Delays in Project Completion:
A comparative study of construction delay factors in Saudi Arabia and the United Kingdom

Ibrahim I Falqi

030734650

A dissertation submitted in partial fulfilment of the requirements for the degree of

MSc in Construction Management (Project Management)

Dissertation supervisor: Professor A. Kaka

Heriot-Watt University

School of the Built Environment

September 2004

Declaration:

I hereby confirm that this dissertation is my own work.

_____ _____

Signature **Date**

THANKS TO ALLAH ALMIGHTY

Acknowledgements

The author would express his sincere gratitude to Professor A. Kaka for his advice on the research and guidance during the preparation of this dissertation.

Special appreciation is also extended to those contractors, consultants and owners who completed the questionnaire used in this survey in Saudi Arabia and United Kingdom, for their generous co-operation and contribution.

Abstract

Construction projects are more often than not linked with delay. Things go wrong and the project completion date is pushed back, with someone to be blamed for it. Many attempts have been made to identify the causes of delay and to highlight the most important of these. It is necessary to create awareness of these causes, their frequency, and the extent to which delays can adversely affect the project delivery (severity). It is also useful to compare causes of delay in different countries in order to share practical solutions.

This study presents the results of a survey undertaken to determine and evaluate the most severe and most frequent factors causing delay in Saudi Arabian and UK construction projects. A survey based on a questionnaire was carried out among randomly selected contractors, consultants, and owners. The experience-based survey is a crop of over 6700 construction projects and covers 67 previously identified delay factors, grouped into four major categories. The main causes of delay are analysed and ranked according to their frequency of occurrence and severity

The results of the study proved that construction projects in developing countries suffer delays more than developed countries do. It was found that the level of importance of the cause is relatively different from SA to the UK, and the number of important causes in SA is higher than in the UK. However, relatively similar results in the both countries with regard to category rank were obtained; since the contractor performance delay group was considered as the most important group, while consultant-related factors were ranked as the least important category in both countries.

Keywords: construction delays, claims, time performance, SA, UK

Contents

ACKNOWLEDGEMENTS ..... **IV**

ABSTRACT ..... **V**

LIST OF TABLES ..... **IX**

LIST OF FIGURES ..... **XI**

LIST OF EQUATIONS ..... **XII**

CHAPTER (1) INTRODUCTION ..... **- 1 -**

1.1. GENERAL ..... **- 2 -**

1.2. STATEMENT OF THE PROBLEM ..... **- 3 -**

1.3. OBJECTIVES OF THE RESEARCH ..... **- 4 -**

1.4. LIMITATIONS OF THE RESEARCH ..... **- 5 -**

1.5. RESEARCH LAYOUT ..... **- 6 -**

CHAPTER (2) THE SAUDI AND BRITISH CONSTRUCTION INDUSTRIES ..... **- 7 -**

2.1. INTRODUCTION TO CHAPTER (2) ..... **- 8 -**

2.2. THE CONSTRUCTION INDUSTRY IN GENERAL ..... **- 8 -**

2.3. THE NATURE OF THE CONSTRUCTION INDUSTRY ..... **- 8 -**

2.4. THE SAUDI CONSTRUCTION INDUSTRY ..... **- 9 -**

2.4.1. ECONOMIC OVERVIEW ..... - 9 -

2.4.2. THE SAUDI CONSTRUCTION INDUSTRY ..... - 9 -

2.5. THE UNITED KINGDOM CONSTRUCTION INDUSTRY ..... **- 11 -**

2.5.1. ECONOMIC OVERVIEW ..... - 11 -

2.5.2. THE UNITED KINGDOM CONSTRUCTION INDUSTRY ..... - 13 -

CHAPTER (3) DELAY IN CONSTRUCTION PROJECTS ..... **- 15 -**

3.1. INTRODUCTION TO CHAPTER (3) ..... **- 16 -**

3.2. TYPES OF DELAY ..... **- 16 -**

3.3. TIME PERFORMANCE RECORD ..... - 21 -

3.4. CAUSES OF DELAY – IDENTIFICATION AND CATEGORIES ..... - 23 -

3.5. CAUSES OF DELAY – THE OUTCOME OF PREVIOUS STUDIES ..... - 27 -

CHAPTER (4) CAUSES OF DELAY ..... - 30 -

4.1. INTRODUCTION TO CHAPTER (4) ..... - 31 -

4.2. CAUSES OF DELAY IN CONSTRUCTION PROJECTS ..... - 31 -

4.2.1. CONTRACTOR RELATED FACTORS ..... - 32 -

A. MATERIALS ..... - 33 -

B. EQUIPMENT ..... - 34 -

C. MANPOWER ..... - 34 -

D. PROJECT MANAGEMENT PERFORMANCE ..... - 35 -

E. PROJECT FINANCE ..... - 38 -

4.2.2. CONSULTANT RELATED FACTORS ..... - 38 -

4.2.3. OWNER RELATED FACTORS ..... - 39 -

4.2.4. OTHERS ..... - 40 -

A. EARLY PLANNING AND DESIGN ..... - 40 -

B. GOVERNMENT REGULATIONS ..... - 41 -

C. EXTERNAL FACTORS ..... - 43 -

4.3. SUMMARY OF CONSTRUCTION DELAY FACTORS ..... - 44 -

CHAPTER (5) RESEARCH DESIGN AND METHODOLOGY ..... - 47 -

5.1. INTRODUCTION TO CHAPTER (5) ..... - 48 -

5.2. RESEARCH DESIGN ..... - 48 -

5.3. LITERATURE REVIEW ..... - 49 -

5.4. QUESTIONNAIRE ..... - 49 -

5.5. QUESTIONNAIRE WRITING, DISTRIBUTION AND COLLECTION ..... - 51 -

5.6. THE SURVEY SAMPLE ..... - 52 -

5.7. DATA COLLECTION ..... - 53 -

5.8. FAULTS IN THE SURVEY DESIGN ..... - 54 -

5.9. METHOD OF ANALYSIS ..... - 55 -

CHAPTER (6) ANALYSIS AND RESULTS ..... - 59 -

6.1. INTRODUCTION ..... - 60 -

6.2. DATA STATISTICS AND ANALYSIS ..... - 60 -

6.2.1. FUNDAMENTAL ANALYSIS ..... - 61 -

6.2.2. **CAUSES OF DELAY ..... - 82 -**

6.2.3. ANALYSIS OF DELAY CAUSES - CATEGORIES AND INDIVIDUALS ..... - 83 -

6.2.4. TEST OF THE HYPOTHESES ..... - 103 -

CHAPTER (7) CONCLUSION ..... - 106 -

7.1. INTRODUCTION ..... - 107 -

7.2. MAJOR FINDINGS ..... - 107 -

7.2.1. BLACK AND WHITE SIDES OF THE RESULTS ..... - 107 -

7.2.2. DELAY CAUSES - EXTENT OF DIFFERENCE IN THEIR IMPORTANCE BETWEEN SA AND THE UK ..... - 108 -

7.2.3. EXTENT OF DELAY ..... - 108 -

6.2.5. ***MOST IMPORTANT CAUSES OF DELAY*** **..... - 109 -**

6.2.6. ***PARTY MOST OFTEN RESPONSIBLE FOR DELAYS*** **..... - 110 -**

7.3. RECOMMENDATIONS FOR FUTURE STUDIES ..... - 110 -

GLOSSARY ..... - 111 -

APPENDIXES ..... - 117 -

List of Tables

Table 1 Economical comparison between UK and SA ..... *- 13 -*
Table 2 Assaf's Classification of construction delay causes ..... *- 25 -*
Table 3 Kumaraswamy's and Chan's Classification of construction delay causes 1995 ..... *- 26 -*
Table 4 Ogunlana's & Promkuntong's Classification of construction delay causes 1996 ..... *- 26 -*
Table 5 A cross-sections of related observations on the major factors causing delays in construction projects ..... *- 29 -*
Table 6 Sample Size ..... *- 53 -*
Table 7 Examples of excuses restrained participants to respond ..... *- 53 -*
Table 8 Total of respondents ..... *- 54 -*
Table 9 Frequency and severity weighting ..... *- 56 -*
Table 10 Frequency-severity matrix ..... *- 57 -*
Table 11 Frequency of participation ..... *- 61 -*
Table 12 Sector types that participants work for ..... *- 62 -*
Table 13 Participants' year of experience ..... *- 63 -*
Table 14 Building construction speciality ..... *- 65 -*
Table 15 Respondents' experience regarding to project sizes they have participated in ..... *- 67 -*
Table 16 Procurement methods that used by respondents ..... *- 69 -*
Table 17 The frequency of the tendering arrangements that experienced by respondents ..... *- 71 -*
Table 18 Number of construction projects that respondents have participated in ..... *- 73 -*
Table 19 The frequency of respondents that experienced delay ..... *- 74 -*
Table 20 Ratio of delayed to non delay projects ..... *- 75 -*
Table 21 The average delayed time of the delayed projects ..... *- 77 -*
Table 22 The average of delayed time authorised by the owner ..... *- 78 -*
Table 23 First responsible party for delays based on all ..... *- 80 -*
Table 24 Parties' attitudes regarding most responsible party for delays ..... *- 80 -*
Table 25 The importance average weight of sub categories by country's respondents ..... *- 86 -*
Table 26 The importance average weight of sub categories by the three parties from both SA and UK ..*- 87 -*
Table 27 Importance index and rank of delay subcategories by country's respondents ..... *- 87 -*
Table 28 Importance index and rank of delay subcategories by the three parties from SA and UK. *- 88 -*
Table 29The importance average weight of major delay categories by country's respondents ..... *- 88 -*
Table 30 The importance average weight of major delay categories by the three parties from SA and UK ..... *- 88 -*
Table 31 Importance index and rank of major delay categories by the three parties from SA and UK ....*- 89 -*
Table 32 Importance index and rank of major delay categories by the three parties from SA and UK ....*- 89 -*
Table 33 Importance index and rank of all causes by all respondents ..... *- 93 -*

Table 34 Importance index and rank by Saudi Arabia respondents ..... *- 95 -*
Table 35 Importance index and rank by The UK respondents ..... *- 97 -*
Table 36 The delay factors that have similar level of imprtance in SA and the UK ..... *- 104 -*
Table 37 Importance index and rank by SA contractors ..... *- 132 -*
Table 38 Importance index and rank by SA consultants ..... *- 134 -*
Table 39 Importance Index and rank by SA owners ..... *- 136 -*
Table 40 Importance index and rank by the UK contractors ..... *- 138 -*
Table 41 Importance index and rank by the UK consultants ..... *- 141 -*
Table 42 Importance index and rank by the UK owners ..... *- 143 -*

List of Figures

Figure 1Delay Types according to liability of construction parties ..... *- 17 -*
Figure 2 Excusable delay types ..... *- 17 -*
Figure 3 Delay Types according to occurrence ..... *- 19 -*
Figure 5 Cause-Effect relationship of construction projects Source: Shi & Arditi, 2001 ..... *- 24 -*
Figure 6 Chan's Principal factors affecting duration of construction projects ..... *- 25 -*
Figure 9 Sector types participants work for in relation to their countries ..... *- 63 -*
Figure 10 The Respondents Percentages regarding to their experience ..... *- 64 -*
Figure 11 Respondents' speciality in building construction ..... *- 66 -*
Figure 12 Respondents in relation to speciality in building construction types ..... *- 66 -*
Figure 13 The percentages of respondents regarding to the size of projects they have participated in ....*- 68 -*
Figure 14 The frequency of each procurement methods regarding to respondents' involvement ..... *- 70 -*
Figure 15 The frequency of respondents regarding the tendering arrangements they have experienced .*- 72 -*
Figure 16 Indication of the range of experts contributed in the survey in relation to the number of projects they have participated in ..... *- 73 -*
Figure 17 SA and UK respondents regarding the number of projects they have participated ..... *- 74 -*
Figure 18 The percentage of respondents who experienced delay ..... *- 75 -*
Figure 19 The percent of the delayed projects in both countries ..... *- 76 -*
Figure 22 The percent of average authorised time of delayed projects in both countries ..... *- 79 -*
Figure 23 Illustration of the averages delayed time that were let passed by the owner and reported by all respondents ..... *- 79 -*
Figure 24 Delay responsibility based on all respondents' opinion ..... *- 104 -*
Figure 25 Contractors' opinions regarding to delay responsibility ..... *- 104 -*
Figure 26 Key box ..... *- 104 -*
Figure 27 Owneors' opinions regarding to delay responsibility ..... *- 104 -*
Figure 28 Consultants' opinions regarding to delay responsibility ..... *- 104 -*
Figure 29 Linear indication of the delay factors ranking in SA and the UK ..... *- 104 -*

List of Equations

Equation 1 Frequency Index..... *- 56 -*

Equation 2 Severity Index..... *- 57 -*

Equation 3 Explanation of the FI and SI equations..... *- 57 -*

Equation 4 Importance index of the delay factor ..... *- 58 -*

Equation 5 Importance Index of the category ..... *- 84 -*

Chapter 1

Introduction

Chapter (1)

Introduction

1.1. General

It is almost axiomatic of construction management that the project may be regarded as successful if the building is completed on time, within budget, and is of the desired quality. It is commonly said, however, that whereas two out of those three can often be achieved, three out of the three cannot (Birkby and Brough, 2002), because of the complexities involved in a construction contract, and in particular the many different trades and professions that are commonly involved.

Realistic construction time is now increasingly of the essence because it often serves as a crucial benchmark for assessing the performance of a project and the efficiency of the project organisation.

A fundamental specification of the construction contract is the project period or time of project execution, which is established prior to bidding. The successful execution of construction projects and keeping them within estimated cost and prescribed schedules depend on a methodology that requires sound engineering judgement (Hancher, 1981).

Project completion for the owner means that he can make use of his new assets on time by habitation, renting, or selling. Any delay in project completion will disturb his/her plans. The client will not be able to make use of the property, and his/her business will be affected in almost all areas, especially finance. For the contractor, any delay in completion of the project gives rise to indirect overhead expenses and additional payments to the project staff and workforce. It also means that he will possibly be subjected to compensation claims. His next project might be cancelled as a result of delays in the present project, and loss of future opportunities will be made more likely by damage to his reputation and credibility. The consultants and all other

parties involved will also lose if the project is delayed: they will at least lose time, which may mean losing money.

Despite the great effort that has been put into the evolution of construction project planning and control during the last four decades, delay is still a very common feature of construction projects, and most experience extensive delays. These often result in adversarial relationships between construction stake holders (clients, contractors, consultants, etc.): distrust, litigation, arbitration, cash-flow problems, and a general feeling of apprehension towards each other.

1.2. Statement of the problem

Delays in the completion of projects produce a harmful effect upon all areas of projects and on all parties involved in these projects. The negative effects of delays are reflected in the cost of developments, the revenue from projects and the quality of those projects. The more time is taken to complete the job, the higher the cost of construction, because delay means more members of staff, more hours worked, more equipment, more plant, more direct and indirect overheads, potential claims between owner and contractor and more interest to be paid to financing institutions. In addition, rental or sale revenues will be lost for the duration of the delay. Other consequences are delays in starting new projects and loss of reputation and credibility. Delays may also affect the quality of the work, because attempting to push the project activities forward to overcome delays can lead to quality being neglected.

The construction industry has a consistently poor record with respect to the completion of projects on time (NEDO, 1983). Since it is clear that the majority of construction projects suffer delays, many authors have striven to identify the causes of delay in construction projects, in order to put forward effective solutions; these include Ogunalana (1996), Kumaraswamy (1998), Mansfield (1994), Assaf (1995), Mezher (1998), Battaineh (1999), Almomani (2000), Jonathan (2001), Alkass, Mazerolle & Harris (1996), and New South Wales (1992). There has also been considerable interest in the effects of construction delays. The information available is diverse and widespread, but almost all the available literature concerns public

projects. Another critical point is that almost all studies of the causes of delay in construction projects either consider a specific country or city, or recognize the causes of construction delay in general, but no research has been carried out into the reasons behind the different causes of delays in different countries. In other words, there has been no comparative study examining the causes of delay in two or more regions, except the one conducted by Chan (1998), whose comparison is based on previous studies by different authors for different purposes, using different techniques and measurements. Moreover, many studies have limited the causes which are included to those for which contractors are entitled to a time extension. The analysis does not cover causes of delay for which the contractor is responsible, such as those related to labour and equipment, planning and site management, construction methods, or the adequacy and capability of the contractor. Other conclusions are based on the number of time extensions, not on the extent of delay attributed to the different causes of delay. In addition, almost all surveys are drawn from records of public building projects, and may therefore deal with causes which are not valid for other types of construction such as industrial facilities, commercial construction projects or housing. This research was carried out to address these points and put them in the right place by using the appropriate method.

1.3. Objectives of the research

The major issues which this study sets out to address are as follows:

1.3.1. To provide a general overview of construction delays

1.3.2. To identify the principal causes of delay in construction projects in SA and the UK, so that efforts can be made to control these causes.

1.3.3. To measure the frequency of occurrence, severity of impact and importance of construction delay factors in SA and the UK.

1.3.4. To compare delay factors in construction projects in the two countries, and to examine the reasons for any differences.

1.3.5. To explore existing practical solutions from the construction industries in both countries, in order to be able to transmit the solutions to delays used in one country to the other, instead of relying only on academic solutions.

1.3.6. To determine the relationships of contractors, consultants, and owners to the most frequent and severe delay factors.

1.3.7. The extent to which the contractor, consultant, and owner agree on the ranking of the importance of the causes of delay.

1.3.8. To test the hypotheses that:

13.8.1. The contractor is the party most often responsible for delays.

13.8.2. The importance of delay causes differs from country to another

1.4. Limitations of the research

The research will be limited to the following:

1.4.1. Only the causes of delay.

1.4.2. Construction projects only; projects of other types will not be discussed.

1.4.3. Projects built in SA and the UK only; other countries will not be included.

1.4.4. Delay that occurs during the construction phase only.

1.5. Research layout

This dissertation is divided into seven chapters, as follows:

Chapter 1. Contains an introduction which is intended to give an overview of the importance of delay in construction projects, followed by the statement of the problem and the objectives of the research.

Chapter 2. Presents an overview and analysis of the Saudi and British economies and construction industries. It attempts to give a general idea of the status and size of the construction industry in each country.

Chapter 3. Reviews the literature on the causes of delays in construction projects. It covers types of delay, a summary of some previous studies related to construction delay, a record of construction projects regarding delay.

Chapter 4. Discusses the major potential causes of delay approved for this study.

Chapter 5. Presents the research methodology, which explains how the investigation was done, and the methods of collecting and analysing data.

Chapter 6. Presents and analyses the data from the survey.

Chapter 7. Presents and summarises the results and major findings, and makes recommendations.

Chapter 2

The Saudi and British Construction Industries

Chapter (2)

The Saudi and British construction industries

2.1. Introduction to Chapter (2)

This chapter provides a context for the research. It sets out some important characteristics of the construction industry in general, then considers each of the survey countries in turn, examining their construction sectors against a broader economic background.

2.2. The construction industry in general

The construction industry can best be described as a collection of industries, because a completed building is generally composed of an assembly of building materials, components and equipment produced by other industries (Kwakye 1998). Moreover, construction has unique characteristics deriving largely from the physical nature of the product and consists of a group of activities interconnected by the nature of their products, technologies and institutional settings.

2.3. The nature of the construction industry

There is a need to understand the nature of the industry and its characteristics before considering the process of construction and delay factors in the UK and SA.

The construction industry is unique. It is possible to produce goods that increase in value over time, unlike the majority of other products, which begin to depreciate immediately from the time of purchase. However, it is highly susceptible to booms and slumps in the economy and the policies of governments. The industry's activities are concerned with the planning, regulation, design, manufacture, construction and

maintenance of buildings and other structures. Construction work includes a wide variety of different activities in terms of the size and type of projects and the professional and trade skills required.

2.4. The Saudi Construction Industry

2.4.1. Economic Overview

SA's economy is dependent on oil revenues, which constitutes 80% of the Kingdom's total revenues. Construction activities therefore have a direct correlation with oil prices. This is reflected by the total value of publicly awarded construction contracts, which leapt by 26% to $3.36 billion in 2000 and fell by 6% to $3.14 billion in 2001. During the last five years, construction investment in SA is estimated at $19.5 billion per year, peaking at $20.8 billion in 2000. After the 11 September economic slowdown, the government curbed its planned expenditure for 2002 by 20.8% to $ 54 billion compared to $ 68 billion in 2001. During the first five months of 2002, the total value of construction contracts awarded increased by 60.7% to $2.13 billion, compared to $1.33 billion in the same period in 2001. This was largely due to the surge in construction activities of the industrial and urban development sectors, which rose substantially (SAMA, 2003; UK Trade & Investment, 2002 and Saudi Ministry of Economy and Planning, 2003) .

2.4.2. The Saudi construction industry

The construction industry in SA faces a number of real challenges; some are unique to SA, while others are inherent in any construction industry. However, owners share three primary concerns: spiralling costs, quality and time of completion. These challenges are compounded by the traditional 'sequential' approach to construction. The design, bidding and construction process is based on the assumption that the solution to a design problem can be embodied in a set of nearly faultless contract

documents that are capable of transmitting all the owner's needs to the general contractor.

Construction experts, however, have long recognized the extreme fragmentation of the industry, which comprises a variety of contractors many of whom are small, undercapitalized and financially unstable. In most construction projects, the use of sub-contractors, whereby specialized trades perform a majority of the work, has become common practice. There is also a general consensus among the construction teams that while the industry is large, it is diffused and as a result, suffers from a high degree of incoherence. Facilities are constructed by a loose aggregate of independent design professionals, builders, land developers, financiers, manufacturers, suppliers and others, all of whom disperse on completion of a project. The owners find themselves in the position of having neither construction expertise nor control over their projects.

In view of the above-mentioned problems, the industry has adapted many tools and techniques from more advanced industries – mainly from the U.S. aerospace and defence industries. An approach that has recently found its way into the construction industry is referred to as the system approach. This includes the use of conventional as well as more elaborate and technologically sophisticated techniques for designing, estimating, organizing, planning, scheduling and controlling.

Within this broad area of management techniques, the construction industry has developed some new concepts of its own. Industrialized or systems building, which proposes to replace handicraft field labour with sophisticated, mass-produced factory techniques, is one of these concepts. Another concept developed by the construction industry is phased construction, which refers to the overlapping of design and construction stages and the packaging of portions of construction work ready for contract before final plans are completed. This concept is sometimes used interchangeably with 'fast tracking' which covers all sequences of programming, design, documentation and construction. Finally, Construction Management (CM) as a concept has already proved to be a significant technique for reducing construction time and overall project cost. It is on this method of operation that this study will focus as an alternative form of delivering construction projects (Al-Saleh, 2001) and (Council of Saudi Chambers, 2003).

2.5. The United Kingdom Construction Industry

2.5.1. Economic overview

The UK, a leading trading power and financial centre, is one of the quartet of trillion dollar economies of Western Europe. Over the past two decades, the government has greatly reduced public ownership and contained the growth of social welfare programs. Agriculture is intensive, highly mechanized and efficient by European standards, producing about 60% of food needs with only 1% of the labour force. The UK has large coal, natural gas, and oil reserves: primary energy production accounts for 10% of GDP, one of the highest shares of any industrial nation. Services, particularly banking, insurance, and business services, account for by far the largest proportion of GDP, while industry continues to decline in importance. GDP growth slipped in 2001-03 as the global downturn, the high value of the pound, and the bursting of the 'new economy' bubble hurt manufacturing and exports. Still, the economy is one of the strongest in Europe; inflation, interest rates, and unemployment remain low. This relatively good economic performance has complicated the Blair government's efforts to make a case for Britain to join the European Economic and Monetary Union (EMU). Critics point out that the economy is doing well outside the EMU, and public opinion polls continue to show a majority of Britons opposed to adopting the Euro. Meanwhile, the government has been speeding up improvements in education, transport and health services, at a cost in higher taxes. The war in March-April 2003 between a US-led coalition and Iraq, together with the subsequent problems of restoring the economy and the polity, have involved a heavy commitment of British military forces. (CIA 2004) and (HM Treasury 2003)

Subject	Saudi Arabia	Est.	United Kingdom	Est.
Area sq km	1,960,582 sq k		244,820 sq km	
Natural resources	petroleum, natural gas, iron ore, gold, copper		coal, petroleum, natural gas, iron ore, lead, zinc, gold, tin, limestone, salt, clay, chalk, gypsum, potash, silica sand, slate,	

Subject	Saudi Arabia	Est.	United Kingdom	Est.
			arable land	
Population	25,795,938	2004	60,270,708	2004
Age structure	0-14 years: 38.3% 15-64 years: 59.3% 65 years and over: 2.3%		0-14 years: 18% 15-64 years: 66.3% 65 years and over: 15.7%	2004
Median age	total: 21.2 years male: 22.8 years female: 19.1 years	2004	total: 38.7 years male: 37.6 years female: 39.8 years	2004
Population growth rate	2.44%	2004	0.29%	2004
Literacy	definition: age 15 and over can read and write total population: 78.8% male: 84.7% female: 70.8%	2003	definition: age 15 and over has completed five or more years of schooling total population: 99%	2000
Constitution	governed according to Shari ‘a (Islamic law); the Basic Law that articulates the government's rights and responsibilities was introduced in 1993		unwritten; partly statutes, partly common law and practice	
GDP	$286.2 billion	2003	$1.664 trillion	2003
GDP - composition by sector	agriculture: 5.2% industry: 50.4% services: 44.4%	2002	agriculture: 1.4% industry: 24.9% services: 73.7%	2000

Subject	Saudi Arabia	Est.	United Kingdom	Est.
Budget	revenues: $78.7 billion expenditures: $66.7 billion, including capital expenditures of $NA	2003	revenues: $565 billion expenditures: $540 billion, including capital expenditures of $NA	2003
Population below poverty line	NA%	2001	17%	2002
Labour force	7 million note: more than 35% of the population in the 15-64 age group is non-national	1999	29.7 million	2001
Unemployment rate	25%	2003	5.1%	2003
Oil - production	8.711 million bbl/day	2001	2.541 million bbl/day	2001
Exports	$86.53 billion f.o.b.	2003	$304.5 billion f.o.b.	2003
Imports	$30.38 billion f.o.b.	2003	$363.6 billion f.o.b.	2003

Table 1 Economical comparison between UK and SA **Est: year of estimation**

Source: CIA, The World Factbook, 2004, Saudi Ministry of Economy and Planning, 2003, and Saudi Arabian Monetary Agency (SAMA), 2003.

2.5.2. The United Kingdom construction industry

The UK construction industry contributes around 8% of GDP and employs about 2 million people. UK construction output is 12% of total European output, the third largest construction output in Europe and the fifth largest in the world. Exports are of the order of £10 billion, whilst domestically, the construction industry is a major deliverer of key government programmes such as housing, hospitals and

infrastructure. It is an extremely diverse industry composed of contractors, consultants and producers of building materials and products. Most of the contracting and consulting companies operating internationally have offices in London and the South East of England. Both the contracting and material/products sectors, particularly the latter, have experienced takeovers by overseas companies. Consolidation of the contracting sector is likely to continue. UK consultants operate in almost every country throughout the world.

The contractors' and consultants' overseas work has moved towards design, project management and value-added services. The UK construction industry enjoys a high reputation in these areas as well as being experienced in innovative procurement methods. Many of the landmark projects worldwide have a UK influence, either in design, management or construction. Fosters were responsible for the design of the Berlin Reichstag building and the highest skyscraper in SA, the Alfaisaliah Tower; Halcrow were involved in the man-made river project in Africa; and Ove Arup are undertaking the Denver Millennium Bridge project. Furthermore, following the September 11th tragedy in the USA, UK-based Bovis Lend Lease and Amec are two of the four companies commissioned by the City of New York to engage in the reclamation work at the World Trade Centre site. This is evidence of the recognition in the world market of UK technical skills. British Standards and Codes are also recognised worldwide and they form the basis of governance in many construction industries all over the world. (Winch 2002), (Murdoch and Hughes 2002) and (UK Trade & Investment 2002)

Chapter 3

Delay in Construction Projects

Chapter (3)
Delay in Construction Projects

3.1. *Introduction to Chapter (3)*

Delay in construction projects can be defined as the time difference between the date of project completion stated in the contract and the date of actual completion. Due to the fact that construction projects frequently suffer delay, the literature contains much discussion of this problem.

This chapter aims to present a general overview of construction delay, including types of delay found by researchers in the field and the background of the construction projects record regarding time performance. This is followed by a summary of some previous studies related to the causes of construction delay.

3.2. Types of delay

Construction delays can be categorised according to the liability of the construction parties, the occurrence of delay and the effects of delay.

This section identifies and explains these types of delay and gives examples of each.

3.2.1. According to the liability of the construction parties

This type of delay falls into two major categories, excusable and non-excusable, as shown in Figure 1.

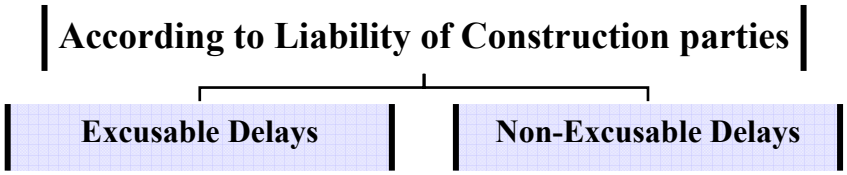


Figure 1 Delay Types according to liability of construction parties

Excusable delay is "a delay to completion which is caused by matters deemed to be outside the control of the contractor" (Pickavance 1997). It excuses a contractor from performing within the contract period and justifies an extension of time to perform. This type of delay can also have an impact on non-critical activities which need more detailed analysis to determine whether additional time extension is warranted or if the reduction of float time can be justified. Generally, whether delays are excusable depends on contract provisions. Acts of God, unexpected weather, labour disputes, owner design problems, owner-intiated changes and similar factors may cause excusable delays.

