to Saudi construction projects, and which were supported by the researcher's analysis.

1. The first of these pertains to the tendering process. It has been shown that the process currently used can give rise to incomplete understanding of project complexities, errors in costing, and so on, which could generate change requests as problems become apparent (see for example, 4.4.1.1.4 and 4.6.2.3). It would be advisable to move from open competitive tenders to a system of pre-qualification and acceptance of the most economically advantageous (not necessarily lowest) tender, as described in the literature

(2.9.1). The government (or other owner) would set the pre-qualification criteria, consistent with Saudi Arabia's high power distance culture. Such a system would also be consistent with the value of uncertainty avoidance, as it would reduce the likelihood of projects failing, or having to be changed due to the contractor's inability to perform the contract.

2. Another important practical implication is that the FIDIC contract or any other similar strict standardised contract should be applied in Saudi Arabia to avoid time and cost overrun by frequent change requests, and to protect the rights of stakeholders (see 4.4.1.1.4 for reported problems, and 4.6.2.4 for participants' suggestions). The FIDIC contract allows for necessary omissions, alterations, additions or change in quality (Charoenngam et al., 2003), but under clearer conditions and with clearer understanding of parties' responsibilities than prevail at present, which may help to reduce change requests or when changes are unavoidable, mitigate their harmful consequences and reduce conflict.

3. It would be useful to appoint a committee chosen by stakeholders, consisting of representatives of the owner, contractor and consultant, to control change requests and have authority to approve or revise them (see 4.6.2.6). This is recommended by the PMI, who refer to a Change Control Board "responsible for reviewing, evaluating, approving, delaying, or rejecting changes to the project, and for recording and communicating such decisions" (PMI, 2013). Such cooperation of stakeholder representatives could be promoted on the basis of Saudi Arabia's collectivism (Hofstede, 2016). Moreover, the committee could contribute to reducing uncertainty by the application of agreed criteria and timescale.
4. It is important that a careful study of the project is undertaken by stakeholders (see 4.6.2.1), and all requirements are determined in writing for the designer.

5. Also, a training course for stakeholders to discuss and clarify any misunderstanding regarding design and specification issues may help to reduce frequent change requests later in the project (see 4.6.2.5).

6. The findings of this study also have important implications for future practice in the design stage, especially before change requests occur. Alsuliman (2014) indicated that it is important to engage stakeholders in the variation order management system at the design stage. However this study contributes, in addition, the benefit of applying value management to handle the design, specifications, function and quality in the early stage (see 4.6.2.2). Some previous studies (Alalshikh & Male, 2009) have reported use of value management in later stages of Saudi projects, but this is too late to capture and pre-empt problems originating in the early stages, where this research suggests many change requests originate. Moreover, previous implementation has been culturally insensitive and a source of conflict (Alalshikh & Male, 2009). Creation of internal VM teams would alleviate these problems.

In addition to the above, there are strategies that the participants had not previously used or envisaged, but which are suggested by the researcher, based on the data analysis.

7. In terms of handling change requests during the process, the need is suggested for a formal, documented change request process. Section 5.3.1 noted the researcher's observation of the informal, inconsistent processes in use, and the difficulties that arose as a result. Introducing a formal process would be consistent with the society's high UA, and it would help to avoid arbitrary abuses of authority caused by high PD. In line with Hofstede's (2016) cultural dimensions, Saudi Arabia is classified as high in power distance with a tendency towards centralisation (Hofstede, 2016), which may cause delay in the process of change requests by the owners. It is important to apply a formal, documented process to mitigate the centralisation and accelerate the process. Most previous studies, because they did not pay enough attention to the process of change requests, failed to address the issue of controlling the process of change request, which may lead to delay in approval and so delay the project delivery. The present research identified a lack of formal procedures for change requests and overlapping stakeholders' functions (see 4.3.1 and 4.3.2), thereby highlighting the need for a formal, documented application process with a timescale and clear

responsibility/authority in every project. It is difficult to suggest a single comprehensive formal process for all projects, because every project has its own circumstances and different functions for the stakeholders. However, it is important to deal with change requests in a special formal application with a time limit, to accelerate the process and reduce the conflict between stakeholders regarding responsibility for delay.

