Identification and assessment of risk factors affecting construction projects in the Gulf region: Kuwait and Bahrain

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Abstract

Many construction projects suffer from mismanagement despite continuous improvement in the field of project risk management. With the construction boom in the Middle East, and especially the Gulf region, construction projects suffer from a high failure rate.

The lack of the implementation of standard risk management methods in the construction industry of the Gulf region leads to construction projects that suffer from poor performance, delays, disputes and claims. In order to design a standard risk management model, there is a need for an in-depth study of the construction environment to lay down the foundation for designing a Standard Construction Risk Management Model in the future. This study aims *to identify and assess risk factors during the construction phase of construction projects in the Gulf region focusing on two countries of the Gulf region – the State of Kuwait and Kingdom of Bahrain.*

The risk factors (RF) were identified and assessed and responsiblty shares were allocated to construction parties: clients, consultants and contractors.

The research strategy was a Sequential mixed-method. It was adopted by means of interview surveys followed by a questionnaire. The study started with a qualitative approach in which eleven practitioners were interviewed to evaluate and validate a questionnaire. This was followed by questionnaires distributed to a representative sample of 140 consultants, 128 contractors and 139 clients in the State of Kuwait, in addition to 71 consultants, 99 contractors and 78 clients in the Kingdom of Bahrain, to assess the negative impact of the risk factors during the construction phase on the completion of construction projects.

Parametric tests were used to analyse the collected data. Including, the Analysis of Variance (ANOVA) test, the independent-samples t-test, and Pearson correlation coefficient (r) test.

The study revealed a difference in perception of the risk factors negative impact on project completion between Kuwait and Bahrain, Bahrain perceives highest degree of impact on projects. On the categories level, both countries agreed on the Finance category as the main factor threatening project completion, and the External category as having the least impact.

In Kuwait, almost all parties agreed on the negative impact of all categories on project completion except contractors who have different perception on management category. Furthermore, clients and consultants held different perceptions on the impact of design category.

Bahrain results reveal significant differences in perceptions on the impact of categories between clients and the other parties, however there are slight differences between consultants and contractors in all categories.

The limitations of the study include only large contractors and consultants in Kuwait and Bahrain were included in the study. The study was limited to the construction phase of construction projects and only six categories of risk factors were included in the study and This research was based on practitioners and participants opinions rather than actual occurrences on projects.

Keywords: project management, risk management, risk identification, risk assessment, risk impact, risk allocation, construction project delays.

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Abbreviation

BSE	Bahrain society of Engineers
B.D	Bahraini dinars
CCC's	Clients, Consultants and Contractors'
COEPP	Committee for Organising Engineering Professional Practice
CRII	Category Relative Importance Index
C.R.W	Category Relative Weight
CTC	Central Tenders Committee
D	Design category
EDB	Bahrain Economic Development Board
EXT	External category
F	Finance category
GCC	Gulf Cooperation Council States
GDP	Gross Domestic Product
KM	Kuwait Municipality
K.D	Kuwaiti Dinars
KSA	Kingdom of Saudi Arabia
KSE	Kuwait Society of Engineers
L&E	Labour and equipment category
M	Management category
MAT	Material category
MOIC	Ministry of Industry and Commerce
MOP	Ministry of Planning
MOW	Ministry of Works (Bahrain)
MPW	Ministry of Public Works
PM	Project Management
PMBOK	Project Management Body of Knowledge
PMP	Project Management Plan
PPP	Public-Private-Partnership
RF	Risk Factors
PRM	Project Risk Management
RM	Risk Management
SPSS	Statistical Package for Social Science (Software)
UAE	United Arab Emirates

Chapter 1

INTRODUCTION

Chapter 1: Introduction

1.1. Introduction

Developing countries are different from developed countries in many ways. Fewer than one billion people, out of a global population of six billion, live in high income countries (Smith, 2002). The Gulf Cooperation Countries (GCC) are developing countries, however they are classified amongst high income countries. With the lack of experienced consultants and contractors in the region, foreign contractors and consultants are welcomed, particularly driven by the construction boom which started in Dubai and has now moved to neighbouring countries.

Construction industries in developing countries are different in many ways from their counterparts in developed countries. For example, the Gulf region has a different climate, which is mostly warm to hot, compared to more northerly developed economies, and this affects the design and type of equipment. Material used in construction is usually not available in developing countries and this leads to the need to import goods from other countries – a high cost activity which also brings with it financial risks, such as exchange rate fluctuations (Smith, 2002).

1.2. Problem Statement

The world is growing too fast and with the continuous population increase, it is difficult to keep up the pace with the expanding population of people who need basic neccessities such as education, health and food . Without civil engineers and project managers who can successfully manage construction projects, these needs will never be met.

The largest and fastest growing cities are found in developing countries, due to the fact that the world is growing rapidly, and has resulted in less developed countries. According to Smith (2002), the construction projects industry in developing countries are significantly different than in developed countries. Recognition to the differences in climate, materials, finance and economics, human resources and cultural factors will lead for successful project management in developing countries,

Successful project management refers to a task of getting all project activities done on time, within the budget and according to the required specifications, (Robbins and Decenzo, 2002).

The Gulf countries are classified as a part of the developing countries. The construction industry place is an important role in the Gulf region, where the oil production has increased and revenues have risen sharply; this has led to the availability of enormous funds that Gulf rulers have invested in massive developments such as the construction industry (Alzayani, 2012).

The number of disputes and court cases due to project delays has increased with the construction industry revolution in the Gulf region – especially in construction projects. According to (MOP, 2011), in Kuwait, 21.2% of the project total budget goes towards the outstanding claims and increase of cost (18% for outstanding claims and 3.2% for increase of cost). The loss of money caused by the number of disputes and court cases due to project delays show that there is a need for managing construction risks effectively.
To design a standard risk management model, there are several phases. First is to investigate the construction environment, design conceptual model, test it in the market, modify it by making feasible or desirable changes then test it in the market again.

For this reason, there is a need to investigate the construction environment in the Gulf region, and this will form the basis of a standard risk management model for the area with the aim of saving money on projects, reducing the percentage of disputes and claims, and protecting foreign investors.

1.3. Research Aim

The research can be summarised in an overall aim and measurable objectives. The aim is: *to identify and assess risk factors during the construction phase of construction projects in the Gulf region focusing on two countries of the Gulf region – the State of Kuwait and Kingdom of Bahrain.*

1.4. Research objectives

In order to achieve the research aim, a set of objectives are set as follows:

1. To identify risk factors associated with construction projects and find an appropriate approach to categorise them by reviewing the relevant literature.

2. To evaluate the practitioners perception of categories' relative weight (C.R.W) and allocation of responsibility using interviews.

3. To investigate the construction environment in the Gulf region by comparing responses from participants in the State of Kuwait and Kingdom of Bahrain to the negative impact of the presented risk factors (RF) using questionnaires.

4. To rank the categorised risk factors (RF) based on their relative importance index (RII) values for their negative impact on project completion from the construction parties' perspective by using a mathematical equation (3.2) section 3.10.8.

5. To identify the direction and the strength of the relationships between potential risk factors (RF's) categories by applying the Pearson product-moment correlation coefficient (r) test.

6. To conduct further data analysis to:
   - Rank the Risk Factors (RF) for the State of Kuwait.
   - Rank the Risk Factors (RF) for Kingdom of Bahrain.
   - Allocate risks to the most significant Risk Factors (RF) for both countries in the region.

1.5. Research Methodology

Stage 1: Literature review

This stage involved a comprehensive review of related studies on risk identification and assessment and investigated the published work regarding construction risk management (RM), specifically important information related to the aim and objectives identified in this research. The literature review was an ongoing process in order to include current and up to date studies. Furthermore, the literature review helped to determine the appropriate research methodology – a vital component in the development of this research. The primary sources for the literature referenced in the research included: the university library system, journal articles, conference proceedings, books, and engineering databases. The data bases used were Science Direct and Elsevier. The key words used were project management, risk management, risk identification, risk assessment, risk impact, risk allocation, construction project delays.

The purpose of the review is to distinguish what has been done and what is needed to be done in the field, discover the important variables to the topic and to identify the methodologies and research techniques that have been used (Hart, 2003). The literature review chapter was divided into three parts. The first part provides an overview information on the Gulf region in general, and on the State of Kuwait and Kindom of Bahrain in particular to guide the reader. The second part presents an overview of the project management and risk management process, in particular information related to the research aim and objectives. The third part presents a relevant literature of the construction risks and causes of delay in addition to their major classifications and categories.

Stage 2: Methodology

Exploratory study

A semi-structured interview process was conducted amongst leading academics and practitioners in the construction sectors in the State of Kuwait and Kingdom of Bahrain. Based on the data collected from the interviews, a questionnaire was developed to be distributed amongst a representative sample of the construction industry in the State of Kuwait and Kingdom of Bahrain.

Descriptive study

As a result of the above literature review and the exploratory study, it was possible to:

- Identify and classify the potential risks factors (RF) in construction projects.
- Structure a questionnaire to gather the views of various parties in the construction industry (clients, consultants and contractors).

Questionnaire design

The questionnaire was carefully designed to meet the objectives of the study and was designed on the basis of the literature review and the outcome of the exploratory study (semi-structure interviews) in adittion to the outcome of the pilot study. To ensure validation of the questionnaire, it was sent twice to eleven senior practitioners to confirm its appropriateness and its suitability to meet the objectives of the research. After revising and reorganising the questionnaire, it was distributed amongst a representative sample of

clients, consultants and contractors in the State of Kuwait and Kingdom of Bahrain. Details of the problems faced during the design and distribution stages are discussed in Chapter 3.

Stage 3: Data analysis

This stage involved qualitative and quantitative analysis of completed responses that had been collected. The results of the survey are presented in diagrammatical and textual form in Chapter 4.

1.6. Scope of the Research

The scope of the research is to investigate the construction environment by identifying and assessing the potential risk factors (RF) during the construction phase of the construction projects in the Gulf region focusing on the State of Kuwait and Kingdom of Bahrain and categorise them based on their nature and sources, in addition to allocating risks (responsibilities). This research is limited to professionals (practitioners) working in consultancies and contracting firms that are listed by the Ministry of Municipality (KM) and Central Tendering Committee (CTC, 2010) in the State of Kuwait and the Ministry of Industry and Commerce (MOIC) and Ministry of Works (MOW) in Kingdom of Bahrain, as well as their clients.

1.7. Report Layout

Chapter 1: Introduction

This chapter includes an introduction that provides a general overview of construction projects in the developing countries. This is followed by the statement of the problem. In addition, the research aim, objectives and methodology, the scope of the study and the research layout are detailed.

Chapter 2: Background: Overview of the Gulf region's economy and construction industry, construction risk management and identification of risk factors

This chapter is divided into three parts. Part one presents an overview on the countries of the Gulf Cooperation Council States (GCC) in general followed by the State of Kuwait's and Kingdom of Bahrain's economies and construction industries. Part two presents the

concept of project management and risk management. Part three reviews the relevant literature on risk identification in construction risk management, categorisation and assessment in developing countries in general, and the Gulf region in particular.

Chapter 3: Methodology

This chapter explains the research strategy, questionnaire design, sample selection and data collection methodology, as well as the statistical and mathematical analysis methods adopted.

Chapter 4: Research findings and analysis

This chapter details the mathematical and statistical analysis of the data gathered from the interviews and questionnaires.

Chapter 5: Conclusions and Recommendations

This chapter presents a review and answers to the research aim and objectives. Further more, it includes conclusions of the state of Kuwait and Kingdom of Bahrain based on the questionnaires results, in addition to the conclusions of the literature review, limitations, and bias and errors of the study. The research contribution to the knowledge in addition to recommendations for further researches are also included.

The summary of the findings indicated that Kuwait's significant risk factors during the construction phase are different than Bahrain's. In both countries, consultants and contractors held the same opinion towards the negative impact of the presented risks on project completion.

In conclusion, Kuwait and Bahrain ranked the Finance-related risks as the leading risk category in impacting the construction phase, which comes in agreement with the study of El-Sayegh (2008) on the United Arab Emarites (UAE). Although Kuwait , Bahrain and UAE have different perceptions on significant risk affecting their projects, they are all in agreement on Finance category, which is deemed the most significant, whilst External risks are said to be the least important.

The recommendations for future researchers are that they could benefit from the result of the research, by launching it as the basic foundation, towards designing the conceptual

standard risk management model, for managing risk factors related to the construction phase of the construction projects in the Gulf region. Furthermore, a similar study could be carried out on different phases of the construction projects.

Chapter 2

LITERATURE REVIEW

Chapter 2: Literature review

2.1. Introduction

The literature review chapter is divided into three parts. The first part is an overview of the economies and construction industries in the Gulf region, specifically the State of Kuwait and Kingdom of Bahrain.

This part covers an overview of the Gulf Cooperation Council States (GCC) and their geographical layout, the economics activities and their shares to the gross domestic product (GDP), in addition to the contribution of the construction sectors to the gross domestic product (GDP). Furthermore, it presents an introductory overview of the State of Kuwait in addition to an overview of the key indicators of the Kuwaiti economics. Moreover, it presents an overview of the construction projects in the State of Kuwait and its lifecycle in addition to the contribution of the construction activities growth rate to the gross domestic product (GDP). It also presents an introductory overview of the Kingdom of Bahrain and its economic indicators, in addition to the construction activities contributions to the gross domestic product (GDP).

The second part presents an overview of the project management (PM) and risk management (RM) processes. It also presents the construction projects lifecycles phases, types of construction projects, and construction parties.

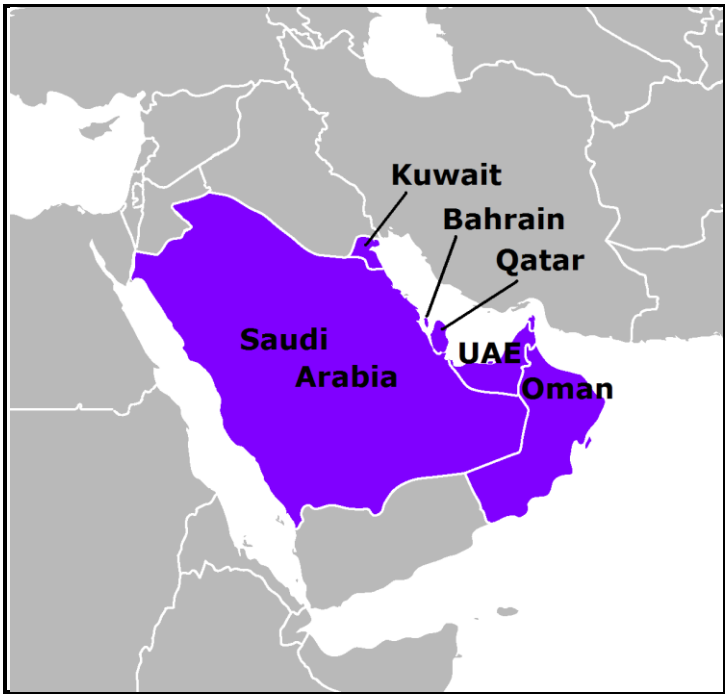
The third part is divided into two sections. The first section presents the relevant literature of construction risks, related studies on identification and assessment of risk. The second section presents the relevant studies on causes of delays on project completion in addition to risk allocation in developed and developing countries.

Part I: Background: the Kuwaiti and Bahraini economies and construction industries

This part is devoted to shedding lights on the Gulf Cooperation Council States (GCC) economies and construction industries statistical data followed by an overview of the economies and construction industries of the State of Kuwait and Kingdom of Bahrain. Furthermore, this part highlights the construction sector's contribution to the gross domestic product (GDP) and construction project life cycle for each country.

2.2. Overview of the Gulf Region

According to the International Hydrographic Organisation (IHO), the Gulf is an internal sea of 251,000 square kilometres; it is 989 kilometres long (IHO, 2013). The countries positioned around the Gulf, starting clockwise from the north, are the Islamic Republic of Iran (which covers most of the northern section of the Gulf), the Sultanate of Oman, the United Arab Emirates (UAE), Qatar, the Kingdom of Saudi Arabia (KSA) (which covers most of the southern section), the Kingdom of Bahrain (which is the only Arab island country in the Gulf), and the State of Kuwait.



Map 2.1 : Gulf region map
Source : (CIA, 2013)

Map 2.1 (above) illustrates the geographic layout of the six Arab states of the Gulf. The Gulf is considered the world's largest source of crude oil, and the oil industry dominates the region; the coastal Gulf countries have united and refer to themselves as the Gulf state or the Gulf Cooperation Countries States (GCC). The GCC countries are the Sultanate of Oman, the United Arab Emirates (UAE), Qatar, the Kingdom of Saudi Arabia (KSA) , the Kingdom of Bahrain and the State of Kuwait. the Islamic Republic of Iran is not included in the Gulf Cooperation Countries States (GCC).

Since the 1970s, oil production has increased and revenues have risen sharply; this has led to the availability of enormous funds that Gulf rulers have invested in massive developments (Al-Zayani, 2012).

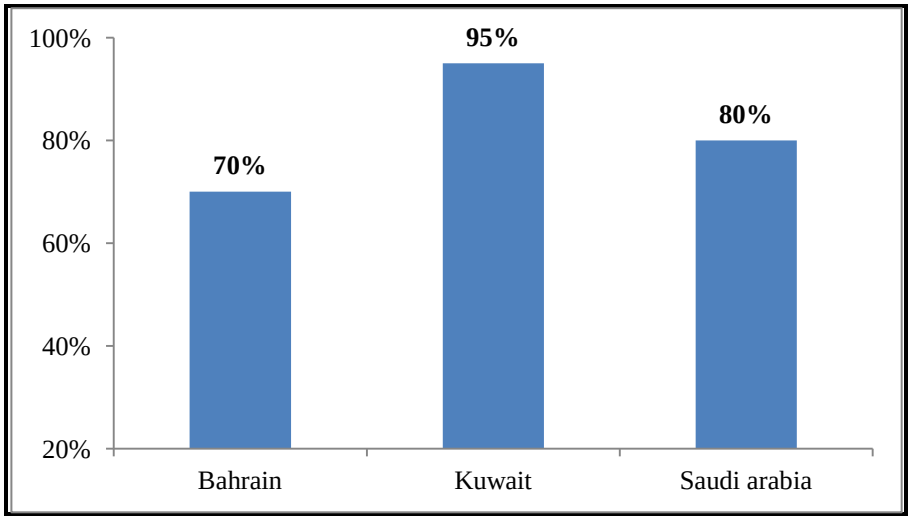


Figure 2.1 Petroleum revenue per cent
Source: (Al-Zayani, 2012)

The Gulf states (GCC) have made great progress in their development since adjusting to and benefiting from their oil wealth, as seen in the Kingdom of Saudi Arabia (KSA), the Kingdom of Bahrain and the State of Kuwait.

As can be seen in figure 2.1 (above), petroleum counts for 70% of government revenue in the Kingdom of Bahrain, about 95% in the State of Kuwait, and in the Kingdom of Saudi Arabia (KSA) it makes up approximately 80% of government revenue (CIA, 2013).

Figure 2.2 shows the gross domestic product (GDP) divided by economic activities in the Gulf Cooperation Countries States (GCC).

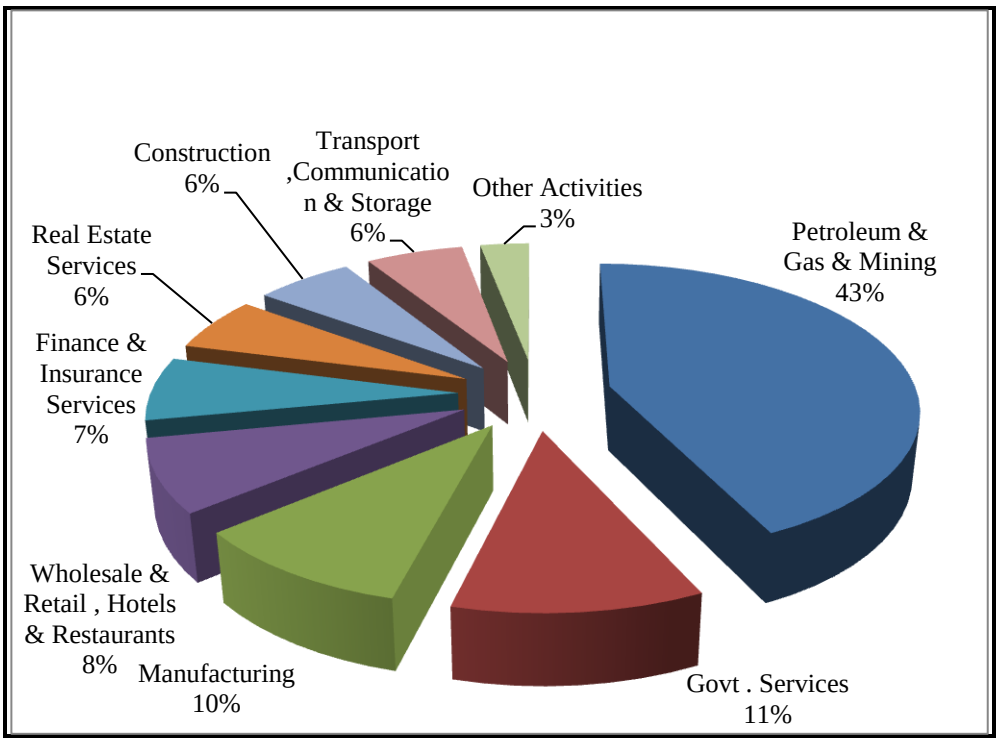


Figure 2.2 Economic activities shares to Gross Domestic Product (GDP) in the Gulf Cooperation Countries States (GCC)
Source: (Al-Zayani, 2012)

As can be seen from figure 2.2, the highest contribution to gross domestic product (GDP) in the Gulf is made by petroleum, gas and mining activities, which represent 43% of the total. In 2010, construction activities represented 6% of the gross domestic product (GDP) for the Gulf Cooperation Countries States (GCC). Transport, communications and storage, and real estate services activities all contributed a similar proportion (6%).