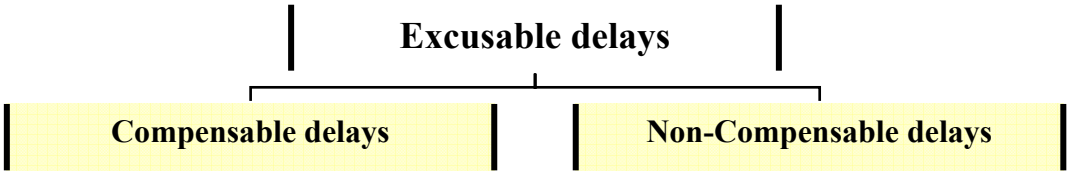


Figure 2 Excusable delay types

The main consideration is whether the factors were beyond the contractor's ability to control or foresee. In other words, delays are generally excusable when another party caused but could have avoided them, or when they were due to environmental factors beyond the control or foresight of anyone. Excusable delays can be further classified into compensable and non-compensable

(
Figure 2):

5.5.1. Excusable compensable delays

Excusable compensable delays are caused by the owner or the owner's agents. A compensable delay usually leads to a schedule extension and exposes the owner to financial damages claimed by the contractor. However, “in some special circumstances a compensable delay does not always mean that additional time is due. Sometimes only additional costs will be compensable” (Callahan et al, 1992). Examples of this would be the late release of drawings from the owner's architect, failure of the owner to hand over the site to the contractor or major changes in the scope of work.

5.5.2. Excusable non-compensable delays

Excusable non-compensable delays are caused by third parties or incidents beyond the control of both the owner and the contractor. In this case “the contractor is entitled to a time extension without the recovery of associated cost of damages” (Leon 1987). Each party (owner and contractor) must pay his own part of the delay cost. Examples typically include acts of God, unusual weather, strikes, fires and acts of government in its sovereign capacity.

3.2.2. According to occurrence

Delays can be classified according to their occurrence into independent and concurrent delays (Figure 3):

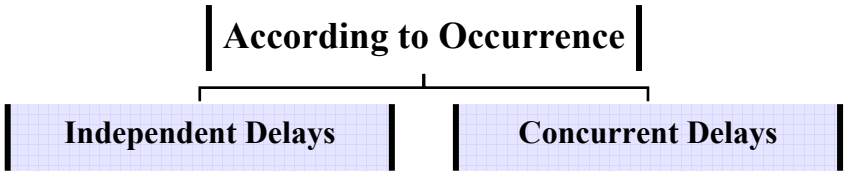


Figure 3 Delay Types according to occurrence

5.5.3. Independent delays

An independent delay is a delay which occurs as a result of causes related to one type of delay or one of the contractual parties, either the contractor or the owner. It may be excusable, non-excusable, compensable or non-compensable (Leon, 1987). Common examples of independent delays are delays made by the owner as a consequence of the delays caused by the contractor due to bad management of the project.

5.5.4. Concurrent delays

Concurrent delay is a delay to completion where at least one of the causes of the events which cause delay is at the contractor's risk as to time (Pickavance, 1997). Concurrent delays consist of two or more independent delays that occur at the same time as a result of different causes. Causes of concurrent delays may be excusable, non-excusable, compensable or non-compensable (Leon, 1987); the right to receive an extension of time or delay damages will depend on which of these types applies. Rubin (1983) presents three conditions of concurrent delays:

1- If excusable and non-excusable delays occur concurrently, only a time extension is granted to the contractor.

2- If excusable compensable and excusable non-compensable delays occur concurrently, the contractor is entitled to a time extension but not to damages

3- If two excusable compensable delays occur concurrently, the contractor is entitled to both a time extension and damages.

However, it is generally the case that the contractor has the right to receive a time extension but not delay damages, and the owner does not receive liquidated damages.

3.2.3. According to effect

Delay in some activities may result in delay to the overall project completion and in other activities it may have no impact upon completion. In other words, delay can be classified into two major categories according to the effect on the time schedule

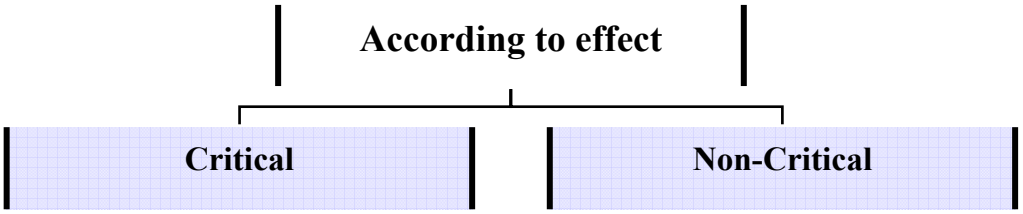


Figure 4 Delay Types according to effect

A. Critical delays

Delays that result in extended project completion times are known as critical delays (Callahan et al, 1992). In the case of excusable critical delays, the contractor will generally be entitled to a time extension. Changing the type of structural steel members while the contractor is erecting structural steel is a clear example of a critical delay that is likely to delay the contractor's overall completion of the project.

B. Non-critical delays

Non-critical delays are delays incurred off the critical path which do not delay ultimate project performance (Leon, 1987). If the delay in this case is excusable, the contractor does not have the right to receive a time extension, because this type of delay does not have an effect on the overall completion of the project. However, non-critical delays may affect the contractor's cost performance; in this case, the contractor may have the right to receive additional performance costs.

3.3. Time performance record

Sadly, constructions projects have a shameful record in terms of project delivery and cost. Despite all the efforts that have been put into improving construction development, and despite all the tools and systems developed to allow successful project delivery, the record of construction projects is in point of fact very disappointing.

In 1987 a study carried out by the World Bank determined that 90% of construction projects were delivered late (World Bank 1990). Onyango (1993) found that 52% of all UK construction projects end with a claim of some type. Jearkjirm (1996) studied the performance of high-rise building construction projects in Bangkok and found that many projects exceeded time forecasts. In 2000 a survey reported that 70% of public construction projects in the UK were running seriously late or seriously over budget (National Audit Office, 2000). Morris undertook a study in the early 1980s, in which he examined 1449 separate construction projects, and found that only 12 were delivered within budget. He repeated his study some time later with 3000 projects and obtained similar results (Morris 1994). Further studies by Kalantjakos (2001) and Pinto & Mental (1990), amongst many others, seriously question the causes of this failure to successfully deliver construction projects on time and within budget.

In SA, one of the critical problems facing the national authorities is the frequent and lengthy delays in construction projects. Several studies have been conducted to examine construction projects in SA. Zain Al-Abedien found that delayed projects accounted for 70% of projects undertaken by the Ministry of Housing and Public Works (Zain Al-Abedien, 1983). Al-Sultan surveyed the time performance of different types of public project and concluded that 70% experienced time overrun (Al-Sultan, 1987). In a preliminary survey of the water and sewage authority in the Eastern Province of SA, it was found that 45 out of a total of 76 projects completed during the period 1985-1994 were delayed. In the same survey, twenty projects were randomly selected from the delayed projects and it was found that the average extent of delay was 110% (Al-Ghafly & Al-Khalil, 1995

Various studies have been carried out in different countries to identify factors causing delay in construction projects, and these have added significantly to the body of knowledge in relation to causes of delay and time performance in construction projects. The next section reviews their findings.

3.4. Causes of delay – identification and categories

The identification of factors leading to construction delays was found to differ from study to study in the literature; no single reliable model of construction delay factors authoritatively established by construction or project management institutions could be found. Rather, individual researchers into this subject identified a variety of categories and causes of delays, using methods appropriate to their particular studies. As the field has developed, it has become easier to conduct studies into construction delay, since many categories of delay factors have already been identified. Consequently, most recent studies have relied on the categorisation of causes identified in the existing literature.

The causes of delay in construction projects can thus be classified in different ways. In 2001, Shi and Arditi put together the fundamental causes of delay in order to determine their relationship with project completion, taking account of the sequence of events. In summary, each project consists of a collection of activities, and the completion of any one of these may be delayed due to a delayed start or to extended activity duration. While the start of an activity may be delayed for one particular reason, its duration may be extended for some other reason. The delayed completion of an activity may cause delays in the succeeding activities, which in turn may cause a delay in the project completion. Schematically, a cause-effect relationship of project delay can be shown as in Figure 5. However, the purpose of the study was not mainly to examine the causes of delay; therefore, more useful identification and classification of delay factors may be found in a study which did have that aim.

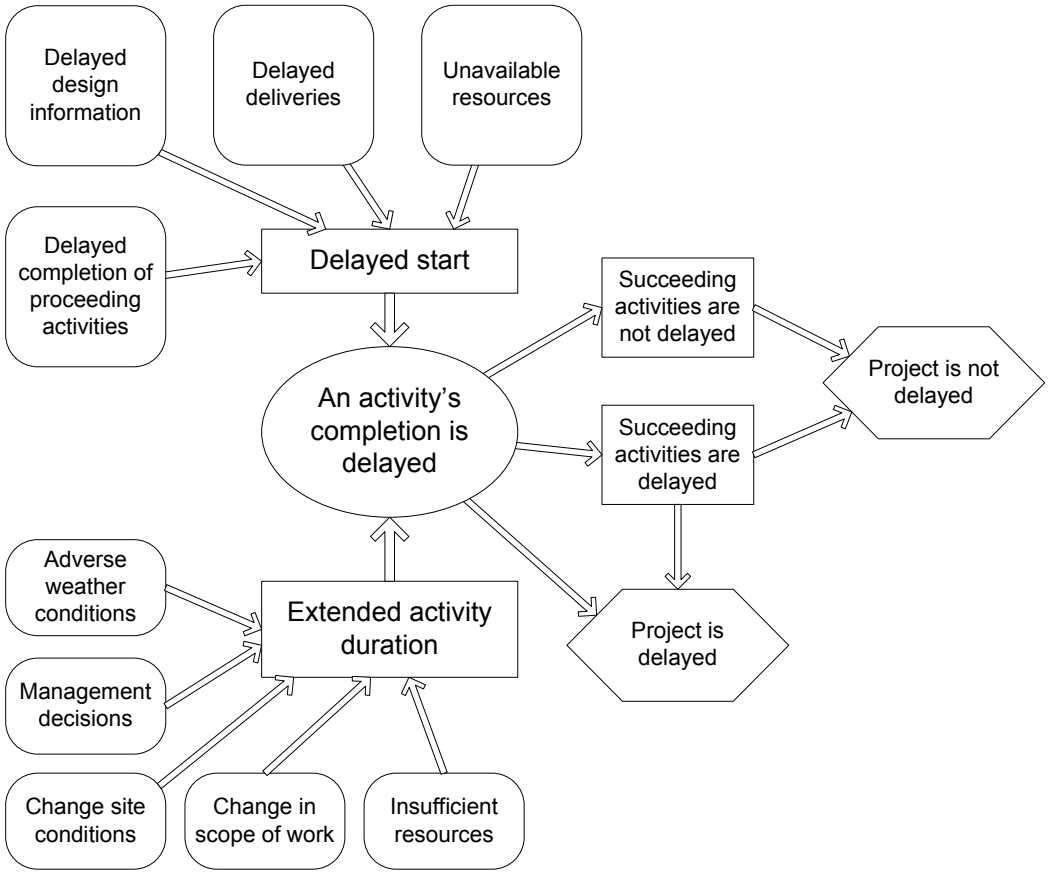


Figure 5 Cause-Effect relationship of construction projects Source: Shi & Arditi, 2001

Such a study is Chan's (1995) PhD thesis, which looked into the principal factors affecting the duration of construction projects. It is proposed that time-influencing factors may be classified into four major categories (Figure 6):

1- Project scope
2- Project complexity
3- Project environment
4- Management-related attributes

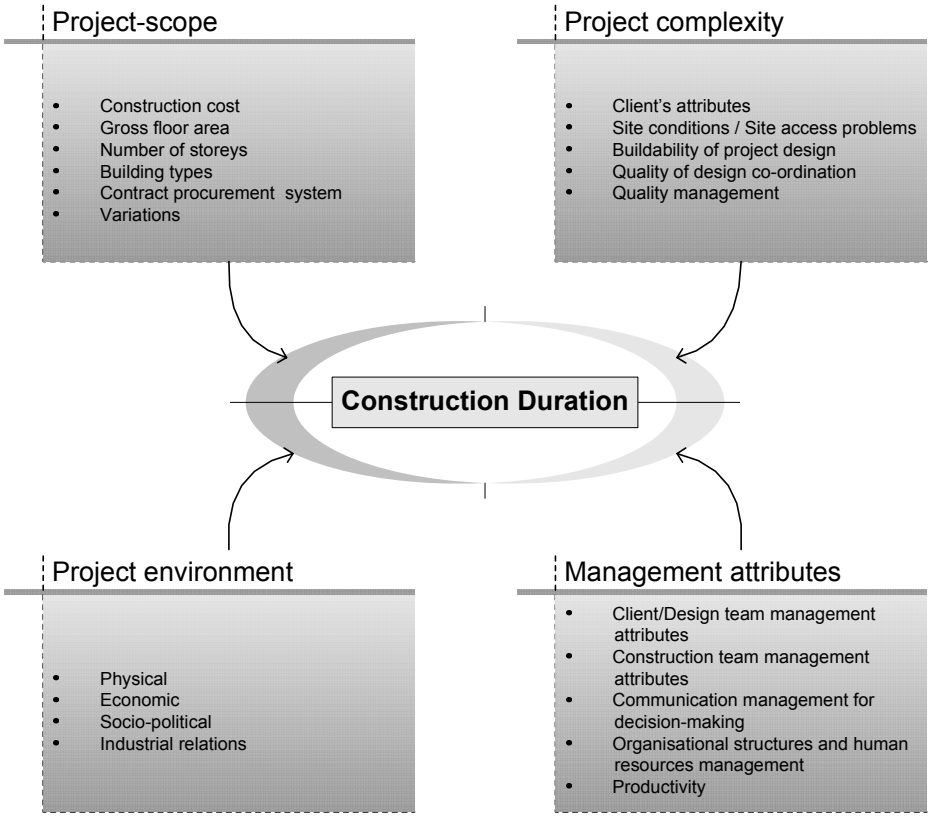


Figure 6 Chan's Principal factors affecting duration of construction projects

Assaf (1995) identifies 56 causes of delay based on a literature review and interviews with local contractors, architectural/engineering firms and owners. As shown in Table 2 he causes are grouped into nine major areas:

Materials	Manpower	Equipment
Financing	Environment	Changes
Government relations	Contractual relationships	Scheduling and controlling techniques

Table 2 Assaf's Classification of construction delay causes

In 1996, Ogunlana and Promkuntong conducted a survey of construction delays in a fast-growing economy. Twenty six causes of construction delays were identified (Table 1), grouped according to who was responsible for the delay.

A more detailed study was carried out by Kumaraswamy and Chan (1995), to investigate the principal causes of construction delay in both building and civil engineering projects. They group 83 hypothesised delay factors into eight major factor categories, as shown in Table 3.

Category	Reasons for delays
Project-related factors	project characteristics
	necessary variations
	communication among the various parties
	speed of decision making involving all project teams
	ground conditions
Client-related factors	client characteristics
	project financing
	their variations and requirements
	interim payments to contractors
Design team related factors	design team experience
	project design complexity
	mistakes and delays in (producing) design documents
Contractor-related factors	contractor experience in planning and controlling
	site management and supervision
	degree of subcontracting
	their cash-flow
Materials factors	shortages
	materials changes
	procurement programming
	proportion of off-site prefabrication
Labour factors encompass	labour shortages
	low skill levels
	weak motivation
	low productivity
Plant/Equipment factors	shortages
	low efficiency
	breakdowns
	wrong selection
External factors	waiting time for approval of drawings and test
	environmental concerns and restrictions

Table 3 Kumaraswamy and Chan 1995

Category	Reasons for delays
Owners	Change orders
	Slow decision-making
Designers	Incomplete drawings
	Slow response
CM or Inspector	Deficiencies in organisation
	Deficiencies in coordination
	Uncompromising attitude
	Delays in work approval
Contractors	Materials management
	Deficiencies in organisation
	Coordination deficiencies
	Planning and scheduling
	Equipment allocation problems
	Financial difficulties
	Inadequacy of site inspection
Resources suppliers	Shortage of construction
	Late delivery
	Price escalation
	Low quality of materials
	Shortage of site workers
	Shortage of technical personnel
	Insufficient numbers of
	Frequent equipment breakdown
Others	Confined site
	Problems with neighbours
	Slow permits by Govt. agencies

Table 4 Ogunlana & Promkuntong 1996

Al-Khalil and Al-Ghafly (1997) conducted a study to determine the most important causes of delay in public utility projects. The causes are grouped into six major categories of delay. The "contractor performance" category is further subdivided into five classifications; thus the major categories are as follows:

- Contractor performance
  - Materials
  - Equipment
  - Manpower
  - Project management
  - Project finance

- Owner administration
- Early planning and design
- Government regulation
- Site and environmental conditions
- Site supervision

3.5. Causes of delay – the outcome of previous studies

As can be seen from the above references, a great amount of information concerned with construction delay and overruns may be found in the recent literature. The increased interest is due to the fact that numerous construction projects significantly exceed the baseline as a consequence of delays. There has therefore been a considerable and continued interest in the effects of construction delays.

Many studies have also been carried out to assess the causes of such delays. Assaf and Al-khalil (1995) outline the main causes of delay in large building projects and their relative importance. They find that 56 causes of delay exist in Saudi construction projects and conclude that contractors, consultants, and owners generally agree on the importance ranking of delay factors. Contractors considered the most important delay factors to be the preparation and approval of shop drawings, delays in payment by the owner, and design changes. The most important delay factors for the consultants were cash problems, the relationship between different subcontractor schedules, and slow decision making by the owner. The owners considered the most important delay factors were design errors, excessive bureaucracy in project-owner organization, labour shortages and inadequate labour skills. Delay factors were categorised into nine groups, of which financing was unanimously ranked highest.

Al-Moumani (2000) conducted a quantitative analysis of construction delays by examining the records of 130 public building projects constructed in Jordan during the period 1990-1997 and presenting regression models of the relationship between actual and planned project duration for different types building facilities. The analysis also includes the reported frequencies of time extensions for the different causes of delays.

The finding is that the main causes of delay in construction projects relate to designers, user changes, weather, site conditions, late deliveries, economic conditions and increase in quantities.

A study of the causes of delay in 12 high-rise building construction projects in Bangkok conducted by Jearkjirm (1996) finds that resource supply problems were the most acute problems faced by the construction industry in the boom years. Most projects suffered delays because materials were in short supply or technical personnel were overstretched. Demands from construction owners for frequent changes also created design and coordination problems for field staff.

Chan and Kumaraswamy (1997) conducted a survey into the causes of time overruns in Hong Kong construction projects, finding that all three major groups of industry participants (contractor, consultant and client) felt that the five most significant sources of overrun were site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client-initiated variations and necessary variations of works.

Another study of delays in public utility projects in SA carried out by Al-Khalil and Al-Ghafly (1999), shows that the most important cause of delay is cash flow and other financial difficulties. Difficulties in obtaining permits is the second most important, followed by the government practice of awarding contracts to the lowest bidder without regard to qualification and the tendency of clients to underestimate project duration. They also found that the contractor is most commonly responsible for project delay (44%), followed by the client (22%) and the consultant (14%).

Chan (1998) analyses many previous surveys investigating the most important causes of delays in different countries. He collates these surveys and investigates the 15 most frequent delay factors in these countries. The results are shown in Table 5.

Factors causing project delays	Countries							
	US	UK	Developing Countries	Turkey	Nigeria	SA	Hong Kong	Indonesia
Inclement weather	*	*						
Labour shortage/low labour productivity	*			*		*		*
Poor subcontractors' performance/high degree of subcontracting	*	*				*		
Variations (design changes/extra work)		*		*		*	*	*
Unforeseen ground conditions		*					*	
Materials shortage/late materials delivery		*		*	*			*
Inadequate construction planning			*	*				*
Financial difficulties				*	*	*		
Delays in design work/lack of design information		*		*				
Poor site management		*			*	*	*	
Impractical design		*						
Poor communication							*	
Inappropriate type of contract used								
Lack of designer's experience								
Inaccurate estimating					*	*		*

Table 5 A cross-sections of related observations on the major factors causing delays in construction projects source: Chan (1998)

Although a comparison of the results of many surveys is valuable, it cannot give an accurate result, since these studies used different techniques, measurements and methods of survey, and had different purposes.

Chapter 4

Causes of Delay

Chapter (4) Causes of Delay

4.1. Introduction to Chapter (4)

It has been shown above that a large number of causes may lead to delays in construction projects, arising from different parties and resources. These causes are in a sense countless, since each construction project has its own characteristics and environment. Efforts have therefore been made by many authors to identify the most significant causal factors of delay in construction projects.

For the purposes of the present research, potential delay factors were carefully identified from almost all of the studies mentioned in Section 3.4 above. This provided an opportunity for the author to select the causes most appropriate to the present survey from a number of previous studies, with a high probability of covering all significant sources of delay. In addition, the major categories of causes of delay are identified, based on several previous studies, to match the purpose of this study.

In this chapter, the causes of construction delay as defined for this study will be discussed in a wide perspective. In order to obtain full understanding of the subject, major categories of construction delay will also be considered on a case by case basis.

4.2. Causes of delay in construction projects

Sixty-seven well recognised causes of delay were identified, based on the literature review. These causes were grouped into four major categories as follows:

- Contractor related factors
- Consultant related factors
- Owner related factors
- Others

4.2.1. Contractor related factors

The contractor is the party responsible for carrying out the work of the project, and generally bears most of the responsibility for construction. Almost all previous surveys conducted to examine responsibility for delay found that the blame, for the most part, lies with the contractor. If truth be told, the contracting profession is extremely complex and demanding compared to other professions. All contractors are familiar with the difficulties of fluctuating work. The main contractor is often expected to take full managerial responsibility, not only for his own work and for safeguarding the owner from delay, but also for liaising with other contractors; however, the level of contractor responsibility differs according to the type of contract.

Putting together a workable schedule that satisfies all constraints is not an easy task. After contractors have evaluated the work to be performed and the most logical and cost-effective sequence of performing that work, there remains further analysis to produce a workable and efficient construction schedule. Often, contractors find that labour, equipment, or materials are in short supply. Shortages of these essential resources can significantly affect the initiation, performance and completion of activities on the schedule and can cause the project to be extended beyond the scheduled duration (Callahan et al, 1992).

The contractor's ability to complete the construction project within the planned time is rooted in his capabilities, which include managerial competence and available resources. These resources include manpower, money, materials, and equipment. A contractor has two sources of manpower: direct hire and sub-contract. In most types of contracts, if a sub-contractor causes a delay, the owner should and will look to the contractor for its resolution. Therefore, it is necessary for the contractor to continuously oversee his sub-contractors' performance. Contractors have a dual problem, balancing their interests between owners and sub-contractors.

Many factors related to contractors may lead to project delay, and these factors are subdivided into five major categories as follows:

- □ Materials
- □ Equipment
- □ Manpower
- □ Project management performance
- □ Project finance

A. Materials

Materials are an important element in any construction project, representing a major expense. The managing of materials by the contractor is not just a concern during on-site construction; decisions about material procurement may also be required during the initial planning and scheduling stages. In some case, more expensive suppliers may be employed to save time.

Materials may be delayed in delivery, deteriorate during storage or be stolen, unless special care is taken. In addition, delays and extra expenses may be incurred if materials required for particular activities are not available. Accordingly, ensuring a timely flow of materials is an important concern of the contractor.

A rise in the price of materials may sometimes inspire the client to wait, hoping that the price will decrease, especially for large projects which require a large amount of materials, and where a rise in price makes a significant difference. Waiting for price changes results in delay to some activities, which might be critical, leading to delays in project completion.

In some cases, changes of project specification take place due to mistakes in design, or to improve the quality. These changes more often than not require a change in material types. The materials required might take time to be delivered because of the price negotiation process or waiting for approval by the owner.

In summary, delays related to materials can be ascribed to four factors: shortage, delay in delivery, change in materials specifications, and changes in materials prices.

B. Equipment

Typically, construction equipment is used to perform essentially repetitive operations, and can be broadly classified according to two basic functions: operators such as cranes and graders, which stay within the confines of the construction site, and haulers such as dump trucks and ready mixed concrete trucks, which transport materials to and from the site.

Contractors may purchase or hire equipment, or both. However, most contractors own their standard equipment as an economical solution, since they use it regularly. In either case, "hire or ownership is subject to a rate for its hire" (Kwakye, 1997). Additionally, the selection of the appropriate type and size of construction equipment often affects the required amount of time and effort and thus the job-site productivity of a project. It is therefore important for contractor to be familiar with the characteristics of the major types of equipment most commonly used in construction.

Selecting the appropriate type of equipment, delivering it to the site on time, ensuring it is maintained and not subject to breakdown, are major duties of the contractor. Any failure to do one of these may slow down the progress of work and lead to a delay in project completion. Shortage or unavailability of the required equipment thus has an impact on the project time, so the contractor should select appropriate equipment procurement and establish an effective plan in order to control it and avoid additional costs and time.

C. Manpower

In the construction industry, many operations and processes are labour intensive. Efficient management of labour or human resources can be the key to a successful construction project.

"Productivity in construction is often broadly defined as output per labour hour" (Hendrickson, 1998). Manpower consists of three types with respect to skill levels: skilled, semi-skilled, and unskilled. These include foremen, technicians, site engineers, civil, mechanical, and electrical engineers and inspectors. Contractors should establish a manpower plan, which involves identifying and assigning project roles, responsibility and reporting relationships. Roles and responsibilities may be

assigned to individuals or groups. “Failure in selecting the correct number and category of the labour force will severely affect the quality, the cost and the progress of the works and may result in complete failure of the project” (Drewin, 19982). Planning should therefore take a place at an early stage of the project. Additionally, control processes must be established to ensure that labourers are working as planned and to take the necessary action during the project’s progress.

In SA, most construction manpower is foreign. Generally, contracting companies are owned by Saudis, but most of the employees, from the top level to labour level, are imported from abroad. In terms of time, this may cause some problems in construction projects, since importing labour requires complicated processes (interviewing, testing, visas, travel, accommodation, health insurance, etc.) which are beyond the control of the contractor and therefore time-consuming. Other problems may arise from culture gaps (different languages and different methods and systems of work), since there are many nationalities involved in the project. These gaps can slow down the project’s progress, as communication and coordination between the workers is slower than for a monolingual workforce. Conversely, the vast majority of people at all levels of manpower in British contracting companies are English-speaking UK citizens. This enables them to operate at an elevated speed of communication and coordination, which in turn has a positive impact on the overall duration of projects, compared to those in SA.

D. Project management performance

There is no one environment for project management; it is a changing environment. It has never been simple, and as with any evolutionary process, it is becoming ever more complex (Kimmons & Loweree, 1989). Before examining project management performance, it is necessary to understand what project management means. The Project Management Institute (1996) identifies project management as “the application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project”. Successful project management requires team leadership and coordination, diligent project planning and effective oversight of the delivery process. But there are obstacles preventing

contractors from performing successfully. The National Audit Office (2001) identifies five major barriers to improving construction performance related to contractors:

- Limited project management skills with a stronger emphasis on crisis management
- Limited identification and management of risk
- Reliance on contracts to resolve problems with adversarial relationships
- Late payment to subcontractors and suppliers
- Limited understanding of the true cost of construction components and processes.

Contractors' responsibilities involve many tasks that contribute to project management performance. Planning and scheduling the project, communication and coordination with project parties, controlling suppliers and sub-contractors are the main issues that impact on project duration.

"As in many other walks of life, if we start off by doing things wrong, one bad practice leads to another, and we end up in a vicious downward spiral" (Horner and Duff, 2001). Planning is a vital issue in any project, and success or failure of construction projects can be primarily ascribed to the planning. Planning for a contractor begins with the selection of the most appropriate procurement method for the project; the final, detailed plan demonstrates what each one has to do, when, and how, and comprises all major decisions necessary. "The plan becomes a vehicle for communication with all project participants and is a prerequisite for detailed scheduling of the work and for the preparation of a definitive cost estimate" (Kimmosons and Loweree, 1989). Scheduling is a vital part of planning; it develops a timetable for the implementation dates of the plan. The lack of an appropriate project plan usually results in poor project implementation. Project planning must obviously take place at an early stage of the project, but there should be a planning revision at any appropriate time during the project because of the changes that commonly happen in construction.

In order to handle the project and ensure that all things are under control, contractors should build coordination and communication routes with all parties involved: sub-contractors, suppliers, owners, the administration team, the local authority, etc. Regular meeting between parties involved can create an effective atmosphere for solving all difficulties that result from the interface of the different parties in a project.

Project quality control can also affect the duration of a project. Completing work without achieving the desired quality standards may lead to having to do it again. To avoid such costly mistakes, quality control is required, to ensure that the project will satisfy the needs for which it was undertaken, which involves proceeding in three stages. Once the client has identified the desired quality standard, the contractor needs to determine how to achieve it. Secondly, he must carry on the process of quality assurance, which involves evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the desired quality. Finally, he must monitor specific project results to determine if they comply with the desired quality and identify ways to eliminate causes of unsatisfactory performance.

Contractors should consider that each project has its own requirements; they should select an appropriate labour force (in terms of qualifications and numbers) that can address the needs of the specific project. Motivating and training the labour force also increases their productivity. Conversely, inadequate selection, motivation and training may lead to poor productivity, which in turn contributes to delays. Managerial issues within the contracting company will play a significant role in handling the project process. Kungari (1988) states that "weakness in the company may disturb the flow of project operations […]. Among the many bad practices of the company that affect the smooth performance of the job we can list changing key personnel, management incompetence, shortage of professional and administrative staff [and] lack of technical and/or managerial experience." Incompetent human resources can lead to an inaccurate study of the project at the tender stage, the choice of inefficient procurement methods, ineffectual planning, imprecise estimations for project duration, and the loss of control of parties standing below the contractor in the hierarchy of the project organisation, such as suppliers and sub-contractors.

E. Project finance

The methods used to finance building and construction projects is one of the most dynamic and complex areas in the modem industry. Where clients used to pay for work done, today it is increasingly common for the construction contractor or consortium to arrange the finance necessary for the projects they are responsible for. These methods, first employed on infrastructure projects in the transport and energy industries, are now being applied to building work (Best and de Valence, 2002). Thus, not only owners but also contractors may face problems in financing the project. Difficulties that may be faced are delay or inability to pay the direct and indirect costs. Direct costs include materials, labour, and subcontract expenditures, while indirect costs are the expenditures that support the direct activities, such as supervision and warehousing. Also, the complexity of construction cash flow, disputes with suppliers with regard to payment, and other problems common in construction projects, all may contribute to delays in completion. The contractor should make sure that he has sufficient capital to enable him to undertake a specific project, and put all financing processes under control by adopting an effective project financing method.