8. As a practical contribution of this study, the researcher, in Chapter Four, sections 4.3.1. and 4.3.2., inferred the informal processes currently operating in the four construction companies, for change requests originating with the owner, and those raised by the contractor. In order to clarify the processes, a flow chart was developed for each project, showing clearly the parties involved in each stage, their responsibilities, and the interaction between them. These diagrams proved to be a valuable tool for understanding what was happening in the organisation. It is suggested that contractors on any project could, at an early stage, use this mapping process to shed light on their procedures. By doing so they could, for example, identify bottlenecks and duplication of responsibilities. This, in turn, would be a useful input to inform the development and documentation of formal procedures for the remainder of the project.

9. A more difficult recommendation to implement in a high PD society is the delegation of a degree of authority to the contractor and project manager, with regard to small changes, and to the owner's representative (in the absence of a committee, as suggested above) to approve change requests. While this would involve the sensitive issue of the owner's status and controlling power, it can be argued that the owner would still maintain control in the sense of setting the parameters within which such delegated authority could be exercised, for example in terms of type of change, monetary value, or other criteria; moreover the owner would ultimately benefit from the smoother running and earlier delivery of the project.

As noted above, project management, including the management of change requests, has been shown to be a contested area with contextually-influenced features. Thus, this study does not assume that an uncritical borrowing of 'universal" solutions is possible in the Saudi context. Nevertheless, by exploring and understanding the

issues and bottlenecks specific to that context, it has been possible to point to some ways of addressing the identified problems that are believed to be culturally appropriate and feasible.

Based on the detailed analysis in Chapter 4, the diagrammatic depiction of the analysis in Fig 24 and the summary of practical implications above, Figure 26 below provides a practical framework for improved handling of change requests. This can be used by practitioners as a guide for change management by anticipating and eliminating likely causes of problems leading to change requests and, where change requests are unavoidable, expediting their processing and execution, to minimize disruption and harmful effects to the project and its stakeholders.