Figure 2.3 (below) shows the construction industry's contribution to the GDP of the Cooperation Council for the Arab States of the Gulf between 2007 and 2010.

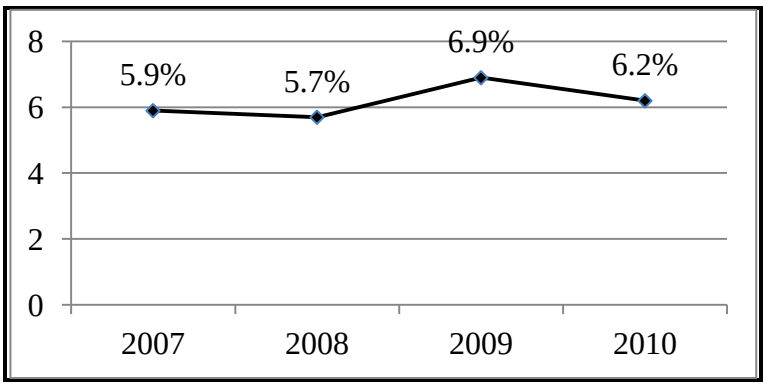


Figure 2.3 : construction industry relative share percentage to the Gross domestic Product (GDP) for GCC. Source: (Al-Zayani, 2012)

Figure 2.3 shows that the construction industry's share of gross domestic product (GDP) in the Gulf between 2007 and 2010 was between 5.7 and 6.9, with the highest percentage in 2009 when it contributed 6.9% (Al-Zayani, 2012). Its decline to 6.2% in 2010 was related to the global financial crisis and its significant effect on world economics (CBK, 2009).

According to (AME-Info, 2013), the construction industry in the Gulf Cooperation Countries States (GCC) has been awarded contracts with a value of $1.35 trillion to the end of 2013, which significantly exceeds 2012's value of $730 billion.

2.3. Overview on Kuwait economics and construction industry

2.3.1. Kuwait introductory overview

Kuwait is one of six countries in the Gulf Cooperation Countries (GCC) and is located on the northern coast of the Gulf. Map 2.2 (below) shows the location of Kuwait in relation to the other Gulf countries.

Map 2.2 : State of Kuwait map
Source: (CIA, 2013)

Geographically, it is bordered by the Republic of Iraq to the north and west, by the Kingdom of Saudi Arabia to the south and south-east, and by the Gulf to the east. The distance from north to south is 200 kilometres (124 miles) and from east to west is about 170 kilometres (160 miles) (CIA, 2013).

Table 2.1 Kuwait introductory overview

Category	State of Kuwait	Year
Country's official name	State of Kuwait	-
Capital	Kuwait	-
Government type	Constitutional Emirates	-
Area	17,818 square kilometers	
Independence	19 June 1961	-
National day	25 February 1950	-
Language and religion	Arabic - Muslims	-
Weather	Dry and hot (summer) Pleasant (winter)	-
Population	3,065,830 45% Kuwaiti – 55% Non-Kuwaiti	2012
Population growth rate	1.79%	2013
Birth rate	20.61%	2013
Death rate	2.14%	2013
Unemployment rate	11.3 %	2005

Source: (CIA, 2013),(Al-Zayani, 2012)

Table 2.1 (above) presents introductory information on Kuwait. The official name of the country is the State of Kuwait and the capital is Kuwait City. The native language is Arabic but English is widely spoken as a second language (CIA, 2013). It is divided into five governorates, which are the Capital, Hawalli, Al-ahmadi, Al-jahra and Al-farwaniya (CSO, 2008). The country gained its independence from the British on 25th February 1950, but on 19th June 1961 Kuwait gained its independence from British protection. In 2012, the estimated population was 3,065,830, made up of 45% Kuwaitis and 55% non-Kuwaitis (Al-Zayani, 2012), with a population growth rate of 1.79 as of 2013. The birth rate in Kuwait is much higher than the death rate, at 20.61 births per 1000 of the population compared to 2.14% deaths per 100. The unemployment rate is around 11.3%, which means it is ranked 102nd in the world as of 2013 (CIA, 2013).

2.3.2. Kuwait economics overview

An overview of Kuwaiti economics is presented in table 2.2 (below), which demonstrates the key indicators of the Kuwait economy.

Table 2.2 Kuwait economics overview

Category	State of Kuwait	Year
Currency	Kuwaiti dinars (KD)	-
Exchange rate	1 KD = 2.30 GBP	2013
Revenue budget	£70.25 billion	2012
Expenditure budget	£45.72 billion	2012
GDP Growth rate	6.3%	2012
GDP per capita (PPP)	£28,759	2012
Industrial production growth rate	8.7%	2011
Export	Fertilisers, oil and refined products	-
Import	Construction materials, food, automobile and auto parts	-
Inflation rate	3.2%	2012
Health expenditure	2.6% of GDP	2010
Education expenditure	3.8% of GDP	2006
Local tax	0%	2013
Foreign trade tax	15%	2013

Source: (CIA, 2013),(Al-Zayani, 2012), (CBK, 2013)

Table 2.2 illustrates the key indicators of the Kuwaiti economy. It shows that the industrial production growth rate is 8.7% in 2011, with a revenue budget of £70.25 billion and expenditure budget of £45.72 billion in 2012. This indicates that the country's expenditure is much less than its revenue budget even though the health and education services are provided as welfare (free services) for Kuwaitis and foreigners. The country spends 3.8% of its gross domestic product (GDP) on education, which is free at all levels for everyone, in addition to 2.6% of gross domestic product (GDP) on free health services.

The economy in Kuwait is strong; one Kuwaiti dinar (K.D) is equivalent to 2.30 GBP and the gross domestic product (GDP) per capita is £28,759, with an inflation rate of 3.2% in 2012. According to (Bossdorf et al., 2013) Kuwait encourages foreign investment by providing many incentives to investors. For example, Kuwait is highly ranked within the region for investor protection, and it is ranked 29th for ease of doing business there (IBRD, 2012). Furthermore, the tax rate for foreigners used to be between 5% to 55%, increasing gradually, however it has been now set at a fixed rate of 15% for foreign companies trading in Kuwait, as can been seen in table 2.2, where the local tax is zero and the tax for foreign businesses is 15%. It is ranked 11th under the paying tax indicator in 2013 (IFC, 2013).

2.3.3. Kuwait construction overview

Kuwait is rich with crude oil reserves, which represent 7% of the world's reserves. Petroleum in Kuwait accounts for 95% of government income and export revenue (CSB, 2012), however, the government is seeking to diversify its domestic economic activity following a decrease in oil prices and a decline in oil revenue of 3.7%. This turndown was the result of reduced global demand for crude oil that led to a 15.5% decrease in production and a decline in the average price of exports by 33.3% per barrel. As a result of the decrease in oil revenue, as well as the increase in non-oil revenue by 11.1% in 2009, the government has started to support non-oil activities (CBK, 2009).

One of the activities it has begun to support is the construction sector, and it spends large sums of money to keep this sector active. The government distributes the gross domestic product (GDP) budget based on expenditure type, and it seeks to maintain a level of ten per cent of annual expenditure on public construction projects, mainly through the Ministry of Planning (MOP, 2008) and Ministry of Public Works (MPW, 2008).
Table 2.3 shows the annual growth rate of construction activities as a percentage of gross domestic product (GDP).

Table 2.3 Construction activities' growth rate as a percentage of GDP

Economic sector	**years**						**Growth rate average**
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	
Construction	5.7%	3.8%	5.6%	-8.0%	0.4%	1.8%	***1.6%***

Source: (CSB, 2012)

From table 2.3, it can be seen that the highest growth rate was in 2006 and that there was a decline in the annual growth rate in 2009. The average growth rate over a period of six years (2006-2011) was 1.6% (CSB, 2012). One may say that there is sustained, steady growth in the construction sector, and it can be noted that the construction sector's contribution to gross domestic product (GDP) grew from 533.9 million K.D (£1,222 billion) in 2006 to 656.3 million K.D (£1,502 billion) in 2008 (CSB, 2012), but it started to recover in 2010 (0.4%) and reached a growth of 1.8% in 2011. Another indicator of sustained, steady growth is the total number of buildings permits issued. In 2007 it was 11,405, and this increased to 16,254 in 2011, as shown in figure 2.4 (below) (MOP, 2011) and (MOP, 2008).

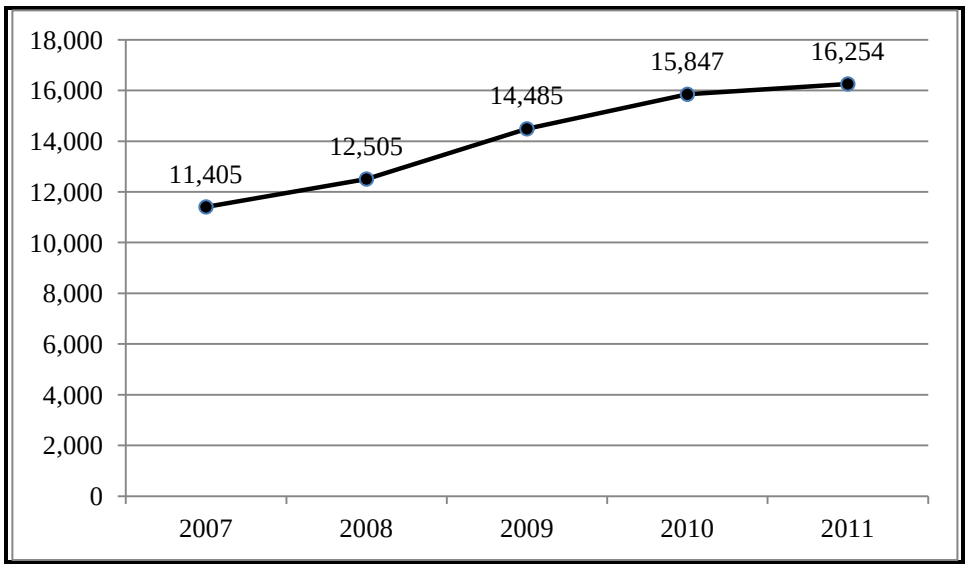


Figure 2.4 Building permits
Source: (MOP, 2011) and (MOP, 2008)

Kuwait ranked 119th for the ease of obtaining construction permits in 2013, compared to 2012 when it was ranked 121st (IFC, 2013). Within the construction sector there are three main parties involved in building projects, namely clients, consultants and contractors (Murali and Wen, 2007). According to the Central Tendering Committee (CTC) there are 629 firms of contractors in Kuwait, and they are registered under four category types, as follows (CTC, 2010):

Grade I:

Contractors who are able to carry out major construction projects of high-level engineering with initial budget estimates of over one million K.D (≥ 1 million K.D), which is greater than or equal to £2.3 million.

Grade II:

Contractors with technical and financial capability, who may participate in tenders budgeted for no more than one million K.D and not less than 500,000 K.D (500,000 to 1 million K.D), which is between £1.146 million and £2.3 million.

Grade III:

Local contractors who are allowed to participate in tenders budgeted up to 500,000 K.D as a total value of their work in progress (up to £1.146 million).

Grade IV:

Local contractors who are allowed to participate in tenders budgeted up to 250,000 K.D (up to £573,000).

According to Salman et al. (2003), almost all private and public projects follow the same lifecycle in Kuwait as follow:

- Project concept and preliminary preparation stage
- Preliminary design studies stage
- Project documentation stage
- Project final preparation stage
- Execution stage
- Maintenance stage

Figure 2.5 (below) illustrates the sequences of the construction project lifecycle in the State of Kuwait.

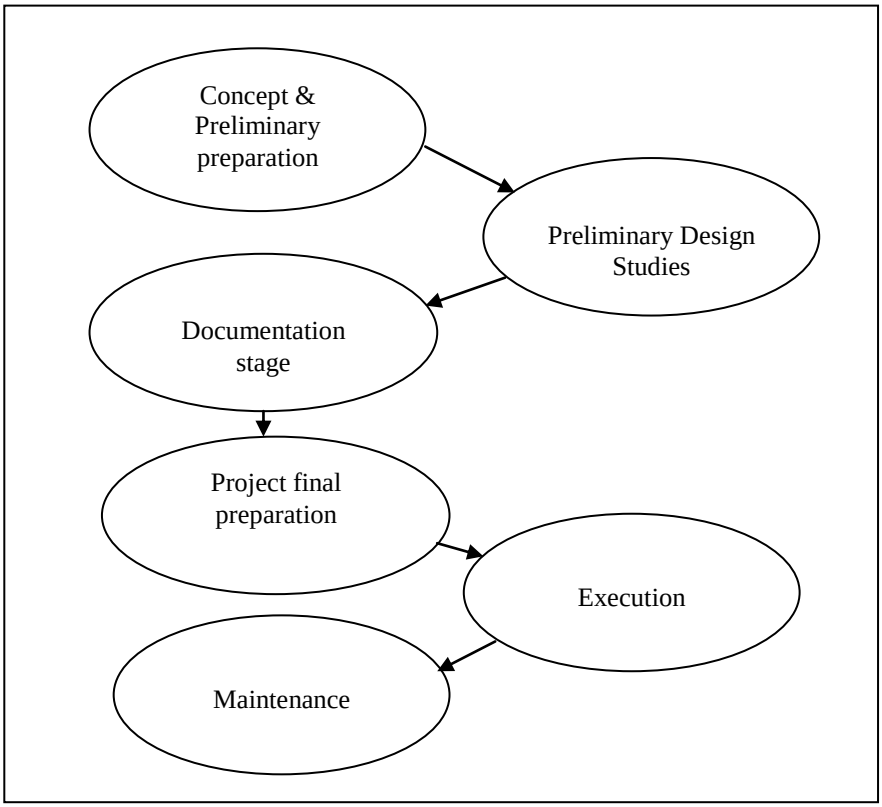


Figure 2.5: Construction projects lifecycle in Kuwait

- Project concept and preliminary preparation stage

The key personnel in the project team are the project manager, designers,cost engineers, and scheduling engineers. At the end of the project conceptual and preliminary stage it is preferable to do a presentation to show the clients what services and benefit they can expect for their money. For example, presenting a location plan showing the project location, approximate duration chart showing the approximate time required for major construction activities . As a result of this stage, the client needs to know what funds are required for consultants and contractors and a cash flow analysis plan in order to keep the project on hold until the funds are available, or authorise the team to proceed to the next stage of planning (Ahuja, 1984).

To summarise, This stage involves a feasibility study, estimates of budget and levels of staffing required for management and workforce, and preparing an application for submission to the Ministry of Planning (Salman et al., 2003).

- Preliminary design studies stage

At this stage, the team (project manager, designers, cost engineer and scheduling engineer) has reached a point where all the information needed for the project has been gathered and designed for the project network, and estimated for the project duration. At this time, the cashflow and final costs are more realistic (Ahuja, 1984).

To summarise, this stage consists of preparation of the project requirements, choosing the project team and consultancy firm, preliminary design drawings, and starting the approval process (Salman et al., 2003).

- Project documentation stage

Here, the project manager and the designer keeps up the communication with the client to ensure the flow of the information at all times (Ahuja, 1984). It is the phase where the project specification is defined, for instant, establishing the project objectives, forming teams, and assigning major responsibilities (Larson and Gray, 2011). In addition to the arrangement of the project documentation, such as the bill of quantity (BQ), specifications and drawing plans (Salman et al., 2003).

- Project final preparation stage

According to (Larson and Gray, 2011) at the final preperation stage schedules, budgets, resources, risks and staffing must be planned.
Review the final documents, drawings, cost and time schedules, and match the drawings with the bill of quantity (BQ) and project specifications (Salman et al., 2003).

- Execution stage

The execution stage represents the process of handing over and starting the project work (Salman et al., 2003). It is a stage where the major portion of work takes place whether it is physical work such as a construction building, or mental work such as establishing reports or dealing with software programs. Furthermore at this stage, measures are used to check if the project is on schedule, on budget and meeting the specifications (Larson and Gray, 2011).

- Maintenance stage

The stage involves both free and periodic maintenance, depending on what is covered in the contract (Nicholas, 2004) and (Salman et al., 2003). On the other hand, Walker (2000), mentioned in his book that maintenance involves closely keeping in touch with people employed on the project and ensuring that each is provided with the neccessity to carry out the task required. This requires formal review of the quality and quantity of the resources required for the project.
Nicholas (2004), stated that there are different types of evaluation or maintenance depending on the contractual agreement. For example, extension of the contractor involvment to form a periodic review countiniously through contractual agreement, a warranty agreement where the contractor provides maintenance during a period of time as part of the agreement, or extended warranty where the contractor is involved for a longer specified period of time.

In 2013, the value of construction industry grants to contractors for major construction projects in Kuwait was £5.2 billion.

Table 2.4 (below) presents few construction projects included in the government construction industry grants.

Table 2.4 Kuwait construction projects

No.	Project	US $ (Million)	GBP £ (Million)
1	Madinat Hareer (City of silk)	86.2	56.0
2	Arifjan housing project	10.0	6.50
3	Subiya township	10.0	6.50
4	Khairan housing project	20.0	13.0
5	Bubiyan island	6.64	4.31
6	Failaka tourism island expanssion	3.32	2.15

Source: (AME-Info, 2006) and (IMF, 2012)

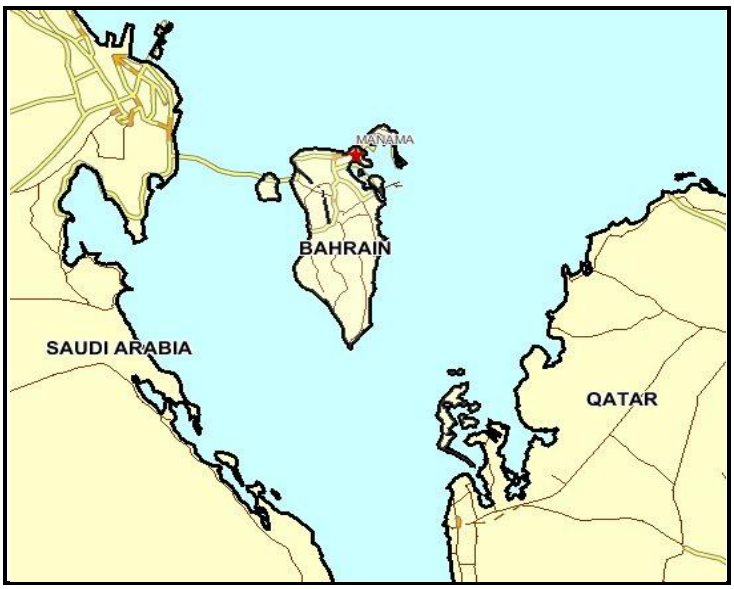
To encourage investment in the construction sector the government permitted high-rise buildings up to 100 storeys, expanded the building area by thirty per cent, and endorsed the Build-Operate-Transfer (B.O.T) and the Public Private Partnership (PPP) systems in the construction sector (NBK, 2013) and (CSB, 2012).

2.4. Overview on Bahrain economics and construction industry

2.4.1. Kingdom of Bahrain introductory overview

The Kingdom of Bahrain is the only island country in the Gulf region, and it is one of the countries of the Cooperation Council for the Arab States of the Gulf (GCC).

Map 2.3 on the next page shows the location of the Kingdom of Bahrain relative to the other Gulf countries.



Map 2.3 Map of the Kingdom of Bahrain
Source: (CIA, 2013)

It is situated on the southern coast of the Gulf and bordered by the Kingdom of Saudi Arabia (KSA) to the east and Qatar to the west. It is made up of more than 36 islands with Manama, the capital, being the largest; the total area of Bahrain is 760 square kilometres. It is divided into five divisions, which are the Capital (Asamah), the Southern (Janubiyah), the Northern (Muharraq), and the Central (Wastah) (CIA, 2010).

Table 2.5 (below) presents introductory information on the Kingdom of Bahrain.

Table 2.5 Bahrain introductory overview

Category	Kingdom of Bahrain	Year
Country official name	Kingdom of Bahrain	-
Capital	Manama	-
Government type	Constitutional Monarchy	-
Area	760 square kilometers	-
Independence	15 August 1971	-
National day	16 December 1971	-
Language and religion	Arabic - Muslims	-
Weather	Hot and humid (Summer) Pleasant (Winter)	-
Population	1,281,332 (46% Bahraini- 54% Non-Bahraini)	2013
Population growth rate	2.57%	2013
Un employment rate	28.3%	2004

Source: (CIO, 2013) and (CIA, 2013)

The official name of the country is the Kingdom of Bahrain and the capital city is called Manama. The population is 1,281,332, of which 46% are Bahraini and 54% are non-Bahraini, and the population growth rate is 2.57% in 2013. The unemployment rate is 28.3% in 2004. Arabic is the native language and Islam is the most commonly practiced religion. Its government is a constitutional monarchy, and the country gained its independence from the United Kingdom on the 15th August 1971 and gained its independence from the British protection on the 16th December 1971.

2.4.2. Kingdom of Bahrain economics overview

Before the discovery of oil, the main sources of income were agriculture and fishing, both of which are still practised today. Bahrain has seen strong economic growth in recent years; aluminium is its second major export after oil, followed by the financial and construction sectors. In addition, Bahrain encourages the privatisation of its economy in order to reduce its dependency on oil (CIA, 2010). Bahrain has sought to diversify to reduce its dependency on oil, and it has become an international banking centre. Its main exports are petroleum, aluminium and textiles, and its main imports are crude oil, machinery and chemicals. It encourages foreign investment in the country, and it ranked seventh in paying taxes indicators in 2013, and 82nd for protecting investors (IFC, 2013). Table 2.6 (below) presents an overview of Bahrain's economic indicators.