4.2.2. Consultant related factors

The owner may employ an external professional consultant to assist him in managing the project. The obligation of the consultant may be to carry out the design of the project (including architectural, structural, mechanical, and electrical designs). He may also be responsible for the preparation of the project documents (e.g. drawings, specifications, bills of quantities and tender documents). In some cases, consultants undertake responsibility for project planning, scheduling, cost estimation and quality control. However, our focus will be on the tasks required during the construction phase, starting with reviewing and approving the design drawings, then monitoring the performance of the contractors and supervising the execution of the works.

Delays occurring in construction projects regarding consultant performance include delays in the preparation of drawings or in the approval of contractor submissions, accepting inadequate design drawings and delays in performing inspection and testing. Such delays and more may came as a result of poor qualifications and

experience of the consultant engineer's staff, or poor communication and coordination with the other parties involved in the project. From time to time during the project, contractors have many inquiries; slow response by the consultant engineer may lead to a slowing down of the progress of the work. In a case where a response is slow in coming, the contractors may extemporise a solution for the problem they face and execute it. This solution may not satisfy the consultant, which in turn results in doing the work again. Therefore, consultants should attend pre-construction meetings with construction contractors and respond promptly to them during construction.

Supervision of production on site is an important factor that contributes to project success. The consultant should constantly inspect the work, keep the client informed of the project progress and issue production instructions as and when required. He must establish a communications protocol for those involved with the contract work, review and approve design drawings and the contractors' work. In addition, he is required to help resolve all discrepancies in the contract documents and visit the job site as required to address construction problems when requested. Any delay in performing these tasks will have a negative impact on the project duration.

4.2.3. Owner related factors

The client (or the owner) is the key to the whole construction production process from inspection to completion and at times to post-occupancy maintenance (Kwakye, 1998). The owner's duties are onerous, since the nature of construction projects is complex and requires a knowledgeable person or organisation to manage the project. Many owners that sponsor a number of projects have their in-house project management teams to fulfil their responsibilities. Nevertheless, many, if not most, clients for construction do not have the organisational capabilities to manage their own construction projects themselves. Therefore, they employ an external project manager to handle the project and act as owner's representative.

One of the critical issues at the early stage of the project is determining the contract duration. Many owners require fast completion, but a thorough study must be made to determine the contract duration. Where an unrealistic contract duration is imposed,

this will obviously force the contractor either to accelerate the progress of the works and neglect the desired quality, or to perform the works as required but not on time. Another significant matter is handing over the site. Failure of the owner to hand over the site to the contractor on time will cause a delay in starting the work.

The involvement of the owner in the project may accelerate the project's progress. He should be able to take quick decisions on various matters, such as changing order, approving work or responding to the contractor, during construction. Such prompt action will avoid hold-ups and maintain the momentum of production. However, his decisions or actions should not cause any disruption to the progress of the works. "The working relationship between an owner and a contractor is one of the most crucial determinants of project success" (Kimmons and Loweree, 1989). The owner's involvement in the project should be smooth and without disruption to the contractor's project plan. Financial aspects should also be considered; the owner must ensure that adequate funds are available to meet progress and professional service payments. Shortage of money or delay to payments may result in a slow-moving project and therefore late completion.

4.2.4. Others

This delay category is further subdivided into three subcategories; early planning and design, government regulations and external factors.

A. Early planning and design

The quality of early planning and design affect the whole life cycle of the project. Accurate planning can secure smooth progress of work and deliver a successful project on time. However, it requires a great deal of information about the project and related maters. "The purpose of the provision of information and the use of the various planning tools is to enable the parties to put their respective contract obligation into effect. It can be reduced to a single question: How are we going to deliver this project on time and within budget?" (Carnell, 2000). Completed and clear documents, specification and design ease the contractor's obligations, create a pleasant atmosphere for work, and do not give the constructor excuses for delays.

Determining the overall timing of the enterprise is crucial to calculating its risks and the dynamics of its implementation and management, including how much time one has available for each of the basic stages of the project (National Economic Development Office, 1991). Determining contract duration needs comprehensive, methodical and careful study of every stage of the project. Some projects are required to be completed in a short duration for economic reasons, but imposing a short duration must be planned in a realistic way with concern for all barriers that may be faced during the project. Short duration contracts may lead parties involved to face difficulties and disputes. These disputes may be escalated to arbitration, then to litigation, and thus consume long periods of time waiting for legal action.

At the early planning and design stage, it must be recognised that drawings are a means of communication rather than an end product and hence, should be carefully detailed and coordinated to provide good production information. Adequate information on the planned shape, size, location and constituent parts of building; and on materials, jointing and fixing methods and so on must be provided in order to convey the designer's intentions adequately to the constructor. Ambiguities, mistakes and inconsistencies in the specifications and drawings will lead to many stoppages during construction, and therefore a longer project duration. Furthermore, unclear specifications and drawings may not give the owner a clear picture of the project, and increase his surprise at the construction stage, which in turn will result in adversarial disputes and changing orders. In actual fact, spending enough time at the early planning and design stage can speed the progress of production and avoid sinking into a 'disputes and blame' culture. Basically, paying careful attention to the early stages of the project will result in completing the project earlier than planned or on time.

B. Government regulations

Almost every country in the world has a government division responsible for controlling the construction of buildings. It is the body that grants planning permission for the execution of construction projects in its area of jurisdiction. For this reason, application forms and drawings must be submitted to this division (municipality in SA and local authority in UK) and approval must be obtained before commencement of site production. However, there are many other governmental

authorities involved in construction, such as statutory authorities and fire authorities. Owners, consultants, contractors and other parties involved in construction projects need to deal with such authorities in order to obtain work permits, labour permits, safety measures, utilities and so on.

It is common that construction parties face difficulties in obtaining work permits from governmental authorities. In some cases, the delays or difficulties in obtaining work permits are due to the bureaucratic system adopted by the authority concerned or the poor qualifications of its members. In order to avoid such delays, project teams should communicate and coordinate with governmental authorities as early as possible and should regularly communicate with the relevant authority during the project. Another significant point is that the consultant should have full information concerning the construction laws and regulations, to avoid the time-consuming redesign of illegal parts of the design.

Changes in regulations and laws are an important factor that may have a negative impact on project duration. Regulatory and legislative changes may be related to the construction specifications (solid to liquid percentage, height of buildings, land use, etc.) to labour law (e.g. barring access to some nationalities) or to other factors. These changes can affect some of the project procedures and result in delayed project completion.

Adopting the tendering system of selecting the lowest bidding contractor in public projects may mean accepting a contractor with poor qualifications or a shortage of resources. This may lead to poor construction performance and delays in project progress. Additionally, this strategy discourages contractors from mobilising the best efforts and resources they have in order to win the bidding competition.

A final legal consideration is that ineffective delay penalties may contribute to corruption in the construction industry. In other words, contractors may choose not to perform the work as stated in the contract, knowing that penalties in place are an inadequate deterrent. This gap in the law gives a chance to unscrupulous contractors to work badly.

C. External factors

There are some factors beyond the control of contractors and owners that cause construction delays. The occurrence of these factors, as stated in Chapter Three above, gives the contractor the right to an extension of time.

Temperatures in SA during the summer season range between 40° and 52°. In contrast, the weather in UK becomes severe in winter, when the temperature ranges between 12° and -13°. In this extreme weather, productivity becomes poor and the progress of work slows. “The contractor is expected to recognise in his programme that during the winter months there will probably be days when the weather will delay or prevent outside work. However, the contractor may be in delay because of his own fault, which results in a delay, for instance, in making the building weather-tight. If there are then exceptionally adverse weather conditions for the time of year, the contractor may be entitled to an extension of time. This can happen even though it is the contractor's own delay that has caused the work to be affected by the adverse weather conditions” (Birkby and Brough, 2002).

Sometimes, contractors face difficulties with subsurface condition on site. These difficulties include very strong rocks below the site, many utility lines (electricity, gas, and so on) and/or a water table in the vicinity of the site; and these may not be marked on available maps. Unexpected subsurface conditions may not only delay the work but also require redesign of the project master plan.

During the year, there are many social and cultural celebrations and festivities. Normally, at that time, the traffic becomes congested and may affect the job site. In such conditions, it would take longer for suppliers and labourers to access site. This negatively affects productivity and causes delays.

Anther factor that affects contract duration and is beyond the control of the parties, is the rise of material prices after the contract has been established. This happened last year (2003) when the price of steel more than doubled. Many projects were stopped in anticipation of a return to old price levels, causing direct delays. Although such price

rises are beyond the control of the contracting parties, they may also create disputes between contractors and clients, which will further increase the project duration.

The interface between many parties in the project is a significant issue. Many disciplines, different backgrounds, different education levels, and different aims and objectives are often involved. It is no easy matter to bring all these people together and expect them to work for, say, a year, without dramas, problems and disputes.

4.3. Summary of construction delay factors

The many causes of delay in construction projects have been examined and categorized. With the same categories used above, construction delay factors can be summarised as follows:

Contractor

Materials

1. Shortage of required materials
2. Delay in materials delivery
3. Changes in materials prices
4. Changes in materials specifications

Equipment

5. Shortage of required equipment
6. Failure of equipment
7. Shortage of supporting and shoring installations for excavations
8. Inadequate equipment used for the works

Manpower

9. Shortage of manpower (skilled, semi-skilled, unskilled labour)
10. Low skill of manpower

Project Management

11. Lack of motivation among contractor's members
12. Shortage of contractor's administrative personnel
13. Shortage of technical professionals in the contractor' s organization

14. Poor communications by the contractor with the parties involved in the project
15. Contractor's poor coordination with the parties involved in the project
16. Slow preparation of changed orders requested by the contractor
17. Ineffective contractor head office involvement in the project
18. Delays in mobilization
19. Poor controlling of subcontractors by contractor
20. Loose safety rules and regulations within the contractor's organization
21. Poor qualifications of the contractor's technical staff assigned to the project
22. Improper technical studies by the contractor during the bidding stage
23. Ineffective planning and scheduling of the project by the contractor
24. Delays to field survey by the contractor
25. Ineffective control of project progress by the contractor
26. Inefficient quality control by the contractor
27. Delay in the preparation of contractor submissions
28. Improper construction methods implemented by the contractor

Project Finance

29. Difficulties in financing the project by the contractor
30. Cash flow problems faced by the contractor
31. Problems between the contractor and his subcontractors with regard to payments

Consultant

32. Poor qualification of consultant engineer's staff assigned to the project
33. Delay in the preparation of drawings
34. Delay in the approval of contractor submissions by the consultant
35. Poor communication between the consultant engineer and other parties involved
36. Poor coordination by the consultant engineer with other parties involved
37. Delays in performing inspection and testing by the consultant engineer
38. Slow response from the consultant engineer to contractor inquiries
39. Inadequate design specifications
40. Poor contract management

Owner

41. Delay in furnishing and delivering the site to the contractor by the client
42. Unrealistic contract duration
43. Delay in the settlement of contractor claims by the client

44. Suspension of work by the client's organisation
45. Delay in issuing of change orders by the client
46. Slow decision making by the client's organisation
47. Interference by the client in the construction operations
48. Uncooperative client with the contractor complicating contract administration
49. Delay in progress payments by the client
50. Client's poor communication with the construction parties and government authorities
51. Client's failure to coordinate with government authorities during planning
52. Poor coordination by the client with the various parties during construction
53. Excessive bureaucracy in the client's administration

Others

Early Planning and design

54. Changes in the scope of the project
55. Ambiguities, mistakes, and inconsistencies in specifications and drawings
56. Subsurface site conditions materially differing from contract documents
57. Original contract duration is too short

Government Regulations

58. Ineffective delay penalty
59. Difficulties in obtaining work permits
60. Government tendering system requirement of selecting the lowest bidding contractor
61. Changes in government regulations and laws

External Factors

62. Severe weather conditions on the job site
63. Effects of subsurface conditions (type of soil, utility lines, water table)
64. Traffic control and restrictions on the job site
65. Effects of social and cultural conditions
66. Rise in the prices of materials
67. Work interference between various contractors

Chapter 5

Research Design and Methodology

Chapter (5)

Research Design and Methodology

5.1. Introduction to Chapter (5)

Having stated the aims and objectives of this research in Chapter 1, setting out a picture of the construction industries in SA and the UK in Chapter 2 and presenting the background of the subject in Chapters 3 and 4, it is time to present the methodology used to carry out this research and address its aims. This chapter explains how the problem was investigated and describes the tools used to undertake the investigation. It also describes the characteristics of the research sample and the method of analysis.

5.2. Research design

The research was designed to address the problem identified in 3.2 and achieve the objectives mentioned in 3.3. It was considered essential to obtain a full understanding of the study by setting out the various elements in a logical sequence, so as to avoid misunderstanding any point in the research. The problem, aims, objectives and hypotheses of the research were therefore stated at the outset. In order to present clear ideas about delays in construction projects and to examine the hypotheses identified, it was decided to conduct two stages of study. The first is a comprehensive review of the relevant literature, starting with an overview of the countries concerned in this research, then shedding light on all significant aspects of construction delays as covered by previous work in the field. The second stage was to prepare a questionnaire which was then used to highlight and compare the main causes of construction delay in Saudi and the UK.

5.3. Literature review

The basic concern throughout the review stage was to identify some of the broader parameters likely to be relevant in studying construction delays. In order to achieve the first objective (see 1.3.1), a systematic literature review was conducted, covering textbooks, institutional and statutory publications, periodicals, trade and academic journals, and seminar and conference papers.

The objectives identified in 1.3.1 can be seen to have been addressed by the literature review in the following points:

5.3.1. Identification and description of various types of delay in construction projects;

5.3.2. Summary of quantities and classifications of construction delays used in previous studies;

5.3.3. Presentation and discussion of the outcome of some previous studies;

5.3.4. Identification and description of the classified list of delay factors adopted in this study.

It was also essential to give an overview of the two countries where the survey was carried out before examining the core subject. Background information on the economic conditions and construction industries in SA and UK were presented in Chapter 2.

5.4. Questionnaire

The questionnaire was designed to meet the research aims and objectives and to test its hypotheses. First, the information presented in the previous chapters helped to widen the author's knowledge and create an awareness of other issues that might not otherwise have been taken into account. A provisional version of the questionnaire was then developed to cover all aspects needed to accomplish the purpose of the

research. However, it was also necessary to ensure that the questionnaire was reliable. For this reason, a quality control process was undertaken, starting by ensuring that each objective and hypothesis had questions corresponding to it, passing through a practical test in which a specialist was asked to fill in the questionnaire in order to examine the level of clarity, and ending with an approval procedure by the research supervisor.

The aim of the questionnaire is to identify the most important causes of construction delay in SA and the UK; however, it was also valuable to examine the grounds that may cause these delays, including procurement methods and tendering arrangements. In addition, it was expected that the respondents' knowledge and experiences would differ from one to another, and that this might have an impact on their answers, so attention was paid to addressing this point. A list of such ideas was considered in constructing the questionnaire.

In order to present the questionnaire in a systematic way, it was decided to divide the questions into four sections:

1. *Questions concerned with the respondent's experience. This contains general questions about the profession, period of experience, sector, type of work, speciality, and the size of projects in which the respondent has participated.*

2. *Questions dealing with contractual arrangements, including procurement methods and tendering arrangements.*

3. *Questions concerning the performance of the projects that the respondent has been involved in. This section identifies the number of projects that respondent has participated in and then asks how many of them were delayed and what the average delay times were. It also has questions about the average delay that was let pass by clients, the party responsible for the delay, and the five most important causes of delay.*

4. *This section includes the list of 67 causes of delay in construction projects. Four scales were identified to calculate the frequency of occurrence and the degree of severity of each cause.*

5.5. Questionnaire writing, distribution and collection

The questionnaire was written in two formats, the first one to be distributed in SA and the other in the UK. Four points were considered in order to obtain a high level of response:

- Providing a covering letter (see Appendix A) to do the following:
  - Identify the type of research, sponsoring organisation and the researcher's name;
  - Explain the purpose and the benefits of the study;
  - Encourage the participants to fill in the questionnaire in tactful language;
  - Inform the participants that their name, department, or company name will not appear in the research.
- Structuring the questionnaire in a smart and attractive design
- Presenting the questionnaire in a multi-options format, limiting open questions to only one question
- Keeping the questionnaire as short as possible, but comprehensive enough, so that it could be completed within 15 to 20 minutes.

Because of the culture differences between the two countries, it was decided to use an appropriate distribution method for each country.

5.5.1. Saudi Arabia

Because the mother tongue of most people working in construction in Saudi Arabia is Arabic, it was necessary to provide an Arabic questionnaire format. However, some English terms are commonly used in the Saudi construction industry, and there are a number of non-Arabic speakers working in this sector; therefore, a format of dual languages (see Appendix C), Arabic and English, was used.

For speed of response, the questionnaire was distributed personally and collected by hand. This method was effective as there is direct communication between the researcher and respondent.

5.5.2. United Kingdom

The questionnaire was written in English and distributed and collected by post to constructing contractors, consultants, and owners. Apart from the simple style and structure of the questionnaire, three points were considered in the postal questionnaire to guarantee a fast and high level of response:

- A reply envelope was provided inside each letter;
- A stamp was affixed to each reply envelope;
- Academic address labels were used on the envelopes.

5.6. The survey sample

The population of this research is composed of three strata: owners and their representatives, consultant engineers (the project supervisors) and contractors working in the construction field in SA and the UK.

The survey covered 24 UK towns and cities: Aberdeen, Birmingham, Bournemouth, Brighton, Bristol, Cambridge, Cardiff, Chester, Edinburgh, Elgin, Glasgow, Lancaster, Leeds, Liverpool, London, Loughborough, Manchester, Newcastle, Oxford, Poole, Sheffield, Southampton, Stirling, and York. The Saudi cities covered are Abha, Jeddah, Madeena, Mahyel Aseer, Makka and Tayef.

Saudi samples were taken from the business directory provided by the Council of Saudi Chambers web site, while British samples were taken from the UK construction companies web site' and the Business Finder web site. Samples were selected randomly but carefully.

5.7. Data collection

Out of 290 questionnaires sent out, 170 were posted in the UK, while the remaining 120 were personally distributed and collected by hand in SA.

Questionnaires	Contractors		Consultants		Owners		Total
	SA	UK	SA	UK	SA	UK	
Distributed	35	65	44	57	41	48	290
Replied	18	14	24	28	5	16	105
Respondents	18	11	24	19	5	6	83

Table 6 Sample Size

Of the total sample, 34 out of 100 questionnaires were received from contractors, 55 out of 101 copies were received from consultants, and 11 out of 89 from owners. All copies received back from Saudi companies were completed, while 36 of those received from UK companies were filled in, and the remaining 22 copies were sent back with apologies for not filling them in. Different excuses were presented in letters explaining the lack of response. Some examples of these letters are shown below:

Thank you for your letter to (OGN). With regards to your survey on 'Causes of Delay in Construction Projects', I regret to inform you that this has no connection with our organisation … etc

OGN: Organisation Name

Thank you for your recent request regarding information about (OGN).

Unfortunately, on this occasion we are unable to assist you with your enquiries, however if you do require any further information … etc

Thank you for your letter received today together with questionnaire. You should be aware that we are a supplier of specific building products and do not act as a sub-contractor. We are therefore not normally involved in tendering for work.

In these circumstances the questionnaire cannot be effectively answered, but in an effort to be of some help, I advise that the three major problems we experience with causes if delay are:

A. Incorrect or insufficient information provided in order to prepare a quotation.

B. Variation made after quotation prepared

C. Insufficient time given from order to manufacture and/or arrange delivery

I hope this is of some assistance to you and … etc

Thank you for your letter and form. I regret we do not have time to complete this and therefore return the originals including your stamped addressed envelope and hopefully you may have a more helpful response elsewhere … etc

We are in receipt of you letter enclosing your survey questionnaire on the construction industry. I am sorry, but I am afraid none of the architects currently have time to complete this. …etc

Table 7 Examples of excuses restrained participants to respond

Generally, the excuses of contractors and consultants were centred around lack of time, while most owner organisations stated that they did not deal with construction projects. In fact, all the owner organisations selected for the survey were indeed involved in construction projects, but some of them thought that they should be working directly in the construction sector in order to answer the questionnaire.

5.8. Faults in the survey design

It is not an easy matter to cover all points needed to obtain a perfect survey. Some details cannot be foreseen before the distribution of the questionnaire, since there are many matters involved in developing a questionnaire within a specific period. The author believes that it will be helpful at this point to state the most two significant mistakes that were committed in this survey, in order to contribute to the survey field by helping others to avoid them in future surveys.

Although it was ensured that all owner organisations selected for inclusion in this survey had dealt with construction projects, almost all owners that responded without filling in the questionnaire said that they believed that their work was not connected with the construction industry. The reason for this is that there was no special covering letter for owners, and the covering letter sent to them was the same one that

was sent to contractors and consultants. The first mistake, therefore, is that the author should have written a special covering letter for owners, explaining that if the letter was received by a department not concerned in any way with construction, it should be passed to the project management or construction department. It would also have been helpful to remind the organisation that they were known to be involved in construction projects. These comments are important, since large organisations have many departments with large numbers of employees who may have little idea of what other departments do.

	Frequency	Percent	Cumulative Percent
Contractors	29	34.9	34.9
Consultants	43	51.8	86.7
Owners	11	13.3	100.0
Total	83	100.0	

Table 8 Total of respondents

The second issue is that question 3.7 in the questionnaire form (see Appendix B) was structured incorrectly. It asks respondents to write in order the five most important causes of delay in construction projects. The answer space was provided with five long lines. The author did not want respondents to write the causes in words, as all potential causes were already listed in the next section. The lines were provided just for respondents to write the identifying number of each cause. However, apart from respondents who omitted this question, the majority wrote out the five causes. This question took a long time at the analysis stage, because each written cause had to be compared with the causes listed in order to find its number. Furthermore, to find the cause number, it was necessary to scan all the causes listed, because respondents wrote the causes in their own words. Three points should be considered here: the question should have been placed after Section 4, to enable respondents first to familiarise themselves with the causes as set out. Secondly, the lines provided for the answer should have been short to give the reader an indication that he was required to write only a number. Finally and most importantly, the question should be: 'Write in order the numbers of the five most common causes of delay'. As far as the present survey is concerned, this mistake was resolved during the analysis stage, but only by the expenditure of additional effort.

5.9. Method of analysis

Data collected from the survey was analysed using descriptive statistical techniques. An advanced and accurate analysis method was needed to arrange the large body of data in a systematic, fast and reliable way. For this purpose the computer software

Statistical Package for Social Science (SPSS) and Excel were chosen as the best options available.

In section four of the questionnaire, the respondents were asked to figure the causes regarding to their frequency and severity weight. The scales provided ranges from 1 to 4 as shown in Table 9. However, in order to launch a quantitative measure of the frequency and the severity, it was decided to weight the causes with the same weight that was assigned to them

Scale	Frequency (F)	Weight	Severity (S)	Weight
1	Never	**1**	No effect	**1**
2	Occasionally	**2**	Fairly severe	**2**
3	Frequently	**3**	Severe	**3**
4	Constantly	**4**	Very severe	**4**

Table 9 Frequency and severity weighting

The average score or the Index of frequency (FI) and severity (SI) for each delay factor was calculated by the following formulae:

:

$$FI = \frac{\sum_{i=1}^{4} Fi \times Pi}{\sum_{i=1}^{4} Pi} \left(1 \le AF \le 4\right)$$

Equation 1 Frequency Index

$$SI = \frac{\sum_{j=1}^{4} Sj \times Pj}{\sum_{j=1}^{4} Pj} \left(1 \le AS \le 4\right)$$

Equation 2 Severity Index

$$= \frac{W_1 \times P_1 + W_2 \times P_2 + W_3 \times P_3 + W_4 \times P_4}{P_1 + P_2 + P_3 + P_4}$$

Equation 3 Explanation of the FI and SI equations

Where;

Fi is the frequency weight (1,2,3 or 4) assigned to option i

Pi is the number of participants who responded to option i

Sj is the severity weight (1,2,3 or 4) assigned to option j

Pj is the number of participants who responded to option j

The calculation of the importance index (II) was determined through two steps; first, identifying the score for every possible answer as shown in the matrix below:

		Frequency (F)			
	⊗	**1**	**2**	**3**	**4**
Severity (S)	**1**	1	2	3	4
	2	2	4	5	6
	3	3	5	7	8
	4	4	6	8	9

Table 10 Frequency-severity matrix

All possible answers are 16. However, because the weight of frequency and severity will be considered equally, the number of the score of integrating F with S will be 9. The importance index (II) for each cause was calculated as follows:

$$II = \frac{\sum_{k=1}^{9} \left(F \otimes S\right)_k \times P_k}{\sum_{k=1}^{9} P_k}$$

Equation 4 Importance index of the delay factor

Where;

$\left(F \otimes S\right)_k$ is the conjunction (1,2, …., or 9) in the matrix shown in Table 10 between the frequency weight, and the severity weight that is assigned to option k.

P_k is the number of participants who responded to option k

Answers concerning the frequency alone or severity alone were neglected.

Chapter 6

Analysis and Results

Chapter (6)

Analysis and Results

6.1. Introduction

The methodology of analysing the questionnaire having been given, the appropriate techniques that will be used to reach the needed results from the survey are set out in Chapter 6. Here the results of the data collected through a questionnaire survey which was distributed among professionals working in the field building construction in SA and UK.is presented and discussed. This chapter consists of two major parts. The first part describes and analyses the data related to the respondents' experience, the contractual arrangements they have used, and the performances of the projects they have participated in. The second focus on the main objectives of this survey presents and ranks the causes of delay based on the opinions of different groups: each rank table is ordered according to the importance of the causes of delay. The importance of these causes is based on the integration of their frequencies and severities.

6.2. Data statistics and analysis

In order to discuss and analyse the result of the survey data collected, it was decided to presents the analysis in the order shown in the questionnaire form. However, some results are needed to integrate more than one component to determine the relationship between them. The integrated results will be discussed as appropriate. Briefly, apart from section D shown in the questionnaire, the analysis of sections A, B, and C will follow the sequences of the questionnaire

6.2.1. Fundamental analysis

The analysis will be presented regarding to the total number of respondents; however, in some sections the comparison will be needed, and accordingly, it would be necessary to refer the data to the country of respondents or perhaps to the professional groups. Therefore, the tables provided will illustrate these links which will be discussed as it seems useful and relevant to the objectives of this research.

The next sections present and discuss data concerning respondents' experience, contractual arrangements, and the performance of the projects in which the respondents participated.

A. Respondents' experience

This section presents general information about the participation of respondents in this survey. The aim of this section is to give an image of the strength of respondents' experience, and therefore indicate the degree of reliability of the data provided by them.

A.1. Legal form of the respondents

Valid	83	Factor	Frequency		Total	Percent	Cumulative
Missing	0		SA	UK			Percent
		Contractor	18	11	29	34.9%	34.9
Business		Consultant	24	19	43	51.8%	86.7
		Owner	5	6	11	13.3%	100.0
Total			**47**	**36**	**83**	100.0%	
Percent			56.7	43.3	100		

Table 11 Frequency of participation

Table 11 indicates the number of professionals who participated in this survey. The respondent was asked to select his/her business in the construction projects. The total number of respondents participating in this survey was 83. Consultants give the highest frequency, having 43 participants with 52%. 24 are from SA, and the other 19

are from the UK. Contractors come in the second position, with 29 participants and 35%; 18 of them are from SA, and the remaining 11 are from the UK. The lowest frequency is for Owners with 11 participants and 13%. 5 of them work in the Saudi construction industry, and the other 6 are from the UK.

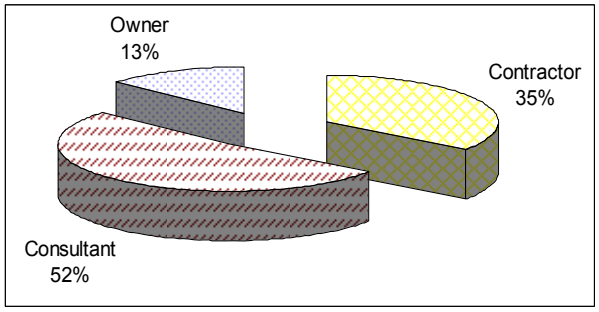


Figure 7 The percent of participants

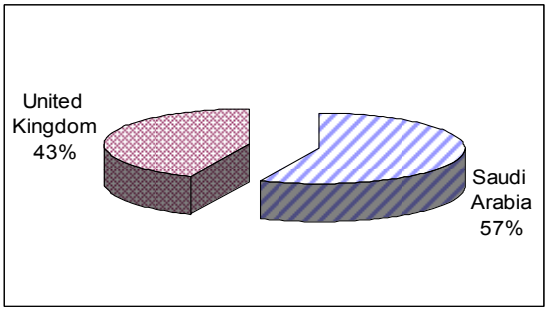


Figure 8 SA & UK percent of participation

At the level of total participants of each country, SA respondents shape 57% of all participants, while the participants of UK form 43%. However, the difference between the number of participants is not large, since the difference percent is just 7%.

A.2. Sector type

Respondents were asked to determine the sector type that they work for. Table 12 shows that the vast majority of respondents are working for both private and public sectors. 22 out of 43 participants working in both public and private sectors are from SA, and the other 21 are from the UK. Respondents working for the private sector comprise 32 of the frequency, including 21 from SA and 11 from the UK.

Valid	83	Sector type			Total
Missing	0	**Public**	**Private**	**Both**	
Country	**Saudi Arabia**	4	21	22	47
	United Kingdom	4	11	21	36
Total		**8**	**32**	**43**	83

Table 12 Sector types that participants work for

The lowest rate of frequency is 8, and that is for respondents working for the public sector only. This is equally divided between respondents in the both of countries, having 4 for each. Figure 9 illustrates the proportion of respondents to the sector they work for and their area.