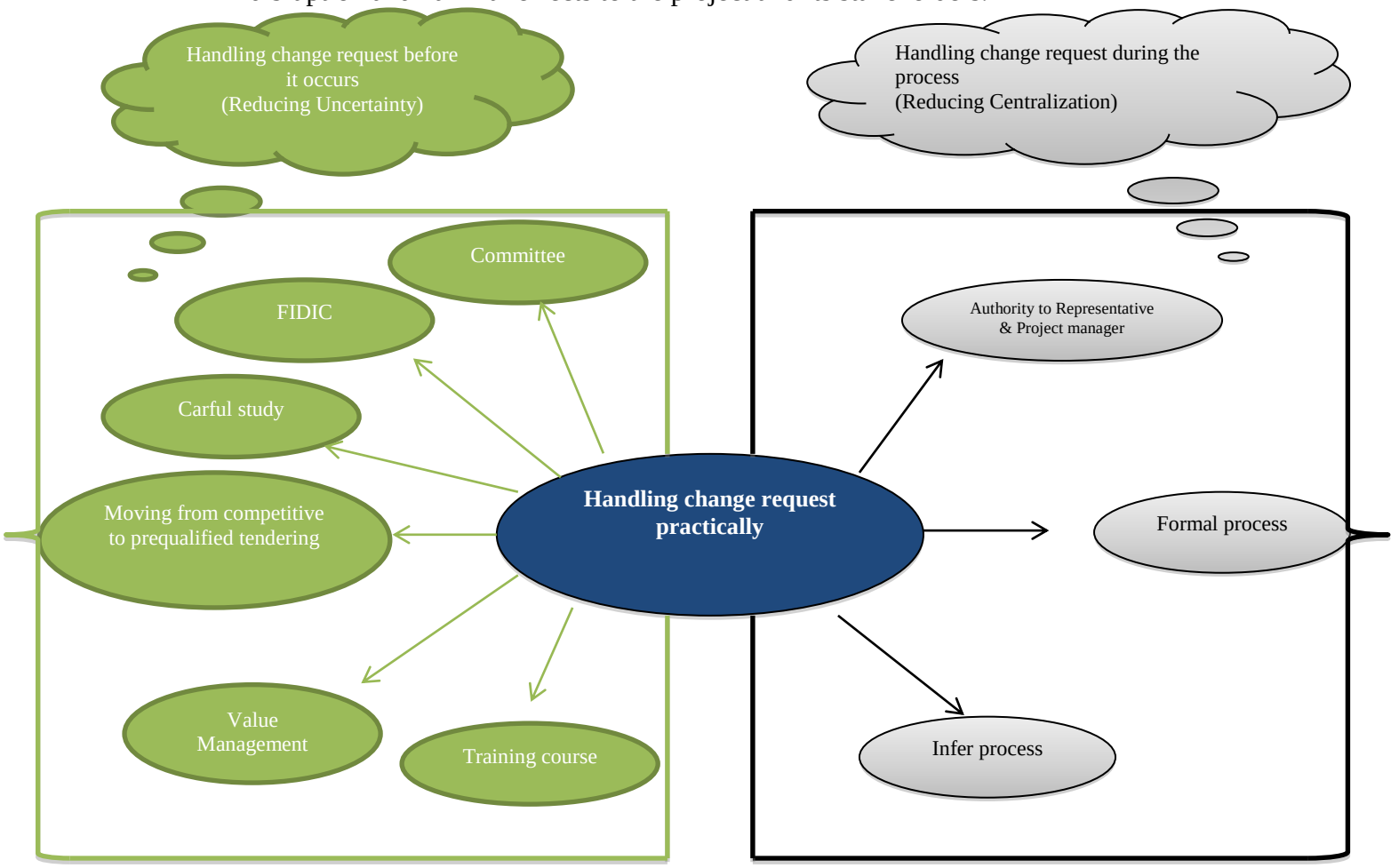


Figure 266 Improving management of handling change request practically

As the model shows, and as indicated above, many causes of change requests can be avoided by a move to pre-qualification in tendering, thorough research to inform the

design, use of a standard contract such as FIDIC, training for stakeholders on the meaning and implications of various project elements, and value engineering in the early project stages. When change requests occur, their evaluation, approval and execution can be expedited by a formal, documented process. If no such process exists, the process of inference applied in this study (section 4.3) can be applied in order to understand prevailing procedures, identify problems and design a suitable protocol. The process should also be tracked by a designated committee or similar, so that causes of delay can be identified and accountability assigned. Lastly, giving a degree of delegated authority to the owner's representative would avoid bottlenecks caused by non-availability of the owner. This model would provide a useful basis on which practitioners could diagnose and design strategies for management of change requests to minimize disruption and delays to projects, and resulting damage to stakeholders and the national economy. A further advantage of the measures suggested is that they will help to alleviate the problems arising from the cultural characteristics of uncertainty avoidance and power distance. As shown in the model, the measures suggested to be taken before a change request occurs will increase certainty for all parties regarding their rights and responsibilities in the project. If a change request is made, the suggestions for handling it will reduce the degree of centralization caused by power distance and so facilitate the efficient processing and implementation of the request. This, in turn, will reduce delays and a associated costs.

6.3.3 Methodological contributions

This research takes an unusual approach in integrating the interpretive and critical realist paradigms, rather than adopting a single paradigm. Interpretivism holds that knowledge can be obtained through individuals' experience, memories, perceptions and expectations. Critical realism considers that knowledge is socially constructed, not solely in the consciousness of individuals (Denzin & Lincoln, 2000). Therefore, combining both paradigms after consideration of the study objectives helped to understand the problem from an individual perspective, but with awareness of the effect of social and cultural factors, for which critical realism accounts.