Table 2.6 Bahrain economics overview

Category	Bahrain	Year
Currency	Bahraini Dinars	-
Exchange rate	1 B.D = £1.74	2013
Revenue budget	£5.59 billion	2012
Expenditure budget	£5.88 billion	2012
GDP growth rate	2%	2012
GDP per capita (PPP)	£18,477	2012
Industrial production growth rate	1.5%	2010
Export	Petroleum, aluminum and textiles	-
Import	Crude oil, machinery and chemicals.	-
Inflation rate	3%	2012
Health expenditure	5% of GDP	2010
Education expenditure	2.9% of GDP	2008

Source: (CIA, 2013) and (CIO, 2013).

As mentioned in table 2.6, the industrial production growth rate in Bahrain is 1.5% and the gross domestic product (GDP) growth rate is 2%; 5% of gross domestic product (GDP) is spent on health and 2.9% on education.

Bahrain has revenues of £5.59 billion and an expenditure budget of £5.88 billion, which indicate that the country's expenditure is almost as much as its revenue, even though health and education services are provided as welfare (free services) for Bahrainis as well as foreigners (CIA, 2013).

The economy in Bahrain is strong, especially in the banking sector; one Bahraini dinar (B.D) is equivalent to £1.74, the gross domestic product (GDP) per capita (PPP) is £18,477, and the inflation rate is 3% in 2012. According to the Bahrain Economic Development Board (EDB, 2010b), Bahrain's economic vision for 2030 is to increase economic competitiveness and provide clear direction to develop the economy of Bahrain.

2.4.3. Kingdom of Bahrain construction overview

According to the Bahrain Economic Development Board (EDB, 2010b), Bahrain is experiencing an economic boom. It has highly developed communications and transport facilities and these, alongside several projects designed to improve the lifestyle of the country, have contributed to it to becoming a destination for many multinational firms with business in the countries of the Arabian Gulf.

Table 2.7, on the next page shows the contribution to to gross domestic product (GDP) by percentage by various industry sectors between 2009 and 2012.

Table 2.7 Percentage contributions GDP by sectors

Industries sectors	Years			
	2009	2010	2011	2012
Mining	22	21.1	21.5	19
Manufacturing	14.6	14.5	14.7	15.5
Electricity & Water	1.1	1.3	1.3	1.4
Other Goods Industries	0.9	0.9	0.9	0.9
Wholesale & Retail Trade	4.8	4.7	4.5	4.5
Hotels & Restaurants	2.5	2.7	2.2	2.7
Construction	***7.6***	***7.4***	***6.8***	***6.8***
Transport & Communications	6.7	6.7	6.8	7
Financial Services	17.1	17.5	17.1	17.1
Business Services	1.5	1.5	1.5	1.5
Other Services Industries	15.4	15.9	17.6	18.4
Real Estate	4.7	4.6	4.2	4.2
Taxes & Duties on Imports	1.1	1	1	1.1

Source: (CIO, 2013)

The percentage of the gross domestic product (GDP) contributed by the construction sector maintained an average of 7.15% between the year of 2009 and 2013. Although it was declined from 7.6% in 2009 to 6.8% in 2012, however it was increased to 7% in 2013. The Bahrain Economic Development Board (EDB, 2013) reports that Bahrain is the twelfth most open economic market worldwide, and it has a liberal environment.

For example, it offers 100% ownership of business; it has an open relationship with, and easy access to, the Gulf market and private companies can benefit from zero percent taxation. Between 2002 and 2009 employment in construction increased sharply, for example, the Bahraini employment rate rose by 18% and the employment rate of foreign workers grew by 160% (EDB, 2010b). The percentage contribution to gross domestic product (GDP) of the construction sector rose from 4% in 2001 to 7% in 2013 (CIO, 2013).

In 2013, Bahrain ranked 7th for ease of dealing with construction permits (IFC, 2013). Table 2.8 (below) shows the number of construction permits issued between 2007 and 2011, alongside the construction sector's percentage contribution to gross domestic product (GDP).

The Central Bank of Bahrain (CBC, 2012) reported that the number of construction permits issued between 2007 and 2008 rose by 9%, however this started to decline in 2008 as shown in table 2.8 below.

Table 2.8 Bahrain building permits and construction industry's percentage contribution to GDP

Year	2007	2008	2009	2010	2011
Construction Permits	10,639	11,579	10,478	10,013	7,770
Contribution (%) to GDP	-	7.19 %	7.6 %	7.4 %	6.8 %

Source: (CIO, 2013) and (CBC, 2012)

Many factors contributed to the weakening of the construction industry, but particularly the impact of the global financial crisis which resulted in the lowering of real estate asset prices, the collapse of oil prices, and an obvious decline in export revenues (ILO, 2013). Nevertheless, in 2013 the construction sector slightly increased its contribution percentage to 7% (EDB, 2013). In a similar way, construction permits reached their peak in 2008 and then started to decline, until they reached 7,770 permits in 2011; however, they started to show improvement in the first quarter of 2012 (CBC, 2012).

Table 2.9, lists a number of construction projects in Kigdom of Bahrain with a brief description.

Table 2.9 Bahrain construction projects

NO	Project name	Description	Budget ($)	Budget (£)
1	Dilmunia	Island hospitals, clinics and hotels	1.0 billion	653,280 million
2	Bahrain Financial Harbour	Master-planned integrated financial community	1.5 Billion	979,957 million
3	Riffa Views	Master-planned residential development Featuring 1,000 designed and built homes	300 million	196 million
4	Durrat Al Bahrain	Urban development	3 billion	1,960 billion
5	Amwaj Islands	High-rise buildings apartments, lofts, studios and villas together with an islands for communications and utilities	1 billion	653,280 million
6	Al Areen	diversified range of health, residential, hospitality and entertainment components	750 million	490 million
7	Bahrain Bay	Four Seasons Hotel and Arcapita's new corporate headquarters	1.5 billion	979,957 million
8	Bahrain World Trade Centre	commercial towers	9.6 million	6.27 million
9	Mina Salam	a complete community concept Shopping malls, hotels, business, leisure and housing facilities.	600 Million	392 Million

Source: (EDB, 2010a)

Bahrain has more or less the same construction project lifecycle as Kuwait section (2.3.3). Construction projects in Bahrain run through twelve stages of development, starting with obtaining an inquiry information certificate from the Ministry of Municipality, a land survey from a private consultant and a final building permit from the Ministry of Municipal Affairs and Urban Planning. This is followed by submitting a form of compulsory supervision to the Municipality for the foundations and passing an inspection, then submitting a form of compulsory supervision for the second floor and passing an inspection. Afterwards, it is necessary to request and receive a final inspection from the Civil Defence, then to obtain a certificate of completion from the Municipality, get connected to the water supply, request an electrical inspection and get connected to the electricity supply, in addition to obtaining a sewage connection from Ministry of Works.

Part II: Overview of the project management and risk management processes.

2.5. Project management process

A project can be defined as " a temporary endeavor undertaken to create a unique product service, or result" and it has major characteristics such as, an established objective, specific time, cost and performance requirements, in addition to the involvement of different sectors and professionals, (Larson and Gray, 2011). Smith (2008) and Kerzner (2001), defines a project as a series of activities with a defined start and end date that has specific objective to be achieved within limited time, cost, and resources.

Project management, on the other hand, has numerous definitions, however the meaning barely differs. Project Management (PM) is defined as planning, organising and managing resources to deliver a project's aims and objectives successfully (PMBOK, 2004). However, the Project Management Institute (PMI) defines project management as " the art of directing and coordinating human and resources through the life of a project by using modern management techniques to achieve pre-determined goals of scope, cost, time, quality and participants satisfaction". On the other hand, the UK Association of Project Managers defines project management as "the planning, organising, monitoring and controlling of all aspects of a project, and the motivation of all involved to achieve the project objectives safely and within agreed time ,cost and performance criteria" as cited in (Smith, 2008).

Every project has the triple constraints of time, budget and the amount and quality of work (scope) to be completed, as shown in figure 2.6 (below).

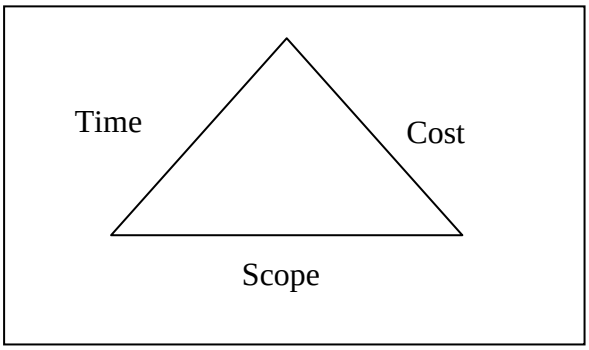


Figure 2.6 Project management constrains

Source:(Fewings, 2005) and (PMBOK, 2004)

The goal of most projects can be simplified in three elements, namely; time, budget and quality. Lock (2001), mentioned that time and cost have a positive relationship, where the original cost is most likely to be exceeded if the planned timescale is exceeded.

According to Kerzner (2001), project management involves a project planning stage which consists of a definition of the work required, quantity and quality of work, and resources needed to carry out the project. This is followed by the monitoring stage which consists of progress tracking, comparison between the actual and predicted outcome, impact analysation and adjustment making. Achieving the project objective within the allocated time period and budget cost, is defined as successful project management.

A successful project manager is required to achieve the project objective successfully. A project manager is defined as a person who is responsible to manage a project to specific objectives (Fewings, 2005) and (Larson and Gray, 2011). On the other hand, an executive project manager will manage the project on behalf of the client from the start to completion (Fewings, 2005).

The project manager is responsible for coordinating and integrating activities. For such reason, the project manager should have general knowledge, and requires communicative and interpersonal skills (Kerzner, 2001). According to Nicholas (2004), the project manager's role is central, as it is the communication hub, the decision maker as well as an entrepreneur.

Although the project manager has to balance between the three objectives (time, cost and quality), there are more aspects to be considered. This includes the project environment and health & safety, as the project team exists in a wider system which includes clients, contractors, sub-contractors and suppliers who are all affected by cultural, social, legal, economic and technological factors (Fewings, 2005).

Project Environment

According to Walker (2000), the complexity of the construction process may relate to the type of the environment which it exists in. Environmental forces act directly or indirectly on the construction procees. The environmental influences acting in indirectly on the client's activities and therefore it will be transmitted to the construction process. On the

other hand, it can act directly on the construction process. Therefore project managers have to overcome these type of problems by carrying out project scanning. Project scanning refers to the process of analysing the project environment for any potential problems and identifying the degree of occurance. On the other hand, an action to anticipate and interpret changes in the environment by monitoring large amounts of information to create a set of scenarios is defined as environmental scanning, (Robbins and Decenzo, 2002).

Many issues are related to the construction environment such as noise, dust, waste, emissions and health issues. To construction sites neighbours, dust and noise are constant problems (Fewings, 2005). However, environmental forces can be classified into four groups (Walker, 2000):

- Political, legal, institutional
- Cultural and sociological
- Technological
- Economic and competitive

Political forces refer to the influence of the government policy on the construction projects. For example, limiting the level of investment and the availability of the finance which might affect the labour market. Furthermore, political relationships between countries might affect international projects. Legal forces refer to legislation that could affect the clients' activities. For example, legislation affecting the construction projects directly (regulation on safety and planning) or having an effect on motivation to build (land controlling). However, Institutional forces refer to the professional institutions such as head office, main company, and stakeholders influencing their members.

Cultural and sociological factors are referred to the tolerability of the locals and general public to specific activities. On the other hand, Technological forces include the influence of the technologies on the process. Economic and competitive forces refer to the availability of finance, labour, materials, equipment, and the level of demands (Walker, 2000).

International projects have complex environments; it can be seen in developing countries. Despite European and American firms contributing to the modernisation of the Arab countries, international firms find it very hard to work on construction projects in the Arab countries. For example, cultural factors play a big role in executing business in the

Kingdom of Saudi Arabia; connections are essential in conducting business (Larson and Gray, 2011).

Project health and safety

Health and safety legislation is mostly enforced by the Health and Safety Executive (HSE) or the local authorities (LAs). The Health and Safety Commission's (HSC) overall responsibility is to supervise health and safety at work. For example, they are responsible for policy development, standard setting and policy enforcement (Appleby and Forlin, 2007).

Management of Health and Safety at Work Regulations 1999 (MHSWR) defined risk as the hazard of likelihood of potential harm or any harm being caused by something. The extent of the risk depends on the probability of occurrence, the potential severity of the risk such as health effect, and the population that could be affected. Regulations of the Management of Health and Safety at Work Regulations 1999 (MHSWR) requires risk assessment by identifying hazard and assessing the risk. For example, the assessment process looks at the probability of accidents that could happen, and the severity of the likelihood harm (Appleby and Forlin, 2007).

In construction business, it is necessary to maintain a safe working environment. (Levy, 2000). Human errors plays an important role in the accident causation process. It contributes up to 90% while the remaining percentage represents technical errors in addition to uncontrollable circumstances (Appleby and Forlin, 2007). According to (Walker, 2000) health and safety regulations are forced in the construction business to reduce accidents. Most large contractors require evidence of minimum safety training for managers and workers.

Project management knowledge areas

There are several potential benefits from project management (Kerzner, 2001), for example:

- Identification of tools and techniques for analysis.
- Early identification of problems.
- Improve estimating skills for future projects.
- Recognise whether the objectives cannot be met or will be exceeded.
- Assess time and achievements against schedules and plans.

Project managment process has twelve knowledge areas namely; project integration management, project scope management, project time management, project cost management, project quality managment, project humman resources management, project communications management, project risk managment and project procurement managment (PMBOK, 2004).

Project integration management refers to bringing the project aspect together in a coordinating way. Project scope management is a written statement of what is to be included and excluded in the project, in order to check on what has been agreed on. The main scoping carries out in the second phase of the project lifecycle. Project time management includes the identification of all activities, sequence them, then assign time to each activity. This will lead to a time schedule which shows when each activity starts and ends in order to ensure the project finishes on time. Project cost management is similar to the time management process, however each activity is associated with its cost, which will form the project budget (Maylor, 2003). Project quality management refers to planning a systematic action to assure that the outcome of the project will satisfy the given specification for quality (Smith, 2008).

Project human resources management refers to planning the employees which will work on the project, identifying the required skills, developing the team and documenting their roles. Project communications management consists of four areas which are communication planning, sharing information, performance reporting and administrative closing. Project risk management refers to the process of identification, quantification and response (PMBOK, 2004) and (Maylor, 2003).

2.5.1. Project lifecycle

In 2011,(Larson and Gray, 2011) illustrated four stages of the project life cycle, which includes:

- Defining stage
- Planning stage
- Executing stage
- Closing stage

Larson and Gray merged the monitoring and controlling stage with the executing stage. Whereas, (PMBOK, 2004) and (OIT, 2005) seperated them and presented the project lifecycle in five major stages:

- Initiation
- Planning and design
- Execution
- Monitoring and controlling
- Closing

Figure 2.7 below illustrates the construction project lifecycle phases.

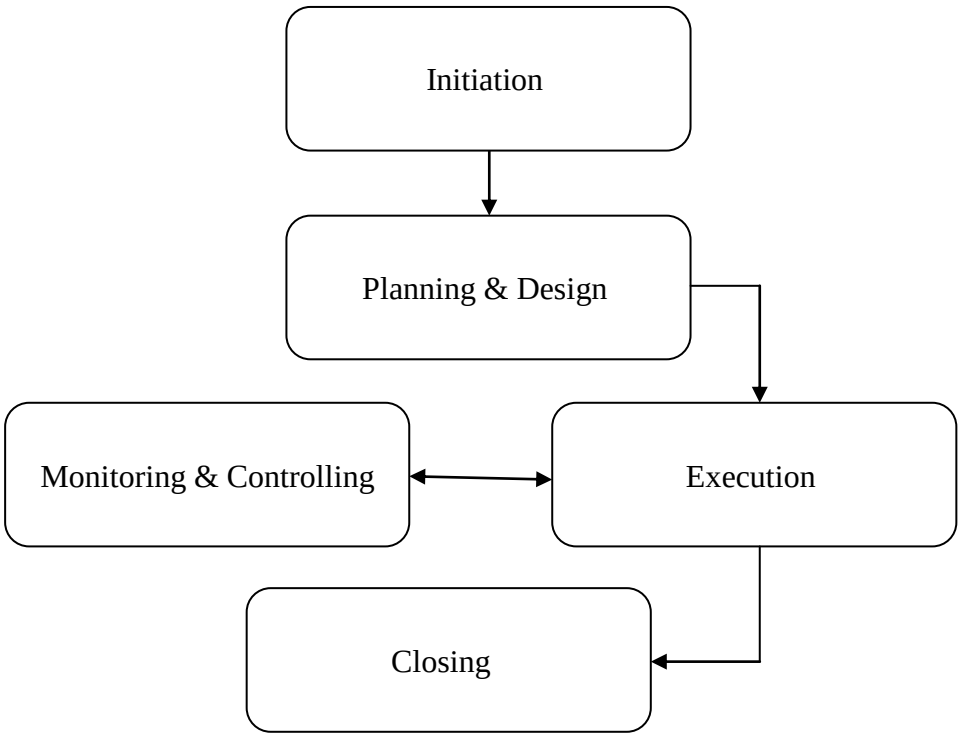


Figure 2.7: Construction project lifecycle

Source:(Larson and Gray, 2011) and (PMBOK, 2004)

Initiation:

The initiation stage establishes the preliminary scope of the project by understating the project environment and incorporates all the required resources in the project by developing a preliminary scope statement. It should include an organised plan that covers contracting, equipment and budget requirements, in addition to costs, tasks and the time schedule (PMBOK, 2004).

Planning and design:

The purpose of the planning and design stage is to show how the project will be managed during the executing, monitoring and controlling processes. In this stage, activities are grouped together by defining tasks and their sequences, in addition to their resources. It should ensure that the project satisfies the end-user and can be achieved within the constraints of time and budget (PMBOK, 2004).

Execution:

The execution stage is the phase in which the activities defined in the project management plan (PMP) are performed in order to achieve the project's aims. Furthermore, it involves coordinating people and resources, in addition to integrating activities, in order to produce the final result identified in the project management plan (PMP), (PMBOK, 2004).

Monitoring and controlling:

The monitoring and controlling stage involves observation of the project execution phase to identify difficulties and to take actions to correct problems. The monitoring and controlling stage includes the ongoing activities, in addition to monitoring the actual cost, time and effort expended against the project management plan (PMP). Moreover, it involves monitoring the project performance baseline, addressing risks and taking actions (PMBOK, 2004).

Closing:

The closing stage is the period in which the construction project is handed over to the end-user with formal acceptance. It has two phases: the project closure stage, where all

activities across the project are finalised, and the contract closure stage, where each contract related to the project is completed and closed (PMBOK, 2004).

A comparison between figure 2.5 (Construction project lifecycle in Kuwait) and figure 2.7 (Construction project lifecycle in general) shows that the lifecycle project in Kuwait aligns with generally accepted lifecycles of all construction projects.

2.5.2. Construction projects

The organisation and coordination of labour, material and equipment are required to complete projects successfully within the time and budget frame and to the designer-specified quality and performance standards (Donald and Boyd, 1992).
A construction project is defined as a physical structures that converts from the designers' drawings after following a set of procedures and processes (Levy, 2000) and (Woodward, 1997).

Executing a construction project is defined as a process to assemble an infrastructure. For the successful execution of such a project, effective planning is essential. Once the design is finalized and the cost and time schedules are approved, the actual construction process starts, (Clough, 1979).

According to (Levy, 2000) some criterias are essential for construction projects to succeed which are:

- Project completed on time.
- Final cost is within the project budget.
- No outstanding claims or disputes during or after the project completion.
- Contractors held a good relationship with the construction parties (client, consultant and sub-contractors).
- Quality level achieved.

Many people are involved in the construction industry; however, the main construction parties are:

- Clients – they invest in and fund construction projects, and could be a user, developer or bank. The client's aim is to receive the project on time and within the designated budget.

- Consultants – they have the professional skills and experience to protect the client's interests, and they are project managers, designers and specialist engineers (civil, structural, mechanical, electrical, etc.). The role of the consultant is to advise the client on all aspects of the project, such as the design, budget and contracts; at the same time, they have to manage their own risks to protect themselves from any potential disputes or lawsuits resulting from incorrect advice or any defect in the work.

- Contractors – they undertake the work necessary to produce a building or any form of construction unit, and they are contractors, sub-contractors, suppliers, manufacturers, etc. The aim of the contractor is to make a profit out of the project.

Failure to manage a construction project properly might result in the failure to complete the project within the budget and time frame, and failure to meet the contract specifications (Flanagan, 1993) and the major source of claims and disputes in the construction industry is related to disruptions and delays in contractors progress (Braimah and Ndekugri, 2008). There are different types of construction projects, which (Gloud, 1997) and (PMBOK, 2004) grouped into four categories:

- Residential construction
- Construction for businesses
- Infrastructure and heavy construction
- Industrial construction projects

This research focuses on construction projects, whether residential or business buildings. Residential construction projects include condominium and apartment buildings, while construction projects for businesses include office buildings and shopping malls. It is worth mentioning that some construction projects are technically more sophisticated than others, and client preferences determine the responsibility of the field of construction

management (Gloud, 1997). That means that the clients choose whether a consultant firm or a contractor firm is responsible for managing the construction projects.