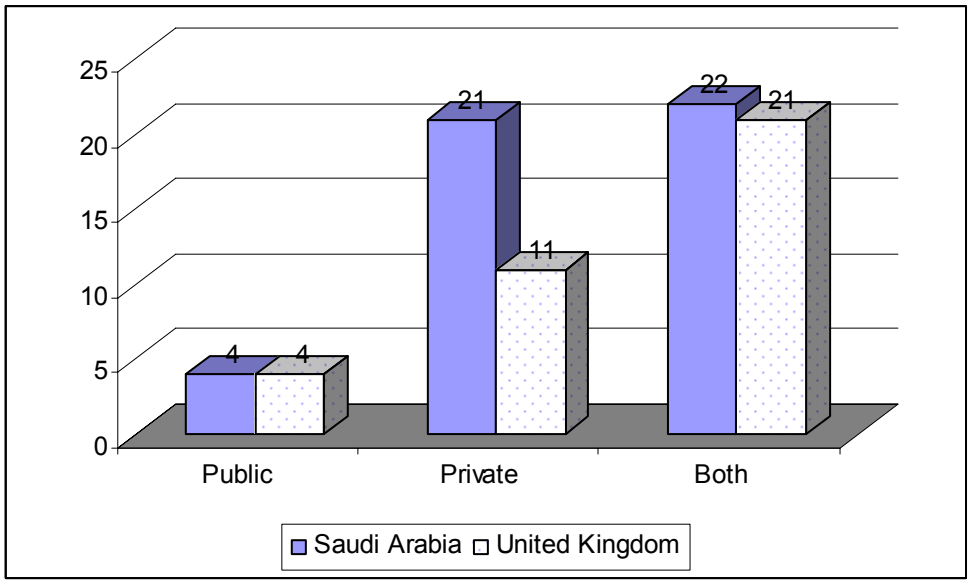


Figure 9 Sector types participants work for in relation to their countries

A.3. Years of experience

Fortunately, most of the professionals who participated in this survey have over 15 years of experience, which in turn raises the reliability of the data collected from the shared knowledge of long years of experience in the building construction field.

Valid	83	year of experience				Total
Missing	0	<5 years	5-10 years	10-15 years	>15 years	
Country	Saudi Arabia	6	4	13	24	47
	United Kindom	4	6	1	25	36
Total		**10**	**10**	**14**	**49**	83

Table 13 Participants' year of experience

Table 13 and Figure 10 show the years of experience of the respondents. It shows that 59% of the participants, which includes 49 respondents, have experience of over 15 years.. The frequency of respondents who have experience of between 10 to 15 years is 14, and form 17 % of total respondents. For half of the remaining 20, their experience ranges between 5 to 10 years, whereas, the other half are the lowest experienced respondents as they have less than 5 years of experience.

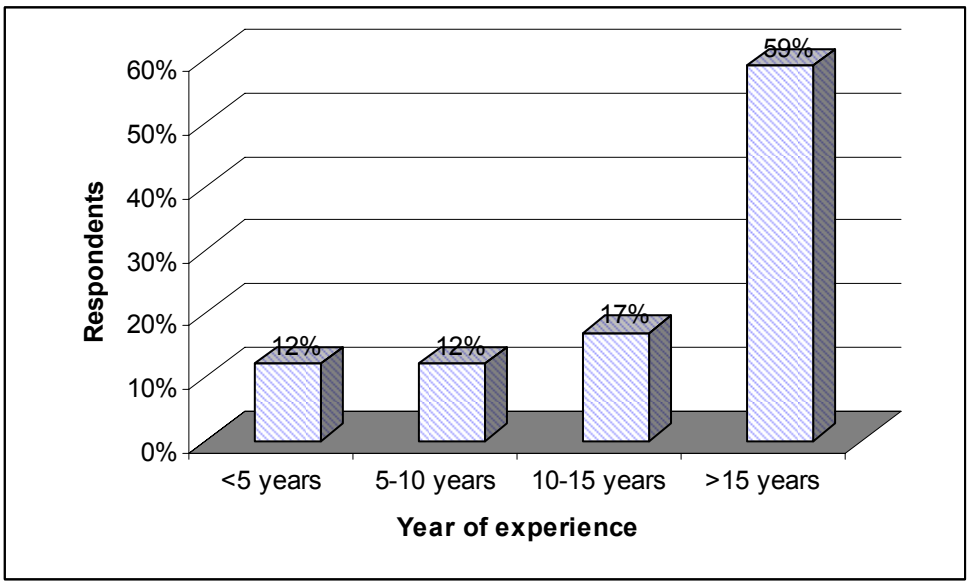


Figure 10 The Respondents Percentages regarding to their experience

A.4. Speciality

The different types of construction projects were grouped into four major categories. However, since many professionals are specialists in more than one type of construction project, the analysis includes all the probabilities that were obtained from respondents. This will enable the researcher to take a wide overview of the respondents' experience in addition to presenting the number of respondents for each of the main four categories.

Valid	83	Building construction specialty	TRMC	Country		Total
Missing	0			SA	UK	
Main category		Commercial buildings	**53**		9	**9**
		Industrial buildings	**30**	2	4	**6**
		Governmental buildings	**43**	3	5	**8**
		Residential buildings	**49**	5	5	**10**
		Commercial & Industrial buildings		1		**1**
		Commercial & Governmental buildings		2	2	**4**
		Commercial & Residential buildings		4	4	**8**
		Industrial & Governmental buildings		3		**3**
		Governmental & Residential buildings		3		**3**
		Commercial, Industrial & Governmental buildings		1	2	**3**
		Commercial, Governmental & Residential buildings		11		**11**
		Commercial, Industrial & Residential buildings		2	4	**6**
		Commercial, Industrial, Governmental & Residential buildings		10	1	**11**
Total				**47**	**36**	83

Table 14 Building construction speciality TRMC: Total respondents of the main categories

Figure 12 indicates that most respondents (33) are specialists in only one type of building construction, while the remaining 50 have dealt with more than one type of construction project. 20 participants have been involved in 3 types of building construction, 19 have been involved in 2 types, and the other 11 have experienced all (4) major types of construction projects. The percentages of each subcategory are shown in Figure 11.

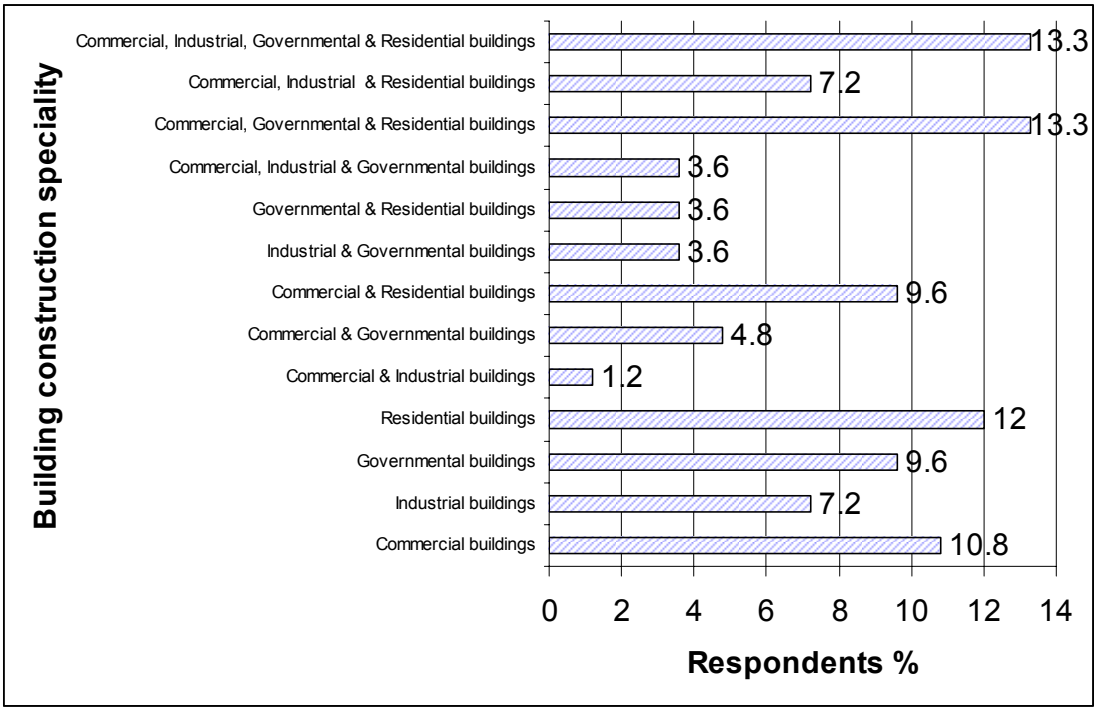


Figure 11 Respondents' speciality in building construction

Regarding the main four categories identified in the questionnaire, commercial buildings hold the highest frequency with 53 specialists, followed by residential buildings with 49. 43 of the respondents deal with governmental buildings while 30 of them deal with industrial buildings.

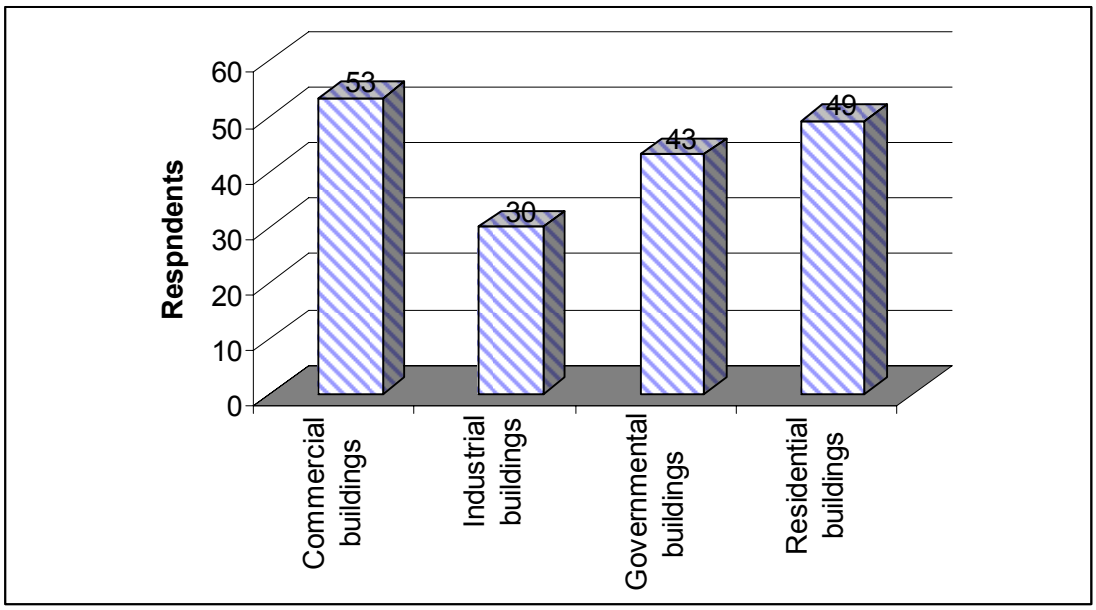


Figure 12 Respondents in relation to speciality in building construction types

A.5. Project sizes

Table 15 illustrates the main categories of project sizes and its sub division regarding respondents' experiences. It shows that the highest frequency deal with medium and large size projects (16), followed by respondents dealing with small, medium, large and very large projects (15). Respondents participated in small and large projects and small, medium, and large projects have the lowest frequency. The other sub categories' frequency ranges between 3 and 10. Most participants (34) deal with 2 sizes, and 23 of respondents are specialists in just one size of construction project. Whereas 32 of participants have dealt with more than 2 sizes of project, 17 of them have dealt with 3 sizes and the other 15 have been involved in the four sizes of construction project.

		The size of projects	TRMC	Country		Total
				SA	UK	
Valid	83					
Missing	0					
Main Category		Very large	**33**	3	2	5
		Large	**57**	4	2	6
		Medium	**67**	2	4	6
		Small	**45**	3	3	6
		Large & Very Large Projects		3		3
		Medium & Very Large Projects		3		3
		Medium & Large Projects		10	6	16
		Small & Large Projects		2		2
		Small & Medium Projects		4	6	10
		Medium, Large & Very Large Projects		3	2	5
		Small, Medium & Very Large Projects		2		2
		Small, Medium, & Large Projects		2	8	10
		Small, Medium, Large & Very Large Projects		9	6	15
Total				**47**	**36**	83

Table 15 Respondents' experience regarding to project sizes they have participated in

TRMC: Total respondents of the main categories

In terms of the four major categories, the medium size project is participated in by 76 respondents with 34%. Respondents dealing with large projects are 57, which forms 28%. Small projects are participated in by 45 respondents with 22%. The very large projects category holds the lowest frequency (33) with 16%.

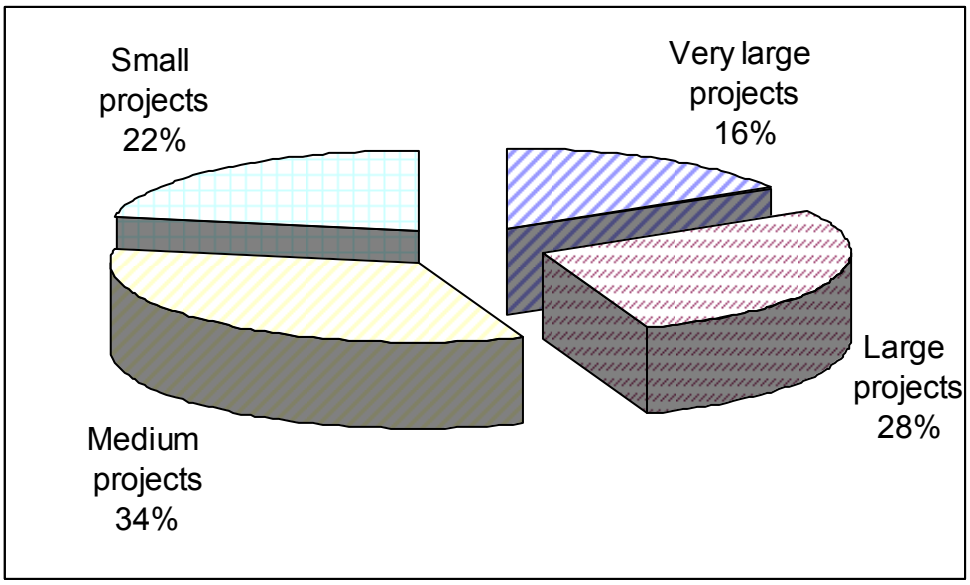


Figure 13 The percentages of respondents regarding to the size of projects they have participated in

B. Contractual arrangements experienced by respondents

The analysis of data concerning the procurement methods and tendering arrangements that have been used by respondents is shown here.

B.1. Procurement Methods

Various types of procurement methods are commonly used in construction projects. These varieties of methods are grouped into four major categories. The respondents were asked to select the method/s that they have experienced. Table 16 indicates that the majority of respondents, including 32 respondents, have experienced 2 types of procurement methods. The second frequency is for respondents who have dealt with only one procurement method. 26 of respondents have experienced more than 2 procurement methods, 16 of them have dealt with 3 types of procurement methods,

whereas 10 respondents have dealt with all 4 procurement methods used in construction projects.

Valid 81 / Missing 2	Procurement methods	TRMC	Country		Total
			SA	UK	
Main Category	Traditional	**50**	2	7	9
	Management contracting	**30**	4		4
	Design & build	**54**	2	3	5
	Construction management	**41**	4	1	5
	Traditional & Management Contracting		2	1	3
	Traditional and Design & build		1	9	10
	Traditional & Construction Management		3	1	4
	Management Contracting and Design & build		3		3
	Management Contracting & Construction Management		1	1	2
	Design & build and Construction Management		10		10
	Traditional, Management Contracting and Design & build		4	2	6
	Traditional, Design & build and Construction Management		3	5	8
	Management Contracting & Design and Build & Construction Management		2		2
	Traditional, Management Contracting, Design & build and Construction Management		4	6	10
Total			**45**	**36**	81

Table 16 Procurement methods that used by respondents

The type of procurement method that is most commonly used by respondents is design and build, which is used by 54 participants. In contrast, the lowest frequency is for management contracting, which is used by 30 participants. Traditional and construction management procurement methods come in between: 50 have dealt with traditional procurement and 41 have been involved in projects using the construction management procurement method.

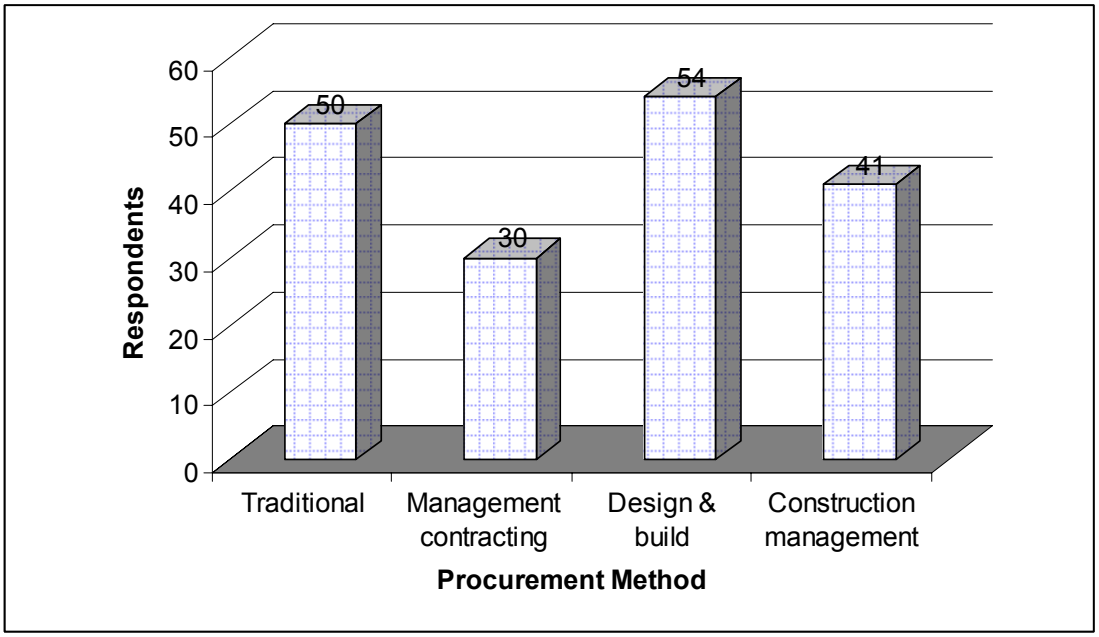


Figure 14 The frequency of each procurement methods regarding to respondents' involvement

B.2. Tendering arrangements

Five main categories of tendering arrangements were identified in the questionnaire, and respondents were asked to select the arrangement they have dealt with. Table 17 shows that 38 respondents out of 81 have been involved in 2 types of tendering arrangement. 18 respondents have dealt with just one type of tendering arrangement, and the remaining 25 have been involved in more than 2 types. 16 of them have dealt with 3 types, 7 have dealt with 4 types and 2 respondents have been involved in all 5 types of identified tendering arrangement.

Valid	81	Tendering arrangement	TRMC	Country		Total
Missing	1			SA	UK	
Main category		Negotiation	**51**	3		3
		Open tendering	**49**	3	2	5
		Selective tendering	**52**	3	2	5
		Two-stage selective tendering	**21**	2		2
		Serial or continuous	**7**	2	1	3

	Negotiation & Open tendering	7	4	11
	Negotiation & Selective tendering	7	5	12
	Negotiation & two-stage Selective tendering		1	1
	Open tendering & Selective tendering	8	5	13
	Selective tendering & two-stage Selective tendering	1		1
	Negotiation, Open tendering & Selective tendering	5	2	7
	Negotiation, Open tendering & two-stage Selective tendering		2	2
	Negotiation, Open tendering & Serial		1	1
	Negotiation, Selective tendering and two-Stage Selective tendering	1	4	5
	Open tendering, Selective tendering & two-stage Selective tendering		1	1
	Negotiation, Open tendering, Selective tendering & two-stage Selective tendering	2	4	6
	Negotiation, Open tendering, two-stages Selective tendering & serial	1		1
	Negotiation, Open tendering, Selective tendering, two-stage Selective tendering & Serial		2	2
Total		**46**	**35**	81

Table 17 The frequency of the tendering arrangements that experienced by respondents

Figure 15 indicates that selective tendering has been experienced by most in tendering arrangements and was selected by 52 respondents, followed directly by negotiation tendering and open tendering, which are experienced by 51 and 49. On the other hand, serial or continuous tendering holds the lowest frequency, experienced by only 7 participants. Lastly, 21 respondents have been involved in projects arranged by two-stage tendering.

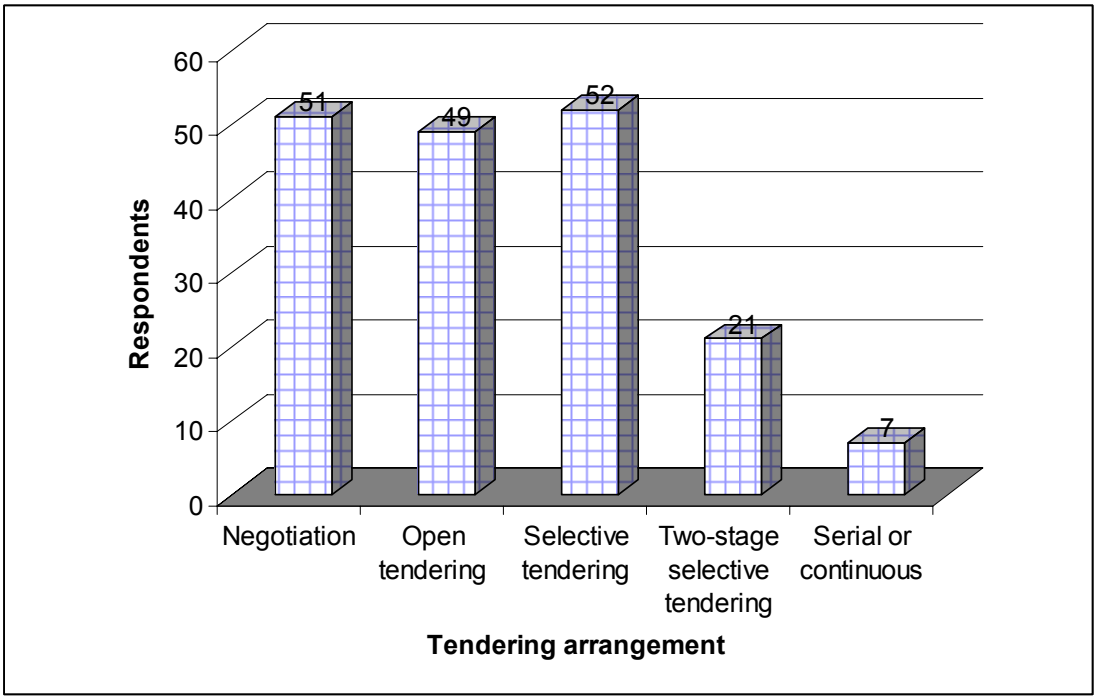


Figure 15 The frequency of respondents regarding the tendering arrangements they have experienced

3.2.1. Performance of projects that respondents have been involved in

This section presents the core data analysis about the construction projects performance that participants have been involved in. It discusses and analyses the number of projects; how many of them were delayed, the average time of delay, authorised time, and the first responsible party for delay.

C.1. Number of construction projects that respondents have participated in

Table 18 indicates that the participation of professionals in this survey is based on over 6700 projects they have been involved in. However, the average number of projects for participants is 99 which means in general that most respondents have a very broad background about construction projects, and sharing their knowledge leads to accurate identification of the most important causes of delay.

Valid 81 Missing 2		Range	Minimum	Maximum	Sum	Average
Country	**SA**	797	3	800	2379	50.6
	UK	1048	2	1050	4388	129
Total		1048	2	1050	**6767**	**98.8**

Table 18 Number of construction projects that respondents have participated in

It can easily be seen in Figure 16 that professionals with different experience contributed in this survey. The participants' experience regarding the number of projects ranges between 2 to 1050 projects.

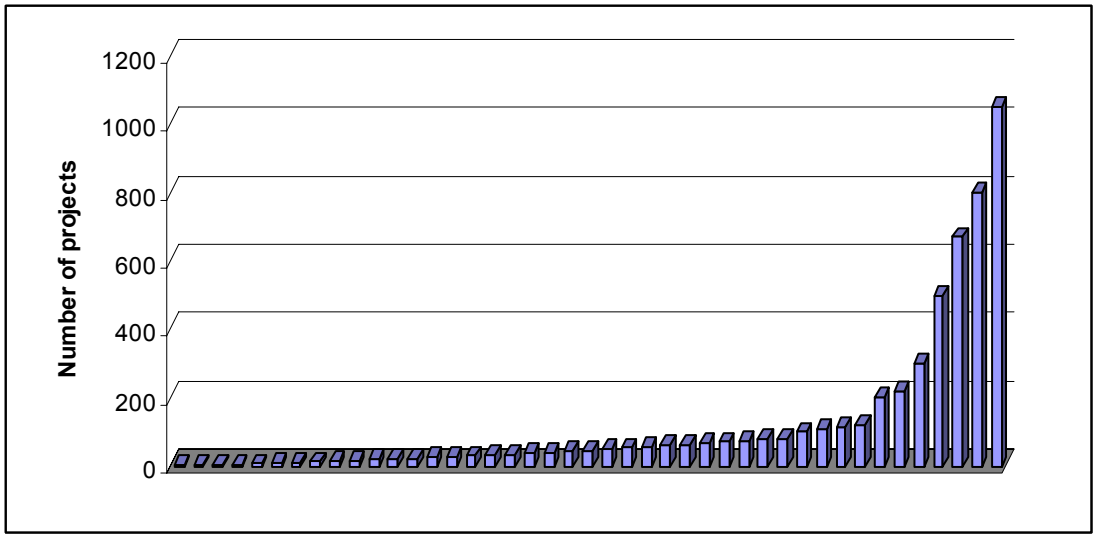


Figure 16 Indication of the range of experts contributed in the survey in relation to the number of projects they have participated in

Figure 17 illustrates how many respondents were involved in how many projects. It shows that the majority of participants were involved in 2 to 70 projects, while, when moving to the right where the direction of higher number of projects is, the number of respondents decreases to single figures. That can clearly be seen since there are single numbers involved in 120, 200, 220, 300, 500... 1050 projects. In addition the figure indicates that participants from SA are in total less experienced than UK participants as the line indicates the SA participants start to go down when one moves to the right side and vice versa for UK participants.

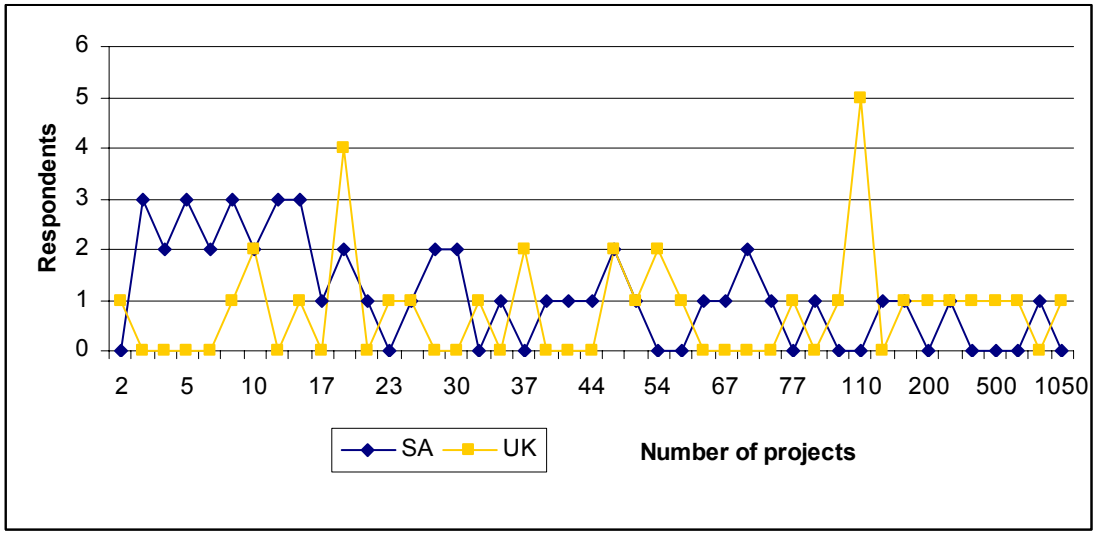


Figure 17 SA and UK respondents regarding the number of projects they have participated

C.2. Delay's experienced

Table 19 and Figure 18 indicate that the vast majority of respondents have experienced delay in a construction project. 78 out of 82 participants have been involved in projects that were not completed as planned or as stated in the contract, whereas just 4 participants have experienced delay. The proportion of respondents who were involved in delayed projects in relation to respondents who were not is 95% to 5%.

			Country	Total
Valid	82		SA	UK	
Missing	1				
Experienced delay		**Yes**	45	33	**78**
		No	2	2	**4**
Total			47	35	82

Table 19 The frequency of respondents that experienced delay

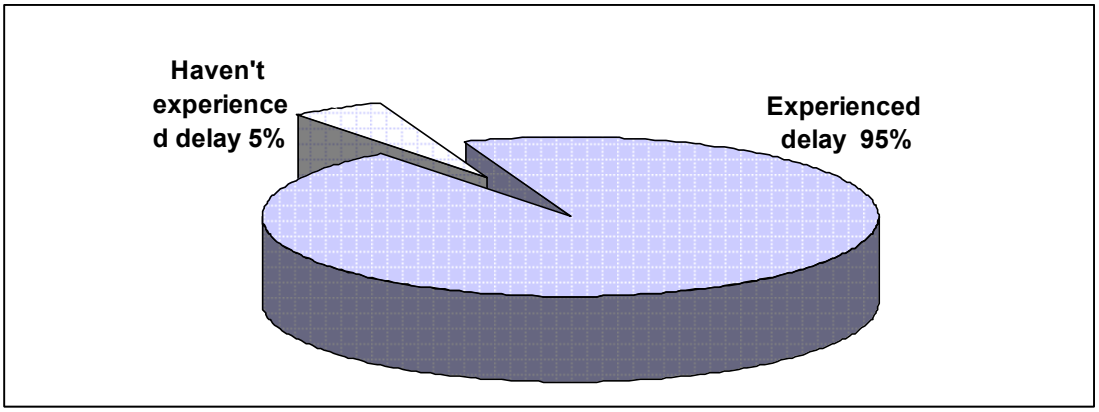


Figure 18 The percentage of respondents who experienced delay

C.3. Ratio of delayed to non delay projects

As shown in the Table 20, 1902 projects out of 6767 were delayed. Conversely, 4865 projects were successfully delivered as scheduled. The number of delayed projects forms 28% of the total projects. Based on the previous surveys concerning time performance of construction projects (see 3.3), these are rose-coloured results. However, compared with results for other industries, this result still very unfortunate.