Quantitative research dominates in the field of change requests, as the work of Hanna et al. (1999), who studied the impact of change orders on labour efficiency in

electrical construction, attests. However, for understanding stakeholders' perceptions in more detail, the researcher used a qualitative approach and multiple case study strategy. Case study contributes to understanding the nature of change requests and the process from stakeholders' perspectives. Also, case study is suitable to focus in depth on cultural, social, and organisational studies, and is interesting for the potential for new issues to emerge through discussion with research participants. The researcher used a case study strategy to obtain and investigate the information from the participants and compare them with the documents and observation of project sites, to check the reliability of this information.

Via two phases of data collection, the analysis of documents as secondary data, and semi-structured interviews with participants as primary data, the researcher gained deep insights into how to handle change requests by understanding the conceptualization, process, causes and effects of change requests. Whilst the methods used are not in themselves original, their significance needs to be appreciated in the context of the immature research context and distinctive culture of Saudi Arabia. It is common in Saudi Arabia for research to be confined to questionnaires; indeed, when companies were approached for this study, it was apparent that potential participants assumed that this would be the method adopted. However, the researcher's experience of the Saudi context suggested that this might not produce trustworthy findings, as questionnaires are often given little thought and attention, but answered from a social desirability perspective. Gaining access and building rapport for a case study, in a secretive culture that emphasises privacy, was challenging, but enabled the researcher to probe deeply in order to uncover inconsistencies and identify the complexities of the situation. In this way the research complements the earlier, predominantly quantitative research on change requests and adds new understandings that quantitative approaches alone cannot capture.

6.4 Research Limitations

The main aim of this study was to explore the handling of change requests in large building projects. However, there are other change requests in other fields, such as IT change requests and infrastructure change requests. In other types of projects, the

stakeholders, and their roles and relationships, may differ. Also the types of deliverables are different, as is the relevant timescale. In IT, for instance, many deliverables may be relatively intangible, with requirements expressed in terms of abstracts such as ‘Speed’, ‘efficiency’ or ‘relevance’, and time-scales may be shorter due to the speed with which technology changes and information becomes obsolete. Hence, it cannot be assumed that the issues uncovered in this study would apply in the same way to other sectors and projects.

This research is limited to Riyadh, because Riyadh is the capital city of Saudi Arabia, and is the largest city in the kingdom, with has more construction projects compared to other cities in the Kingdom. Considering projects in areas other than Riyadh might have generated different causes, or suggested different relative importance. External, environmental factors may also differ, for instance, due to Saudi Arabia’s varied topography.

Also, the research is limited to three large companies, which are classified as grade 1, because these companies are dealing with giant projects that cost over 600,000,000 million Saudi Riyals, (about £100,000,000), which affects the economy of the government strongly. Small companies handling small projects may face different challenges, and differ from larger ones in the relationships between stakeholders and in the methods used to handle change requests. However, preliminary enquiries suggested that such companies do not follow a clear or documented procedure for addressing change requests (even to the limited extent followed by the large companies that participated in this research). It therefore appeared that they would not have the information needed to meet the requirements of the study. Nevertheless, it must be borne in mind that due to differences in resources and contexts, what is feasible for a large company may not be for a small company. Therefore caution would be needed in trying to apply the practical implications of this study to smaller companies.

Several private projects suffer from failure and delay because of frequent change requests; however the research was confined to government projects, because these projects are more expensive, more complicated, and related to citizens’ needs, such as education, economy and healthcare projects, where frequent change requests and

delays can have serious impacts. Again, this has implications for generalizability, as private projects are often smaller, the owner may be more directly involved, payment would not be subject to the same bureaucratic procedures as in government projects, and there is likely to be less involvement of foreign designers and consultants. These factors, too, warrant careful consideration when attempting to transfer conclusions from this research to other contexts.