2.6. Risk Management overview

Managing risk has existed when people needed to store their harvest for future use in the beginning of the civilisation, and when people built forts and fences to protect their villages and possessions. Another example is when a tradesman manages his risk when moving goods from one place to another by having the buyer pay the seller a security deposit to be returned once the buyer receives the merchandise in good condition, so if the tradesman faces any disasters during his journey he receives compensation. From Babylonian times until the Age of Enlightenment, risk was not managed systematically, but was more or less based on 'gut feeling'. However, a more systematic methodology was seen after statisticians and theorists developed quantified techniques for assessing risk (Douglas, 2009).

Risk management is an important part of the decision-making process in construction project management (Tang et al., 2007), particularly regarding the project's integration, scope, time, cost, quality, human resources, communications and procurement. Risk management (RM) improves the future prospects of a project as it identifies uncertainties and probabilities (Borge, 2001); it is defined as 'a system which aims to identify and quantify all risks to which the project is exposed so that a conscious decision can be taken on how to manage the risk' (Zou et al., 2007).

Effective risk management in construction requires a comparison between the potential risk and the potential return or future profits on the project (Flanagan, 1993). According to (Walker, 2000), Construction project management is defined as:

" The planning , co-ordination and control of a project from conception to completion (including commissioning) on behalf of a client requiring the identification of the clients' objectives in terms of utility, function, quality, time and cost, and the establishment of relationships between resources, integrating, monitoring and controling the contibutors to the project and their outputs, and evaluating and selecting alternativesin pursuit of the client's satisfaction with the project outcomes."

In construction projects, risk and uncertainty could have either a positive or negatve outcome. Threat is a result of a negative risk and opportunity is an outcome of positive risk. Therefore, risk does not indicate a bad thing however, it means things are uncertain (Cretu et al., 2011).

Risk is defined as a threat that has an impact on the success of a project, (Barber, 2005). On the other hand, uncertainty is defined as the chance occurance of an event where the probability is unknown (Smith et al., 2014). Put simply, uncertainty describes a situation being considered by decision makers that has no previous data with which to identify the probability of its occurrence (Flanagan, 1993).

Risk and uncertainty change the actual outcome of an activity from the planned outcome if it is negative. Both have two directions, either a positive or negative deviation on the time frame or the budget of the construction project. Risk and uncertainty are attached to every construction activity and to the construction parties, such as clients, consultants, contractors, sub-contractors and suppliers. There are differences between risks and uncertainty. The word risk originated from France, and began to be used in insurance transactions around 1830 in England. Risk is classified under three categories, namely; known risks, known unknown, and unknown unknown. Known risks include minor changes to the project, known unknown risks are the predicted event either by their probability or by the likely effect, and unknown unknown risks are those events with unknown probability attached to it and unknown likely effect (Smith et al., 2014).

Some researchers prefer to differentiate between risk and uncertainty, while others believe that the words are synonymous (Flanagan, 1993). All projects are subject to risk and uncertainty, and they could have a positive or negative impact on a project's success. Risk factors could be initiated internally or externally during a project's lifecycle, and to succeed and meet the project's objectives and aims it is necessary to identify potential risks and have a plan to manage them (Smith, 2002).

Risk management (RM) is a form of decision making within project management (PM) and it is an important part of the project management plan (PMP); it describes the types, sources and impacts of potential risks in the project, in addition to which, tools and techniques will be used in risk identification and assessment. Furthermore, Lester defines risk as 'the combination of the probability of an event and its consequences' (Lester, 2007).

The Institute of Risk Management (IRM) states that risk management (RM) is a rapidly developing discipline with no clear viewpoints or consensus on what is involved in risk. The IRM identifies risk as having two dimensions: positive and negative. Positive risks are those that could have a positive impact on the success of a project, and negative risks are associated with the possible failures of a project (IRM, 2002).

2.6.1. Risk Management Process

Most construction projects experience cost and/or time overrunning. According to Cretu et el. (2011), a study of analysing cost was carried out on public works projects in Europe and North America. The study resulted in occurrence and the severity of cost overruns was significantly high. A round 86% of 258 projects experienced cost overrun which resulted in the actual cost being 28% higher than the estimated cost. The major factors responsible in cost overrunning is inappropriate risk analysis. This is where during the early stage of the project, the scope of work was poorly described and identified at the time of the developing the project budget, or affected by political pressure where the project was delayed on purpose to serve political agendas.

The concept of risk management is completely different to that of risk assessment, although some may use the term risk management to describe a risk assessment process (Kaplan and Garrick, 1981). Westland (2007), defines risk management as 'the process by which risks to the project are formally identified, quantified and managed'.
At the planning and construction stage, various risk types may start to be identified, assessed and analysed by using the probability theory or the relative importance index theory in order to evaluate the risks and control their influence on the construction project (Paek, 2009).

Risk management assists in minimising delays, and in turn reduces contractual disputes. According to Braimah and Ndekugri (2009), one of the main findings of the existed methodologies for analysis delays in construction projects from the percepctive of clients and consultants was the use of simple methodolgies instead of the complex one in delay analysis although it is known for its less reliability.

The general categorisation of risk in construction projects is divided into internal and external risks. Other classifications are more detailed and consist of more specific

categories, such as political, financial, market, intellectual property, social and safety risks (Songer et al., 1997) and (El-Sayegh, 2008).

In general, risks can be identified at any stage in a project by recording the risk details in the risk register; however, in the construction industry risks can be identified by the probability of occurrence of an event or the actual occurrence of an event during the construction process (Faber, 1997).

Risks can also occur due to a lack of predictability of structured outcomes or consequences in a decision or planning situation (Hertz and Thomas, 1983). The result of an estimation based on the uncertainty associated with various outcomes could be better or worse than expected (Lifson and Shaifer, 1982). This research will adopt the more general and broad definitions of risk management as presented by (Larson and Gray, 2011) and (Westland, 2007) in which managing risks is the process by which risks to the project are formally identified, quantified (assess) and managed (responses).

A major source of uncertainty for multinational companies investing in the Gulf region is financial risk, which is considered to be the main reason behind the claims and disputes between parties in the region, as financial overruns lead to delays in project completion dates (Han et al., 2005). Companies in the region have started to realise the importance of risk management as a project management tool, and as an integrated process in any project. Figure 2.8 illustrates the process of Risk Management (RM).

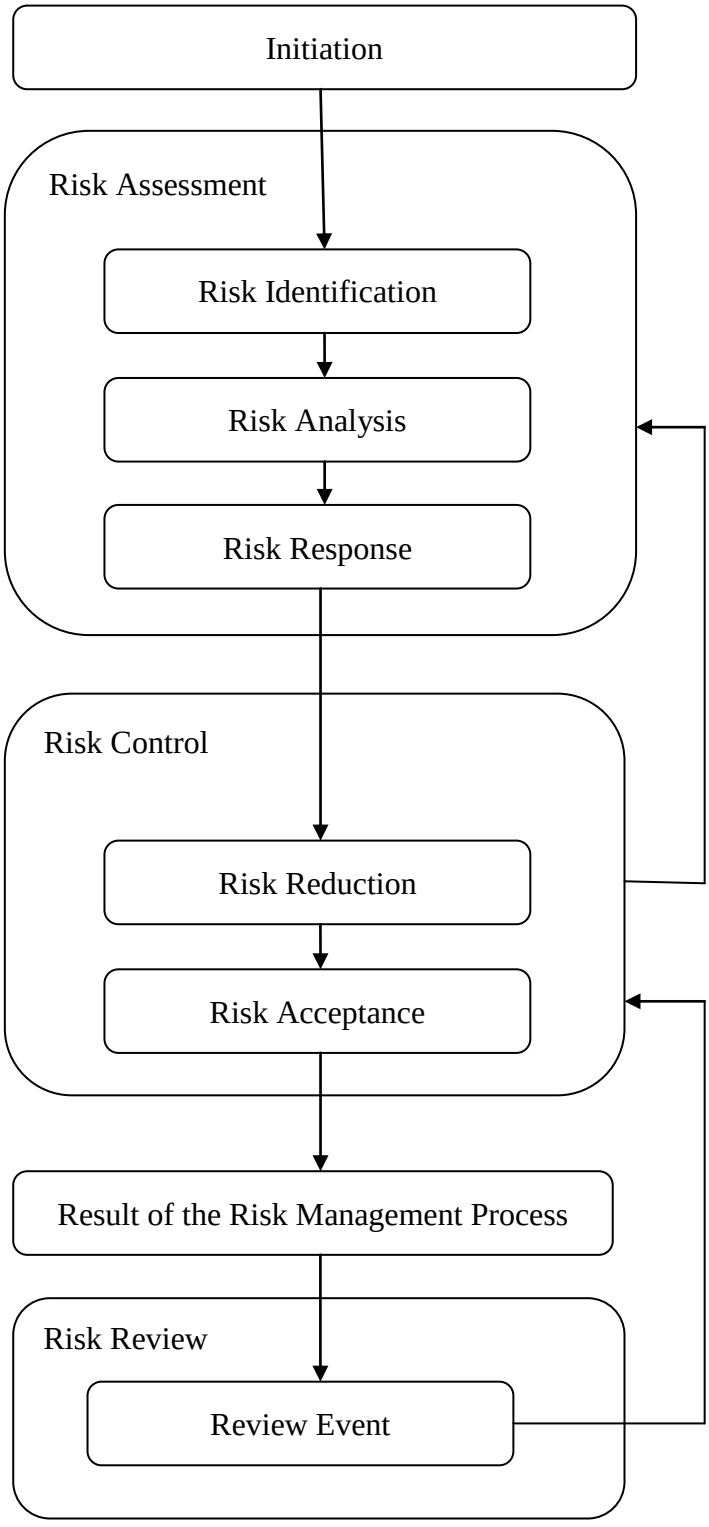


Figure 2.8 Process of risk management.

Source: (Simon and Gunn, 2009), (Gray and Larson, 2003) and (Murch, 2001)

Figure 2.8 (above) illustrates the three stages in the initiation of the risk management process tool. The initiation process starts with the risk assessment phase, proceeds to risk control and ends with a risk review. It is worth mentioning that there are several types of risk, for example controllable and uncontrollable, dependent and independent risks.

2.6.2. Risk assessment

Managing changes has led to the introduction of techniques for risk assessment as a major part of the planning process. Risk assessment concentrates on quantifying identified risks by using statistical analysis, since the identified risk in most cases can be either quantitively or subjectively assessed factors (Lockyer and Gordon, 1996).

The risk management cycle (the risk assessment phase) can be viewed in three stages (Smith, 2008), (Maylor, 2003) and (Zayed et al., 2008): risk identification, risk analysis and risk response. Figure 2.9 (below) illustrates the risk management cycle.

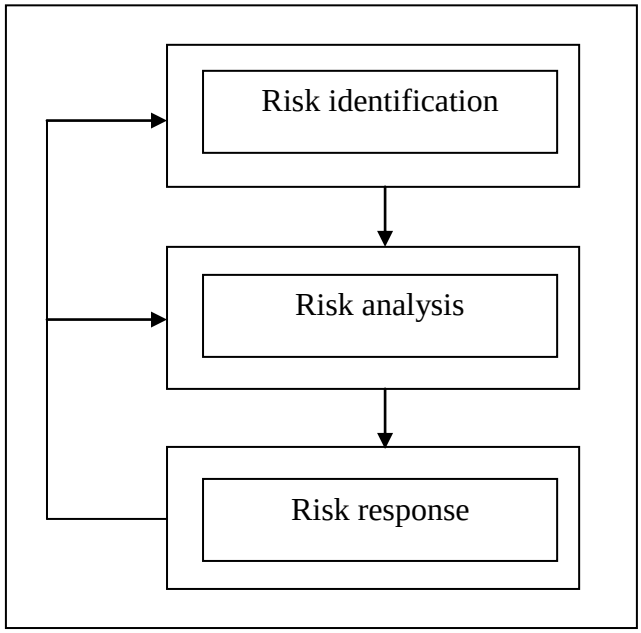


Figure 2.9 Risk assessments

Source:(Smith, 2008) and (Maylor, 2003)

Risk identification

Risk identification is the first step in the risk assessment process, whereby the potential risk factors (RF) associated with construction projects are identified and classified (Zou et al., 2007).

William (1995), suggests that the strategy for identifying, controlling and allocating risks should be formed in the early stages of the construction project lifecycle. It is useful to consider the potential internal and external risks to the client, contractor, and project team, from the point of view of different contractors, anticipating sources for claims or disputes. At the stage of risk identification it is important to identify the risk source and its effect (Raftery, 1999).

Figure 2.10 (below), illustrates the risk classification.

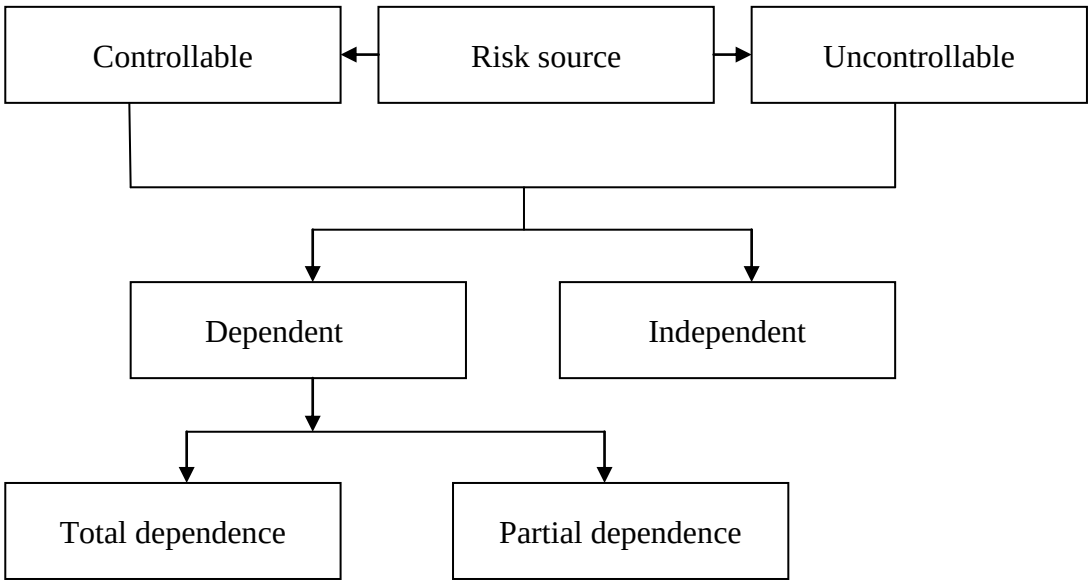


Figure 2.10 Risk classifications

Source: (Flanagan, 1993)

Controllable risks are those for which the outcomes are within the control and influence of the decision makers. Uncontrollable risks are those where the decision makers have no control or influence over them, and they usually stem from external sources (Flanagan, 1993) and (Chapman, 2001).

One of the effective tools for indentifying potential risks is the work breakdown structure (WBS) which reduces the chance of missing risk event (Gray and Larson, 2003).

Work Breakdown Structure (WBS) refers to identifying activities required to deliver the design needed to construct the project, in addition to what resources will be needed to carry out the work (Smith, 2008) and (Maylor, 2003).
It is useful to seek an answer to the three essential questions in the risk identification phase which are; what could go wrong?, how likely is it? (probability), and how it will affect the project? (Impact). Project manager and the team could use the experience and lessons learnt from the past, use a simulation model to present possible risks in addition to brainstorming in order to recognise the potential risk factors (Lockyer and Gordon, 1996).

Risk analysis

Risk analysis is the intermediate process between risk identification and risk response. Risk analysis techniques are grouped into qualitative and quantitative methods (Oztas and Okmen, 2004). The potential risks are analysed using a qualitative or quantitative method to evaluate their potential impacts (Zou et al., 2007). Another way of defining risk analysis is estimating what could happen if an alternative action or response were selected (Smith, 1999).

According to Gray and Larson (2003), analysing risks could be qualitative or quantitative. Qualitative analysis represented in experts opinion and it could carry serious errors based on the respondents or the decision maker judgment skills. On the other hand, the qualitative method is more reliable and it requires serious data collection and more detailed analysis.

To identify the potential risk factors (RF) and investigate their impact on construction projects completion, a classification that covers all types of presented potential risk factors is needed (Tchankova, 2002).

Risk response

The risk identification and analysis process helps decision makers to make judgements before problems occur. There are many forms of reaction to identified risks, such as risk avoidance, risk reduction or risk transfer (Raftery, 1999).

All projects are at risk to potential problems in the form of events or factors called risks, and it is known that they influence the time frame, budget and quality of projects(Santoso et al., 2003), however, all risks involve both threats and opportunities (Chapman and Stephen, 2002).

As mentioned earlier, a few researchers and decision makers like to make a distinction between uncertainty and risk. Uncertainty is not insurable and is found in situations where it is not possible to attach a probability to the likelihood of the occurrence of a problem (Raftery, 1999), or where the uncertainty could lead to risk events, threats and opportunities (Chapman and Stephen, 2002). Kartam and Kartam (2001), identify risk as the prediction of a project's success based on the probability of uncertainties occurring. Project risks increase with the level of uncertainty; according to (Kindrick, 2003), any event associated with work can represent risk. Risks can be positive, which means the result is better than anticipated, or negative, where the result is worse (Raftery, 1999). Many options are available for responding to risk, such as avoidance, sharing, transfer, reduction, insurance, deference, mitigation and acceptance (Staveren, 2006).

Thus, the field of risk management (RM) has developed to analyse and manage these uncertainties and risks (William, 1995), Although evaluating the risk and opportunity can be affected by uncertainity, however it is important to know that both have different mindsets and different data (Smith, 2008) . According to El-Sayegh (2008), there is a need for risk management processes to be used to manage construction risks. The impact of risk can be reduced by several ways such as obtaining more information, running more tests, allocating more resources, improving communications and allocating risk to parties who can control it (Smith, 2008).

Various paths can be followed to respond to risks, based on the degree of severity. To avoid obstacles project objectives can be modified if the difficulties are severe enough, find alternative methods for managing the project, increase management strength,reduce dependence of one task on another, increase resources or increase flexibility (Lockyer and Gordon, 1996).

Larson and Gray (2011), stated that decisions must be made after identifiying and assessing risks by choosing the appropriate solution to the risk event. Classification to risk responses are:

- Mitigate
- Avoid
- Transfer
- Share
- retain

Mitigating risk

There two strategies for mitigating risk:

- Reduce the occurrence probability of the event
- Reduce the impact of the risk on the project.

Risk teams usually prefer to reduce the likelihood that the risk will occur to reducing the inpact of it on the project as reducing the impact is costly (Larson and Gray, 2011) .

Avoiding risk

Although all risks cannot be avoided however, some risks can be avoided before the project launch and others can be avoided or eliminated by changing the project plan (Larson and Gray, 2011).

Jannadi (2008) describes the avoiding risk strategy as a continious decision process to avoid a particular risk completely. According to (Nicholas, 2004), risks can be avoided by minimising project complexity, reducing quality requirements for end items or eliminating risk activities.

Transferring risk

Passing risks to another party does not change the risk, however risk should be transferred to the party who can best control it. One way of transferring risk is insurance, which could be very costly for large projects. Another way of transferring risk is to add financial risk factors to the contract bid price (Larson and Gray, 2011).

Sharing risk

Contractors and clients may decide to split the risk between them through a contractual agreement. For example, each can manage the risk they can handle best. There are different types of contractual agreement to share responsibilities towards risks (Nicholas, 2004), which are:

- Fixed-price: Contractors are almost responsible for all risks.
- Fixed-price with incentive fee: contractors accept up to 60% of the risk and the remaining is clients' responsibilities.
- Cost plus incentive fee: contractors accept up to 40% of the risks and clients accept the remaining 60%.
- Cost plus fixed fee: clients are responsible for all risks.

Retaining risk

Risk can be retained in cases where it can not be avoided or transferred, for example earthquake or flood. However the risk can be retained by implementing a contingency plan. Contingency plan is defined as an substitute plan that will be applied in case risk becomes a reality. It is considered as an action to reduce the negative impact on the project if the risk materialises (Larson and Gray, 2011).
It also refers to a legal assignment of cost of potential risk from one party to another as in insurance (Jannadi, 2008).

2.6.3. Risk control

The risk control phase comes after the risk assessment phase. The main act of risk control is to either reduce or accept risk. Activities included in the risk control phase (Cretu et al., 2011) are :

- Track risk on risk register
- Identify new risks
- Adjust risk responses or develop new responses strategies
- Monitor the implementation and effectiveness of the responses strategies.

To control risk, identification of specific strategy response will assist in controlling risk. For example, in case of negative risk (threats) it is preferable to accept, avoid, mitigate or transfer risk, however, if the risk is positive (opportunity), it is preferable to enhance, exploit or share risk. Identification of risk responses will provide the best solution (Cretu et al., 2011).

According to Smith (2002), all construction parties carry risk at some point, and since every project combines risk and uncertainty, contracts between parties should allocate responsibility for risks during the project's life.

To summarise, risk management is one of the nine focus areas in the Project Management Body of Knowledge (PMBOK). It has many advantages, such as identifying the best action for a situation, reducing uncertainty, increasing confidence that the projects aims and objectives will be achieved, and reaching accurate estimates which will lead to success (KarimiAzari et al., 2011).

In this study, the overall aim is to identify and assess risk factors during the construction phase of construction projects in the Gulf region focusing on the State of Kuwait and Kingdom of Bahrain. For this reason, the research will focus on the risk assessment stage.