Valid 81 Missing 2		No of projects	Delayed projects	None delayed project	% of delayed project
Country	**SA**	2379	952	1427	**40%**
	UK	4388	950	3438	**21.6%**
Total		6767	**1902**	4865	**28%**

Table 20 Ratio of delayed to non delay projects

The most notable point in this part is the big difference of the delayed ratio between SA and the UK. That can be seen clearly in Figure 19. The percent of delayed projects in SA is 40%, which is a depressing result, while, the percent in UK is 21.6 which is a positive indication. That may be the result of the difference of knowledge, experience, and resources, as the UK is a developed country, whereas SA is still classified today in the CIA's World Factbook (2004) as a developing country, although major developments have taken place in recent decades.

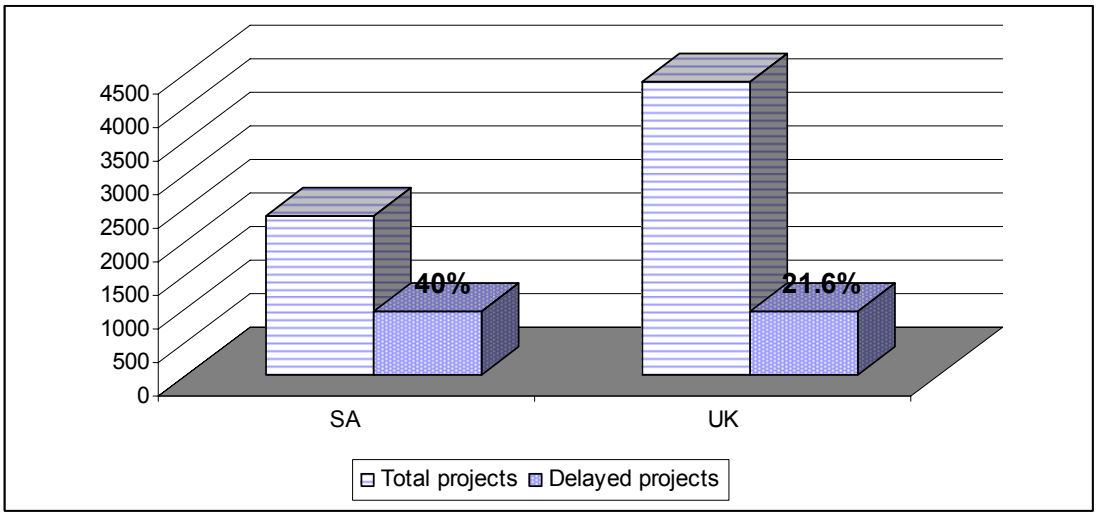


Figure 19 The percent of the delayed projects in both countries

C.4. Average delayed time of the delayed projects

Average delayed time was classified into 5 categories, and respondents were asked to select one of these categories to indicate the average delayed time of whole delayed projects they had participated in. Table 21 demonstrates that the average delayed time of delayed projects for approximately half respondents (37 – 48%) is from 10% to 30% of the project plan. Then, projects that had been delayed by less than 10% of the project plan come as the second frequency including 29 respondents and give a percentage of 37.7%. The percent of respondents who had experienced an average delay from 51% to 100% is 5.2% which includes 4. Also those respondents who experienced from 31% to 50% delay time hold the same percent of the previous one. The lower frequency is for participants who experienced an average delay of over 100% of the project schedule, and that includes 3 respondents and forms 3.9% of the total number of respondents.

		Country				Total	Percent
		SA		UK			
		No	%	No	%		
Valid	77						
Missing	6						
Average of delayed time	<10%	9	20	20	62	29	37.7%
	10-30%	26	58	11	34	37	48%
	31-50%	4	8.8		0	4	5.2%
	51-100%	3	6.6	1	3.1	4	5.2%
	>100%	3	6.6		0	3	3.9%
Total		45	100	32	100	77	100%

Table 21 The average delayed time of the delayed projects

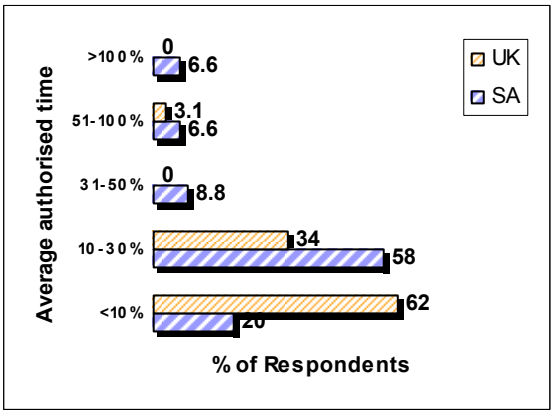


Figure 21 The percent of average delayed time of delayed projects in both countries

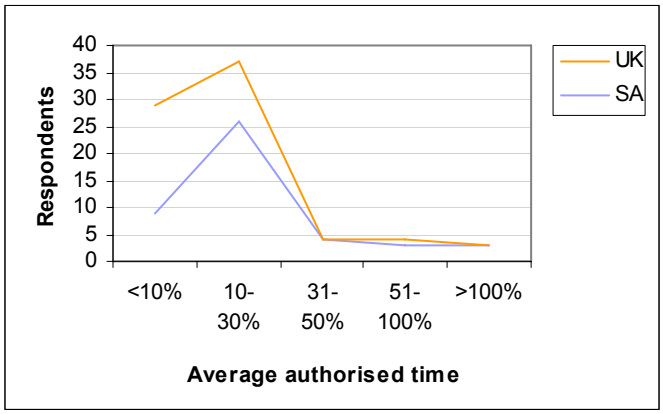


Figure 20 Linear indication of average delayed time

Figure 21 illustrates the percentage of each country's respondents regarding average delay dime. It shows that over the half of SA respondents (58%) experienced an average delay of 10% to 30%, whereas most UK respondents who had been involved in delayed projects experienced an average delay time of less than 10% of the project plan. However, the noteworthy issue, which may be frustrating to some extent, is that the average length of delay of delayed projects that reported by 6.6% of SA respondents exceeds double the time of the project plan!! In general, the average delay time in both of countries ranges between 5% and 30%, as shown in the linear indicator in Figure 20.

C.5. Average delayed time that authorised by client

The delayed time of a project may be let past by the client or it may not. That usually depends on the type of delay, contract specification, and characteristics of the owner. The durations of authorised time were divided into 5 categories which include all probabilities that may occur in a delayed project.

Valid 78 Missing 5	The average of authorized delayed time	Country				Total
		SA		UK		
		No	%	No	%	
	All the delayed time	20	**44**	12	**37**	32
	About 75% of delayed time	7	**16**	6	**18**	13
	About 50% of delayed time	1	**2**	7	**21**	8
	About 25% of delayed time	12	**27**	7	**21**	19
	The contractor paid the liquidated damages for all delayed time	5	**11**	1	**3**	6
Total		45	100	33	100	78

Table 22 The average of delayed time authorised by the owner

Table 22 illustrates the average delay time authorised by the owner. 32 participants declared that the average of authorised delay was all delayed time, while 19 estimate the average authorised time as about 25 % of delayed time. 13 respondents approximate it about 75%, while, 8 respondents approximate the average to about 50%. Finally, 6 respondents answered that delayed time was not authorised by the owner in the average of all delayed projects they had been involved in; therefore, the contractor paid liquidated damages for all delayed time.

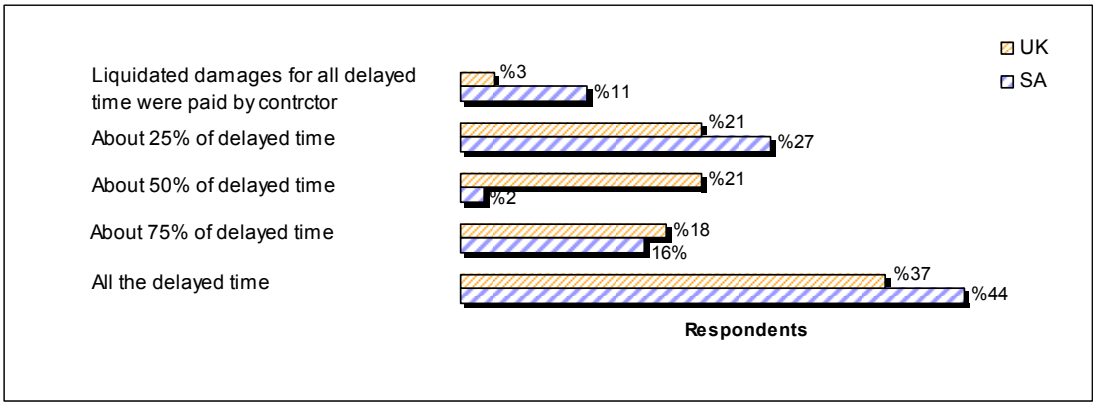


Figure 22 The percent of average authorised time of delayed projects in both countries

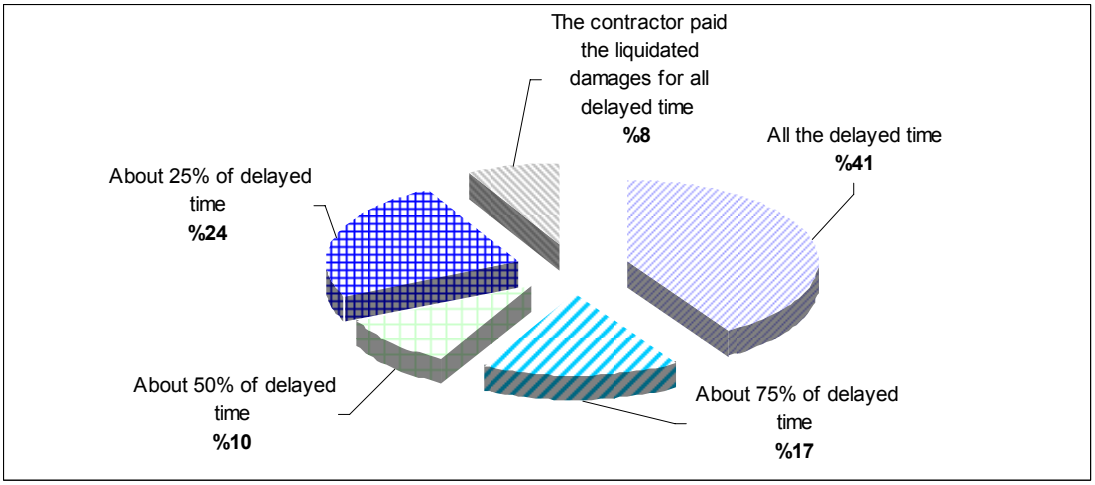


Figure 23 Illustration of the averages delayed time that were let passed by the owner and reported by all respondents

Figure 22 indicates the averages of authorised time of delayed projects in SA and the UK. It shows that in the Saudi Arabian construction industry the common action taken by owners in delay projects is to let pass all delayed time, and not charge the contractor for liquidated damages. It is the same in the UK but with a lower percent since it is 44% in SA and 37 in the UK. On the other hand, the chart shows that 11% of SA respondents experienced delayed projects with an average of no authorisation for any liquidated damages, while only 3% of UK respondents experienced that. Nevertheless, the entire average of the both countries, shown in Figure 23 indicates that the majority of owners in SA and the UK do not authorise all delayed time; despite that, a high percentage (41%) of respondents estimate the average as authorising all delayed time.

C.6. Party most often responsible for delays

valid	74	**Country**		**Total**
missing	9	**SA**	**UK**	
1st responsible party	**Contractor**	17	17	**34**
	Owner	22	9	**31**
	Consultant	5	4	**9**
Total		44	30	74

Table 23 First responsible party for delays based on all respondents' opinions

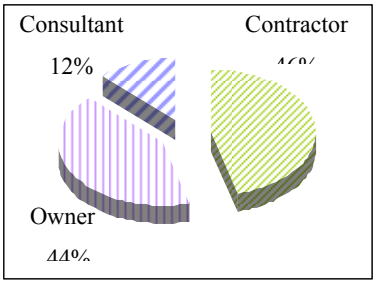


Figure 24 Delay responsibility based on all respondents' opinion

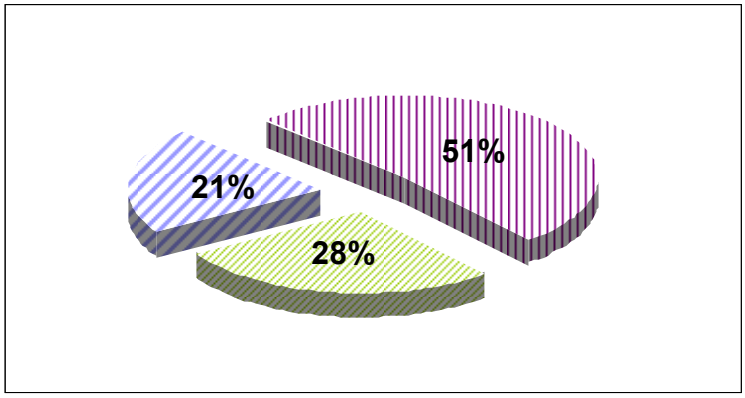
The total answers of all respondents, including contractors, consultants and owners in both countries identify the contractor as being most responsible for construction delays. Table 23 and Figure 9 highlight this since 34 respondents out of 74 expressed that. Owners came the second with little difference compared with contractors; the difference was only three respondents and that just forms 2%. 31 respondents accused the owners as being the most responsible party for delays. With a low percentage which is 12% formed by 9 respondents, consultants emerged as being the least responsible party for delays. However, this is the result of all the respondents; hidden points can be discovered in the next part as it shows the results according to group opinions.

Valid	74					
Missing	9		**Parties' opinion**			Total
			Contractor	**Consultant**	**Owner**	
1st responsible party for delays		**Contractor**	8	19	7	34
		Consultant	6	3		9
		Client	15	15	1	31
Total			29	37	8	74

Table 24 Parties' attitudes regarding most responsible party for delays

Table 24 demonstrates the attitudes of the group parties towards the party most responsible for delay. The level of agreement appears not high as each group has different attitudes from those of the others. However, the positions of the contractors' and owners' groups are almost contrasted. Moreover, the agreement between contractors and consultants is low. But the judgment of consultants and owners seem to bee higher.

Based on the total response of the contractors, the owners are the party most often responsible for delays, and the contractors' group judgment on themselves indicates that their responsibility for delay is high, yet they admit that consultants are the lowest responsible party. Nevertheless, Figure 25 shows that there is a difference of only 7% between the responsibility of the contractors and the consultants for the delays.



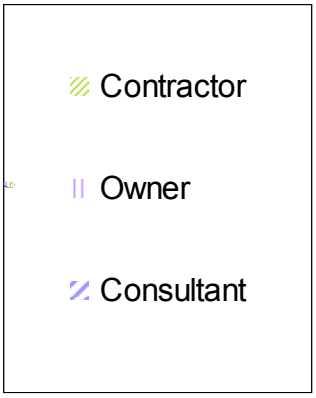


Figure 25 Contractors' opinions

Figure 26 Key box

Owners strongly agree that contractors are the party most responsible for delays, which is indicated from the high percentage (87%) given to contractors by owners. The owners' group gave themselves 13 % of the responsibility. But the most notable point is that 0% percent was given to consultants by owners. Not one of the respondent owners identified the consultants as being most often responsible.

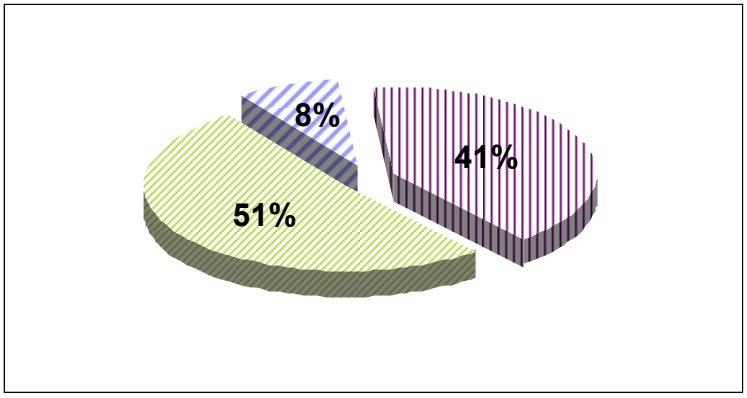


Figure 28 Consultants' opinions

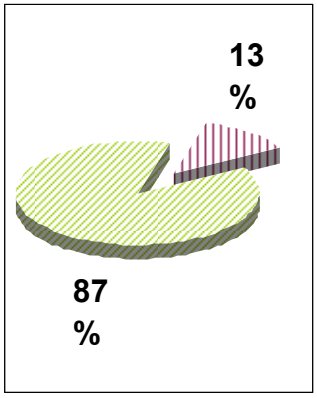


Figure 27 Owners' opinions

In the middle ground between contractors and owners stands the group of consultants. They gave just about half the responsibility (51%) to contractors while the other half is divided between them and owners; they hold 8% of responsibility and gave 41% to owners.

6.2.2. Causes of delay

67 well-recognised causes of delay were identified and provided in the questionnaire form. Determining the importance degree of each cause was sought as it leads to the main objectives of this survey. The respondents were asked to calculate the level of frequency and severity of each cause using the range of weights provided. The following parts present and discuss the data collected regarding the frequency and severity of the causes. Different sorts of ranking analysis will be presented and discussed, and importance-based ranks will include a group ranking,either by the total answers of each professional group (contractors, consultants, owners) or of a country group (respondents from SA and the UK respectively). Moreover, three ways of ranking are used; all causes rank, subcategories rank, and main categories rank

The analysis and discussion of ranking focuses directly on the importance of causes rather than ranking them based on frequency and severity separately. However, because of the significance value of presenting the rank of causes based on the frequency and severity separately, tables showing the causes rank based on frequency and severity separately are provided in the appendix D. The importance of each cause

was consequential of integration between frequency and severity of that cause. The method of gathering the weight of frequency and severity of each cause is explained in part 5.9. Several abbreviations are introduced in the following tables. The abbreviations and their meanings are explained as follows:

C: Contractor

MT: Materials

EQ: Equipment

MP: Manpower

PM: Project Management

PF: Project Finance

CNS: Consultant

OWN: Owner

Ctg: Category

II: Importance Index

IW: Importance Weight

AW: Average Weight

R: number of Respondents

RNK: Rank

No: delay factor's Number

m: modulus of the number of causes in the delay category

6.2.3. Analysis of delay causes - categories and individuals

The causes of delays were grouped into four main categories: causes related to contractor performances and related to other factors are further subdivided into five and three subcategories respectively. Therefore the total became ten categories. These were analysed based on the Average Weight (AW) which was determined as the average of importance index (II) of all causes that came under the category. However, analysing the AW of causes of a specific category is useful for determining the average importance weight of the category, but does not take into account the number of causes listed in the category. In other words, the contractor performance category includes 31 individual delay factors, while the consultant category includes just nine,

so that the AW of consultant delays factor by a particular group may be higher than the AW of contractor causes, although there are ten causes in the contractor category. The important AW of each one is higher than the highest cause in consultant category. This resulted from the existence of many of the non- important causes listed in the contractor category. Accordingly, another method was identified in order to take into account the number of causes for each category thus ranking these categories. That was by multiplying the AW of the category by the modulus of the number of the causes of the category. This was calculated as shown below:

$$\mathbf{II = AW * m}$$

Equation 5 Importance Index of the category

While

$$m = \frac{\text{the number of category causes}}{\text{Total number of all causes (which is 67)}}$$

Before moving to the analysis it must be clear that, when *AW* is said it means the importance index of category without an effect on the number of causes in the category and that just *indicates the average importance weight of all causes listed in that category but its rank does not point out the entire importance*. AW creates an awareness of the importance average level of the causes under the category and compares it with the others. Whereas, when *II* is said, it means the importance index of the category with consideration to the number of causes in the category, and it helps *to realise the entire importance of the category among the other categories*, and therefore its rank. In order to cover the analysis of ranking delay factors, it was decided to discuss each category separately to widen the discussion, so that the AW and II of the category for both of the countries with opinions of the three parties can be presented; however, the II of the individual delay factors will be discussed in relation to the country group only.

A.1. Contractor performance

This major delay category includes causes 1-31. Contractor performance links with contractor's capacity to deliver sufficient resources at the appropriate time to meet

project requirements. The contractor performance category was subdivided into five groups: materials, equipment, manpower, project management, and project finance.

In considering the number of causes of the contractor performance category which are too much (31) compared with the other categories, the result would seem different to some extent from the AW but this creates an awareness of the entire importance (II) of the category. Table 31 Table 32 illustrate a complete agreement between the three parties in both countries, with the contractor delay category being the most important category. However, that was not the same opinion of contractors in SA and the UK when they determined the party most often responsible for delay, as discussed in (6.2.1-C6), and that proves that the investigations can tell the precise truth. It should be known that the category ranks are taken from the total answers of all 67 causes; therefore, respondents may not realise from their answers who is the party most often responsible for delays. As a result, measuring responsibility by respondents' answers regarding the causes is more reliable than the opinion taken directly from respondents since human beings may have a tendency to blame the others for ambiguous faults.

Referring to Table 29, among the four main categories, contractor performance was given completely different AWs. The highest AW (4.654) among the other four major categories was given by the SA respondents while it was given the least (3.568) by the UK respondents, so that SA respondents think the average of the 31 causes of contractors' delay is the most frequent and severe, and vice versa for the UK respondents. In addition, the consultants group in SA gave contractor categories the highest AW (4.505), as shown in Table 30, while it received a third rank by contractors and owners in the same country. On the other hand, there was high agreement among the contractors, consultants, and owners groups in the UK about the AW of the contractors' delay category since they weight it as the least, and that is because several causes related to contractors are not frequent and severe in the UK construction industry. However, some of them are very high, as will be explained later in this part.

With regard to the ranking of the individual resources sub-classifications within the contractor performance category; causes were distributed among different ranks. However, in SA ten of them were ranked in the fifteen most important causes, which

form two thirds of the most important causes. Furthermore, apart from the cause that ranked third, delay causes that took ranks from 1 to 6 belong to contractor performance. This is an excellent correspondence with the direct judgment by owners and consultants that was reported in 6.2.1-C6. Nevertheless, the majority of the other causes centre around the middle ranks and begin to hide in the last ranks.

In the importance index and ranks by the UK respondents, the situations are different to some extent. Delay factors related to contractor performance concentrated on the middle ranks, while only six causes were ranked with the most important fifteen causes; the first four of them were ranked 5, 6, 8, and 9.

Ctg	Saudi Arabia			RNK	United Kingdom			RNK	Average			RNK
	IW	R	AW		IW	R	AW		IW	R	AW	
C/MP	378	79	4.787	3	279	58	4.801	2	657	137	4.796	1
EP	707	156	4.531	5	575	117	4.905	1	1282	273	4.696	2
C/PF	637	118	5.397	1	286	85	3.356	8	923	203	4.547	3
OWN	2409	518	4.646	4	1422	366	3.876	3	3831	884	4.334	4
C/PM	3254	678	4.799	2	1883	512	3.666	7	5137	1190	4.317	5
CNS	1570	361	4.351	6	966	261	3.701	6	2536	622	4.077	6
C/MT	704	165	4.267	7	448	119	3.753	5	1152	284	4.056	7
GR	631	148	4.263	8	282	104	2.712	9	913	252	3.623	8
EF	782	231	3.384	10	665	176	3.756	4	1447	407	3.555	9
C/EQ	598	157	3.807	9	283	117	2.418	10	881	274	3.215	10

Table 25 The importance average weight of sub categories by country's respondents

Ctg	Saudi Arabia						United Kingdom					
	Contractors		Consultants		Owners		Contractors		Consultants		Owners	
	AW	RNK	AW	RNK	AW	RNK	AW	RNK	AW	RNK	AW	RNK
C/MT	4.727	7	4.057	7	3.625	7	3.955	6	3.624	4	3.708	8
C/EQ	4.453	8	3.497	9	3.250	9	2.477	10	2.183	10	3.417	9
C/MP	4.821	6	5.027	2	3.375	8	5.050	1	4.544	2	5.208	2
C/PM	4.835	5	4.754	3	4.917	3	3.278	9	3.672	3	4.856	5
C/PF	5.651	1	5.190	1	**5.583**	1	4.167	4	2.672	8	4.111	6
CNS	5.204	2	3.652	8	5.056	2	3.822	7	3.396	6	4.926	3
OWN	5.147	4	4.380	4	4.327	5	4.062	5	3.555	5	4.897	4
EP	5.161	3	4.166	6	4.313	6	4.736	2	4.750	1	**6.333**	1
GR	4.154	9	4.239	5	4.750	4	3.325	8	2.196	9	3.250	10
EF	3.647	10	3.341	10	2.750	10	4.409	3	3.202	7	4.056	7

Table 26 The importance average weight of sub categories by the three parties from both SA and UK

Ctg		Saudi Arabia			United Kingdom			Average		
	M	AW	II	RNK	AW	II	RNK	AW	II	RNK
C/PM	0.269	4.799	1.30	1	3.666	1.06	1	4.317	1.18	1
OWN	0.194	4.646	0.90	2	3.876	0.81	2	4.334	0.85	2
CNS	0.134	4.351	0.62	3	3.701	0.54	3	4.077	0.58	3
EF	0.090	3.384	0.29	4	3.756	0.35	4	3.555	0.32	4
EP	0.060	4.531	0.27	5	4.905	0.31	5	4.696	0.29	5
C/MT	0.060	4.267	0.25	8	3.753	0.22	6	4.056	0.23	6
GR	0.060	4.263	0.26	6	2.712	0.17	7	3.623	0.22	7
C/PF	0.045	5.397	0.25	7	3.356	0.16	8	4.547	0.20	8
C/EQ	0.060	3.807	0.22	9	2.418	0.16	9	3.215	0.19	9
C/MP	0.030	4.787	0.13	10	4.801	0.15	10	4.796	0.14	10

Table 27 Importance index and rank of delay subcategories by country's respondents

Ctg	Saudi Arabia						United Kingdom					
	Contractors		Consultants		Owners		Contractors		Consultants		Owners	
	II	RNK	II	RNK	II	RNK	II	RNK	II	RNK	II	RNK
C/MT	0.28	6	0.24	7	0.22	8	0.24	6	0.22	6	0.22	6
C/EQ	0.27	7	0.21	9	0.19	9	0.15	10	0.13	9	0.20	7
C/MP	0.14	10	0.15	10	0.10	10	0.15	9	0.14	7	0.16	10
C/PM	1.30	1	1.28	1	1.32	1	0.88	1	0.99	1	1.31	1
C/PF	0.25	8	0.23	8	0.25	6	0.19	8	0.12	10	0.18	9
CNS	0.70	3	0.49	3	0.68	3	0.51	3	0.46	3	0.66	3
OWN	1.00	2	0.85	2	0.84	2	0.79	2	0.69	2	0.95	2
EP	0.31	5	0.25	6	0.26	5	0.28	5	0.28	5	0.38	4
GR	0.25	9	0.25	5	0.28	4	0.20	7	0.13	8	0.19	8
EF	0.33	4	0.30	4	0.25	7	0.39	4	0.29	4	0.36	5

Table 28 Importance index and rank of delay subcategories by the three parties from SA and UK

Ctg	Saudi Arabia				United Kingdom				Average			
	IW	R	AW	RNK	IW	R	AW		IW	R	AW	RNK
OWN	2409	518	**4.646**	2	1422	366	**3.876**	1	3831	884	**4.334**	1
C	5571	1197	**4.654**	1	3179	891	**3.568**	4	8750	2088	**4.191**	2
CNS	1570	361	**4.351**	3	966	261	**3.701**	3	2536	622	**4.077**	3
Other	2120	535	**3.963**	4	1522	397	**3.834**	2	3642	932	**3.908**	4

Table 29The importance average weight of major delay categories by country's respondents

Ctg	Saudi Arabia						United Kingdom					
	Contractors		Consultant		Owners		Contractors		Consultants		Owners	
	AW	RNK	AW	RNK	AW	RNK	AW	RNK	AW	RNK	AW	RNK
C	4.897	3	4.505	1	4.150	3	3.785	4	3.339	4	4.260	4
CNS	5.204	1	3.652	4	5.056	1	3.822	3	3.396	2	4.926	1
OWN	5.147	2	4.380	2	4.327	2	4.062	2	3.555	1	4.897	2
Other	4.321	4	3.915	3	3.938	4	4.157	1	3.383	3	4.546	3

Table 30 The importance average weight of major delay categories by the three parties from SA and UK

Ctg	Saudi Arabia				United Kingdom			Average		
	m	AW	II	RNK	AW	II	RNK	AW	II	RNK
C	0.463	**4.654**	2.15	1	**3.568**	1.65	1	**4.191**	1.94	1
OWN	0.194	**4.646**	0.90	2	**3.876**	0.75	3	**4.334**	0.84	2
Other	0.209	**3.963**	0.83	3	**3.834**	0.80	2	**3.908**	0.82	3
CNS	0.134	**4.351**	0.58	4	**3.701**	0.50	4	**4.077**	0.55	4

Table 31 Importance index and rank of major delay categories by the three parties from SA and UK

Ctg	Saudi Arabia						United Kingdom					
	Contractors		Consultant		Owners		Contractors		Consultants		Owners	
	IIm	RNK	IIm	RNK	IIm	RNK	IIm	RNK	IIm	RNK	IIm	RNK
C	2.24	1	2.11	1	2.08	1	1.61	1	1.60	1	2.07	1
CNS	0.70	4	0.49	4	0.68	4	0.51	4	0.46	4	0.66	4
OWN	1.00	2	0.85	2	0.84	2	0.79	3	0.69	3	0.95	2
Other	0.89	3	0.80	3	0.79	3	0.87	2	0.70	2	0.93	3

Table 32 Importance index and rank of major delay categories by the three parties from SA and UK

A.1.1. Materials

Concerning the II of the categories, the materials group of delay occurred in the eighth rank in SA as Table 27 indicates, and the sixth with total agreements by the three parties in the UK (see Table 28). Therefore, SA projects suffer delays because of materials-related factors more than UK projects, and that can be ascribed to the difference of technologies and materials used in SA and the UK.

In general, this category is not considered in either country to have a high average weight (AW). In the average of the both countries, delays occur because of materials matters, which held the seventh rank of average importance weight among ten categories, as Table 25 shows. Moreover, the same rank was given by all SA parties as shown in Table 26, while it takes higher position in the UK projects, and is seen as the fifth rank.

With regard to the individual causes, in SA not one of the materials related causes of delay was allocated with the ten most importance causes of delay (TMICD); this was also found in the UK. However, in the UK delay in materials delivery was ranked eleventh. This delay can be ascribed to the delay in ordering materials, absence of accurate schedule of ordered materials and vehicle congestion.