Lastly, a limitation should be noted with regard to the access to data afforded for this research, in particular, the fact that the researcher was not allowed to see the contracts for any of the projects investigated in this study. Thus has implications for confirmability, as it was not possible to verify independently any claims made by interviewees about the project terms and parameters, or the impact on them of change requests. It is possible, moreover, that access to the contracts might have provided insights into errors and omissions that may have contributed to stakeholder conflict and to proliferation of change requests. Nevertheless, this limitation was somewhat mitigated by the triangulation of multiple stakeholder perspectives. Moreover, the information gleaned with regard to the problems of using non-standard contracts in itself was a contribution to the insights provided by this study.

6.5 Research Agenda for Further Research

Several suggestions can be made for research areas to address limitations in the present work and build on the work undertaken in this study, as follows.

- This research focused on the main objective of handling change requests in large building projects, as a major problem in Saudi Arabia. However, it would be useful to study other fields of change requests, such as IT change requests and infrastructure change requests, because all of them affect projects, and hence could affect the economy of Saudi Arabia.

- This research was conducted in Riyadh as the capital city of Saudi Arabia and the largest city in the Kingdom. However, further research could examine other cities of Saudi Arabia and other Arab Gulf countries with a similar culture, to expand the generalisation of the research.

- This study was conducted in the public sector as a necessary sector that

affects the economy of the country. However, it would be of interest to conduct studies in the private sector, because it addresses citizens' needs and requirements directly.

- This research studied the problem qualitatively, and used a case study strategy to study the problem deeply and precisely, and produce a model for handling change requests. However, there are issues of generalisability since there were only four case studies. Further insights, and the possibility of generalization, could be obtained by combining qualitative and quantitative methods, with a larger sample. A good next step in the study would be to take the concepts developed in this study, as described particularly in Figures 24, 25 and 26, and use those as the basis of a questionnaire to look across as much of the Saudi Arabia construction industry as possible. This would test whether the conclusions of this thesis about the causes, outcomes, and most particularly the treatment of change were valid across a wider range of the industry. A sufficiently large sample might reveal a wider range of treatment strategies in use in different organizations, and would also enable statistical tests of associations to be performed – for example, between the type of contract employed and outcomes such as frequency of change requests. It would also be useful to expand the focus of the study beyond Saudi Arabia, for example to the other Gulf countries and the wider Arab world, in order to test whether the model remains valid across a range of cultural contexts. It is also possible that change requests and practices are industry specific, so the extension of the study to other industries would be on interest further approach to build on the contribution of the present work.

- As mentioned previously, the main concern of the study was handling frequent change requests, especially before they occur. However, the researcher faced a constraint on handling change requests, which is uncertainty avoidance, as a cultural barrier to applying the full process of project management in Saudi Arabia. As indicated in the findings and discussion chapters, applying project management may reduce the frequency of change requests. However, currently project management is only applied in Saudi Arabia incompletely, which may increase the number of change

requests. Therefore, the researcher recommends future research to investigate how to overcome uncertainty avoidance and apply project management.

- Also, centralisation is another restriction on handling change requests, especially during the process, which affects the process of change requests and delays the decisions by the owner. This research recommends another study to research how to mitigate centralisation by the owners i construction projects, by giving authority to other stakeholders to deal with change requests, and to assess the impact of such measures.

6.6 Concluding Remarks

This research has explored a comprehensive way to handle frequent change requests, starting with understanding the meaning of change requests, because understanding the meaning of any problem may help to solve it. After that, understanding the process of change requests is very important in order to track the problem, accelerate the processes and identify bottlenecks. Following that, exploring the causes of change requests can help to suggest effective ways to handle them. Also, understanding the effects of change requests helps in anticipating the direct and potential, positive and negative effects. Eventually, after understanding all aspects of change requests, handling them more effectively would be possible. Therefore, this research tried to suggest ways to handle change requests before they occur, during the process and after they occur. It is hoped that the insights provided by this study will benefit project stakeholders, including the government, pointing ways to speedier, more economical and less conflicting ways of managing major construction projects in the Kingdom.