Part III: Literature Review on Causes of Delay, Risk Identification, Assessment and Risk Allocation

This part presents a literature review of the related information of major risk factors and their categories. The purpose of this section is to gain an understanding of the topic and to lay a solid foundation from which to generate clear and direct questions for the semi-structured interviews and the research pilot study. Several studies have been conducted in recent years on risk factors and the causes of delay, and the causes of delay in construction projects can be considered risk factors for future projects.

The layout of this study is split into three sections. The first section is related to idenfying risk factors in construction project and the second section is related to identify causes of delay in construction projects. The third section is related to the classification of risk factors. All sections variables are consider to be dependent variables. This layout model was chosen because it narrows the study, focuses the surveyed materials, and relates them closely to the research aim and objectives (Creswell, 2009).

2.7. Identification of risks factors in construction projects

The available resources, such as the library search system for journals, conference papers and books, in addition to internet resources, were used to review and examine information related to the topic.

Many researchers have studied potential risks in construction projects in developed and developing countries, looking at a range of projects from small to large scale. Various studies have considered risks relating to the three main parties in the construction industry – clients, consultants, and contractors. Others have used sub-categories of related factors, grouping together risks based on their nature.

Table 2.10 presents recent relevant studies related to the identification of risk in construction projects.

Table 2.10 Related literatures of risk factors

No	Author & Title	Case study	Risk factors
1	" Risk assessment and allocation in the UAE construction industry", (El-Sayegh, 2008).	UAE	42
2	" Learning from risks: A tool for post-project risk assessment", (Dikmen et al., 2008).	Turkey	73
3	"Risks associated with trenching works in Saudi Arabia", (Jannadi, 2008).	KSA	7
4	"An evaluation of risk factors impacting construction cash flow forecast", (Odeyinka et al., 2008).	UK	26
5	"Risk Management in the Chinese Construction Industry", (Tang et al., 2007).	China	32
6	"Understanding the key risks in construction projects in China", (Zou et al., 2007)	China	85
7	" Risk analysis in "fixed-price design–build construction projects", (Oztas and Okmen, 2004).	Turkey	14
8	"Assessment of risks in high rise building construction in Jakarta", (Santoso et al., 2003).	Jakarta	130
9	"The controlling influences on effective risk identification and assessment for construction design management", (Chapman, 2001)	UK	85
10	Kartam et al. (2001): "Risk and its management in the Kuwaiti construction industry: a contractors perspective"	Kuwait	26
11	"A systematic approach to risk management for construction", (Mills, 2001).	Australia	29
12	" Risk management trends in the Hong Kong construction industry: a comparison of contractors and owners perceptions", (Ahmed et al., 1999).	Hong Kong	25
13	"Project risk management in Hong Kong", (Shen, 1997).	Hong Kong	8

2.7.1. The Gulf region - related studies

United Arab Emirates UAE

El-Sayegh (2008), identified forty-two significant risks from the review of literature to be assessed from local and international companies' experts in the United Arab Emirates (UAE) construction industry. The risk factors were assessed by a questionnaire completed by construction experts. The questionnaire had two sections: the first section was concerned with the respondents' personal information, and the second section was to evaluate their perception of the probability of the occurrence of events, and the allocation of each risk to the construction parties (clients, consultants, contractors). Risk breakdown structure (RBS) was used to categorise risks, according to their sources, into external and internal groups where each group had five categories with related risk factors. The internal group consisted of clients, designers, contractors, sub-contractors and suppliers categories, and the external group consisted of political, social and cultural, economic, natural and other categories.

As a result of the study, the most significant top ten risks were identified in the UAE construction industry based on the risk rating. In addition, a comparison between the perception of local and international companies' experts was conducted, and both agreed that 'inflation and sudden changes in prices' constituted the most significant risk.

Kingdom of Saudi Arabia KSA

According to Jannadi (2008), all risk should be taken into consideration by contractors to reduce and avoid delays. The author used a mixed-method approach of questionnaire and interviews to measure contractors' perceptions of seven risk factors associated with trench construction works in Kingdom of Saudi Arabia (KSA), and identified potential risks from their responses. Risks relating to soil condition, equipment, material handling and site condition ranked top in the study.

State of Kuwait

A list of twenty-six risks was formulated and measured in the State of Kuwait by (Kartam and Kartam, 2001). The authors focused on the assessment, allocation and contribution of each risk to delays in construction projects from the point of view of large Kuwaiti

contractors. The main investigation in their study was on finding the best contractual arrangement to avoid or reduce construction risks.

A questionnaire was used as a survey tool and consisted of three parts. The first part was designed to investigate the attitude of large Kuwaiti contractors towards risk identification. The second part was intended to measure the risk allocation, and the final part aimed to collect data on the way contractors manage these risks. As a result of risk identification, the highest relative significant risk factor was 'financial failure', followed by 'delayed payment on completion of contract'.

2.7.2. Asia related studies

Tang et al. (2007), studied the risk management system and the barriers to the application of risk management techniques in China from the perspective of different groups in the construction industry from 6 different cities around China. Questionnaires and interviews were deployed as survey tools to study thirty-two risks that had been identified from the literature review. The results of their study showed that there were no significant differences among the respondent groups in the ranking of twenty-six of the thirty-two risk factors; however, there were different perceptions on 6 factors: premature failure of facility; safety; claims and disputes; insufficient technology; organisational interface; and poor coordination.

Zou et al. (2007), identified and ranked the main risks according to their significance, and developed a plan to manage those risks in Chinese construction projects. A questionnaire was used as a survey tool to collect data on twenty-five risks that were grouped into 6 categories: clients; designers; external issues; subcontractors and suppliers; government agencies; and contractors. The results showed that all parties involved in a construction project should take responsibility for managing risks and work together from an early stage to address the potential risks in good time. Moreover, contractors and subcontractors should employ a risk management plan to minimise or avoid risks in order to ensure that construction activities are of high quality and take place in a safe and efficient environment.

Ahmed et al. (1999), compared the views of contractors and clients of construction projects in Hong Kong on the importance of identifying and allocating risks to assist professionals in improving contractual documents. A questionnaire, which included twenty-six risks, was used to collect data from contractors and clients. The study results showed that

contractors and clients displayed strong agreement on the significance of the presented risk factors, although contractors allocated more responsibility for risk to themselves than the clients.

Shen (1997), studied the significant risks and their role in delaying construction projects in Hong Kong. A questionnaire was used as the survey method to evaluate contractors' perceptions of the significance of 8 risk factors and their relative contribution to project delays. These risk factors were: insufficient design information; poor coordination with subcontractors; poor accuracy of project programme; subcontractors' labour shortage; changes in ground and weather conditions; unsuccessful works due to poor workmanship; skills or techniques shortage; shortage of materials resources. The relative importance weighting approach adopted in the study gave the risk with the highest contribution to project delay the greatest weight in the ranking. On the other hand, the results related to the action of managing risk showed the different effectiveness levels of different prevention methods that were applied in the construction industry, and the most effective method to manage risks was the practitioner's experience and judgment.

Santoso et al. (2003), identified, ranked and categorised potential risks in high-rise building projects that are important to contractors in Jakarta. A quantitative approach, which used a questionnaire survey tool, was employed to evaluate 130 risks that were grouped into 9 categories and twelve sub-categories based on the frequency of occurrence and their degree of impact. The results of the study showed that management and design-related risk factors ranked as the most significant in high-rise building construction projects in Jakarta.

2.7.3. United Kingdom (UK) related studies

Odeyinka et al. (2008), identified and assessed the impact and the frequency of occurrence of twenty-six potential risk factors (RF) responsible for variations between forecast and actual cash flow. A structured questionnaire was used to evaluate UK contractors' perceptions of the impact of these factors on cash flow forecast. The study results showed that 11 out of twenty-six risk factors have a significant impact, and these were grouped into 3 categories which are: 'changes in the design or specification', 'project complexity' and 'natural inhibition'. The author suggests that the Delphi technique is one of the best tools in interviews to collect data, and Analysis of Variance (ANOVA) is the best method to

examine the differences in perception between the contractor groups (small, medium, and large firms).

Chapman (2001), focused on examining the steps involved in the process of risk identification, as it influences the risk analysis and management process which contribute directly to the overall management of the construction project. The eighty-five identified risks were grouped into 4 categories with sub-groups. One of the techniques used to collect data was the semi-structured face-to-face interview. The assessment process started with encoding to measure the impact and probability of risk occurrence in order to quantify the risk and its influence on project success.

2.7.4. The Australia related study

Mills (2001), developed a systematic risk management approach to identify and allocate risks in a structured way. He used a small project that was affected by the economic crisis as a case study to show the effectiveness of the approach. The case study measured twenty-nine risks that were grouped into 4 categories: planning risks, design and construction risks, site-related risks, and market risks. As a result, the researcher verified that risk management tools cannot remove all risk from project but will ensure that risks can be managed. He also concluded that the party responsible for each risk should carry out the risk management process.

2.7.5. Turkey related studies

Dikmen et al. (2008), developed a tool that stores risk-related information and risk assessment information through the life cycle of a project (pre-project, during project and post-project phases). The tool was tested on a real construction project in which the author identified seventeen risk factors grouped into fifteen categories under 3 types of risk (external, project, and country).

Oztas and Okman (2004), studied the techniques used to identify project risks, risk analysis and cost risk analysis in the fixed-price design-build (DB) contract system used in Turkey. The aim of the study was to show the effect of not applying risk identification and analysis on the fixed-price design-build (DB) projects during an economically difficult time in Turkey from the perspective of designer-contractor firms. The fourteen risk factors (RF) were identified from project documents, interviews and contract clauses. Inflation, the

exchange rate and bureaucratic problems were ranked as the most significant potential risk factors.

2.8. Identification of causes of delay in construction projects

After reviewing the relevant literature on risk identification and assessment, the researcher noticed a repeated statement: risk factors lead to project delays. For this reason, the researcher decided to review the literature related to the causes of delays in construction projects and compare them to the studies included in table 2.10.

A comprehensive review of the relevant literature on the causes of delay was carried out. Table 2.11 shows a summary of the most relevant literature on causes of delay in construction projects.

Table 2.11 Related literatures on causes of delay

No	Author & Title	Case study	Delay causes
1	"Delays in construction projects", (Sweis et al., 2008).	Jordan	40
2	"Causes and effects of delays in construction industry", (Sambasivan and Soon, 2007).	Malaysia	28
3	"The significant factors causing delay of building construction projects", (Alaghbari et al., 2007)	Malaysia	31
4	"Construction Delays in Civil Engineering Projects", (Lo et al., 2006).	Hong Kong	30
5	"Causes of delay in large construction projects", (Assaf and Al-hejji, 2006).	KSA	73
6	"Construction Delays and Their Causative Factors", (Aibinu and Odeyinka, 2006).	Nigeria	44
7	"Delays and Cost Increases in the Construction of Private Residential Projects", (Koushki et al., 2005).	Kuwait	9
9	"Large Construction Projects in Developing Countries", (Long et al., 2004).	Vietnam.	59
10	"Identifying The Important Causes Of Delays In Building Construction Projects", (Sugiharto and Keith, 2003).	Indonesia	31
11	"Causes of Delay and Cost Overruns in Construction of Groundwater Projects in a Developing Countries", (Frimpong et al., 2003).	Ghana	26
12	"Causes of Construction Delay: Traditional Contracts", (Odeh and Battaineh, 2002).	Jordan	28
13	"Expert System for Diagnosing Delay's Problems in Construction Projects", (Amer, 2002).	Egypt	33
14	"Construction Delays in Florida: An Empirical Study", (Ahmed et al., 2002).	Florida in Miami	17

2.8.1. The Gulf region related studies on causes of delay

Kingdom of Saudi Arabia KSA

Assaf and Al-hejji (2006), identified seventy-three causes of delay and ranked them based on the frequency of occurrence and their impact on construction projects in the eastern province of Kingdom of Saudi Arabia (KSA). The significance and degree of impact of the causes of delay were based on the collected data from the clients, consultants and contractors of construction projects in the eastern province. The seventy-three causes of delay were grouped in to 9 categories.

State of Kuwait

Koushki et al. (2005), focused on the causes of time delays and cost overruns in Kuwaiti private residential projects from the client's perspective. The results of the study showed that clients felt that changes and financial constraints during the design phase were the main reasons for time delays and cost overruns. In other words, the availability of sufficient time and funds at the design stage, as well as the selection of reliable consultants and contractors, can minimise time delays and cost overruns.

2.8.2. Asia related studies of causes of delay

Sambasivan and Soon (2007), identified twenty-eight major causes of delay and their effects on the construction industry in Malaysia, and measured the perceptions of clients and consultants on the relative importance of these major causes of delay. The twenty-eight causes of delay were grouped into 8 categories, and the most significant 10 causes of delay were identified as follows: improper planning; poor site management by the contractor; insufficient contractor experience; insufficient finance and payments for completed work; problems with subcontractors; shortage of materials; labour supply; equipment availability and failure; lack of communication between parties; and mistakes during the construction stage. On the other hand, the main effects of delay were: time and cost overruns; disputes; arbitration; litigation; and total neglect.

Alaghbari et al. (2007), studied the views of different parties on thirty-one delaying factors that were grouped into 4 categories affecting construction projects in Malaysia, as well as allocating responsibilities and types of delay. A questionnaire was completed and the results identified that the most significant causes of delay in Malaysia were related to

contractors, followed by consultants, and finally clients. On the other hand, external factors ranked as the least significant in delaying projects.

Lo et al. (2006), identified thirty common causes of delay in Hong Kong construction projects that led to contractual claims and cost overruns. The causes of delay were grouped into 7 categories and presented to clients, consultants and contractors from 6 projects to assess their point of view on the significance of these causes of delay. The results showed that there was strong agreement between clients and consultants on the significance of many of the causes of delays, but consultants and contractors held different views on their significance.

Long et al. (2004), identified sixty-two factors causing delays in large construction projects in Vietnam, and these were grouped into 7 categories. The top twenty factors were ranked according to the views of clients, designers/consultants and contractor/sub-contractors on the frequency of occurrence and the level of influence. Consultant- and contractor-related causes were highly ranked in terms of frequency of occurrence.

Alwi and Hampson (2003), identified thirty-one causes of delay, which were grouped in to 6 categories and presented to large and small contractor firms to evaluate the most important causes of delays in Indonesian construction projects. A questionnaire survey and interviews were the tools for collecting data. The results showed that there was disagreement between large and small contractors in all categories. Management-related factors were ranked the highest by the large contractors and external factors were ranked the lowest. On the other hand, design-related factors were ranked the highest by the small contractors and execution-related factors were ranked the lowest.

2.8.3. Africa related causes of delay

Aibinu & Odeyinka (2006), focused on the factors contributing to the delay of projects in Nigeria and assessed the contribution of forty-four causes of delay, which were grouped into 9 categories. The results of a questionnaire for construction managers showed that thirty-nine out of forty-four factors are responsible for ninety per cent of project delays.

Frimpong et. al (2003), identified and ranked the importance of twenty-six factors that contribute to delays and cost overruns in groundwater construction projects in Ghana. Respondents to the study were from public and private clients, consultants and contractors.

The results of the study showed that the major cause of delay was payment difficulties, followed by poor contract management and material procurement.

Amer (2002), focused on the construction project life cycle in Egypt and identified thirty-three causes of delays during the pre-construction stage and during the construction project stage. These were grouped into 4 categories. Clients, consultants and contractors were surveyed. As a result, an expert diagnosis system was proposed to anticipate and minimise or avoid delays in construction projects.

2.8.4. Middle East-related studies on causes of delay

Sweis et al (2008), identified forty causes of construction delays in residential projects classified according to Drewin's Open Conversion System, which consists of:

- Input Factors (IF): materials, labour and equipment
- Internal Environment (IE): client, consultant and contractor
- External Factors (EF): weather and government regulations

The data was collected from clients, consultants, and contractors by questionnaires and interviews with senior professionals in the construction field. The study resulted in general agreement that financial difficulties and changing orders by clients are the leading causes of delays, and that weather conditions and changes in government regulations are the least important factors.

Odeh and Battaineh (2002), identified significant delay factors in the traditional contracts used in Jordanian construction projects that lead to costly disputes and claims from contractors and consultants. A questionnaire was deployed to identify the major causes of delay; client interference, financing, labour productivity and slow decision-making were among the top ten ranked factors.

2.8.5. United State of America-related studies of causes of delay

Ahmed et al. (2002), identified seventeen causes of delays, which were grouped into 6 categories, for the Miami, Florida construction industry, and ranked them based on their frequency of occurrence. The study was limited to construction projects in the state of Florida, and data was gathered by questionnaire to identify the most significant causes of

delay to construction projects, to allocate responsibilities and to identify the types of delays.

The leading delay factors were: building permit approval; changes to orders; changes to drawings; incomplete document inspections; changes in specifications; decision made during the development stage; shop drawings approval; design development; and changes to laws and regulations. The perceived share of responsibility for each party was: contractor – 44%; client – 24%; government – 14%; shared – 12%; consultant – 6%.

Summary

The literature presented in Table 2.10 (related literature on risk factors) and table 2.11 (related literature on causes of delay) might be seen definitive. The result of the literature review the researcher has chosen from five different regions (UK, USA, Australia, Asia, and Africa), which represent twenty-seven countries. Although some literature related exists it was not included because it was published after the study took place in field. For example,the study of (Hwang et al., 2014).

At this stage, a list of risk factors (RF) was drawn up from the review of the literature related to the risk identification and assessment, and an additional list was compiled from the review of literature related to causes of delay in construction projects. By comparing both, a new list of 128 risk factors was produced and was ready to be categorised. The classification system is explained in the following section.

2.9. Classification of risk factors (RF)

Classifying risk can be done in various ways depending on the purpose. For instance, some risks are generally categorised into internal and external risks, while others are classified in more detail as client risk, financial risk, design risk, contractor risk, material risk, etc. (Raftery, 1999) (El-Sayegh, 2008). The categorisation of the risks factors included in the previous 14 relevant studies are presented in table 2.12.

Table 2.12 Categories Classifications of Risk Factors

Categories	Rank
External factors related.	1
Materials related.	2
Labours and equipments related.	3
Design – related	4
Financial/economical	5
Management/administrative	5
Project –related	7
Construction-related	7
Project attributes –related	9
Engineer –related	9
Environmental –related	9
Sub-contractor related	9
Supplier- related	9

By comparing the categories included in all the reviewed literature that related to the identification of risk factors, the results (Table 2.12) show that the external category was included in every study, and the leading six categories included in the reviewed literature were external, materials, labour and equipment, design, financial, and management.

Table 2.13 (below) shows the categories included in the reviewed studies of causes of delay. Most authors included the external category followed by material, labour and equipment, design, and finance in their studies.

Table 2.13 Categories classification of causes of delay

Categories	Rank
External factors related.	1
Materials related.	2
Labours and equipments related.	2
Design – related	4
Financial/economical	4
Project –related	6
Construction-related	6
Engineer –related	8
Environmental –related	8
Sub-contractor related	10
Supplier- related	11

In this research, the main categories were chosen based on the comparison between table 2.12 and table 2.13 and the identification of the categories included most often in previous studies. The final categorisations are as follows:

1. Management-related factors
2. Design-related factors
3. Financial/economic-related factors
4. Materials-related factors
5. Labour- and equipment-related factors
6. External – related factors

The selection of the categories was based on the most often included categories in the relevant literature. These categories were presented to the practitioners to evaluate them. They approved the categories, however there were some minor changes in ranking.

Management category

In project management there are two major aspects: the art and the science of the project. The art deals with the people involved in the project, while the science deals with defining and coordinating the work to be done; for example, it involves the knowledge, understanding, and skilful application of a project management process (Heerkens, 2001).

Design category

One of the most important requirements to minimise time delay and cost overrun is the allocation of sufficient time and money at the design phase (Koushki et al., 2005). Design is one of the most critical categories because its related factors were identified as key risks in construction projects (Fereig and Kartam, 2006).

Finance category

This category includes all factors related to potential financial difficulties on the project, such as delayed payments, cash flow problems, and external economic issues (Alaghbari et al., 2007). Most of the studies show that the main finance-related risk factor is delayed payment for completed work (Sweis et al., 2008) and (Aibinu and Odeyinka, 2006).

Material category

Project activities can be directly affected by factors related to materials, and the impact on the total cost of any project could be significant (Manavazhi and Adhikari, 2002). Risk factors that are related to materials include selection time, type of materials, their availability in the local market, and all causes related to the material category. This category can have an obvious effect on delays and increases in cost.

Labour and equipment category

Labour risk factors are related to manpower problems, such as the shortage of available workforce and the presence of unskilled labour; whereas factors related to equipment refer to the availability, reliability and quality of the equipment (Sweis et al., 2008)

External category

External risks are usually ranked low and do not play a major role in the delay of the project (Sugiharto and Keith, 2003). Most of the studies show that external risks, including weather and site conditions, have the lowest impact on the completion of a project (Alaghbari et al., 2007).

2.10. Conclusion

This chapter has helped in gaining a better understanding of the topic, and has resulted in finding the gap in the subject of construction risk management. It has helped to initiate the identification of potential risk factors (RF) for the interviews as well as the main categorisation (included in Appendix B). In general, it has helped in compiling the pilot questionnaire.

The review of the relevant studies led to an investigation of several areas, including global risk identification, assessment and management. This may encourage the Gulf region to develop a standard risk management model in the construction sector.

This chapter also discussed the project management concept and its use in the risk management process. Furthermore, this chapter identified the most significant risk factors and causes of delays and classified them in accordance with the global research into construction projects.

A list of 128 risk factors was determined firstly by the literature review. Secondly, by practitioners, who commented on the list after it had been done.

The following chapter presents the research methodology that was adopted to conduct the survey.