A.1.2. Equipment

In terms of II, equipment was ranked ninth in both SA and the UK and there was just a little difference of rates given by the three parties. However, when considering AW, the causes of this category held the least importance weight among the ten categories in the UK with agreement between contractors and consultants, while owners think that the average of the weight of its causes takes the ninth rank. On the other hand, SA consultants and owners agree on its rank as they assigned it the ninth position, whereas contractors see it one rank above (8).

With regard to the rank of the individual causes related to this group, in both SA and the UK none of four causes is considered to be important, since all of them were ranked at the bottom of the importance index rank.

A.1.3. Manpower

The manpower subcategory is ranked as the last category in both countries regarding II. That means that delays caused by factors listed in the manpower category are rare, and to some extent not severe. This is the case particularly in SA more than in the UK since all the three parties in SA give it the same rank (10), while, the judgments of the UK parties differ as it held seventh, ninth, and tenth ranks by contractors, consultants and owners respectively.

The manpower group appears as the most important subcategory in relation to the average of the weight of its causes, and that may because it includes just two causes. It is ranked by respondents from both countries with almost near and high average (4.787 and 4.801). Dissimilar averages were given by the three parties in SA, their ranks ranging between 2 to 8, while UK consultants and owners agreed to rank it as second and contractors ranked it first.

In the importance index of SA delay factors, one of the two delay factors of the manpower group was ranked fifteenth. This is 'low manpower skill' whereas shortage of manpower does not act as a barrier in construction projects as there are more than enough foreigner labourers; however most of them are low skilled because of the inadequate training system and the absence of the training institutions. On the other hand, in the UK it is one of the two causes considered to be from the TMICD. UK Projects suffer from shortage of manpower as it was ranked fifth. Despite that, this shortage fails to reduce British unemployment and as a result that is seen by the construction industry as ambiguous, complex, and dangerous.

Importance index and rank by all respondents (the three parties in both SA & UK)

No	Causes of delay	RNK	Ctg	IW	R	II
54	Changes in the scope of the project	1	EP	375	69	5.435
46	Slow decision making by the owner's organisation	2	OWN	359	70	5.129
25	Ineffective control of project progress by the contractor	3	C/PM	327	64	5.109
23	Ineffective planning and scheduling of the project by the contractor	4	C/PM	345	68	5.074
15	Contractor's poor coordination with the parties involved in the project	5	C/PM	355	70	5.071
42	Unrealistic contract duration	6	OWN	342	69	4.957
19	Poor controlling of subcontractors by contractor	7	C/PM	319	66	4.833
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	8	C/MP	337	70	4.814
10	Low skill of manpower	9	C/MP	320	67	4.776
47	Interference by the owner in the construction operations	10	OWN	331	70	4.729
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	11	EP	326	69	4.725
30	Cash flow problems faced by the contractor	12	C/PF	320	68	4.706
14	Poor communications by the contractor with the parties involved in the project	13	C/PM	322	69	4.667
31	Problems between the contractor and his subcontractors with regard to payments	14	C/PF	317	68	4.662
2	Delay in materials delivery	15	C/MT	325	71	4.578
43	Delay in the settlement of contractor claims by the owner	16	OWN	311	68	4.574
49	Delay in progress payments by the owner	17	OWN	311	68	4.574
22	Improper technical studies by the contractor during the bidding stage	18	C/PM	295	65	4.539
57	Original contract duration is too short	19	EP	307	68	4.515
34	Delay in the approval of contractor submissions by the consultant	20	CNS	310	69	4.493
33	Delay in the preparation of drawings	21	CNS	307	69	4.449
1	Shortage of required materials	22	C/MT	311	71	4.380

Importance index and rank by all respondents (the three parties in both SA & UK)						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
13	Shortage of technical professionals in the contractor' s organization	23	C/PM	289	66	4.379
53	Excessive bureaucracy in the owner's administration	24	OWN	288	66	4.364
45	Delay in issuing of change orders by the owner	25	OWN	301	69	4.362
26	Inefficient quality control by the contractor	26	C/PM	283	65	4.354
36	Poor coordination by the consultant engineer with other parties involved	27	CNS	298	69	4.319
16	Slow preparations of change orders required	28	C/PM	288	67	4.299
62	Severe weather conditions on the job site	29	EF	299	70	4.271
29	Difficulties in financing the project by the contractor	30	C/PF	286	67	4.269
52	Poor coordination by the owner with the various parties during construction	31	OWN	290	68	4.265
27	Delay in the preparation of contractor submissions	32	C/PM	276	65	4.246
39	Inadequate design specifications	33	CNS	287	68	4.221
21	Poor qualifications of the contractor's technical staff assigned to the project	34	C/PM	273	65	4.200
40	Poor contract management	35	CNS	281	67	4.194
35	Poor communication between the consultant engineer and other parties involved	36	CNS	291	70	4.157
17	Ineffective contractor head office involvement in the project	37	C/PM	277	67	4.134
56	Subsurface site conditions materially differing from contract documents	38	EP	274	67	4.090
67	Work interference between various contractors	39	EF	274	67	4.090
4	Changes in materials specifications	40	C/MT	290	72	4.028
50	Owner's poor communication with the construction parties and government authorities	41	OWN	265	66	4.015
60	Government tendering system requirement of selecting the lowest bidding contractor	42	GR	251	63	3.984
11	Lack of motivation among contractor's members	43	C/PM	258	65	3.969
28	Improper construction methods implemented by the contractor	44	C/PM	254	64	3.969
44	Suspension of work by the owner's organisation	45	OWN	273	69	3.957
41	Delay in furnishing and delivering the site to the contractor by the owner	46	OWN	272	69	3.942
63	Effects of subsurface conditions (type of soil, utility lines, water table)	47	EF	266	68	3.912
38	Slow response from the consultant engineer to contractor inquiries	48	CNS	269	70	3.843
20	Loose safety rules and regulations within the contractor's organization	49	C/PM	249	65	3.831
12	Shortage of contractor's administrative personnel	50	C/PM	257	68	3.779
51	Owner's failure to coordinate with government authorities during planning	51	OWN	248	66	3.758
18	Delays in mobilization	52	C/PM	247	66	3.742
59	Difficulties in obtaining work permits	53	GR	234	64	3.656
48	Uncooperative owner with the contractor complicating contract administration	54	OWN	240	66	3.636
37	Delays in performing inspection and testing by the consultant engineer	55	CNS	252	70	3.600

Importance index and rank by all respondents (the three parties in both SA & UK)						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
61	Changes in government regulations and laws	56	GR	219	63	3.476
32	Poor qualification of consultant engineer's staff assigned to the project	57	CNS	241	70	3.443
24	Delays to field survey by the contractor	58	C/PM	223	65	3.431
5	Shortage of required equipment	59	C/EQ	239	70	3.414
58	Ineffective delay penalty	60	GR	209	62	3.371
6	Failure of equipment	61	C/EQ	226	68	3.324
3	Changes in materials prices	62	C/MT	226	70	3.229
8	Inadequate equipment used for the works	63	C/EQ	216	68	3.177
66	Rise in the prices of materials	64	EF	213	68	3.132
64	Traffic control and restrictions on the job site	65	EF	209	67	3.119
7	Shortage of supporting and shoring installations for excavations	66	C/EQ	200	68	2.941
65	Effects of social and cultural conditions	67	EF	186	67	2.776

Table 33 Importance index and rank of all causes by all respondents

Importance index and rank by Saudi Arabia respondents						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
29	Difficulties in financing the project by the contractor	1	C/PF	218	39	5.590
30	Cash flow problems faced by the contractor	2	C/PF	220	40	5.500
43	Delay in the settlement of contractor claims by the owner	3	OWN	216	40	5.400
23	Ineffective planning and scheduling of the project by the contractor	4	C/PM	203	38	5.342
15	Contractor's poor coordination with the parties involved in the project	5	C/PM	211	40	5.275
25	Ineffective control of project progress by the contractor	6	C/PM	188	36	5.222
4	5Changes in the scope of the project	7	EP	203	39	5.205
49	Delay in progress payments by the owner	8	OWN	202	39	5.179
14	Poor communications by the contractor with the parties involved in the project	9	C/PM	200	39	5.128
46	Slow decision making by the owner's organisation	10	OWN	210	41	5.122
31	Problems between the contractor and his subcontractors with regard to payments	11	C/PF	199	39	5.103
19	Poor controlling of subcontractors by contractor	12	C/PM	188	37	5.081
13	Shortage of technical professionals in the contractor' s organization	13	C/PM	193	38	5.079
21	Poor qualifications of the contractor's technical staff assigned to the project	14	C/PM	185	37	5.000
10	Low skill of manpower	15	C/MP	193	39	4.949
22	Improper technical studies by the contractor during the bidding stage	16	C/PM	181	37	4.892
27	Delay in the preparation of contractor submissions	17	C/PM	181	37	4.892
60	Government tendering system requirement of selecting the lowest bidding contractor	18	GR	181	37	4.892

Importance index and rank by Saudi Arabia respondents						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
45	Delay in issuing of change orders by the owner	19	OWN	199	41	4.854
34	Delay in the approval of contractor submissions by the consultant	20	CNS	194	40	4.850
26	Inefficient quality control by the contractor	21	C/PM	174	36	4.833
42	Unrealistic contract duration	22	OWN	197	41	4.805
16	Slow preparations of change orders required	23	C/PM	187	39	4.795
47	Interference by the owner in the construction operations	24	OWN	196	41	4.780
17	Ineffective contractor head office involvement in the project	25	C/PM	181	38	4.763
53	Excessive bureaucracy in the owner's administration	26	OWN	180	38	4.737
36	Poor coordination by the consultant engineer with other parties involved	27	CNS	188	40	4.700
11	Lack of motivation among contractor's members	28	C/PM	176	38	4.632
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	29	C/MP	185	40	4.625
52	Poor coordination by the owner with the various parties during construction	30	OWN	180	39	4.615
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	31	EP	183	40	4.575
33	Delay in the preparation of drawings	32	CNS	182	40	4.550
2	Delay in materials delivery	33	C/MT	186	41	4.537
1	Shortage of required materials	34	C/MT	183	41	4.463
50	Owner's poor communication with the construction parties and government authorities	35	OWN	174	39	4.462
51	Owner's failure to coordinate with government authorities during planning	36	OWN	174	39	4.462
57	Original contract duration is too short	37	EP	169	38	4.447
20	Loose safety rules and regulations within the contractor's organization	38	C/PM	162	37	4.378
40	Poor contract management	39	CNS	166	38	4.368
59	Difficulties in obtaining work permits	40	GR	165	38	4.342
44	Suspension of work by the owner's organisation	41	OWN	178	41	4.341
18	Delays in mobilization	42	C/PM	164	38	4.316
58	Ineffective delay penalty	43	GR	155	36	4.306
28	Improper construction methods implemented by the contractor	44	C/PM	159	37	4.297
4	Changes in materials specifications	45	C/MT	179	42	4.262
32	Poor qualification of consultant engineer's staff assigned to the project	46	CNS	174	41	4.244
35	Poor communication between the consultant engineer and other parties involved	47	CNS	174	41	4.244
24	Delays to field survey by the contractor	48	C/PM	157	37	4.243
12	Shortage of contractor's administrative personnel	49	C/PM	164	39	4.205
39	Inadequate design specifications	50	CNS	163	39	4.179
41	Delay in furnishing and delivering the site to the contractor by the owner	51	OWN	170	41	4.146
37	Delays in performing inspection and testing by the consultant engineer	52	CNS	169	41	4.122

Importance index and rank by Saudi Arabia respondents						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
5	Shortage of required equipment	53	C/EQ	163	40	4.075
67	Work interference between various contractors	54	EF	157	39	4.026
38	Slow response from the consultant engineer to contractor inquiries	55	CNS	160	41	3.902
56	Subsurface site conditions materially differing from contract documents	56	EP	152	39	3.897
8	Inadequate equipment used for the works	57	C/EQ	149	39	3.821
3	Changes in materials prices	58	C/MT	156	41	3.805
63	Effects of subsurface conditions (type of soil, utility lines, water table)	59	EF	143	38	3.763
6	Failure of equipment	60	C/EQ	145	39	3.718
7	Shortage of supporting and shoring installations for excavations	61	C/EQ	141	39	3.615
61	Changes in government regulations and laws	62	GR	130	37	3.514
48	Uncooperative owner with the contractor complicating contract administration	63	OWN	133	38	3.500
66	Rise in the prices of materials	64	EF	133	39	3.410
64	Traffic control and restrictions on the job site	65	EF	120	38	3.158
62	Severe weather conditions on the job site	66	EF	119	39	3.051
65	Effects of social and cultural conditions	67	EF	110	38	2.895

Table 34 Importance index and rank by Saudi Arabia respondents

Importance index and rank by The UK respondents						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
62	Severe weather conditions on the job site	1	EF	180	31	5.806
54	Changes in the scope of the project	2	EP	172	30	5.733
42	Unrealistic contract duration	3	OWN	145	28	5.179
46	Slow decision making by the owner's organisation	4	OWN	149	29	5.138
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	5	C/MP	152	30	5.067
25	Ineffective control of project progress by the contractor	6	C/PM	139	28	4.964
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	7	EP	143	29	4.931
15	Contractor's poor coordination with the parties involved in the project	8	C/PM	144	30	4.800
23	Ineffective planning and scheduling of the project by the contractor	9	C/PM	142	30	4.733
47	Interference by the owner in the construction operations	10	OWN	135	29	4.655
2	Delay in materials delivery	11	C/MT	139	30	4.633
57	Original contract duration is too short	12	EP	138	30	4.600
10	Low skill of manpower	13	C/MP	127	28	4.536
19	Poor controlling of subcontractors by contractor	14	C/PM	131	29	4.517
56	Subsurface site conditions materially differing from contract documents	15	EP	122	28	4.357
33	Delay in the preparation of drawings	16	CNS	125	29	4.310

Importance index and rank by The UK respondents						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
39	Inadequate design specifications	17	CNS	124	29	4.276
1	Shortage of required materials	18	C/MT	128	30	4.267
67	Work interference between various contractors	19	EF	117	28	4.179
63	Effects of subsurface conditions (type of soil, utility lines, water table)	20	EF	123	30	4.100
22	Improper technical studies by the contractor during the bidding stage	21	C/PM	114	28	4.071
31	Problems between the contractor and his subcontractors with regard to payments	22	C/PF	118	29	4.069
14	Poor communications by the contractor with the parties involved in the project	23	C/PM	122	30	4.067
35	Poor communication between the consultant engineer and other parties involved	24	CNS	117	29	4.034
34	Delay in the approval of contractor submissions by the consultant	25	CNS	116	29	4.000
40	Poor contract management	26	CNS	115	29	3.966
53	Excessive bureaucracy in the owner's administration	27	OWN	108	28	3.857
48	Uncooperative owner with the contractor complicating contract administration	28	OWN	107	28	3.821
36	Poor coordination by the consultant engineer with other parties involved	29	CNS	110	29	3.793
52	Poor coordination by the owner with the various parties during construction	30	OWN	110	29	3.793
26	Inefficient quality control by the contractor	31	C/PM	109	29	3.759
38	Slow response from the consultant engineer to contractor inquiries	32	CNS	109	29	3.759
49	Delay in progress payments by the owner	33	OWN	109	29	3.759
4	Changes in materials specifications	34	C/MT	111	30	3.700
41	Delay in furnishing and delivering the site to the contractor by the owner	35	OWN	102	28	3.643
45	Delay in issuing of change orders by the owner	36	OWN	102	28	3.643
16	Slow preparations of change orders required	37	C/PM	101	28	3.607
30	Cash flow problems faced by the contractor	38	C/PF	100	28	3.571
28	Improper construction methods implemented by the contractor	39	C/PM	95	27	3.519
13	Shortage of technical professionals in the contractor' s organization	40	C/PM	96	28	3.429
61	Changes in government regulations and laws	41	GR	89	26	3.423
27	Delay in the preparation of contractor submissions	42	C/PM	95	28	3.393
43	Delay in the settlement of contractor claims by the owner	43	OWN	95	28	3.393
44	Suspension of work by the owner's organisation	44	OWN	95	28	3.393
50	Owner's poor communication with the construction parties and government authorities	45	OWN	91	27	3.370
17	Ineffective contractor head office involvement in the project	46	C/PM	96	29	3.310
12	Shortage of contractor's administrative personnel	47	C/PM	93	29	3.207
21	Poor qualifications of the contractor's technical staff assigned to the project	48	C/PM	88	28	3.143
20	Loose safety rules and regulations within the contractor's organization	49	C/PM	87	28	3.107

Importance index and rank by The UK respondents						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
64	Traffic control and restrictions on the job site	50	EF	89	29	3.069
11	Lack of motivation among contractor's members	51	C/PM	82	27	3.037
18	Delays in mobilization	52	C/PM	83	28	2.964
37	Delays in performing inspection and testing by the consultant engineer	53	CNS	83	29	2.862
6	Failure of equipment	54	C/EQ	81	29	2.793
66	Rise in the prices of materials	55	EF	80	29	2.759
51	Owner's failure to coordinate with government authorities during planning	56	OWN	74	27	2.741
60	Government tendering system requirement of selecting the lowest bidding contractor	57	GR	70	26	2.692
59	Difficulties in obtaining work permits	58	GR	69	26	2.654
65	Effects of social and cultural conditions	59	EF	76	29	2.621
5	Shortage of required equipment	60	C/EQ	76	30	2.533
29	Difficulties in financing the project by the contractor	61	C/PF	68	28	2.429
3	Changes in materials prices	62	C/MT	70	29	2.414
24	Delays to field survey by the contractor	63	C/PM	66	28	2.357
8	Inadequate equipment used for the works	64	C/EQ	67	29	2.310
32	Poor qualification of consultant engineer's staff assigned to the project	65	CNS	67	29	2.310
58	Ineffective delay penalty	66	GR	54	26	2.077
7	Shortage of supporting and shoring installations for excavations	67	C/EQ	59	29	2.034

Table 35 Importance index and rank by The UK respondents

A.1.4. Project management

All three parties were comprehensively unanimous both SA and UK on the II rank of the project management delay group (Table 27 and Table 28). All parties gave it the first rank. Therefore, without doubt, it is the most important subcategory among the ten categories. The average of SA and UK II of the category is (4.317).

In SA the AW of this group is very high (4.799). It held the second rank; the consultants and owners ranked it third but the contractors ranked it the fifth as contractors do not perceive that their project management leads to a high level of delay. On the contrary, it is ranked as seventh in the UK but with no agreement between parties; third and fifth ranks were given by consultants and owners, but again contractors in the UK also think the same as in Saudi and gave it the ninth rank.

Causes of this delay category forms about half (4 causes) of the TMICD in SA, as can be seen in Table 34. The issues of contractor performance in relation to project planning, scheduling and controlling, coordination and communication with other parties involved in the project seem to be some of major reasons in each delayed project in SA. In the UK three causes of this category were listed in the TIMC of delays. Apart from communication, these centre around the same issues considered in SA as mentioned above but with different order.

A.1.5. Project finance

Among the ten delay categories, project finance was ranked seventh and eighth by respondents in SA and the UK respectively. The rank of the parties in both SA and the UK ranges between 6 and 10. The only three causes listed under this group form the highest AW of delay category (5.397) in SA. All the three parties placed it in the first rank. In contrast, UK respondents ranked it as eighth, but different ranks - 4, 8, and 6 - were provided by the three parties, contractors, consultants, and owners.

In general, despite that this category being held highest AW in SA, it does not mean it is the most important category since it ranked as seventh based on II, however, it means the II of individual causes listed under this category are incongruous, which in turn indicates there are two causes in this category considered to be very important and the other one is not (see their ranks in Table 34). Whereas the similarity of UK ranking between the AW and II proves that II of causes listed in project finance category are similar and that can clearly be seen in their ranks in Table 35.

The two most important causes of delay in SA are related to this category. These are difficulties in financing the project by contractor and cash flow problems. What happens in the Saudi construction industry is that many contractors bid for projects that are above their financial capacity as they think they will distribute the work to many subcontractors. Still, some of owners require a financial guarantee to prove that the contractor is capable to carry out the project; however, some contractors take a loan in order to provide a bank guarantee, but at the end of the day, they find themselves lf committed financially with many parties, facing great difficulties in

financing the project, and they may not able to manage the project cash flow. On the other hand, no causes of this category were determined by UK respondents in the TMICD.

A.2. Consultant related factors

This delay category includes causes 32-53. According to the II of categories, total agreement of the three parties in both SA and the UK on the ranking of this category. They assigned the least important category among the four categories to the consultant related factors group. Such agreement leads to total belief in this rank and an acceptance of it as an undoubted fact.

In both SA and the UK the average importance weight of the causes of this group was ranked third among the four major categories. However, in SA the consultants determined the fourth AW to this category, but it was increased in importance to first by contractors and owners. This means contractors and owners gave a high weight for the average causes related to consultants. On the other hand, the category was ranked first by owners, based on AW in the UK, but relegated to second and third by consultants and contractors respectively.

With regard to the ranking of the individuals resources sub-classifications within this delay category, there is no cause considered to be very important in either country as the highest cause was ranked twentieth in SA and sixteenth in the UK.

A.3. Owner related factors

This delay group includes causes 41-53. The average rank for both countries of the II of the group is second. Although different ranks were received by both countries, in SA all three parties considered this delay group as a major delay category since all of them rank it second, while it is the third in the UK. The extraordinary point is that, in UK the category was allocated third by contractors and consultants in the importance category but owners ranked it second.

The AW of this category received ranks 1 and 2 by the UK and SA respondents respectively. As may be seen in Table 30, apart from consultants from the UK who ranked it first, all the other parties in SA and the UK assigned the second importance average of causes to the owner delays group.

Construction projects in SA suffer badly from delays that come as a result of delay in settlement of contractor claims by the owner (ranked 3), delay in progress payment by the owner (ranked 8), and slow decision making by the owner's organisation. Respondents from the UK also assigned three delay causes related to owners in the TMICD; sequentially, unrealistic contract duration was ranked third, directly followed by slow dissection making by owner's organisation, and at the tenth rank, interference by owners in the construction operations.

A.4. Other factors

This main category contains causes that are not related to the three parties during the construction stage, and includes causes 54-67. It comprises three subcategories: early planning and design, government regulations and external factors. Among the four main categories, this group was ranked second by all respondents. This rank is the average of the respondents from both countries. It received second place by the UK respondents and third by SA respondents. High agreement was achieved between the three parties in SA as they assigned the same rank (third) to this delay group. While there is agreement between contractors and consultants in ranking it second, owners considered it to be the third most important delay category.

This delay category held the least important AW in SA among four categories, while it was ranked second by the UK respondents. In SA, it received the rank 4 by contractors and owners, whereas consultants assigned a third rank to it. On the other hand, it was ranked third by the UK consultants and owners, while contractors gave it a very high importance average weight (4.57) as they rank it first.

Three out of fourteen causes of this major delay group were identified as very important in the UK, while in SA only one cause of them was assigned as one of the TMICD.

A.4.1. Early panning and design

This delay subcategory includes causes 54-57. Poor early planning usually leads to change in the scope of the projects; these problems are faced in projects in the UK more than they are in projects in SA. However, this category was ranked by both SA and the UK respondents in the middle (5) among ten subcategories. It received fifth rank by SA owners and contractors, while consultants think it is less important as they assign the sixth rank to this delay category. In the other country, a complete agreement was achieved between the three parties on its ranking since it received the fifth rank by each of them.

Consultants and owners in SA agree on the same AW rank (6). Just as in SA, consultants and owners in the UK assigned the same rank (1) to this delay group. However, contractors in SA and the UK gave it the third and second rank respectively. It should be noted that the highest importance weight (6.333) of all the subcategories is shown for this group and by the UK owners.

Considering the individual sources of this delay group, the UK and SA respondents think that changes in the scope of the project is a common cause of delay resulting from inadequate early planning and design as they ranked it the second most important delay factor and the seventh in the UK and SA correspondingly. In addition, delay caused by ambiguities, mistakes and inconsistencies in specifications and drawings was assigned to be the seventh important cause of delay in the UK.

A.4.2. Government regulation

Causes number 58-61 are related to the government regulations delay category. This group was considered to be more important in SA than in the UK. It was ranked sixth by SA respondents and seventh by the UK respondents. In SA, owners consider the government regulation to be the fourth important delay group but it was relegated to fifth and ninth by consultants and contractors respectively. Their ranks indicate the level of involvement with local authorities, since consultants and owners are more involved in governmental procedures than contractors. In the UK, this delay category

does not have a high impact on project duration. It was ranked eighth by both consultants and owners in the UK, whereas contractors placed it seventh.

A very small AW (2.712) was reported to the government regulation delay category by the UK respondents. This small rate forms the ninth rank. The same rank was given by consultants from the same country, while one rank above (8) and one down (least important) was received by contractors and owners respectively. On the other hand, SA respondents assigned a higher rank to this category as it was ranked the eighth. The ranks were given by SA three parties are the same as the II rank of this category.

In the both of countries, the causes of government regulations group were considered to be relatively unimportant, and their ranks start in about the middle and then are relegated to the end of the II rank.

A.4.3. External factors

This delay group includes delay factors that are beyond the control of parties involved in the project. Causes numbered 62-67 are related to this delay category. It was ranked fourth important category in both SA and the UK. A compete agreement between contractors and consultants was achieved from both countries they assigned the fourth rank to this group, while owners in the both countries do not think this delay category is in the importance level, as was reported by the other two parties; SA owners gave it seventh and UK owners gave it fifth rank.

In SA the external factors delay category held the least importance AW with a total agreement by the three parties, whereas it is the fourth in UK, and that is owing to the high importance index given to the cause related to severe weather conditions by UK respondents. The UK contractors considered it as a heavy (important) delay group, and ranked it third, while consultants and owners agreed to assign it as seventh.

Severe weather conditions on a job site is one of the delay causes that belong to the external factors delay category, and this was identified as the most important cause of delay in the UK (see Table 35)as almost all projects suffer rainy, stormy, and snowy

weathers in the winter seasons. No other cause in this category was listed in the TMICD in the UK. Quite the opposite, in SA severe weather conditions were not considered to be important since they were listed with other three causes related to this category as the least important causes of delay.

6.2.4. Test of the hypotheses

With regard to the objectives of this survey, the testing of two hypotheses was required (see 13.8). One of them was based on the theory that conditions, weather, culture, economy, political system … etc. in an environment shape the characteristics of the construction industry; therefore, each environment of the construction industry has its own features and problems. This issue was considered in this study but in relation to the importance of delay causes. The other hypothesis is related to the first party responsible for delays; as was stated by a very large number of authors, it is the contractor.

A - The importance of delay causes differs from country to another

The importance-based ranking of the 67 delay factors by respondents in SA and the UK, shown in tables Table 34 and Table 35, gives an impression that the importance of causes is relatively different between SA and the UK. That can clearly be seen in Figure 29 as most of the blue nodes are vertically distant from the reddish brown nodes.

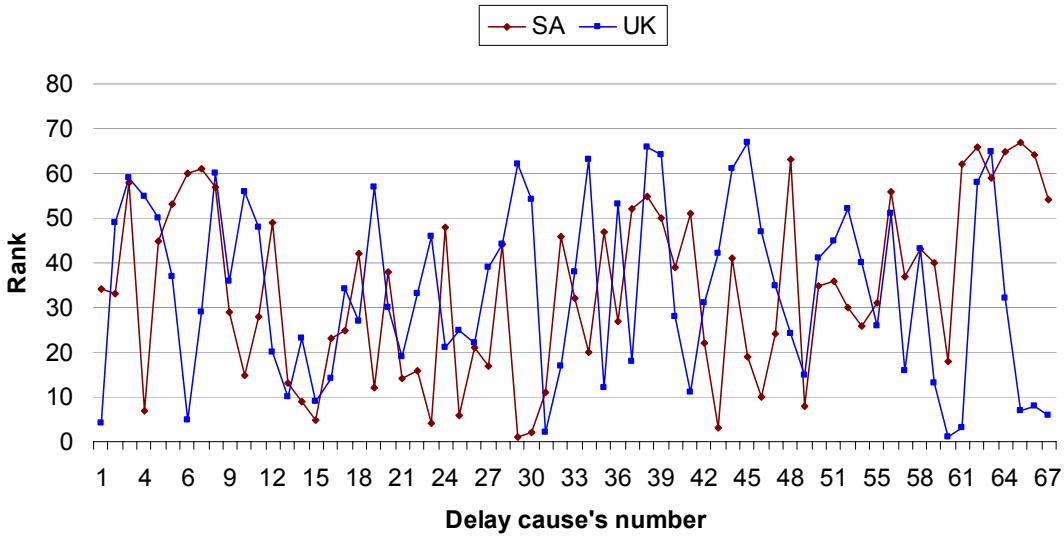


Figure 29 Linear indication of the delay factors ranking in SA and the UK

However, there are several causes in SA and the UK which are similar in importance to some extent; Table 36 presents the top ten with a maximum difference of five ranks.

RAN		Causes of delay	No	Ctg
SA	UK			
6	6	Ineffective control of project progress by the contractor	25	C/PM
30	30	Poor coordination by the owner with the various parties during construction	52	C/PM
26	27	Excessive bureaucracy in the owner's administration	53	C/PM
52	53	Delays in performing inspection and testing by the consultant engineer	37	C/PM
15	13	Low skill of manpower	10	C/PM
49	47	Shortage of contractor's administrative personnel	12	C/PM
5	8	Contractor's poor coordination with the parties involved in the project	15	C/PM
58	62	Changes in materials prices	3	C/PM
4	9	Ineffective planning and scheduling of the project by the contractor	23	C/PM
20	25	Delay in the approval of contractor submissions by the consultant	34	C/PM
44	39	Improper construction methods implemented by the contractor	28	C/PM

Table 36 The delay factors that have similar level of imprtance in SA and the UK

B. The contractor is the party most often responsible for delays

As discussed in 6.2.1-C6, there is no agreement between the three parties on determining the party most often responsible for delay. In both countries consultants and owners believe it is the contractor, while contractors believe it is the owner, but the direct opinion of the three parties may not be enough evidence. Nevertheless, after investigating and analysing in detail the three parties' answers regarding the causes of delay, it was ascertained that the contractor is the party most often responsible for delay. Section 6.2.3-A and particularly Table 31 and Table 32 illustrate complete agreement between the three parties, including contractors, in both countries, that the contractor delay category is the most important category. Additionally, with regard to the ranking of the individual resources sub-classifications within the contractor performance category, in SA ten of them were ranked with the fifteen most important causes, which forms two thirds of the most important causes. Furthermore, apart from the cause that ranked third in SA, delay causes taking ranks from 1 to 6 belong to contractor performance. In the UK six causes of the contractor performance category were ranked with the most important fifteen causes; the first four of them were ranked 5, 6, 8, and 9. Additionally, a comprehensively unanimous agreement by all three parties, including contractors in both SA and the UK, was reported on the II rank of project management delay group (see Table 27 and Table 28); all parties identified it as the most important subcategory among the ten subcategories. Therefore and without doubt, the contractor is the party most often responsible for delay.