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Appendices

Appendix 1: Preliminary Interview Schedule

Previous Questions

1. Can you tell me a bit about your work experience and your role in this company?

2. To what extent do you face change requests in the course of your work?

3. What does the term 'Change Request' mean to you?

4. What is the process for making change requests?

5. What internal factors lead to change requests occurring? E.g. related to the consultants – Owner- Stakeholders-Contractors, any other.

6. Are there external factors that can lead to change requests? What are they?

7. To what extent do cultural factors cause change requests? How? Why?

8. What type of project management system do you apply in your project? American system? If so, is it suitable to the culture of Saudi Arabia? How? Is this system a cause of change request? If so in what way?

9. What other factors can be causes of change requests? Why?

10. Can you explain the impact change requests have on the project and on your business generally? E.g. on the design- Financial-Relationships, scope, progress, quality, delay....?

11. Are there any positive effects? If yes, what are they? How do these effects occur?

12. Are there any negative effects? If yes, what are they? How do they occur?

13. What can you do to avoid change requests? E.g. Planning- Contracts.

14. If, nevertheless, a change request occurs, how do you handle it? What can

you do to alleviate the effects? Why do you adopt this approach? How effective do you think it is? Why?

15. Is the way you handle change requests affected by cultural factors? In what way?

16. Are there any changes you would like to see, that would enable you to manage change requests more effectively?

Appendix 2: Revised Interview Schedule

New Questions

1. Can you tell me a bit about your role in this company and your work experience?

2. What does the term 'Change Request' means to you?

3. What is the difference between change order and change request?

4. What about variation order?

5. How frequently do you have to deal with change requests? Is it once a week, a month…?

6. What is the process for making change requests?

7. What internal factors lead to change requests occurring in this current project? E.g. related to the consultants – Owner- Stakeholders-Contractors, any other? How?

8. What is the time limit to complete change requests from initiation to authorisation?

9. What is the percentage of failed or delayed projects due to change requests?

10. From your previous projects and your experience, are there internal factors that can lead to change requests? What are they? How?

11. Are there external factors that can lead to change requests in this current project? What are they? How?

12. From your previous projects and your experience, are there external factors that can lead to change requests? What are they? How?

13. Are there cultural factors for the workers in this company such as focusing on smaller groups rather than focusing on the efficiency, and effectiveness of the organisation as a whole, delay in duty, or others that cause change requests? How? Why?

14. Do you apply the standard of the Project Management Institute PMI or similar in your project? If so, is it suitable to the culture of Saudi Arabia? How?

15. Do you think not applying PMI or similar completely in Saudi Arabia one of the causes of change requests?

16. What other factors can be causes of change requests in the current project? And what about previous projects? How?

17. In this current project, are there positive effects from the change requests to the stakeholders? Or on the project? If so, what are they? And how do these effects occur?

18. From your previous projects and your experience, what positive effects can change requests have for stakeholders? And the project itself? E.g. on the design-Financial-Relationships, scope, progress, quality, delay… How?

19. In this current project, are there negative effects from change requests on the stakeholders? Or on the project? If so, what are they? And how do these effects occur?

20. From your previous projects and your experience, what negative effects can change requests have for stakeholders? And the project itself? E.g. on the design-Financial-Relationships, scope, progress, quality, delay… How?

21. What can you do to avoid or reduce change requests before executing the process of a project? E.g. Planning- Contracts.). How?

22. When creating the change request, what can you do to speed up decision-making for its approval and adoption? Why did you adopt this approach? How effective do you think it is?