Chapter 3

METHODOLOGY

Chapter 3: Methodology

3.1. Introduction

Selecting an appropriate research methodology is crucial and depends on the research objectives and resource limitations, such as time and funds. To obtain valid and reliable data, it is imperative to select a methodology that serves the research objectives.
This chapter describes in detail the research design, strategy and sampling method, in addition to the data collection and analysis techniques.

3.2. The research aim

Reviewing the relevant literature helps in beginning the investigation and ensuring it meets the research objectives and aim (Denscombe, 2004). The overall aim of the research *to identify and assess risk factors during the construction phase of construction projects in the Gulf region focusing on two countries of the Gulf region – the State of Kuwait and Kingdom of Bahrain.*

3.3. Research design

To achieve the research aim and objectives the study has been divided into three stages. The first stage was to present an overview of the gulf countries (GCC) focusing on the Kuwaiti and Bahraini construction sectors in order to enhance the reader's knowledge, followed by a comprehensive review of the related literature on the history of project risk management concept. The second stage reviewed the relevant studies of and research into risk identification and assessment, in addition to the causes of delay in construction projects in developed and developing countries. Furthermore, it identified the most significant potential risk factors that were encountered by each party in any construction project, i.e. clients, consultants and contractors. The third stage was the conducting of semi-structured interviews with professionals in order to evaluate and verify the risk factors (RF) to be measured; a questionnaire was then designed to serve the research aim.

A philosophical worldview assists in determining the research strategy and has an effect on the research practice; additionally, it needs to be recognised and is usually identified based on the researcher's preferences (Slife and Williams, 1995).

The pragmatic worldview is defined as '*a basic set of beliefs that guide action*' (Guba, 1990), as cited in (Creswell, 2009). It consists of four major types, namely: postpositivism, constructivism, advocacy and pragmatism (Creswell, 2009). Table 3.1 (below) presents a comparison between the four major types of philosophical worldviews.

Table 3.1 Types of worldview

Postpositivism	**Constructivism**
• Determination • Reduction • Empirical observation and measurements • Theory verification	• Understanding • Multiple participant meanings • Social and historical construction • Theory generation
Advocacy/ Participatory	**Pragmatism**
• Political • Empowerment issue-oriented • Collaborative • Change-oriented	• Consequences of actions • Problem-centred • Pluralistic • Real-world practice oriented

Source: (Creswell, 2009)

The pragmatic approach was adopted at the early stage of the research design and led to the selection of the mixed-methods strategy, in which the researcher focuses on the research problem and uses all the appropriate approaches to gain knowledge about it.

The characteristics of the pragmatic worldview provide the theoretical basis for the research, such as (Creswell, 2009):

- Lack of restrictions in choosing methods and procedures for the investigation to meet the research purpose
- Mixed-method approach (qualitative and quantitative method) for better understanding of the research problem
- Assist in applying multiple methods for data collection and analysis

According to Creswell (2009), the representative sample have been managing risk based on their best understanding developed over the years and, since the research focuses on the perceptions of the participants who are human beings influenced by social, historical, political and other contexts. Thus, the pragmatic worldview is the approperiate approach for such study because it allows the researcher to look at *what* risks are associated with construction projects in the Gulf region by applying several methods.

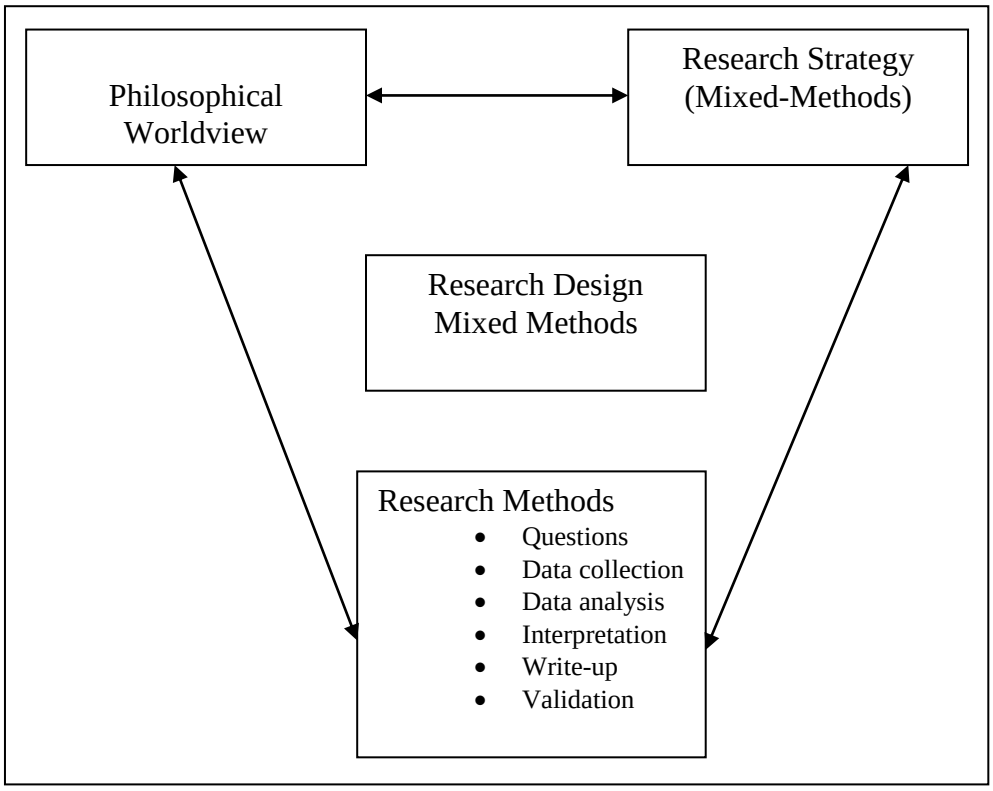


Figure 3.1 A Framework of research design stages interaction

Source: (Creswell, 2009)

Figure 3.1 (above) shows the interconnection between the philosophical worldview, research methodology and research methods adopted by the researcher. The outcome (research aim) was achieved by adopting the research design framework.

3.4. Research strategy

Methodology is essential in conducting surveys, and one of the purposes of the literature review is to identify the methodologies and techniques that were used in similar studies (Hart, 2003).
The process of selecting the research methodology is demonstrated as follows:

3.4.1. Mixed-methods strategy

The overall aim of this research is to *to identify and assess risk factors during the construction phase of construction projects in the Gulf region focusing on two countries of the Gulf region – the State of Kuwait and Kingdom of Bahrain* by identifying the risk factors (PR) and exploring the perception of participants towards the impact of these factors on project completion.

The mixed-method concept was introduced in the early 1990s when researchers started to mix and integrate two different methods, for example merging qualitative and quantitative data (Tashakkori and Teddlie, 1998). The mixed-method approach was chosen based on the discussion earlier (in Section 3.3) and it is the most appropriate strategy to achieve the research's aim and objectives for various reasons, including:

- The result of one method helps to launch the questions for the next method;
- Any bias in results from one method can be cancelled or neutralised by the other method;
- The resulting qualitative and quantitative data can be integrated into one large database;
- The data resulting from both methods can be used side by side to reinforce each other.

In this research the pragmatic worldview was adopted as mensioned in section 3.3, which helped in designing the research strategy as shown in figure 3.2 below.

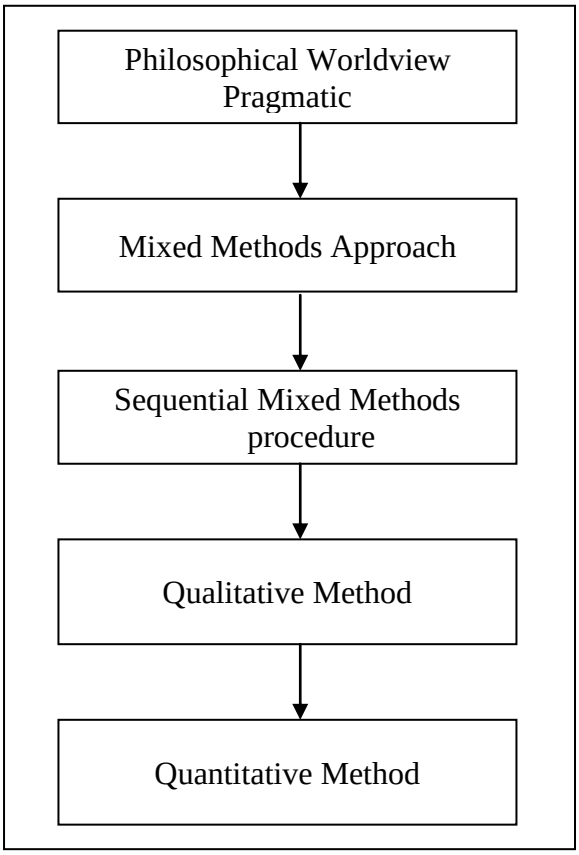


Figure 3.2 Components of the Research Design

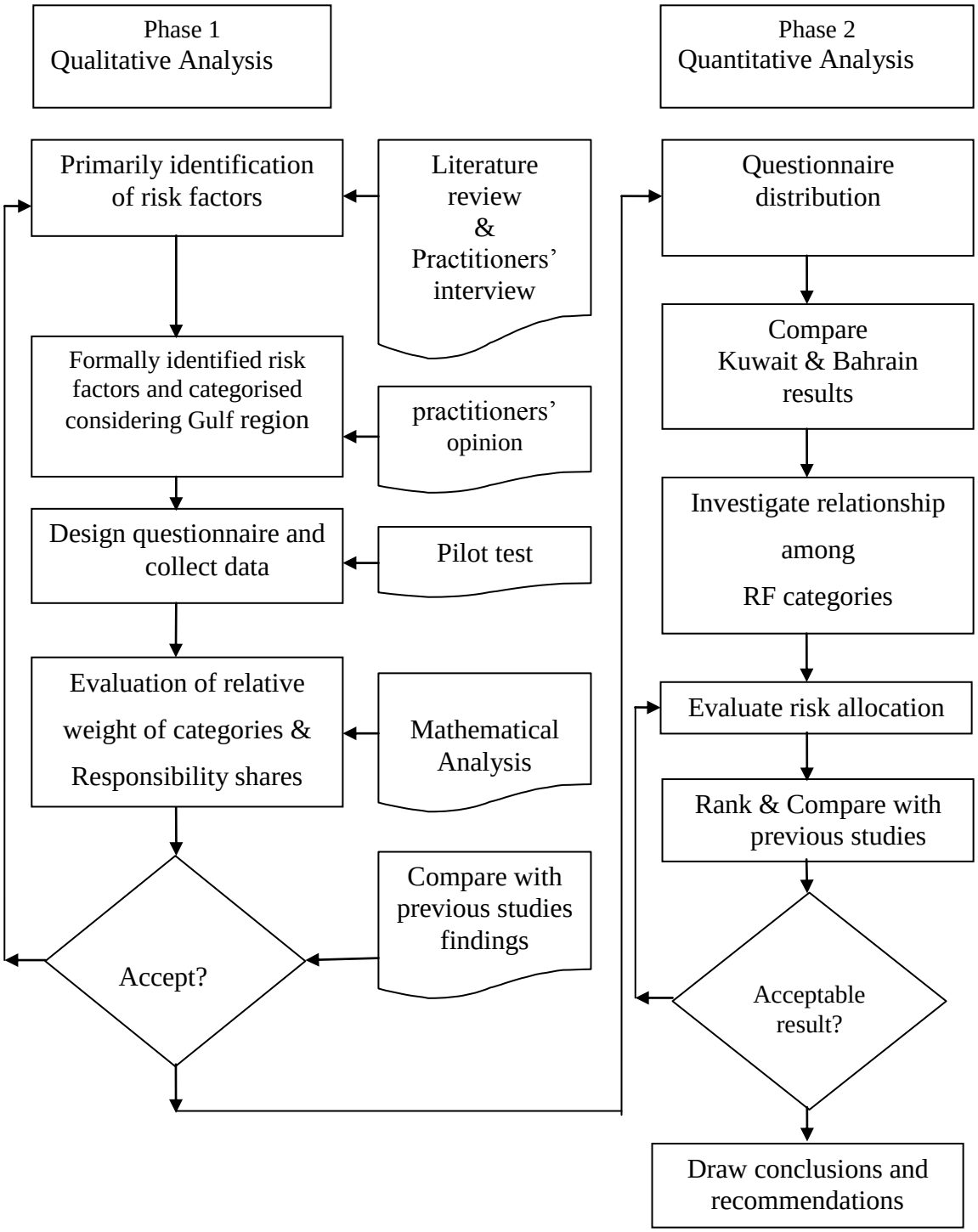
The qualitative data helped in creating the questions to be put to participants. Table 3.2 shows the mixed-methods approach overview provided by (Creswell, 2003).

Table 3.2 Selection of a research design - Source:(Creswell, 2003)

Mixed Methods Approach	
Philosophical assumption	• Pragmatic
Strategy	• Sequential
Methods	• Both open and close-ended questions • Emerging and predetermined approaches • Both quantitative and qualitative data and analysis
Practice of research	• Collects both qualitative and quantitative data • Develop a rational for mixing • Integrates the data at different stages of inquiry • Present visual pictures of the procedures in the study • Employs the practices of both qualitative and quantitative research

Two phases of mixed-method were deployed in the process of collecting data. The purpose of using mixed-method was to help in collecting different types of data to provide better understanding, and to specify the type of data that was collected (Creswell, 2009). Figure 3.3 on the next page shows how the strategy was applied step by step.

Figure 3.1 Research strategy



3.4.2. Sequential Mixed-methods

Qualitative approach (interviews):

Interviews are considered to be one of the qualitative techniques in data collection. There are three types of research interview: structured, semi-structured and unstructured. The degree of control used by the researcher to lead and direct the interview, and to dictate the length of the interviewees' answers, are what differentiates the three types. Several forms of interview can be applied, such as face-to-face, group interviews and focus groups (Denscombe, 2004).

Before conducting interviews, planning and preparing are essential. It helps if the interviewer has a clear list of issues to be addressed. For example, interviewers should prepare a framework of questions to be answered and choose specific people to be interviewed who are specialists and highly experienced in the field being studied.
There are advantages and disadvantages of using interviews, and these are detailed below (Denscombe, 2004, Creswell, 2009).

Advantages:

- Usually the response rate is high
- Interviewers can control the interview.
- Ideas and responses explained easily during the interview.
- Simple tools are required such as recorder, notes and interviewing skills.
- More in depth detailed information can be extracted from the interview.

Disadvantages:

- Data analysis is time consuming.
- No standard responses
- Researcher's skills might affect the interviewees' responses.
- slow down responses if the interviewees put off
- Interviewees may postpone or delay their responses because of the recording process.
- Interviewees may have a fear of revealing certain information if they feel their privacy is being invaded.
- The financial and time costs are relatively high depending on the geographic location of the interviewees.

Before starting the interviews, the following preparation steps were carried out:

- Semi-structured questions were designed
- Authorisation was obtained from the interviewees
- The tools for capturing data from the interviewees were prepared (notes, audio recorder).
- Interviewees informed of the time needed to complete the interview.

Section 3.5.2 presents the qualitative approach in more detail.

Quantitative approach (questionnaire):

Many studies and organisations have used questionnaires as a tool to assess and analyse risk data in this field, such as (El-Sayegh, 2008, Jannadi, 2008) and (Tang et al., 2007). There is no limit to the number of questions that can be included in a questionnaire – it depends on many aspects, such as the nature of the topic and the respondents' characters, in addition to the time needed to complete the questionnaire (Denscombe, 2004). There are two types of questions: open or closed. This questionnaire used a closed question structure because it provides the researcher with uniform information that is pre-coded, quantified and easy to compare and analyse. On the other hand, the downside of closed questions is that respondents do not have a chance to fully express their opinions when answering the questions.

Closed questions were used to structure multiple choice questions, and respondents were asked to choose one of the answers. There are advantages and disadvantages of using questionnaires (McNeil, 1990) and (Denscombe, 2004) and these are detailed below.

Advantages:

- Respondents' answers can be easily analysed and compared.
- The results presented as statistics, graphs and tables.
- Questions and answers are standardised.

Disadvantages:

- Respondents cannot fully express their opinions.
- It is difficult to know whether respondents understood the questions as intended.
- Respondents may interpret the questions differently.

The criteria for constructing a questionnaire are (Denscombe, 2004):

- Simple and clear words.
- No sensitive questions.
- No leading questions.
- Logical flow.
- Questions are not influenced by previous questions or answers.
- Questions are related to the topic.

Section 3.5.3 presents the quantitative approach in more detail.

3.5. Process of Data Collection

A survey can be define as the method, process or technique of collecting or obtaining data from people in a short time, and it could be a descriptive or exploratory survey, or a combination of the two (Fink and Kosecoff, 1985) and (McNeil, 1990).
there are various methods of data collection, and the selection of a method depends on the nature of the investigation, the availability and the type of data (Naoum, 2007). In order to gather the required information about construction risk factors in the Gulf region, a dynamic approach was needed. Two approaches to primary data collection were adopted: exploratory interviews followed by a questionnaire.

3.5.1. Literature based data

The investigation began by reviewing the relevant literature to collect the primary data and in order to determine the gaps in research related to the proposed topic, and to critically review the issues related to the study. The literature review stage also helped to identify the related factors, and their classification helped to determine the most appropriate techniques to be applied in order to achieve the research aim.

3.5.2. Exploratory Interviews (Qualitative approach)

3.5.2.1. Semi-structured interviews

The most appropriate way to collect data from the very beginning, without depending on questionnaires developed by other researchers, is to collect data using face-to-face interaction with the practitioners (Belson, 1981). Creswell (2009) stated that qualitative study helps in collecting data from face-to-face interaction with participants who have experienced the problems in the field or on site; it also assists in collecting data from multiple sources, such as interviews and documents, then reviewing all the data to make sense of it and organise it.

In designing the interview questions several aspects were taken in consideration, such as the exact information it was necessary to gather, and what type of questions – open or closed – would best serve the purpose of the interview (Belson, 1986). Furthermore, sending information to respondents ahead of time with an assurance of confidentiality was another way of improving the interview process (Bradburn and Sudman, 1981). The main purpose of asking questions in interviews is to extract information from specific people and transmit it to others (Sudman and Bradburn, 1989).

A semi-structured interview was designed and conducted face-to-face with interviewees who have a relationship with risk management in the construction sector in Kuwait and Bahrain. The essential reason for conducting semi-structured interviews was to identify the risk factors (RF) in the construction phase of construction projects in the Gulf region, specifically in Kuwait and Bahrain.

The process of selecting interviewees began with contacting the Kuwait Society of Engineers (KSE) and the Bahrain Society of Engineers (BSE) to seek their assistance in identifying relevant interviewees. A copy of the request letter is attached in Appendix (A-1) and (A-2).

With the assistance of Kuwait Society of Engineers (KSE) and the Bahrain Society of Engineers (BSE), five face-to-face interviews were conducted in Kuwait and six in Bahrain. The interviewees were: two professors of civil engineering from Kuwait University and the Arabian Gulf University who are both interested in construction management; two specialist engineers from the Ministry of Works in Kuwait and Bahrain;

two specialist engineers from the Ministry of Municipality; two consultants who are actively involved in designing and managing construction projects, one from each country; two contractors, one from Kuwait and one from Bahrain; and a senior legal advisor at the Economic Development Board (EDB) in Bahrain.

The interviews lasted up to an hour. interviews should last between sixty and ninety minutes, but sixty minutes is preferable because neither interviewer nor interviewee lose their concentration (Laforest, 2009).

For the detailed version of the questions, see appendix (B1 – B6). Interviews were carried out in Arabic. The translation was done word by word and no bias was introduced. For analysis strategy see section (3.5.2.3).

Following the exploratory interviews, figure 3.4 (below) illustrates the process of evaluating the risk factors in the research.