Chapter 7

Conclusion

Chapter (7)

Conclusion

7.1. Introduction

This chapter provides and discusses the major findings obtained from the previous chapter, and supplies recommendations that could assist in future research studies related to causes of delay in construction.

7.2. Major findings

Valuable data were provided as a crop of over 6700 projects that had been experienced by 83 professionals (contractors, consultants, and owners) from over 30 cities in SA and the UK. 51% of them had worked for both public and private sectors, 60% of them are specialists in more than one type of construction building projects and professionals with the same percent have over 15 years of experience. The respondents have dealt with different sizes of projects, and experienced different types of procurement and tendering arrangements.

The next part will draw attention to the foremost issues that were obtained from the results and briefly comment on them.

7.2.1. Black and white sides of the results

Based on the results of this study, depressed records were added to the previous unfortunate records of the construction industry. 96% of participants were involved in projects that had not been completed as planned. Furthermore, 7% of 45 SA respondents had been involved in projects that had exceeded double the time of the

project plan. The problem does not stop here, 952 out of a total of 2379 projects in SA had been subject to delay. However, optimistic results were found in the UK as 79% of 3438 projects in UK had been completed within the project plan or before, and that seems a positive indication compared with results obtained by the World Bank (1990), Onyango (1993), and the other studies mentioned in 3.3.

7.2.2. Delay causes - Extent of difference in their importance between SA and the UK

With regard to the analysis of the survey and particularly the test of hypotheses, the importance of most the 67 delay causes varies from SA to the UK. The difference expands to the extent that some causes ranked as the most important causes in the UK were found to be least important in SA. That results from the different conditions, economy status, weather, government regulations, construction knowledge … etc, between SA and the UK. However, several causes (about ten) were found to be relatively similar in importance in both countries.

7.2.3. Extent of delay

Most delayed projects that investigated in this survey in both SA and the UK experienced severe delay. The results indicate that the average ratio of actual completion time to the planned contract duration in both of the countries ranges between 110% and 130%. However, delayed projects in SA suffer extensive delay more than in the UK as 21% of respondents from SA experienced an average extent of delay that ranges between 131% to over 200%. Most delayed projects were considered in SA and the UK as excusable delays and owners bore the damages for all delayed time. Nonetheless, it was reported that 11% of SA respondents testified that contractors had paid liquidated damages for all delayed time of the average projects they had been involved in.

6.2.5. Most important causes of delay

In this study, the contractors, consultants, and owners in each country were shown to agree statistically on the relative importance ranking of delay causes. However, the extent of suffering delay causes differ between SA and the UK, as 21 causes considered to be important by SA respondents since they received an importance index exceed 5, while only 5 causes were reported by the UK respondents as important.

The survey showed all the three parties in SA totally agree on the ranking of the four major delay categories. The contractor performance group was recognised as the most important delay category, followed by owner-related factors, while the consultants' delay factors were assigned as the least important delay group since it took a place after the other factors' categories.

With regard to the ranking of individual delay factors, the two most important causes were related to contractor performance-project finance, difficulties in financing the project and cash flow problems. Delay in the settlement of contractor claims was ranked 3rd by owners. It should be noticed that these three causes were over passed in UK projects and not considered to be important as they received a very low importance index. The 4th, 5th, and 6th important causes belong to contractor performance in relation to project management. These are ineffective planning, scheduling, and control of project progress and poor coordination with the parties involved in the project.

In UK the situation is different to some extent. Little disagreement between the three parties on the importance ranking was reported. It was shown that the contractors and consultants agree on the ranking of the groups of delay factors while owners assigned a relatively different ranking. All the parties believe that contractor performance is the most important category. Contractors and consultants ranked other factors category 2nd. They also considered owner- and consultant-related factors as 3rd and 4th respectively. However, owners assigned their related factors group as 2nd, followed by other factors, and they agree with the other two parties on the ranking of consultant-related factors group.

Among the most important causes found are severe weather conditions on the job site, changes in the scope of the project, unrealistic contract durations and slow decision making by owners. The first two of these are related to external factors and early planning which belong to the other factors group, while the other two are owner related factors.

6.2.6. Party most often responsible for delays

The direct answers of the three parties from both countries on this issue showed that consultants and owners believe it is the contractor who is most often responsible for delays, while contractors believe it is the owner. However, the detailed analysis of the importance of the delay causes indicated that all three parties identify the contractor as the party most often responsible for delays.

7.3. Recommendations for future studies

Identifying the importance level of each delay factor can facilitate in-focus efforts to control the important causes of them. There may be a continuous improvement in SA and the UK construction industries so that regular studies about the subject can be helpful in obtaining up-to-date results. Studies in the same field could go in parallel with this type of research, perhaps for different countries. It would also be useful if a comparative study of construction delay factors were to consider more than two countries. The innovative idea could be a study that compares between two decades or more in relation to construction project performance and that can reflect the rate of improvement in a specific country; however that requires a survey using cases studies rather than relying on the experience of professionals. The effect of delay on the cost and quality of the work may give an impression of the hidden dimensions that behind delay.

Glossary

- ***Cause and effect:***

A cause is the event that gives rise to the alleged delay. The effect is the alleged period of delay that the event causes. There must be a demonstrable link between the two.[1]

- ***Consultant:***

The party who is in charge of the design of the project components and the supervision of the contractor's work and ensures that the project is constructed in full compliance with the project documents.

- ***Contractor:***

A person, company or firm who holds a contract for carrying out the works and/or the supply of goods in connection with the project[2].

- ***Contract Disputes:***

Disagreement between the parties. This may occur during contract execution or at completion and may include misinterpretation of technical requirements and any terms and conditions or due to changes not anticipated at the time of contract award.[3]

- ***Completion date***

The date calculated by which the project should finish, following careful estimating.[4]

- ***Critical activity***

Any activity on a critical path. Most commonly determined by using the critical path method [5].

---

[1] Gillian Birkby and Paul Brough 2002

[2] Association of Project Management 2000

[3] Project Management Institute 1987

[4] Project Management Solutions 1998

[5] Project Management Institute 1996

– ***Date for completion***

The date stated in the contract when practical completion is to be achieved.[6]

– ***Owner:***

The party legally responsible under the terms of a contract for financing the project.[7]

– ***Project Plan:***

A formal, approved document used to guide both project execution and project control. The primary uses of the project plan are to document planning assumptions and decisions, to facilitate communication among stakeholders, and to document approved scope, cost, and schedule baselines[8].

[6] Gillian Birkby and Paul Brough 2002

[7] Project Management Institute 1996

[8] Project Management Institute 1996

References

1 Al-Ghafly, M. A and Al-Khalil M. I, 1995, Delay in the Construction of Public Utility Projects in Saudi Arabia, Master thesis, KFUPM, Dhahran.

2 Al-Moumani H A, 2000, Construction Delay: A Quantitative Analysis, International Journal of Project Management, 18(1), pp. 51-9

3 Al-Saleh, F A, 2001, Technology Delivery System: Construction Management, Saudi Projacs, Riyadh

4 Al-Sultan, A. S, 1987, Determination of Construction Contract Duration for Public Projects in Saudi Arabia, Master thesis, KFUPM, Dhahran, Saudi Arabia

5 Assaf, S, AL-Khalil M. and Al Hazmi M, 1995, Causes of delay in large building construction projects. Journal of Management in Engineering, 11(2), pp. 45-50.

6 Association of Project Management, 2000, APMP Syllabus (2nd Edition), APM, UK

7 Best R and De Valence G, 2002, *Design and Construction: Building in Value* (part 2) - *Project finance and procurement*, Elsevier Science Ltd. Oxford

8 Birch J and Mouch J, 1983, *Guide to the Successful Thesis and Dissertation: Conception to publication*: A handbook for students and faculty, Marcel Dekker, Inc

9 Birkby G and Brough P, 2002, Construction Companion to Extensions of Time, RlBA Enterprises Ltd, London

10 Business Finder, 2004, (www.scoot.co.uk) available:http://www.scoot.co.uk/business/london/londondistricts.asp?c=F00072&ce=contractor&a=&ae=london&s=V2C&cp=&sid=&sno=&st=1&, Accessed: 14 June 2004

11 Callahan M. T,1992, *Construction Project Scheduling*, McGraw-Hill, Inc, New York

12 Carnell N. J, 2000, *Causation and Delay in Construction Disputes*, Blackwell Science Ltd, Oxford

13 Chan D. M and Kumaraswamy, 2002, Compressing Construction Durations: Lessons Learned From Hong Kong Building Projects, International Journal of Project Management, 20(1), PP. 23-35

14 Chan D. W, 1998, Modelling Construction Durations for Public Housing in Projects in Hong Kong, PhD thesis, The University of Hong Kong, Hong Kong

15 CIA, The World Factbook 2004, Brassey's Inc

16 Council of Saudi Chamber, 2004, "business directory" (www.saudichambers.org.sa) available: http://www.saudichambers.org.sa/market.asp?cid=32, Accessed: 19 June 2004

17 D Bowntree, 1981, *Statistics without tears: a primer for non-mathematicians*, Penguin Books

18 Drewin F, 19982, Construction Productivity, Elsevier, New York

19 Hancher D. E, Rowing R. E, 1981, Sitting highway construction contract durationmm, Journal of Construction Engineering and Management,16979,107(2)

20 Hendrickson C, 1998, Project Management for Construction - Fundamental Concepts for Owners, Engineers, Architects and Builders, Carnegie Mellon University, Pittsburgh

21 Horner M and Duff R, 2001, A Contractor's Guide To Improving Productivity in Construction, CIRIA, London

22 Jearkjirm V, 1996, Construction Delays in A Fast-growing Economy: Comparing Thailand with Other Economies, International Journal of Project Management, 14(1), pp. 37-45

23 Kumaraswamy M. M and Chan D. W,1995, Determinants of Construction Duration, Construction Management and economics 13(3), pp. 209-217

24 Kungari R, 1988, Business Failure in Construction Industry, Journal of Construction and Engineering Management, 114(2), pp. 55-62

25 Kwakye A. A, 1998, Construction Project Administration in practice, The Chartered institute of buildings, Ascot Berkshire

26 Leon G. P,1987, *Theories of Concurrent Delays*, AACE Transactions

27 Ministry of economy and planning, Saudi Arabia, 2003, The Statistical Year Book, Statistical Indicator, CDS, Ryiadh

28 Murdoch J and Hughes W, 2002, *Construction Contracts Law and Management*, (3rd edition) Spon press, London

29 Murray S and Larry S, 1999, Statistics (3rd Edition), McGraww-Hill.

30 Naoum S G, 1998, *Dissertation research and writing for construction students*, Butterworth-Heinemann

31 National Audit Office, 2001, Modernising Construction, NAO, London

32 National Economic Development Office, 1991,Guidelines For the Management of Major Construction Projects, HMSO, London

33 NEDO,1983, Faster Building for Industry, The Building Economic Development Committee, HMSO, London.

34 Ogunlana S. T and Promkuntong K, 1996, Construction Delays in Fast-Growing Economy: comparing Thailand with other economies International Journal of Project management, 14(1) ,pp. 37-45

35 Onyango D, 1993, Reduction of Conflicts in construction. MSc report, Loughborough University of Technology, UK.

36 Pickavance K, 1997, *Delay and Disruption in Construction Contracts*, LLP, London

37 Project Management Institute, 1987, Project Management Body of Knowledge, PMI, Pennsylvania

38 Project Management Institute,1996, A Guide to the Project Management Body of Knowledge, PMI, Pennsylvania,

39 Project Management Solutions,1998, "PM Glossary", (www.wst.com), available: www.wst.com/content.cfm?page=136, Accessed: 18 July 2004

40 Rubin R,1983, *Construction Claims Analysis*, Van Nostrand Reinhold, New York

41 Saudi Arabian Monetary Agency, 2003, Thirty-Ninth Annual Report, SAMA, Riyadh

42 Shi J. J and Arditi D, 2001, Construction Delay Computation Method, Journal of Construction Engineering and Management, January/February, pp. 60-65

43 UK Search Engine-UK Directory, 2004, "UK construction companies" (http://www.theenginerooms.com) available:http://www.theenginerooms.com/ukdirectory/c/construction_companies.html , Accessed: 14 June 2004

44 UK Trade and Investment, (www.trade.uktradeinvest.gov.uk), Available: www.trade.uktradeinvest.gov.uk/building/saudi_arabia/profile/overview.shtml, Accessed: 22 July 2004

45 Winch G M, 2002, *Managing Construction Projects*, Blackwell, Oxford

46 World Bank, 1990, Annual Review of Project Performance Results, World Bank

47 Zain Al-Abedien, H. M., About the Effect Of Delay Penalty On the Construction of Projects and Modification Proposals, Proceedings - First Saudi Engineering Conference, Jeddah, May 14-19, 1983

Appendixes

A- Covering Letter sent with the questionnaire

B- Questionnaire Form – the copy distributed in the UK

C- Questionnaire Form – the copy distributed in SA

D- Importance and Ranking Tables by The Three Parties in Both SA and the UK

Appendix - A. Covering Letter sent with the questionnaire

Dear Sir or Madam:

Subject: Survey

I am presently preparing a thesis on the delay of construction project completion as part of my Masters degree course in Construction Management.

An important element of the thesis is to carry out a field survey to assess the causes of delays as actually experienced by the construction parties.

Enclosed please find a questionnaire, and based on your experience as a professional in the field of construction, I kindly request you to spare part of your valuable time to fill it in. Please note that your name and your company or department name will remain confidential as far as the results are concerned.

The collected data will be statistically analysed, and a conclusion will be finalised. If you wish, I shall be happy to provide you with the results of the study once finished.

Your assistance and cooperation will be highly appreciated

Thank you,
Ibrahim Falqi

Appendix - B. Questionnaire Form – the copy distributed in the United Kingdom

Delay in Project Completion: A comparative study of construction delay factors in Saudi Arabia and the United Kingdom.

A part of the dissertation research for an MSc Project management study, by Ibrahim Falqi

The purpose of this study is to measure the frequency of occurrence, severity of impact, and importance of delay factors in construction projects.

Please respond to the following questions either by ticking the appropriate box or by writing your answer in the space provided.

Please note:

- The answers should be based on your experience in construction projects.
- All information provided will be treated in the strictest of confidence.

Section one – ***Questions related to the respondent's experience***.

1.1. What is your business?

☐ Contractor
☐ Consultant
☐ Client/ Client representative
☐ Other please specify _____

1.2. What is the sector type you work for?

☐ Public
☐ Private
☐ Both

1.3. How long have you been dealing with construction projects?

- ☐ <5 years
- ☐ 5-10 years
- ☐ 10-15 years
- ☐ >15 years

1.4. **What is your speciality in building construction?**

- ☐ Commercial buildings
- ☐ Industrial buildings
- ☐ Governmental buildings
- ☐ Residential Buildings
- ☐ Other please specify _____

1.5. **What is/are the size of project/s have you participated in?** (you might select more than one)

- ☐ Very large
- ☐ Large
- ☐ Medium
- ☐ Small

Section two – ***Questions related to the contractual arrangements***

2.1. **What is/are the procurement method/s have you dealt with?** (you might select more than one)

- ☐ Traditional
- ☐ Management contracting
- ☐ Design and build
- ☐ Construction management
- ☐ Other please specify _____

2.2. **What is/are the tendering arrangement/s have you experienced?** (you might select more than one)

- ☐ Negotiation
- ☐ Open tendering
- ☐ Selective tendering
- ☐ Two-stage selective tendering
- ☐ Serial or contentious please specify _____

Section three – ***Questions related to the performance of project/s you Have been involved in.***

3.1. How many construction project have you participated in?

Please specify _____

3.2. Was one or more of them delayed?

☐ Yes
☐ No

If the answer to question 3.2 is NO please go to question 3.6

3.3. How many of them were delayed?

Please specify _____

3.4. What is the average delay time of the delayed project/s?

☐ Less than 10%
☐ 10 to 30 %
☐ 31 to 50 %
☐ 51 to 100%
☐ Over 100 % please specify _____

3.5. What is the average of delayed time that was authorised by client/s?

☐ All the delayed time
☐ About 75% of delayed time
☐ About 50 % of delayed time
☐ About 25% of delayed time
☐ The contractor paid the liquidated damages[9] for all delayed time.

[9] The compensation payable to someone for a civil wrong, as opposed to a criminal wrong, for which a different system applies

Who is the first responsible party for the delay?

- ☐ Contractor
- ☐ Consultant
- ☐ Client

3.6. Please write down the most important 5 causes of delay of construction projects in order in your region? (see the causes of delay in section four)

1. _____
2. _____
3. _____
4. _____
5. _____

Section four – ***Causes of delay***

4.1. Figure the following causes regarding to their frequency and severity weight. The range of weighting in the research survey scaled from 1 to 4, as shown below:

Scale	Frequency	Severity
1	Never	No effect
2	Occasionally	Fairly severe
3	Frequently	Severe
4	Constantly	Very severe

Causes of delay	Frequency	Severity
Contractor	1 2 3 4	1 2 3 4
Materials		
1. Shortage of required materials	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
2. Delay in materials delivery	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
3. Changes in materials prices	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
4. Changes in materials specifications	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Equipment		
5. Shortage of required equipment	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

6. Failure of equipment	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
7. Shortage of supporting and shoring installations for excavations	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
8. Inadequate equipment used for the works	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Manpower		
9. Shortage of manpower (skilled, semi-skilled, unskilled labour)	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
10. Low skill of manpower	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Project Management		
11. Lack of motivation among contractor's members	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
12. Shortage of contractor's administrative personnel	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
13. Shortage of technical professionals in the contractor' s organization	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
14. Poor communications by the contractor with the parties involved in the project	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
15. Contractor's poor coordination with the parties involved in the project	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
16. Slow preparation of changed orders requested by the contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
17. Ineffective contractor head office involvement in the project	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
18. Delays in mobilization	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
19. Poor controlling of subcontractors by contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
20. Loose safety rules and regulations within the contractor's organization	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
21. Poor qualifications of the contractor's technical staff assigned to the project	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
22. Improper technical studies by the contractor during the bidding stage	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
23. Ineffective planning and scheduling of the project by the contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
24. Delays to field survey by the contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
25. Ineffective control of project progress by the contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
26. Inefficient quality control by the contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
27. Delay in the preparation of contractor submissions	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
28. Improper construction methods implemented by the contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Project Finance		
29. Difficulties in financing the project by the contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
30. Cash flow problems faced by the contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
31. Problems between the contractor and his subcontractors with regard to payments	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Consultant	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
32. Poor qualification of consultant engineer's staff assigned to the project	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
33. Delay in the preparation of drawings	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
34. Delay in the approval of contractor submissions by the consultant	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
35. Poor communication between the consultant engineer and other parties	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

involved		
36. Poor coordination by the consultant engineer with other parties involved	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
37. Delays in performing inspection and testing by the consultant engineer	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
38. Slow response from the consultant engineer to contractor inquiries	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
39. Inadequate design specifications	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
40. Poor contract management	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Client		
41. Delay in furnishing and delivering the site to the contractor by the client	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
42. Unrealistic contract duration	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
43. Delay in the settlement of contractor claims by the client	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
44. Suspension of work by the client's organisation	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
45. Delay in issuing of change orders by the client	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
46. Slow decision making by the client's organisation	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
47. Interference by the client in the construction operations	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
48. Uncooperative client with the contractor complicating contract administration	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
49. Delay in progress payments by the client	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
50. Client's poor communication with the construction parties and government authorities	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
51. Client's failure to coordinate with government authorities during planning	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
52. Poor coordination by the client with the various parties during construction	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
53. Excessive bureaucracy in the client's administration	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Early Planning and design		
54. Changes in the scope of the project		
55. Ambiguities, mistakes, and inconsistencies in specifications and drawings	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
56. Subsurface site conditions materially differing from contract documents	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
57. Original contract duration is too short	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Government Regulations	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
58. Ineffective delay penalty		
59. Difficulties in obtaining work permits	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
60. Government tendering system requirement of selecting the lowest bidding contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
61. Changes in government regulations and laws	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
External Factors	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
62. Severe weather conditions on the job site		

63. Effects of subsurface conditions (type of soil, utility lines, water table)	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
64. Traffic control and restrictions on the job site	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
65. Effects of social and cultural conditions	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
66. Rise in the prices of materials	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
67. Work interference between various contractors	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐
Contractor	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

Comments:

Thank you very much; your response is highly appreciated.

Please send your response to:

317 Lord Home Hall

Heriot Watt University

Edinburgh

UK

EH14 4YJ

or e-mail it to

i@saedinburgh.com

Appendix - C. Questionnaire Form – the copy distributed in Saudi Arabia

أسباب تأخر المشاريع الانشائية: دراسة مقارنة بين قطاعي الانشاءآت في السعودية وبريطانيا

Delay in Project Completion: A comparative study of construction delay factors in Saudi Arabia and the United Kingdom.

متطلب دراسي لاكمال درجة الماجستير في تخصص إدارة المشاريع الانشائية بواسطة ابراهيم بن ادريس فلقي.

A part of the dissertation research for an MSc Project management study, by Ibrahim Falqi.

فضلا اجب عن الاسئلة اما باختيار الاجابة الانسب او بكتابة اجابتك في المكان المتاح لذلك.

Please respond to the following questions either by ticking the appropriate box or by writing your answer in the space provided.

ملاحظة:

- يجب ان تكون الاجابات مبنية على الخبرة في هذا المجال بدلا من الاستناد لمعلومات مشروع محدد
- سوف يتم الاخذ بالمعلومات المعطاة على اساس من الثقة وسيتم اعتمادها كشاهد في النتائج النهائية للدراسة.

Please note:

- The answers should be based on your experience in construction projects.
- All information provided will be treated in the strictest of confidence.

القسم الأول – ***معلومات عن الخبرة العملية.***

Section one – ***Questions related to the respondent's experience***.

1.1. ما هو الدور الذي تلعبه في المشاريع الانشائية

□ مقاول
□ استشاري
□ عميل (زبون) / ممثل لعميل
□ آخر فضلا حدد _____

1.6. What is your business?

□ Contractor
□ Consultant
□ Client/ Client representative
□ Other please specify _____

1.2. ما هو القطاع الذي تعمل به

□ القطاع العام
□ القطاع الخاص
□ كليهما

1.7. What is the sector type you work for?

□ Public
□ Private
□ Both

1.3. كم هي المدة التي قضيتها في العمل في المشاريع الانشائية؟

1.8. How long have you been dealing with construction projects?

- □ <5 years
- □ 5-10 years
- □ 10-15 years
- □ >15 years

- □ أقل من خمس سنوات
- □ من خمس الى عشر سنوات
- □ من عشر الى خمسة عشر سنة
- □ اكثر من خمسة عشر سنة

1.9. **What is your speciality in building construction?**

- □ Commercial buildings
- □ Industrial buildings
- □ Governmental buildings
- □ Residential Buildings
- □ Other please specify _____

1.4. في اي من المشاريع المعمارية تخصصك؟

- □ منشآت تجارية
- □ منشآت صناعية
- □ منشآت حكومية
- □ مباني سكنية
- □ أخرى فضلا حدد _____

1.10. **What is/are the size of project/s have you participated in ?** (you might select more than one)

- □ Very large
- □ Large
- □ Medium
- □ Small

1.5. ما هو حجم المشاريع التي شاركت فيها؟ (قد تختار اكثر من اجابة)

- □ كبيرة جدا
- □ كبيرة
- □ متوسطة
- □ صغيرة

القسم الثاني – ***معلومات عن العقود الانشائية***

Section two – ***Questions related to the contractual arrangements***

2.3. **What is/are the procurement method/s have you dealt with?** (you might select more than one)

- □ Traditional
- □ Management contracting
- □ Design and build
- □ Construction management
- □ Other please specify

_____

2.1. ماهي انواع العقود الانشائية التي تعاملت معها؟ (قد تختار اكثر من اجابة)

- □ التقليدية
- □ ادراة المقاولين
- □ تصميم وتنفيذ
- □ ادارة التنفيذ
- □ اخرى فضلا حدد _____

2.4. **What is/are the tendering arrangement/s have you experienced?** (you might select more than one)

- □ Negotiation
- □ Open tendering
- □ Selective tendering
- □ Two-stage selective tendering
- □ Serial or contentious please specify

_____

2.5. ماهي طرق تقديم العروض التي جربتها؟ (قد تختار اكثر من اجابة)

- □ المفاوضة
- □ مناقصة مفتوحة
- □ دعوات خاصة
- □ مناقصة بمرحلتين
- □ مناقصة مستمرة بمراحل عديدة فضلا حدد

_____

القسم الثالث – ***معلومات عن أداء المشاريع التي اشتركت فيها***

Section three – ***Questions related to the performance of project/s you have been involved in.***

3.1. كم عدد المشاريع التي شاركت بها؟

فضلا حدد _____

3.7. How many construction projects have you participated in?

Please specify _____

3.2. هل تأخر تسليم واحد او اكثر منها؟

□ نعم
□ لا

3.8. Was one or more of them delayed?

□ Yes
□ No

If the answer to question 3.2 is NO please go to question 3.6

اذا كانت اجابتك للسؤآل السابق (3.2) بلا فضلا توجه الى السؤآل رقم 3.6 ، واذا كانت الاجابة بنعم ، فضلا استمر

3.9. How many of them were delayed?

Please specify _____

3.3. كم عدد المشاريع المتأخرة منها؟

فضلا حدد _____

3.4. ماهو معدل التأخر الزمني للمشاريع التي شاركت بها؟

□ أقل من 10% من زمن المشروع
□ من 10 % الى 30 % من زمن المشروع
□ من 31 % الى 50% من زمن المشروع
□ من 51% الى 100% من زمن المشروع
□ اكثر من 100% من زمن المشروع (اكثر من ضعف زمن المشروع)

3.10. What is the average delay time of the delayed project/s?

□ Less than 10%
□ 10 to 30 %
□ 31 to 50 %
□ 51 to 100%
□ Over 100 % please specify _____

3.5. كم معدل الوقت المتأخر الذي تغاضى عنه العميل

□ كامل الوقت المتأخر
□ 75% من الوقت المتأخر تقريبا
□ 50% من الوقت المتاخر تقريبا
□ 25% من الوقت المتأخر تقريبا
□ دفع المقاول غرامة التأخير لكل الوقت المتأخر

3.11. What is the average of delayed time that was let pass by client/s?

□ All the delayed time
□ About 75% of delayed time
□ About 50 % of delayed time
□ About 25% of delayed time
□ The contractor paid the liquidated damages for all delayed time.

3.6. من هو المتسبب الاول في تأخير المشاريع في نظرك

□ المقاول

3.12. Who is the first responsible party for the delay?

□ Contractor
□ Consultant
□ Client

□ الاستشاري
□ العميل

3.13. Please write down the most important 5 causes of delay of construction projects in order in your region? (see the causes of delay in section four)

1. _____
2. _____
3. _____
4. _____
5. _____

3.7 **فضلا اكتب اهم خمسة أسباب في تأخر المشاريع الانشائية** (شاهد أسباب تأخر المشاريع في القسم الرابع)

.1 _____
.2 _____
.3 _____
.4 _____
.5 _____

Section four – ***Causes of delay***

القسم الرابع – ***أسباب التاخر***

4.2. **Figure the following causes regarding to their frequency and severity weight. The range of weighting in the research survey scaled from 1 to 4, as shown below:**

4.1. حدد مدى التردد والتاثير السلبي لمسببات تأخر المشاريع الانشائية المدرجة في الجدول, مع العلم بان مدى تردد وقوة التاثير السلبي للاسباب قسمت الى اربع مستويات من 1 الى 4 كما هو مبين في الجدول التالي:

Comments: تعليق:

Thank you very much; your response is highly appreciated.