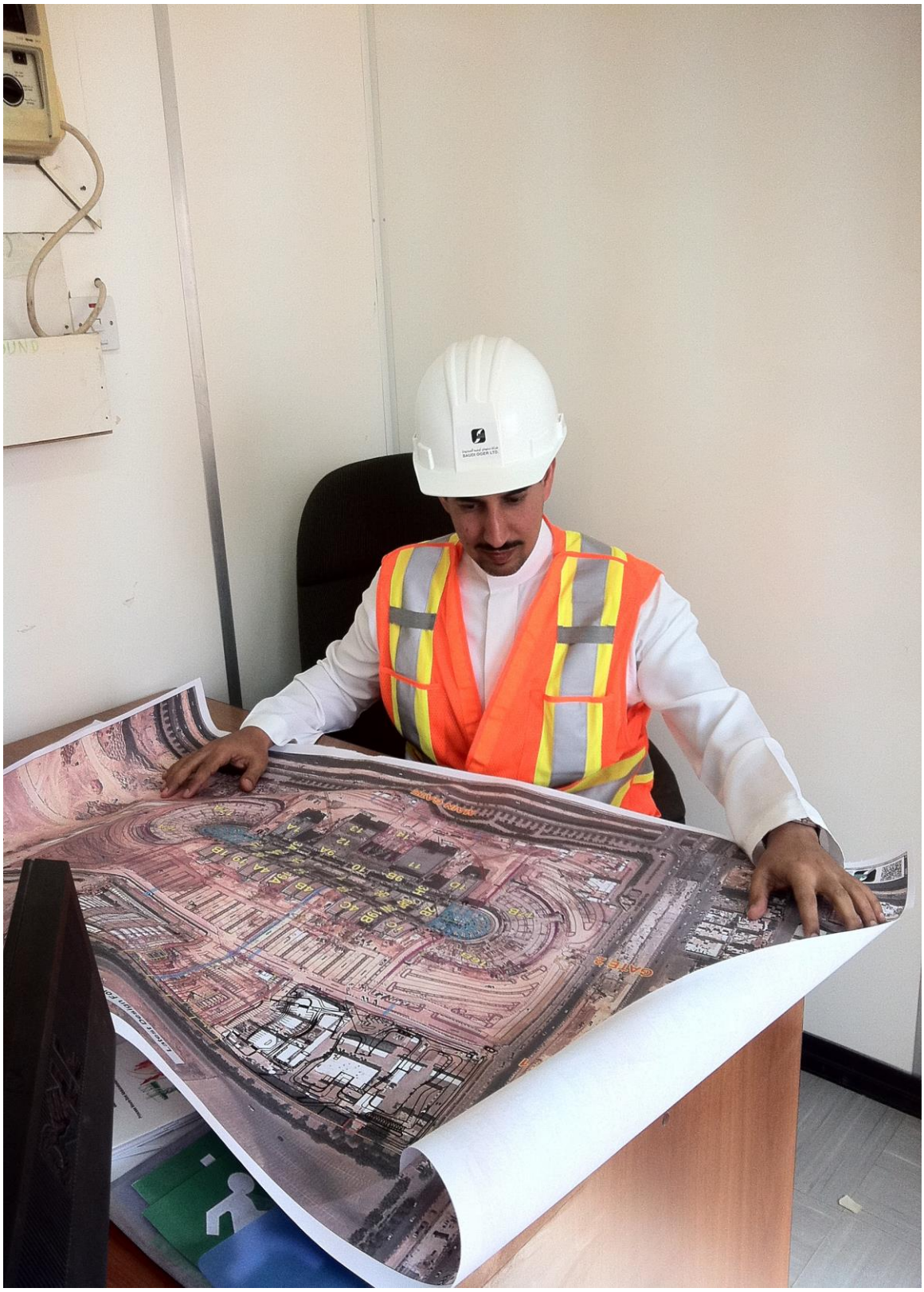
23. After the authorisation of the change request, what can you do to speed up its implementation?

24. Is the way you handle change requests affected by cultural factors of the business environment? In what way?

25. Are there any changes you would like to see, that would enable you to manage change requests more effectively? How?

26. Do you have anything else you would like add? What is it?

Appendix 3: Photgraphs from the fieldwork



The researcher compares project scope at the site with the original project plan, revealing the impact of change requests.

The researcher observes a worker implementing a specification change, which slowed the progress of the project.