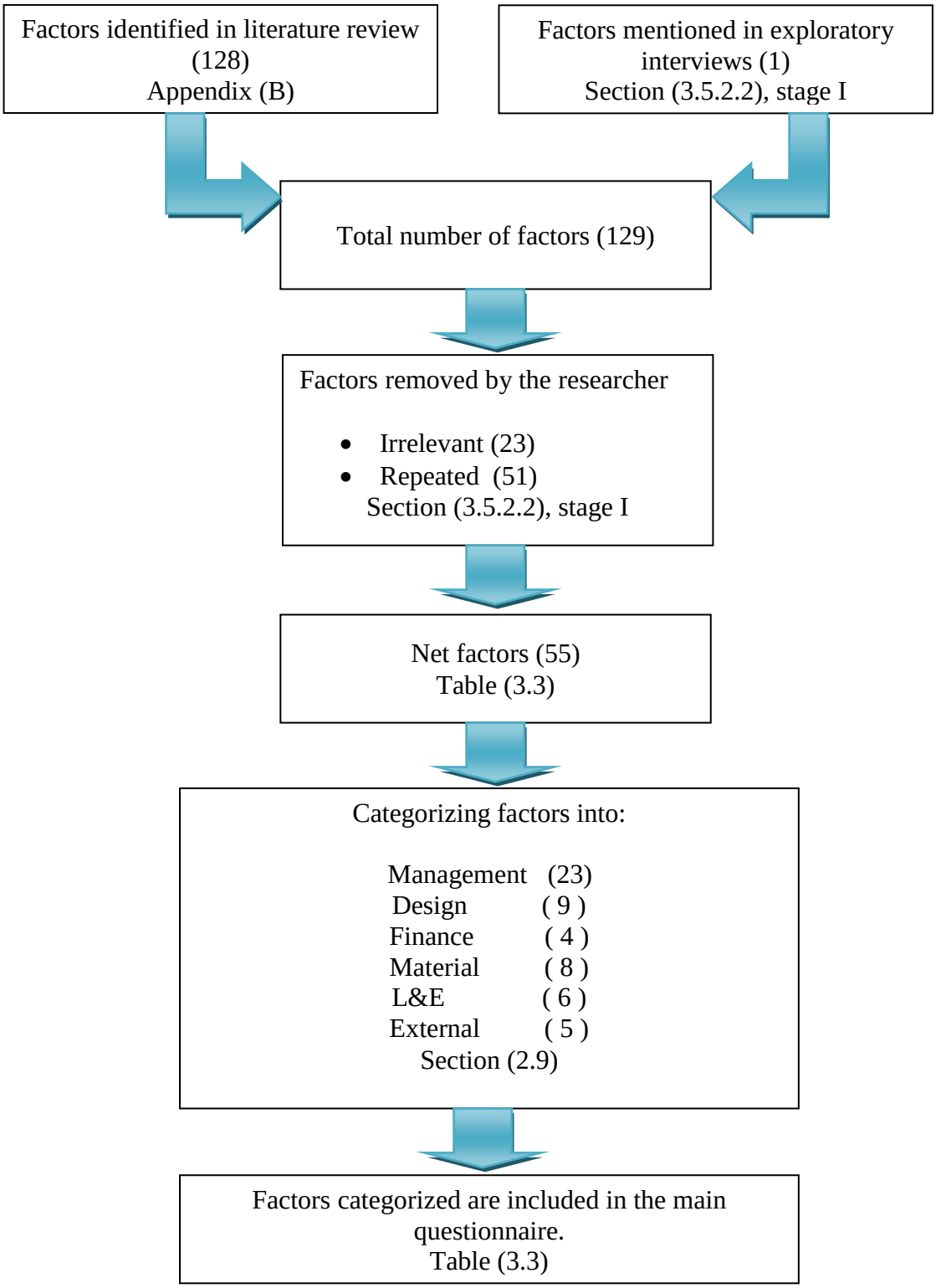


Figure 3.2 Process of risk factors (RF) evaluation

A 128 risk factors (RF) extracted from the literature review (Appendix B) and practitioners introduced one new risk factor, bringing the total to 129 risk factors. Practitioners execluded 74 risk and a final list of 55 risks factors were agreed to be measured. Detailed discriptions are presented in section (3.5.2.2).

3.5.2.2. The process of conducting the interview

The aim of the interview is to take a more in-depth look at the risk factors (RF) affecting construction projects during the construction phase, and to help in designing the questionnaire which will assess the negative impact of these factors on project completion. Furthermore, it will help in assigning a relative weigh to each risk factor (RF) category and allocating a share of responsibility to each party (clients, consultants and contractors). To meet the objectives of the interview, the process was divided into two stages as follows:

Stage I

Exploratory interviews were conducted with industry professionals (practitioners) to develop a robust questionnaire that would bring clarity to the research aim. Practitioners are people who have a greater degree of knowledge, experience and skills than the general population (Flanagan, 1993).

Semi-structured interviews (face-to-face and online via Skype) were conducted with a mix of consultants, contractors and certified project management specialists working in the Kuwait and Bahrain construction sectors, and with professors working in the civil engineering department at Kuwait University and the Arabian Gulf University (Section 3.5.2). Interviewees were selected using professional relationships and referrals from engineering societies (Yin, 2003) to assist in structuring and validating the appropriateness of the main study questionnaire.

In the first exploratory interview the researcher presented 128 risk factors (RF) extracted from the literature review (Appendix B). The practitioners introduced one new risk factor related to the finance category that was not previously included " Cash flow plan analysis" bringing the total to 129 risk factors (RF). Subsequently, seventy-four risk factors were excluded and the valid finalised list of fifty-five Risk Factors (RF) was divided into six categories and it was agreed that they would be used in the questionnaire, as shownin figure 3.4. Afterwards, the questionnaire was refined to take into account the valuable

insight and contribution of the practitioners, and seventy-four risk factors were excluded for the following reasons:

- Irrelevance: this research is limited to the investigation of the risk factors (RF) during the construction phase of the construction projects in private organisations not during different construction phase. Several risk factors (RF) were deemed to be related to different construction phase or related to public organisations and so were not within the scope of this study as the practitioners believed.

- Repetitiveness: several studies were conducted and similar factors were described in different words. Such repeated factors were eliminated.

To identify risks and to facilitate the selection of the most appropriate risk management strategy, it is recommended to categorise the projects' risks. Risks associated with a project can be classified as global or elemental risk. Elemental risks are those associated with elements of the projects, namely; implementation risks and operational risks. Implementation risks are those risks represented by physical, construction, design, technology and financial risks. However, operational risks refer to operation, maintenance and training risks (Smith, 2002).

The final fifty-five risk factors were classified into six categories based on their source: Management, Design, Finance, Materials, Labour and equipment, and External factors. Table 3.3 (below) shows the final fifty-five Risk Factors (RF) which were evaluated earlier.

Table 3.3 Risk Factors (RF) included in the questionnaire

Management-related factors	
1	Decision-making process
2	Communication and coordination between parties (clients, consultants and contractors)
3	Unclear responsibility
4	Availability of capable representatives
5	Postponement of work (held orders)
6	Issuance of instructions
7	Availability of project management team members (experience)
8	Information dissemination
9	Site mobilisation and delay in site handover
10	Contractors' experience
11	Availability of competent subcontractors and suppliers
12	Rework due to errors during construction
13	Availability of disputes and claims – comprehensive dispute resolution
14	Conflicts in subcontractors' schedules in execution of project
15	Delays in subcontractors' work
16	Unsatisfactory work of contractor
17	Delay in approving major changes in the scope of the work
18	Long wait for approval of tests and inspection
19	Quality assurance / control
20	Excessive use of contractors / subcontractors
21	Unreasonable risk allocation
22	Frequent change of subcontractors because of their inefficient work
23	Revising / approving design documents, shop drawings and sample materials

Design-related factors	
24	Design team experience
25	Complexity of project design
26	Confusing requirements
27	Design modifications
28	Data collection and survey before design
29	Complete documents and drawings of project
30	Producing design modification documents
31	Clarity of details in drawings
32	Excessive change order
Finance-related factors	
33	Payment for completed work
34	Financing project by contractor / client
35	Cash flow plan analysis
36	Cost estimation accuracy

Material-related factors	
37	Quality of materials (below standard)
38	Availability of construction materials in market
39	Change in material types and specifications during construction
40	Material delivery
41	Manufacturing special building materials
42	Material supplier problems
43	Material waste handling
44	Compliance of material to specifications
Labour- and equipment-related factors	
45	Labour performance / productivity
46	Equipment availability
47	Productivity and efficiency of equipment
48	Labour and management relations
49	Necessity of specific skills
50	Labour strikes and disputes
External-related factors	
51	Site's topography is changed after design
52	Civil disturbances
53	Problems with neighbours
54	Government permits
55	Changes in regulations

Stage II

After finalising the factors to be measured, a second visit was conducted to the same interviewees and they were asked to assign a relative weight to each category based on their negative impact on project completion, and to allocate a share of responsibility for each Risk Factors (RF) to the clients, consultants and contractors (CCCs) [Appendix C]. After detailed discussion, the finalised questionnaire was considered to be appropriate and relevant to the real life issues faced by the clients, consultants and contractors (CCCs) within the construction sector of the Gulf countries (GCC).

3.5.2.3. Data analysis of semi-structured interviews

Several techniques were applied to analyse the data from the semi-structured interviews. The first step was to write up the voice-recorded information and examine the notes taken during the interviews (transcribe), then categorise the information extracted from the

interviews by identifying the risk factors to be measured and classified based on their nature and source then checking the coding procedure (table 4.14) and transcripts.
To substantiate the end results a second visit was paid to the interviewees to check the outcome of the interviews and validate their perceptions; this was followed by triangulation (section 3.10.2) of the interviewees' results to be certain that the findings were corroborated.

3.5.3. Questionnaire survey (Quantitative approach)

(Kindrick, 2003) stated that the format of a risk assessment questionnaire should be reviewed to select only the risks relevant to the type of project, with simple responses offered. Thus, the number of risk factors was kept to a minimum and the questions were re-evaluated throughout the pilot test in order to maximise the usefulness of the survey, to design an effective questionnaire, and to ensure the reliability of the risk factors. The researcher focused on the Gulf region, and the questionnaire was designed to suit the local environment and bring out the key local issues faced by the clients, consultants and contractors (CCCs) during the construction phase.

The following stages describe the designing of the questionnaire:

Stage I

A comprehensive list of 128 risk factors (RF) was developed based on the reviewed literature, and these risks were grouped into six categories according to their sources and nature. A content validity test was conducted by asking practitioners with at least twenty-five years of experience in the construction industry in private and governmental agencies to review the questionnaire in order to identify weaknesses in the wording, structure and order of questions, the instructions and the layout. Practitioners were asked to:

- Evaluate the relevance of the contents and check the reliability of the language to get rid of non-relevant questions.

- Assign a relative weight to each category and a share of the responsibility to each party – clients, consultants, and contactors – for these Risk Factors (RF) (the practitioner's perception of which party is responsible for each risk).

At this stage, a final list of identified risks was formed for Stage II (Table 3.3)

Stage II

The approved questionnaire design consists of two sections. The first section gathers the respondent's personal details in case any follow-up is necessary, followed by the actual questionnaire, which measures the participant's perception of the impact of risk factors (RF) on project completion using a five-point Likert Scale.

The dual-language and English-only tests were found to be equivalent (Ong, 2013). The questionnaire was dual language, English and Arabic (Appendix D). The researcher was aware of the difficulties of conducting a dual language questionnaire, therefore a vairety of strategies were applied to overcome such problems. For example, testing the wording of questions in both languages to defeat any mistranslation.

3.5.4. Pilot Study

Sudman and Bradburn (1989), state that it is essential to include a pilot test in the design process of a questionnaire in order to note and correct any problems.
A pilot survey was conducted to test the validity of the content and the design of the survey (for example, ease of understanding and consistency), and to improve the questions and the format to be used in the final test (Creswell, 2003) and (Sudman and Bradburn, 1989). The questionnaire was sent to a sample group of ten which represent contractors, consultants, clients and Phd students within the Kuwait and Bahrain region. The selection mechanism of the participants was based on the societies of engineers recommendations in the State of Kuwait and Kingdom of Bahrain.
The pilot questionnaire was piloted to two engineers, two project managers, two contractors, two Phd students and two clients.
The participant were asked to pay attention to few issues such as:

- How long does it take to complete the questionnaire?
- Were the questions clear to them?
- Were there any sensitive questions?
- Were the instructions clear enough to them?
- Do they have any suggestion on the questionnaire presentation or specific issue?

The participants reported that the questionnaire is well defined and easy to be answered. On the other hand, the outcome of the pilot survey highlighted that some of the questions about risk factors were leading and some were too general. Six of the practitioners considered most of the questions about risk factors to be leading, and four said that most of the questions were too general and needed to be more specific. For example, question one, which was assigned to the Management category, was written as: 'Slowness in decision making process'. This was considered to be a leading question so it was rephrased to read: 'Decision making process'. Subsequently, all suggestions were taken on board and the questionnaire was revised and deployed. A copy of the final design is included in Appendix (D).

3.6. Research Population and Representative Sample

3.6.1. Population

Population is defined as '*units (people, employee or members) that have the chance to be included in the survey sample*' (Groves et al., 2009).

The population in this study included clients, consultant and contractors from the State of Kuwait and Kingdom of Bahrain. Clients are the key decision makers who are responsible for the projects, whether they are private organisations or individuals (Frimpong et al., 2003). Consultants include consulting engineering firms acting in a supervisory role on a project in a contract and Contractors' firms (Lo et al., 2006).

The population at this stage of the research included contractors listed under the Central Tenders Committee (CTC), consultants listed in the Kuwait Ministry of Municipality (KM), and their clients. However, the research population in Bahrain were consultants registered at the Committee for Organising Engineering Professional Practice (COEPP, 2010) and contractors firms listed under the Ministry of Works (MOW, 2011). Clients were nominated by consultants and contractors.

3.6.2. Representative Sample

The goal of sampling is to create a selection that is representative of the population it is drawn from. It is essential to provide a '*representative*' sample of the whole population in order to generalise the findings of the research.

The sample is drawn from the target population and is usually a small fraction (Groves et al., 2009). Kanji, as cited by (Baker, 1997), found that a sample size of 20 or more can

produce a reliable conclusion. Numerous formula types are presented to determine sample size. However, calculating the sample size with known population for this research was based on a formula presented by (Kish, 1965).

The minimum sample size (n) is calculated as follows:

$$n = \frac{\acute{n}}{\left(1+\frac{\acute{n}}{N}\right)}$$

Equation 3.1 Size sampling

Where;
n = Sample size for finite population

N = Total number of the population

n′ = Sample size

$$\grave{n} = \frac{S^2}{V^2}$$

$$S^2 = (P)\,(1-P)$$

Where:

P = the proportion of population elements belonging to the defined class (0.5 is the maximum possible proportion).

S = Maximum standard deviation in the population.

V = Acceptable margin of error

Three criteria needs to be specified before calculating the appropriate sample size; the confidence level (Z), the confidence error (V), and the degree of variability in the attributes being measured (P) (Israel, 2009).

Equation 3.1 was designed based on a confidence level of 95% and the researcher is willing to accept 5% of margin error (called sometimes of confidence interval) in the study, which means that the parameters that were used in the equation are confidence level of 95% and confidence interval of 5%.

For example, when the confidence level (95%) and confidence interval (5%) combined together, that means the researcher is 95% confident that the true percentage of population response will be between ±5% of the research result.

Parameters for calculating the minimum sample size

P (the probability of participation response): since P (1-P) takes its maximum value when P = 0.5. The value of 'P 'used in this research is 50%.

Margin of error (V): also called Confidence interval. In a randomly drawn sample the sample value has a certain probability of being in a certain range either side of the population value. Most researchers use the 5% confidence interval, (Brancato, 2006) and (Hossein, 2002). The margin of error tell us how far off the estimate is likely to be and how much confident in our estimate.

Sample size calculation:

By using equation 3.1, the Kuwaiti and Bahraini sample size are calculated as follows:

$$S^2 = (P)\ (1 - P)$$

$$S^2 = (0.5)\ (1\text{-}0.5) = 0.25$$

$$\acute{n} = \frac{0.25}{(0.05)^2} = 100$$

Kuwait sample size:

Kuwaiti contractors sample size

$$n = \frac{100}{1+\frac{100}{164}} = 62.1 \approx 62 \text{contractors}$$

Kuwaiti Consultants Sample size

$$n = \frac{100}{1+\frac{100}{187}} = 65.35 \approx 65 \text{ Consultants}$$

Kuwaiti Clients Sample size:

$$n = \frac{100}{1+\frac{100}{186}} = 64.9 \approx 65 \text{ Clients}$$

Bahrain sample size:

Bahraini contractors sample size:

$$n = \frac{100}{1+\frac{100}{242}} = 70.7 \approx 71 \text{ Contractors}$$

Bahraini consultants sample size:

$$n = \frac{100}{1+\frac{100}{103}} = 50.7 \approx 51 \text{ Consultants.}$$

Bahraini clients sample size:

$$n = \frac{100}{1+\frac{100}{123}} = 55.5 \approx 56 \text{ Clients}$$

3.7. Questionnaire Distribution

The minimum sample size (*n*) needed was calculated by applying equation 3.1. However, many researchers commonly add ten per cent to the sample size to allow for people they are unable to contact, and thirty per cent for non-response (Israel, 2009).

Based on the calculations presented in section 3.6.2 the minimum representative samples of the Kuwait and Bahrain construction populations are shown table 3.4 and table 3.5 below.

After adding forty per cent of the population to the representative sample size, the total number of questionnaire to be sent out are represented by the targeted sample and shown in table 3.4 and table 3.5.

3.7.1. Kuwait Questionnaire Distribution

Table 3.4 (below) illustrates the breakdown of the population, representative sample and the targeted sample of Kuwait.

Table 3.4 Kuwait questionnaire distribution breakdowns

Kuwait Parties	Clients	Consultants	Contractors
Population	186	187	164
Representative sample size	65	65	62
Targeted sample	139	140	128

As mentioned earlier in section 3.6.1, the Kuwaiti consultants' population consists of firms that are registered under the Kuwait Ministry of Municipality (KM), the contractors' population is made up of the grade one and two firms which are listed under the Central Tenders Committee (CTC), and the client population is nominated by either the consultants or contractors who have been contacted.

In order to obtain the minimum responses necessary from each party, a simple calculation was applied to work out the number of questionnaires that should be distributed to the population; this is represented as the targeted sample, as explained in section 3.7.

In table 3.4, Kuwait questionnaire distribution breakdown indicates that a minimum of 65 responses is necessary, which means that approximately 35% of the clients' and consultants' population and 38% of the contractors' population must respond in order to be able to generalise the results of the study on the population as a whole.

3.7.2. Bahrain Questionnaire Distribution

Tabel 3.5 (below) shows the Bahraini questionnaire distribution breakdown of the construction parties' total population, representative sample and targeted sample.

Table 3.5 Bahrain questionnaire distribution breakdowns

Bahrain Parties	Clients	Consultants	Contractors
Population	123	103	242
Representative sample size	56	51	71
Targeted sample	78	71	99

As mentioned earlier in section 3.7, forty per cent was added to the minimum representative sample to calculate the number of questionnaires that should be distributed to each population.

As can be seen from table 3.5 (above), usable replies from fifty-six (46%) clients, fifty-one (50%) consultants – firms registered at the Committee for Organising Engineering Professional Practice (COEPP, 2010) – and 71 (29%) contractors – listed under the Ministry of Works (MOW, 2011) – must be obtained in order to generalise the research findings.

3.8. General Response Rate Discussion

Response rates are widely used to judge the quality of a survey (Biemer and Lyberg, 2003). A response rate of 20% is considered too low, 80% is considered high, and in between is a grey area to most editors of academic journals; nevertheless, it is preferable for the researcher to consider the effect of non-respondents in the outcome or the results of the study (Johnson and Owens, 2003). As cited in (AAPOR, 2009), the response rate definition adopted in this research is defined by (Frankel, 1983) as cited in (CASRO 2010) and other sources (Groves, 1989; Hidiroglou, et al., 1993; Kviz, 1977; Lessler and Kalsbeek, 1992; Massey, 1995): '*the response rate is the number of complete interviews with reporting units divided by the number of eligible reporting units in the sample*'.

The survey was executed with the assistance of the Kuwait Society of Engineers (KSE) and Bahrain Society of Engineers (BSE). At this stage the distributed survey was paper-based and posted to the intended sample. Unfortunately there was a low response rate of 0% from Bahrain and 3% from Kuwait in the first round. In order to deal with the low response rate, an online questionnaire (Proquestionnaire.com) was developed and distributed. Hence a mixed-mode design was used to survey the sample – paper- and web-based questionnaires. The outcome of the online survey was more encouraging, with a response rate of 45.8% from the targeted sample of Kuwaiti consultants and 63.9% of the representative sample. However, due to the recent and ongoing civil disturbances in Bahrain the response rate remained at 0%.

In order to generalise the results of the survey to the whole population a response rate of 100% of the representative sample must be achieved. A field visit to the Kingdom of Bahrain was the final step to enhance the resonse rate.The response rate interpretation is presented in section 4.2.1.

3.9. Weaknesses in Data Collection

Although a pilot-test was deployed (section 3.5.4), a few concerns arose during the questionnaire distribution process. It is essential at this stage to report the significant observation that might help in developing future questionnaires.

Time is a crucial element in carrying out surveys, and planning contingency strategies to deal with unforeseen events, such as an un-expected low response rate, will help.

3.10. Method of Data Analysis (Statistical Analysis)

3.10.1. Kolmogorov-Smirnov (K-S) normality test

The Kolmogorov-Smirnov (K-S) test is a non-parametric test for normality. The test can be used to compare either the frequency distribution of one group against a theoretical distribution, or the frequency distribution of two independent groups against each other (Frude, 1990). If the data is normally distributed the parametric procedures will be followed, and if it is not normally distributed a non-parametric test will be applied. However, it is preferable to use parametric tests in cases where the distribution of the collected data is close to normality. Data is normally distributed when the value of Sig > 0.05 (Pallant, 2005). As shown in Section 4.2.3 the final results indicate that the data is close to normal distribution. For this reason, parametric statistical procedures were deployed for this study.

3.10.2. Reliability and validity

According to McNeil (1990), reliability means that if anyone else were to use the same method or techniques to collect data at a different time under similar conditions, they would get the same results.

There are several ways to test reliability, such as test-retest, the internal consistency method (Cronbach's coefficient alpha), the split half method, and the parallel-form method (Oppenhein, 1992). In this research, Cronbach's coefficient alpha test was used to check the reliability of the collected data, in addition to applying other strategies, such as checking the coding procedure and transcripts to make sure they contained no mistakes.

However, validity refers to '*the problem of whether the data collected is a true picture of what is being studied*' (McNeil, 1990); in more specific definitions, qualitative validity means '*the researcher checks for the accuracy of the findings by employing certain procedures*', and quantitative validity refers to '*whether one can draw meaningful and useful inferences from scores on a particular* instrument' (Creswell, 2009).

Multiple strategies to check validity were presented by (Creswell, 2009), such as triangulation strategy between the participants' perspectives, a follow up interview to present the concluding description and perform a final check on the results of the interview, or contacting a participant to check the accuracy of the findings by reviewing and asking questions. Both strategies were applied in the study.