شكرا جزيلا, نقدر لك تعاونك

Appendix - D. Importance and Ranking Tables by The Three Parties in Both SA and the UK

C - 1. Importance index and rank by Saudi Arabia contractors

Importance index and rank by Saudi Arabia contractors						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
29	Difficulties in financing the project by the contractor	1	C/PF	88	14	6.286
54	Changes in the scope of the project	2	EP	83	14	5.929
42	Unrealistic contract duration	3	OWN	87	15	5.800
34	Delay in the approval of contractor submissions by the consultant	4	CNS	80	14	5.714
30	Cash flow problems faced by the contractor	5	C/PF	85	15	5.667
36	Poor coordination by the consultant engineer with other parties involved	6	CNS	78	14	5.571
43	Delay in the settlement of contractor claims by the owner	7	OWN	83	15	5.533
46	Slow decision making by the owner's organisation	8	OWN	83	15	5.533
15	Contractor's poor coordination with the parties involved in the project	9	C/PM	81	15	5.400
35	Poor communication between the consultant engineer and other parties involved	10	CNS	81	15	5.400
45	Delay in issuing of change orders by the owner	11	OWN	81	15	5.400
47	Interference by the owner in the construction operations	12	OWN	81	15	5.400
52	Poor coordination by the owner with the various parties during construction	13	OWN	70	13	5.385
4	Changes in materials specifications	14	C/MT	86	16	5.375
37	Delays in performing inspection and testing by the consultant engineer	15	CNS	80	15	5.333
50	Owner's poor communication with the construction parties and government authorities	16	OWN	69	13	5.308
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	17	EP	74	14	5.286
11	Lack of motivation among contractor's members	18	C/PM	73	14	5.214
22	Improper technical studies by the contractor during the bidding stage	19	C/PM	67	13	5.154
27	Delay in the preparation of contractor submissions	20	C/PM	67	13	5.154
53	Excessive bureaucracy in the owner's administration	21	OWN	67	13	5.154
33	Delay in the preparation of drawings	22	CNS	72	14	5.143
40	Poor contract management	23	CNS	72	14	5.143
49	Delay in progress payments by the owner	24	OWN	72	14	5.143
44	Suspension of work by the owner's organisation	25	OWN	77	15	5.133
10	Low skill of manpower	26	C/MP	71	14	5.071
16	Slow preparations of change orders required	27	C/PM	71	14	5.071
2	Delay in materials delivery	28	C/MT	76	15	5.067
14	Poor communications by the contractor with the parties involved in the	29	C/PM	70	14	5.000

Importance index and rank by Saudi Arabia contractors						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
	project					
23	Ineffective planning and scheduling of the project by the contractor	30	C/PM	70	14	5.000
26	Inefficient quality control by the contractor	31	C/PM	60	12	5.000
31	Problems between the contractor and his subcontractors with regard to payments	32	C/PF	70	14	5.000
39	Inadequate design specifications	33	CNS	70	14	5.000
57	Original contract duration is too short	34	EP	65	13	5.000
19	Poor controlling of subcontractors by contractor	35	C/PM	69	14	4.929
25	Ineffective control of project progress by the contractor	36	C/PM	64	13	4.923
1	Shortage of required materials	37	C/MT	73	15	4.867
38	Slow response from the consultant engineer to contractor inquiries	38	CNS	73	15	4.867
20	Loose safety rules and regulations within the contractor's organization	39	C/PM	63	13	4.846
21	Poor qualifications of the contractor's technical staff assigned to the project	40	C/PM	63	13	4.846
51	Owner's failure to coordinate with government authorities during planning	41	OWN	62	13	4.769
41	Delay in furnishing and delivering the site to the contractor by the owner	42	OWN	71	15	4.733
13	Shortage of technical professionals in the contractor' s organization	43	C/PM	66	14	4.714
24	Delays to field survey by the contractor	44	C/PM	61	13	4.692
32	Poor qualification of consultant engineer's staff assigned to the project	45	CNS	70	15	4.667
5	Shortage of required equipment	46	C/EQ	65	14	4.643
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	47	C/MP	64	14	4.571
28	Improper construction methods implemented by the contractor	48	C/PM	59	13	4.538
60	Government tendering system requirement of selecting the lowest bidding contractor	49	GR	59	13	4.538
7	Shortage of supporting and shoring installations for excavations	50	C/EQ	63	14	4.500
59	Difficulties in obtaining work permits	51	GR	58	13	4.462
56	Subsurface site conditions materially differing from contract documents	52	EP	62	14	4.429
6	Failure of equipment	53	C/EQ	57	13	4.385
8	Inadequate equipment used for the works	54	C/EQ	60	14	4.286
17	Ineffective contractor head office involvement in the project	55	C/PM	60	14	4.286
12	Shortage of contractor's administrative personnel	56	C/PM	64	15	4.267
58	Ineffective delay penalty	57	GR	53	13	4.077
18	Delays in mobilization	58	C/PM	56	14	4.000
63	Effects of subsurface conditions (type of soil, utility lines, water table)	59	EF	51	13	3.923
66	Rise in the prices of materials	60	EF	54	14	3.857
64	Traffic control and restrictions on the job site	61	EF	50	13	3.846
67	Work interference between various contractors	62	EF	51	14	3.643

Importance index and rank by Saudi Arabia contractors						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
48	Uncooperative owner with the contractor complicating contract administration	63	OWN	47	13	3.615
65	Effects of social and cultural conditions	64	EF	47	13	3.615
3	Changes in materials prices	65	C/MT	54	15	3.600
61	Changes in government regulations and laws	66	GR	46	13	3.538
62	Severe weather conditions on the job site	67	EF	42	14	3.000

Table 37 Importance index and rank by SA contractors

C - 2. Importance index and rank by Saudi Arabia consultants

Importance index and rank by Saudi Arabia consultants						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
49	Delay in progress payments by the owner	1	OWN	115	21	5.476
30	Cash flow problems faced by the contractor	2	C/PF	112	21	5.333
43	Delay in the settlement of contractor claims by the owner	3	OWN	112	21	5.333
13	Shortage of technical professionals in the contractor' s organization	4	C/PM	106	20	5.300
21	Poor qualifications of the contractor's technical staff assigned to the project	5	C/PM	106	20	5.300
29	Difficulties in financing the project by the contractor	6	C/PF	111	21	5.286
60	Government tendering system requirement of selecting the lowest bidding contractor	7	GR	105	20	5.250
10	Low skill of manpower	8	C/MP	109	21	5.190
23	Ineffective planning and scheduling of the project by the contractor	9	C/PM	103	20	5.150
14	Poor communications by the contractor with the parties involved in the project	10	C/PM	108	21	5.143
54	Changes in the scope of the project	11	EP	108	21	5.143
19	Poor controlling of subcontractors by contractor	12	C/PM	96	19	5.053
15	Contractor's poor coordination with the parties involved in the project	13	C/PM	104	21	4.952
31	Problems between the contractor and his subcontractors with regard to payments	14	C/PF	104	21	4.952
25	Ineffective control of project progress by the contractor	15	C/PM	94	19	4.947
17	Ineffective contractor head office involvement in the project	16	C/PM	98	20	4.900
18	Delays in mobilization	17	C/PM	98	20	4.900
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	18	C/MP	107	22	4.864
46	Slow decision making by the owner's organisation	19	OWN	105	22	4.773

Importance index and rank by Saudi Arabia consultants						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
11	Lack of motivation among contractor's members	20	C/PM	95	20	4.750
45	Delay in issuing of change orders by the owner	21	OWN	103	22	4.682
22	Improper technical studies by the contractor during the bidding stage	22	C/PM	93	20	4.650
47	Interference by the owner in the construction operations	23	OWN	102	22	4.636
26	Inefficient quality control by the contractor	24	C/PM	92	20	4.600
27	Delay in the preparation of contractor submissions	25	C/PM	92	20	4.600
16	Slow preparations of change orders required	26	C/PM	95	21	4.524
20	Loose safety rules and regulations within the contractor's organization	27	C/PM	87	20	4.350
34	Delay in the approval of contractor submissions by the consultant	28	CNS	95	22	4.318
53	Excessive bureaucracy in the owner's administration	29	OWN	90	21	4.286
1	Shortage of required materials	30	C/MT	94	22	4.273
28	Improper construction methods implemented by the contractor	31	C/PM	85	20	4.250
2	Delay in materials delivery	32	C/MT	93	22	4.227
51	Owner's failure to coordinate with government authorities during planning	33	OWN	93	22	4.227
67	Work interference between various contractors	34	EF	88	21	4.190
52	Poor coordination by the owner with the various parties during construction	35	OWN	92	22	4.182
12	Shortage of contractor's administrative personnel	36	C/PM	83	20	4.150
58	Ineffective delay penalty	37	GR	78	19	4.105
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	38	EP	90	22	4.091
24	Delays to field survey by the contractor	39	C/PM	81	20	4.050
3	Changes in materials prices	40	C/MT	89	22	4.045
36	Poor coordination by the consultant engineer with other parties involved	41	CNS	89	22	4.045
41	Delay in furnishing and delivering the site to the contractor by the owner	42	OWN	89	22	4.045
42	Unrealistic contract duration	43	OWN	89	22	4.045
50	Owner's poor communication with the construction parties and government authorities	44	OWN	88	22	4.000
59	Difficulties in obtaining work permits	45	GR	83	21	3.952
33	Delay in the preparation of drawings	46	CNS	86	22	3.909
63	Effects of subsurface conditions (type of soil, utility lines, water table)	47	EF	81	21	3.857
32	Poor qualification of consultant engineer's staff assigned to the project	48	CNS	84	22	3.818
5	Shortage of required equipment	49	C/EQ	83	22	3.773
57	Original contract duration is too short	50	EP	79	21	3.762
40	Poor contract management	51	CNS	75	20	3.750
44	Suspension of work by the owner's organisation	52	OWN	82	22	3.727
8	Inadequate equipment used for the works	53	C/EQ	78	21	3.714

Importance index and rank by Saudi Arabia consultants						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
4	Changes in materials specifications	54	C/MT	81	22	3.682
56	Subsurface site conditions materially differing from contract documents	55	EP	77	21	3.667
61	Changes in government regulations and laws	56	GR	73	20	3.650
39	Inadequate design specifications	57	CNS	75	21	3.571
48	Uncooperative owner with the contractor complicating contract administration	58	OWN	74	21	3.524
6	Failure of equipment	59	C/EQ	77	22	3.500
66	Rise in the prices of materials	60	EF	71	21	3.381
35	Poor communication between the consultant engineer and other parties involved	61	CNS	74	22	3.364
62	Severe weather conditions on the job site	62	EF	69	21	3.286
38	Slow response from the consultant engineer to contractor inquiries	63	CNS	68	22	3.091
7	Shortage of supporting and shoring installations for excavations	64	C/EQ	63	21	3.000
37	Delays in performing inspection and testing by the consultant engineer	65	CNS	66	22	3.000
64	Traffic control and restrictions on the job site	66	EF	58	21	2.762
65	Effects of social and cultural conditions	67	EF	54	21	2.571

Table 38 Importance index and rank by SA consultants

C - 3. Importance index and rank by Saudi Arabia owners

Importance index and rank by Saudi Arabia owners						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
23	Ineffective planning and scheduling of the project by the contractor	1	C/PM	30	4	7.500
25	Ineffective control of project progress by the contractor	2	C/PM	30	4	7.500
15	Contractor's poor coordination with the parties involved in the project	3	C/PM	26	4	6.500
31	Problems between the contractor and his subcontractors with regard to payments	4	C/PF	25	4	6.250
57	Original contract duration is too short	5	EP	25	4	6.250
33	Delay in the preparation of drawings	6	CNS	24	4	6.000
58	Ineffective delay penalty	7	GR	24	4	6.000
59	Difficulties in obtaining work permits	8	GR	24	4	6.000
17	Ineffective contractor head office involvement in the project	9	C/PM	23	4	5.750
19	Poor controlling of subcontractors by contractor	10	C/PM	23	4	5.750
30	Cash flow problems faced by the contractor	11	C/PF	23	4	5.750
37	Delays in performing inspection and testing by the consultant engineer	12	CNS	23	4	5.750

Importance index and rank by Saudi Arabia owners						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
53	Excessive bureaucracy in the owner's administration	13	OWN	23	4	5.750
14	Poor communications by the contractor with the parties involved in the project	14	C/PM	22	4	5.500
26	Inefficient quality control by the contractor	15	C/PM	22	4	5.500
27	Delay in the preparation of contractor submissions	16	C/PM	22	4	5.500
46	Slow decision making by the owner's organisation	17	OWN	22	4	5.500
13	Shortage of technical professionals in the contractor' s organization	18	C/PM	21	4	5.250
16	Slow preparations of change orders required	19	C/PM	21	4	5.250
22	Improper technical studies by the contractor during the bidding stage	20	C/PM	21	4	5.250
36	Poor coordination by the consultant engineer with other parties involved	21	CNS	21	4	5.250
42	Unrealistic contract duration	22	OWN	21	4	5.250
43	Delay in the settlement of contractor claims by the owner	23	OWN	21	4	5.250
32	Poor qualification of consultant engineer's staff assigned to the project	24	CNS	20	4	5.000
29	Difficulties in financing the project by the contractor	25	C/PF	19	4	4.750
34	Delay in the approval of contractor submissions by the consultant	26	CNS	19	4	4.750
35	Poor communication between the consultant engineer and other parties involved	27	CNS	19	4	4.750
38	Slow response from the consultant engineer to contractor inquiries	28	CNS	19	4	4.750
40	Poor contract management	29	CNS	19	4	4.750
44	Suspension of work by the owner's organisation	30	OWN	19	4	4.750
51	Owner's failure to coordinate with government authorities during planning	31	OWN	19	4	4.750
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	32	EP	19	4	4.750
39	Inadequate design specifications	33	CNS	18	4	4.500
52	Poor coordination by the owner with the various parties during construction	34	OWN	18	4	4.500
67	Work interference between various contractors	35	EF	18	4	4.500
2	Delay in materials delivery	36	C/MT	17	4	4.250
12	Shortage of contractor's administrative personnel	37	C/PM	17	4	4.250
50	Owner's poor communication with the construction parties and government authorities	38	OWN	17	4	4.250
60	Government tendering system requirement of selecting the lowest bidding contractor	39	GR	17	4	4.250
1	Shortage of required materials	40	C/MT	16	4	4.000
21	Poor qualifications of the contractor's technical staff assigned to the project	41	C/PM	16	4	4.000
5	Shortage of required equipment	42	C/EQ	15	4	3.750

Importance index and rank by Saudi Arabia owners						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
7	Shortage of supporting and shoring installations for excavations	43	C/EQ	15	4	3.750
24	Delays to field survey by the contractor	44	C/PM	15	4	3.750
28	Improper construction methods implemented by the contractor	45	C/PM	15	4	3.750
45	Delay in issuing of change orders by the owner	46	OWN	15	4	3.750
49	Delay in progress payments by the owner	47	OWN	15	4	3.750
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	48	C/MP	14	4	3.500
3	Changes in materials prices	49	C/MT	13	4	3.250
10	Low skill of manpower	50	C/MP	13	4	3.250
47	Interference by the owner in the construction operations	51	OWN	13	4	3.250
56	Subsurface site conditions materially differing from contract documents	52	EP	13	4	3.250
4	Changes in materials specifications	53	C/MT	12	4	3.000
20	Loose safety rules and regulations within the contractor's organization	54	C/PM	12	4	3.000
48	Uncooperative owner with the contractor complicating contract administration	55	OWN	12	4	3.000
54	Changes in the scope of the project	56	EP	12	4	3.000
64	Traffic control and restrictions on the job site	57	EF	12	4	3.000
6	Failure of equipment	58	C/EQ	11	4	2.750
8	Inadequate equipment used for the works	59	C/EQ	11	4	2.750
61	Changes in government regulations and laws	60	GR	11	4	2.750
63	Effects of subsurface conditions (type of soil, utility lines, water table)	61	EF	11	4	2.750
18	Delays in mobilization	62	C/PM	10	4	2.500
41	Delay in furnishing and delivering the site to the contractor by the owner	63	OWN	10	4	2.500
65	Effects of social and cultural conditions	64	EF	9	4	2.250
11	Lack of motivation among contractor's members	65	C/PM	8	4	2.000
62	Severe weather conditions on the job site	66	EF	8	4	2.000
66	Rise in the prices of materials	67	EF	8	4	2.000

Table 39 Importance Index and rank by SA owners

C - 4. Importance index and rank by the UK contractors

Importance index and rank by the UK contractors						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
62	Severe weather conditions on the job site	1	EF	67	11	6.091
67	Work interference between various contractors	2	EF	63	11	5.727
42	Unrealistic contract duration	3	OWN	55	10	5.500
46	Slow decision making by the owner's organisation	4	OWN	55	10	5.500

Importance index and rank by the UK contractors						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	5	C/MP	54	10	5.400
47	Interference by the owner in the construction operations	6	OWN	53	10	5.300
54	Changes in the scope of the project	7	EP	56	11	5.091
1	Shortage of required materials	8	C/MT	55	11	5.000
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	9	EP	55	11	5.000
10	Low skill of manpower	10	C/MP	47	10	4.700
31	Problems between the contractor and his subcontractors with regard to payments	11	C/PF	47	10	4.700
34	Delay in the approval of contractor submissions by the consultant	12	CNS	47	10	4.700
25	Ineffective control of project progress by the contractor	13	C/PM	45	10	4.500
30	Cash flow problems faced by the contractor	14	C/PF	45	10	4.500
57	Original contract duration is too short	15	EP	49	11	4.455
56	Subsurface site conditions materially differing from contract documents	16	EP	44	10	4.400
2	Delay in materials delivery	17	C/MT	48	11	4.364
63	Effects of subsurface conditions (type of soil, utility lines, water table)	18	EF	48	11	4.364
15	Contractor's poor coordination with the parties involved in the project	19	C/PM	43	10	4.300
33	Delay in the preparation of drawings	20	CNS	43	10	4.300
35	Poor communication between the consultant engineer and other parties involved	21	CNS	43	10	4.300
43	Delay in the settlement of contractor claims by the owner	22	OWN	42	10	4.200
61	Changes in government regulations and laws	23	GR	42	10	4.200
28	Improper construction methods implemented by the contractor	24	C/PM	37	9	4.111
36	Poor coordination by the consultant engineer with other parties involved	25	CNS	41	10	4.100
48	Uncooperative owner with the contractor complicating contract administration	26	OWN	41	10	4.100
49	Delay in progress payments by the owner	27	OWN	41	10	4.100
52	Poor coordination by the owner with the various parties during construction	28	OWN	41	10	4.100
41	Delay in furnishing and delivering the site to the contractor by the owner	29	OWN	40	10	4.000
14	Poor communications by the contractor with the parties involved in the project	30	C/PM	38	10	3.800
39	Inadequate design specifications	31	CNS	38	10	3.800
40	Poor contract management	32	CNS	37	10	3.700
4	Changes in materials specifications	33	C/MT	40	11	3.636
66	Rise in the prices of materials	34	EF	40	11	3.636
13	Shortage of technical professionals in the contractor' s organization	35	C/PM	35	10	3.500
45	Delay in issuing of change orders by the owner	36	OWN	35	10	3.500

Importance index and rank by the UK contractors						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
59	Difficulties in obtaining work permits	37	GR	35	10	3.500
64	Traffic control and restrictions on the job site	38	EF	38	11	3.455
19	Poor controlling of subcontractors by contractor	39	C/PM	34	10	3.400
22	Improper technical studies by the contractor during the bidding stage	40	C/PM	34	10	3.400
23	Ineffective planning and scheduling of the project by the contractor	41	C/PM	34	10	3.400
37	Delays in performing inspection and testing by the consultant engineer	42	CNS	34	10	3.400
38	Slow response from the consultant engineer to contractor inquiries	43	CNS	34	10	3.400
18	Delays in mobilization	44	C/PM	33	10	3.300
27	Delay in the preparation of contractor submissions	45	C/PM	33	10	3.300
29	Difficulties in financing the project by the contractor	46	C/PF	33	10	3.300
44	Suspension of work by the owner's organisation	47	OWN	33	10	3.300
53	Excessive bureaucracy in the owner's administration	48	OWN	33	10	3.300
65	Effects of social and cultural conditions	49	EF	35	11	3.182
16	Slow preparations of change orders required	50	C/PM	31	10	3.100
50	Owner's poor communication with the construction parties and government authorities	51	OWN	31	10	3.100
60	Government tendering system requirement of selecting the lowest bidding contractor	52	GR	31	10	3.100
5	Shortage of required equipment	53	C/EQ	32	11	2.909
26	Inefficient quality control by the contractor	54	C/PM	29	10	2.900
3	Changes in materials prices	55	C/MT	31	11	2.818
11	Lack of motivation among contractor's members	56	C/PM	28	10	2.800
20	Loose safety rules and regulations within the contractor's organization	57	C/PM	28	10	2.800
51	Owner's failure to coordinate with government authorities during planning	58	OWN	28	10	2.800
6	Failure of equipment	59	C/EQ	30	11	2.727
21	Poor qualifications of the contractor's technical staff assigned to the project	60	C/PM	27	10	2.700
24	Delays to field survey by the contractor	61	C/PM	27	10	2.700
32	Poor qualification of consultant engineer's staff assigned to the project	62	CNS	27	10	2.700
12	Shortage of contractor's administrative personnel	63	C/PM	25	10	2.500
17	Ineffective contractor head office involvement in the project	64	C/PM	25	10	2.500
58	Ineffective delay penalty	65	GR	25	10	2.500
7	Shortage of supporting and shoring installations for excavations	66	C/EQ	26	11	2.364
8	Inadequate equipment used for the works	67	C/EQ	21	11	1.909

Table 40 Importance index and rank by the UK contractors

C - 5. Importance index and rank by THE UK consultants

Importance index and rank by THE UK consultants						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
62	Severe weather conditions on the job site	1	EF	101	17	5.941
54	Changes in the scope of the project	2	EP	93	16	5.813
15	Contractor's poor coordination with the parties involved in the project	3	C/PM	83	16	5.188
23	Ineffective planning and scheduling of the project by the contractor	4	C/PM	80	16	5.000
42	Unrealistic contract duration	5	OWN	75	15	5.000
19	Poor controlling of subcontractors by contractor	6	C/PM	78	16	4.875
2	Delay in materials delivery	7	C/MT	77	16	4.813
25	Ineffective control of project progress by the contractor	8	C/PM	72	15	4.800
46	Slow decision making by the owner's organisation	9	OWN	76	16	4.750
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	10	C/MP	75	16	4.688
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	11	EP	70	15	4.667
10	Low skill of manpower	12	C/MP	66	15	4.400
39	Inadequate design specifications	13	CNS	70	16	4.375
56	Subsurface site conditions materially differing from contract documents	14	EP	65	15	4.333
22	Improper technical studies by the contractor during the bidding stage	15	C/PM	63	15	4.200
14	Poor communications by the contractor with the parties involved in the project	16	C/PM	67	16	4.188
57	Original contract duration is too short	17	EP	67	16	4.188
53	Excessive bureaucracy in the owner's administration	18	OWN	62	15	4.133
47	Interference by the owner in the construction operations	19	OWN	65	16	4.063
16	Slow preparations of change orders required	20	C/PM	60	15	4.000
33	Delay in the preparation of drawings	21	CNS	64	16	4.000
26	Inefficient quality control by the contractor	22	C/PM	63	16	3.938
17	Ineffective contractor head office involvement in the project	23	C/PM	62	16	3.875
40	Poor contract management	24	CNS	62	16	3.875
63	Effects of subsurface conditions (type of soil, utility lines, water table)	25	EF	62	16	3.875
38	Slow response from the consultant engineer to contractor inquiries	26	CNS	61	16	3.813
4	Changes in materials specifications	27	C/MT	57	15	3.800
1	Shortage of required materials	28	C/MT	60	16	3.750
31	Problems between the contractor and his subcontractors with regard to payments	29	C/PF	60	16	3.750
12	Shortage of contractor's administrative personnel	30	C/PM	58	16	3.625
35	Poor communication between the consultant engineer and other parties involved	31	CNS	57	16	3.563

Importance index and rank by THE UK consultants						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
49	Delay in progress payments by the owner	32	OWN	57	16	3.563
36	Poor coordination by the consultant engineer with other parties involved	33	CNS	56	16	3.500
50	Owner's poor communication with the construction parties and government authorities	34	OWN	49	14	3.500
52	Poor coordination by the owner with the various parties during construction	35	OWN	56	16	3.500
48	Uncooperative owner with the contractor complicating contract administration	36	OWN	51	15	3.400
45	Delay in issuing of change orders by the owner	37	OWN	49	15	3.267
34	Delay in the approval of contractor submissions by the consultant	38	CNS	52	16	3.250
11	Lack of motivation among contractor's members	39	C/PM	48	15	3.200
13	Shortage of technical professionals in the contractor' s organization	40	C/PM	48	15	3.200
21	Poor qualifications of the contractor's technical staff assigned to the project	41	C/PM	48	15	3.200
41	Delay in furnishing and delivering the site to the contractor by the owner	42	OWN	48	15	3.200
27	Delay in the preparation of contractor submissions	43	C/PM	45	15	3.000
44	Suspension of work by the owner's organisation	44	OWN	44	15	2.933
67	Work interference between various contractors	45	EF	41	14	2.929
28	Improper construction methods implemented by the contractor	46	C/PM	43	15	2.867
30	Cash flow problems faced by the contractor	47	C/PF	42	15	2.800
61	Changes in government regulations and laws	48	GR	39	14	2.786
20	Loose safety rules and regulations within the contractor's organization	49	C/PM	41	15	2.733
64	Traffic control and restrictions on the job site	50	EF	39	15	2.600
51	Owner's failure to coordinate with government authorities during planning	51	OWN	36	14	2.571
6	Failure of equipment	52	C/EQ	38	15	2.533
18	Delays in mobilization	53	C/PM	37	15	2.467
60	Government tendering system requirement of selecting the lowest bidding contractor	54	GR	34	14	2.429
43	Delay in the settlement of contractor claims by the owner	55	OWN	35	15	2.333
37	Delays in performing inspection and testing by the consultant engineer	56	CNS	37	16	2.313
8	Inadequate equipment used for the works	57	C/EQ	34	15	2.267
3	Changes in materials prices	58	C/MT	32	15	2.133
5	Shortage of required equipment	59	C/EQ	32	16	2.000
7	Shortage of supporting and shoring installations for excavations	60	C/EQ	29	15	1.933
65	Effects of social and cultural conditions	61	EF	29	15	1.933
66	Rise in the prices of materials	62	EF	29	15	1.933
32	Poor qualification of consultant engineer's staff assigned to the project	63	CNS	30	16	1.875

Importance index and rank by THE UK consultants						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
59	Difficulties in obtaining work permits	64	GR	26	14	1.857
24	Delays to field survey by the contractor	65	C/PM	26	15	1.733
58	Ineffective delay penalty	66	GR	24	14	1.714
29	Difficulties in financing the project by the contractor	67	C/PF	22	15	1.467

Table 41 Importance index and rank by the UK consultants

C - 6. Importance index and rank by THE UK owners

Importance index and rank by THE UK owners						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
54	Changes in the scope of the project	1	EP	23	3	7.667
25	Ineffective control of project progress by the contractor	2	C/PM	22	3	7.333
57	Original contract duration is too short	3	EP	22	3	7.333
23	Ineffective planning and scheduling of the project by the contractor	4	C/PM	28	4	7.000
19	Poor controlling of subcontractors by contractor	5	C/PM	19	3	6.333
20	Loose safety rules and regulations within the contractor's organization	6	C/PM	18	3	6.000
33	Delay in the preparation of drawings	7	CNS	18	3	6.000
43	Delay in the settlement of contractor claims by the owner	8	OWN	18	3	6.000
44	Suspension of work by the owner's organisation	9	OWN	18	3	6.000
45	Delay in issuing of change orders by the owner	10	OWN	18	3	6.000
46	Slow decision making by the owner's organisation	11	OWN	18	3	6.000
55	Ambiguities, mistakes, and inconsistencies in specifications and drawings	12	EP	18	3	6.000
9	Shortage of manpower (skilled, semi-skilled, unskilled labour)	13	C/MP	23	4	5.750
22	Improper technical studies by the contractor during the bidding stage	14	C/PM	17	3	5.667
26	Inefficient quality control by the contractor	15	C/PM	17	3	5.667
27	Delay in the preparation of contractor submissions	16	C/PM	17	3	5.667
34	Delay in the approval of contractor submissions by the consultant	17	CNS	17	3	5.667
35	Poor communication between the consultant engineer and other parties involved	18	CNS	17	3	5.667
47	Interference by the owner in the construction operations	19	OWN	17	3	5.667
39	Inadequate design specifications	20	CNS	16	3	5.333
40	Poor contract management	21	CNS	16	3	5.333
28	Improper construction methods implemented by the contractor	22	C/PM	15	3	5.000
42	Unrealistic contract duration	23	OWN	15	3	5.000
48	Uncooperative owner with the contractor complicating contract	24	OWN	15	3	5.000

Importance index and rank by THE UK owners						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
	administration					
2	Delay in materials delivery	25	C/MT	14	3	4.667
10	Low skill of manpower	26	C/MP	14	3	4.667
38	Slow response from the consultant engineer to contractor inquiries	27	CNS	14	3	4.667
41	Delay in furnishing and delivering the site to the contractor by the owner	28	OWN	14	3	4.667
15	Contractor's poor coordination with the parties involved in the project	29	C/PM	18	4	4.500
1	Shortage of required materials	30	C/MT	13	3	4.333
6	Failure of equipment	31	C/EQ	13	3	4.333
13	Shortage of technical professionals in the contractor' s organization	32	C/PM	13	3	4.333
18	Delays in mobilization	33	C/PM	13	3	4.333
21	Poor qualifications of the contractor's technical staff assigned to the project	34	C/PM	13	3	4.333
24	Delays to field survey by the contractor	35	C/PM	13	3	4.333
29	Difficulties in financing the project by the contractor	36	C/PF	13	3	4.333
30	Cash flow problems faced by the contractor	37	C/PF	13	3	4.333
36	Poor coordination by the consultant engineer with other parties involved	38	CNS	13	3	4.333
52	Poor coordination by the owner with the various parties during construction	39	OWN	13	3	4.333
53	Excessive bureaucracy in the owner's administration	40	OWN	13	3	4.333
56	Subsurface site conditions materially differing from contract documents	41	EP	13	3	4.333
63	Effects of subsurface conditions (type of soil, utility lines, water table)	42	EF	13	3	4.333
67	Work interference between various contractors	43	EF	13	3	4.333
14	Poor communications by the contractor with the parties involved in the project	44	C/PM	17	4	4.250
5	Shortage of required equipment	45	C/EQ	12	3	4.000
8	Inadequate equipment used for the works	46	C/EQ	12	3	4.000
37	Delays in performing inspection and testing by the consultant engineer	47	CNS	12	3	4.000
59	Difficulties in obtaining work permits	48	GR	8	2	4.000
61	Changes in government regulations and laws	49	GR	8	2	4.000
62	Severe weather conditions on the job site	50	EF	12	3	4.000
64	Traffic control and restrictions on the job site	51	EF	12	3	4.000
65	Effects of social and cultural conditions	52	EF	12	3	4.000
31	Problems between the contractor and his subcontractors with regard to payments	53	C/PF	11	3	3.667
49	Delay in progress payments by the owner	54	OWN	11	3	3.667
50	Owner's poor communication with the construction parties and government authorities	55	OWN	11	3	3.667
66	Rise in the prices of materials	56	EF	11	3	3.667

Importance index and rank by THE UK owners						
No	**Causes of delay**	**RNK**	**Ctg**	**IW**	**R**	**II**
4	Changes in materials specifications	57	C/MT	14	4	3.500
12	Shortage of contractor's administrative personnel	58	C/PM	10	3	3.333
16	Slow preparations of change orders required	59	C/PM	10	3	3.333
32	Poor qualification of consultant engineer's staff assigned to the project	60	CNS	10	3	3.333
51	Owner's failure to coordinate with government authorities during planning	61	OWN	10	3	3.333
11	Lack of motivation among contractor's members	62	C/PM	6	2	3.000
17	Ineffective contractor head office involvement in the project	63	C/PM	9	3	3.000
58	Ineffective delay penalty	64	GR	5	2	2.500
60	Government tendering system requirement of selecting the lowest bidding contractor	65	GR	5	2	2.500
3	Changes in materials prices	66	C/MT	7	3	2.333
7	Shortage of supporting and shoring installations for excavations	67	C/EQ	4	3	1.333

Table 42 Importance index and rank by the UK owners