Content validity is frequently evaluated by the researcher (Ghosh and Jintanapakanont, 2004). The steps taken in designing the questionnaire helped in checking the content validity. For example, the risk factors included in the questionnaire were based on the literature review and checked by several practitioners during the review process, and a pilot test was carried out before the questionnaire was finalised.

3.10.3. Statistical analysis

After examining the accuracy of the data by checking the frequency and descriptive statistics using software (SPSS 12.0), the data was analysed using the following test.

3.10.4. Independent sample T-test

There are two types of T-tests; the independent-samples t-test and the paired-samples t-test. The independent-samples t-test is a procedure used to form a comparison between two independent variables (Frude, 1990) and the paired-samples t-test is used to compare the mean scores for the same group under two different circumstance (Pallant, 2005). The independent-samples t-test was applied in this study to compare the mean values of two groups (Kuwait and Bahrain) and to check whether the difference is statistically significant or not. Note that the difference is statistically significant from zero to 5% (Pallant, 2005).

3.10.5. ANOVA-test

The Analysis of Variance (ANOVA) test is a technique that can be used to compare more than two groups for statistical significance (Pallant, 2004) and (Aibinu and Odeyinka, 2006). Frude (1990), stated that the ANOVA test performs a comparison between dependent variables that fall into different groups; however, t-test analysis does the same but only for comparison of two independent variables. Pallant (2005), stated that the one-way ANOVA with post-hoc test are used to compare one independent variable with three or more groups .The ANOVA test was used in this study to assess the mean differences between clients, consultants and contractors by evaluating the level of variation between responses to perception of the risk factors (RF). The ANOVA test highlights where there is a significant difference in the mean scoress between two groups, however it does not show where these differences lie.

3.10.6. Post-HOC: Least significant Difference (LSD) Test

The Post-hoc Least Significant Difference (LSD) test is one of the Analysis of Variance (ANOVA) procedures and is usually used when additional investigation to check where the differences among the groups occurs (Pallant, 2005) as explained in the previous section . The rationale behind deploying the Post-hoc Least Significant Difference (LSD) test was to provide more in-depth information on where mean values are significantly different from each other and to determine where exactly the difference between the groups lies.

3.10.7. Pearson correlation coefficient (r) test

The collected data is normally distributed, randomly obtained and independent from each other. These sets of parameters led to the use of the Pearson correlation coefficient (r) test to assess if there is correlation between two factors or more, or not at all. The test results range usually fall between zero where no relationship between two variables and one which represent the perfect relationship (Pallant, 2005).

However, the actual scale is between -1 to +1. When r = +1 that implies a positive correlation which means there is a strong association between the variables. For example, when one variable increases, the other variable increases. On the other hand, if r = -1 or nearby that implies an inverse correlation, whci means when one variable increases the other variable decreases. The strength of the degree of association between variables is classified as (Pallant, 2004):

- r = 0.1 to r = 0.29 orr = - 0.1 to r = - 0.29 (Small).
- r = 0.3 to r = 0.49 orr = - 0.3 to r = - 0.49 (Medium).
- r = 0.5 to r = 1.00 orr = - 0.5 to r = - 1.00 (High))

3.10.8. Relative importance index

The final stage of the data analysis is to rank the risk factors (RF) according to their relative importance index (RII) based on their negative impact on project completion from the perspective of the respondents.

The relative importance index (RII) is calculated using the following equation (Ghosh and Jintanapakanont, 2004), (Azis, 2012)and (Braimah and Ndekugri, 2008) :

$$\text{Importance Index} = \sum (a\ x)*100/5$$

Equation 3.2 Importance index

Where:

$$X = n / N$$

Where:

a = constant representing the weighting given to each response

- 1 (no effect)
- 2 (medium effect)
- 3 (moderate effect)
- 4 (high effect)
- 5 (extensive effect)

n = frequency of responses

N = total number of responses

The weight average was calculated for each risk factor then divided by 5, which is the upper scale of the Likert-scale measurement.

3.11. Conclusion

The most appropriate approach for the research methodology was the sequential mixed-method (section 3.4), which started with exploratory interviews followed by questionnaire for data collection. The purpose of the exploratory interviews was to evaluate and validate the presented risk factors (RF) in addition to assigning a relative weight to each risk factor related category. Furthermore, practitioners were asked to assign a share of responsibility to each construction party – clients, consultants and contractors – for each risk factor.

A pilot study (section 3.5.4) was conducted to ensure the clarity and ease of use of the questionnaire and to validate it for field study. The response rate was relatively high because of the strategies that had been followed to elevate it, such as contacting the authorities, personal visits and a web-based questionnaire.

Furthermore, several techniques and statistical procedures were used to analyse the responses, such as the Kolmogorov-Smirnov (K-S) test, Cronbach's coefficient alpha, the independent sample t-test, Analysis of Variance (ANOVA), the post hoc Least Significant Difference (LSD) test and the Pearson correlation coefficient (r). The following chapters will present the research results.

Chapter 4

ANALYSIS AND FINDINGS

Chapter 4: Analysis and Findings

4.1. Introduction

The purpose of this chapter is to explain and analyse the collected data. Several methods and equations have been used, as mentioned earlier in Chapter 3:

- General statistical analysis (section 4.2)
- Reliability Test (Cranach's Coefficient Alpha) analysis (section 4.2.2)
- Kolmogorov-Smirnov (K-S) normality test (section 4.2.3)
- General Linear Model (Wilks' Lambda) Test (section 4.4.1)
- Independent sample t-test (section 4.4.2)
- One-way ANOVA (section 4.5.1)
- Post hoc Least Significant Difference Test (section 4.5.2)
- Pearson product-moment correlation coefficient (r) (section 4.5.4)
- Relative importance index (RII) (section 4.6).

(For explanation of each test, see chapter 3)

This chapter is divided into six stages: stage I – general statistical analysis for the collected data, which presents the breakdown of the questionnaire and response rate, in addition to the respondents' personal information. Stage II – analysis of practitioners' responses; which includes the risk factors (RF) categories assigned relative weight and responsibility shares. Stage III – analysis of respondents' general perceptions (comparison of responses between Kuwait and Bahrain) by applying the multivariate tests such as the independent sample t-test and the ANOVA-test. In both stage IV – Kuwaiti data analysis and stage V – Bahraini data analysis the One-way ANOVA test was used to compare the perceptions of the construction parties (Clients, consultants, and contractors) on the risk factors categories. Stage VI – further data analysis. This includes the ranking of the presented risk factors (RF) in each category along with the responsibility shares.

4.2. Stage I: General statistical analysis

4.2.1. Questionnaire distribution breakdown and response rates

The response rates achieved in both countries were relatively high as the researcher sought help from the Kuwait Society of Engineers (KSE) and Bahrain Society of Engineers (BSE) in addition to collecting data from individuals. Chapter 3, section 3.8 illustrates the full strategy used to enhance the response rate.

Kuwait statistical analysis

Table 4.1 (below) illustrates the construction industry population in Kuwait and the questionnaire distribution breakdown.

Table 4.1 Questionnaire distribution breakdown - Kuwait

Kuwait	Clients	Consultants	Contractors
Population	186	187	164
Targeted sample size	65	65	62
Questionnaires distributed	139	140	128
Usable responses	77	65	86
Response rate	55.4%	46%	67%

The client population in Kuwait was nominated by the consultants and contractors, as mentioned earlier. The total number of clients considered as a population in the study was 186, and the calculated minimum representative sample of client was 65; however, 139 clients were approached to participate in the study. The Kuwaiti population of consultants was 187 and the calculated representative sample was 65; 140 questionnaires were distributed and 65 usable responses were obtained. The population of contractors from grades I and II was 164; the calculated representative sample was 62 and 128 questionnaires were distributed.

The highest response rate of Kuwait participants was from the contractors (67%), followed by the clients (55.4%). The lowest response rate was from the consultants (46%). On average, the response rate of the Kuwait representative samples was 56.1%.

Bahrain statistical analysis

Table 4.2 (below) shows the questionnaire distribution breakdown for the construction industry population and the targeted sample in Bahrain.

Table 4.2 Questionnaire distribution breakdowns - Bahrain

Bahrain	Clients	Consultants	Contractors
Population	123	103	64
Targeted sample size	56	51	39
Questionnaires distributed	105	144	65
Usable responses	91	51	39
Response rate	87%	35%	60%

The client population nominated by the Bahraini consultants and contractors was 123, from which 56 responses needed to ensure as a representative sample. A hundred and five questionnaires were distributed and 91 usable responses were obtained. The population of consultants was 103, and the targeted sample size was 51. Of 144 questionnaires distributed, 51 usable responses were received. The population of Bahraini contractors was 64, and 39 responses were needed for a representative sample; 65 questionnaires were distributed.

The highest response rate of the Bahraini participants was from the clients (87%), followed by the contractors (60%). The lowest response rate was from the consultants (35%). The average response rate of the Bahraini representative sample was 60.7%.

It is noticeable that the response rates in both countries were quite high; this was due to the strategies discussed in section 3.8.

4.2.2. Reliability Test (Cranach's Coefficient Alpha)

As mentioned in section 3.10.2, several methods are available to test the reliability of data, but the coefficient of reliability (Cranach's Alpha) was used in this study.

Kuwait data reliability test

The coefficient of reliability (Cranach's Alpha) was used to test the consistency of the collected data. In 1994, Miles and Huberman recommended that at the level of 0.80 the data was considered reliable, as cited in (Creswell, 2009).

Table 4.3 : Coefficient of reliability- Kuwait

Reliability statistics	Contractors	Consultants	Clients
Cranach's Alpha	0.97	0.968	0.958
Cranach's Alpha (total)	***0.965***		

The test results, in table 4.3 (above), show that the coefficient of reliability is high in Kuwait – consultants 0.968, contractors 0.970 and clients 0.958 – which means that the data collected from Kuwait is consistent and reliable to use.

Bahrain data reliability test

Table 4.4 (below) shows the coefficient of reliability of the Bahraini representative samples; all values are above 85%.

Table 4.4 Coefficient of reliability- Bahrain

Reliability statistics	Contractors	Consultants	Clients
Cranach's Alpha	0.965	0.865	0.966
Cranach's Alpha (total)	***0.932***		

The average coefficient of reliability value for the Bahraini representative samples is 0.932, which means that the data collected from Bahrain is consistent and reliable to use.

In chapter 3, section 3.10.2 coefficient reliability is discussed in more detail. In general, both countries have a coefficient reliability value above 85%.

4.2.3. Kolmogorov-Smirnov (K-S) normality test

Two tests (Kolmogorov-Smirnov and Shapiro-Wilk) were applied to check the normality of distribution, and both results show that the data is normally distributed.

As mentioned in section 3.10.1 data is normally distributed at sig. > 0.05 or close to 0.05. Table 4.5 (below) illustrates the result of the Kolmogorov-Smirnov test.

Table-4.5: K-S normality test

	Kolmogorov-Smirnov			**Shapiro-Wilk**			**Skewness**
	Statistic	df	Sig.	Statistic	df	Sig.	Descriptive
RF	.045	409	***.043***	.994	409	***.098***	.004

*RF: risk factor

It is appear from this table that the value of Sig. is either close to normality (sig. = 0.043) or it is normally distributed (sig. = 0.098). Furthermore, in normal distribution the value of Skewness is approximate to zero.

Figure 4.1 (below) shows the histogram of normally distributed data.

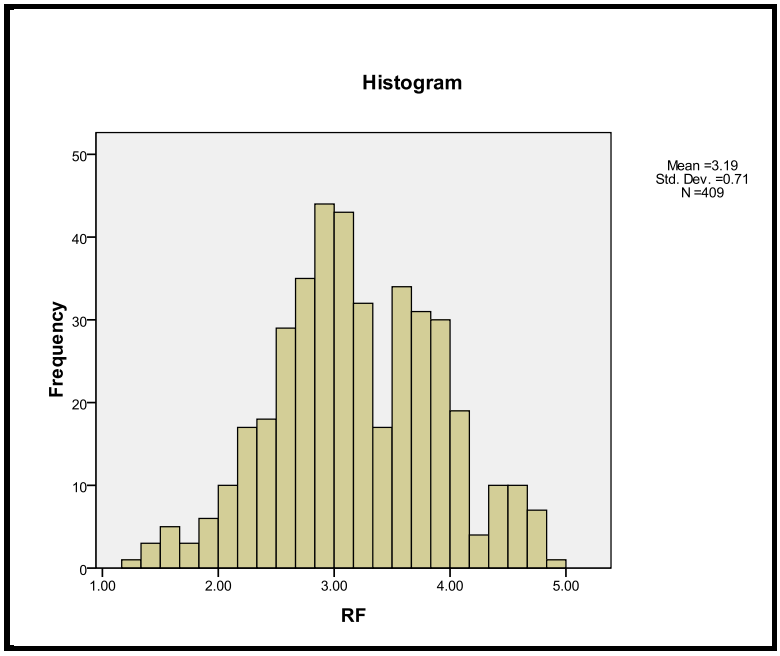


Figure 4.1 Normality of the 55 risk factors
*RF: risk factors

The histogram in figure 4.1 indicates that the data is almost normally distributed, and based on these results parametric tools were used to analyse the collected data.

4.2.4. Respondents' personal information

After ensuring that the obtained responses are reliable and normally distributed, the data is ready to be processed.

The first section of the questionnaire asked for the participants' details, such as the participants' name and contact information in case it was necessary to get in touch with them in future. This was followed by questions about the respondents' professional experience, and was divided based on the Civil Service Commission (CSC) regulation of the engineering profession: consultant engineer (17 years' experience and above), specialist engineer (9-17 years' experience), engineer (3-8 years' experience), and trainee engineer (0-2 years' experience) (CSC, 2001).

Table 4.6 shows the breakdown of participants based on their years of experience.

Table 4.6 Participants years of experiences

State of Kuwait		
Years of work experience	**valid returns**	**Percentage of valid returns**
17 +	33	21.8%
9-16	42	27.8%
3-8	61	40.4%
0-2	15	10.0%
Total	151	100%
Kingdom of Bahrain		
17 +	47	52.2%
9-16	27	30%
3-8	9	10%
0-2	7	7.8%
Total	90	100%

The Kuwaiti results show that, of a total of 151 engineers, 61 had work experience of three to eight years, and at 40.4% made up the largest proportion of the total responses; fifteen engineers with zero to two years' experiences made up the smallest proportion of the total, at 10%. Forty-two respondents had nine to sixteen years' experience, making up 27.8% of the total, and the remaining 21.8% was made up of thirty-three engineers with the most professional experience of seventeen years or more.

The Bahraini results show that engineers with experience of seventeen years or more made up the largest proportion of total responses at 52.2%. Twenty-seven respondents with nine to sixteen years' experiences made up 30% of the total, and nine participants with three to

eight years of work experiences accounted for 10%. The remaining 7.8% was made up of seven engineers with zero to two years' experience.

4.3. Stage II: Analysis of practitioners responses

Practitioners' perceptions were measured based on two questions [Appendix C]. The first question asked the Practitioners' to allocate the share of responsibility of each party in the construction process (client, consultant and contractor) for every risk factor included in the study. The second question was intended to investigate the relative weight impact of each risk category on the completion of construction projects. Section 4.3.1 and section 4.3.2 present the results obtained from the practitioners' responses.

4.3.1. Relative Weight

The relative weight given to each suggested category by the practitioners was based on their perceptions of the negative impact of each category during the execution phase of construction projects and its effect on delaying completion, if any. They also suggested a percentage share to show each party's responsibility for all the risk factors (RF) [Appendix C]. The average of practitioners responses in regards to category relative weight, and party's responsibility for risks was calculated and presented in figure 4.2 and 4.3

Figure 4.2 (below) shows the relative weight given to each category by the practitioners.

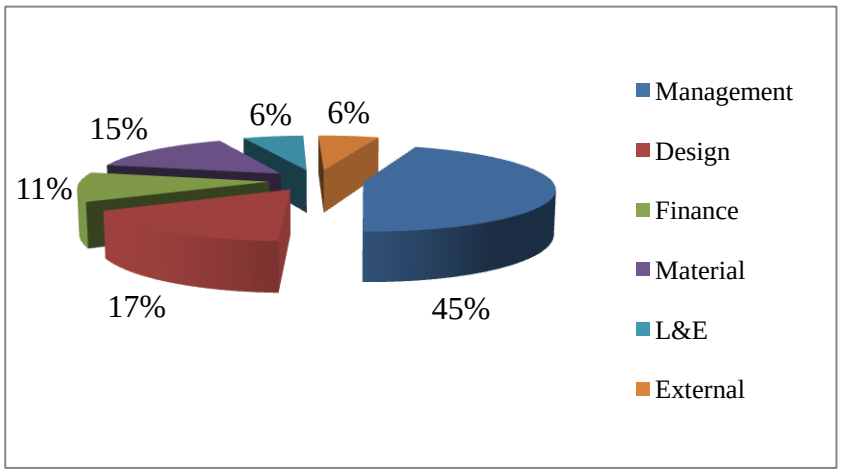


Figure 4.2 Practitioners perceptions on categories relative weight
L&E: Labour and equipment

The management category has the highest relative weight (45%) followed by design (17%). The material category has a relative weight of 15%, finance has 11%, labour and equipment and external factors each have a relative weight of 6% (Figure 4.2).

4.3.2. Responsibilities

The three main groups of participants in the construction industry who may share responsibility for the Risk Factors (RF) are clients, consultants, and contractors (CCCs). The average responsibility percentage allocated to each group by the practitioners' is shown in figure 4.3.

According to the practitioners approached by the researcher, the results show that clients are responsible for 7.4% of the risk factors (RF), consultants for 35.6%, while contractors are responsible for the highest proportion of the risk factors (RF) at 57.0%. The percentage shown in figure 4.3 shows the average percentage of responses of practitioners on responsibility shares assigned to each party (clients, consultants and contractors).

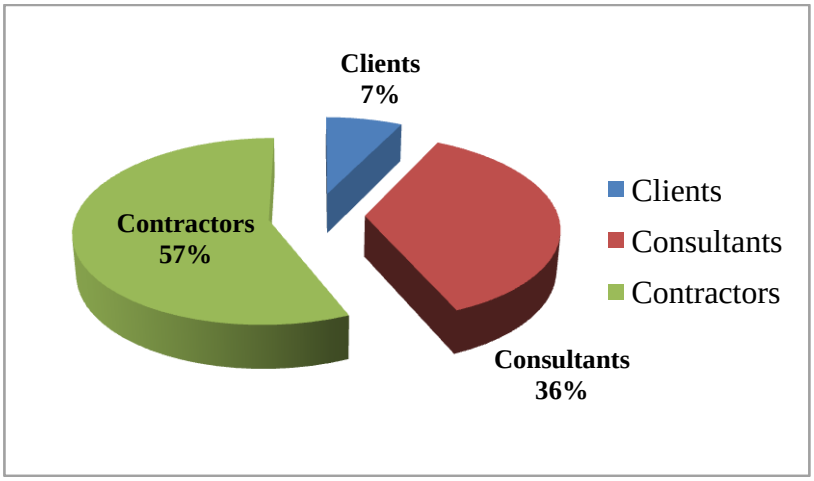


Figure 4.3 Practitioners' perceptions of the share of responsibility

By analysing the data collected from the practitioners about the relative share of responsibility of the construction parties, it was found that the highest level of responsibility for clients is related to factor number thirty-two – 'Excessive change orders' – in the design-related category. The highest level of responsibility for consultants and designers is related to factor number fifty-one – 'Site's topography is changed after design'

– within the external category. Contractors, however, have responsibility for many highly scored factors, including those related to the labour and equipment category, such as factor number forty-two – 'Materials' suppliers problems' – factor number forty-eight – 'Labour and management relations' – factor number fifty – 'Labour strikes and disputes' – factor number forty-six and forty-seven "Equipment availability" and " Productivity and efficiency of equipment". In addition, contractors are perceived as having responsibility for factor number fifty-two – 'Civil disturbances' – in the external category.

4.4. Stage III: Analysis of respondents general perceptions

The first set of analysis was to compare responses from Kuwait and Bahrain on the negative impact of Risk Factors (RF) on construction projects completion.

Participants were provided with six categories of Risk Factors (RF) and asked to evaluate the degree of negative impact on projects based on their experiences [Appendix D]. The categories were discussed in more depth in (section 2.9).

4.4.1. General linear model – multivariate tests (RF comparison)

General linear model multivariate tests were applied to compare two independent data groups – the perception of the risk factors (RF) of the Kuwaiti and Bahraini representative samples. In this case, Kuwait and Bahrain were considered two independent variables.

Wilks' Lambda is a statistical test used to check whether there are differences between the averages of identified groups, on a combination of dependent variables. The dependent variables in this case are clients, consultants and contractors. There are alternative statistics such as Pillai's Trace, Hotelling's Trace and Roy's Largest Root, where they do similar check, however Wilks' Lambda is widely used for such test (Crighton, 2000).

Table 4.7 Multivariate Tests

Independent Variables	Value	Sig.
COUNTRY	Pillai's Trace	0.00
	Wilks' Lambda	***0.00***
	Hotelling's Trace	0.00
	Roy's Largest Root	0.00

Table 4.7, shows that the Wilks' Lambda test value = 0.000, which means that there is a significant difference in general perception for each country towards the negative impact of risk factors (RF).

Table 4.8 (below) shows the test results of the differences in perceptions for both countries for each category.

Table 4.8 Kuwait and Bahrain Perception of Categories

Independent Variables	Dependent Variable	Sig.
COUNTRY	Management	.000
	Design	.000
	Finance	.000
	Material	.000
	Labour and equipments	.000
	External	.000

As table 4.8 shows, there are significant differences in perceptions between the two countries on all the categories, as P-value zero (sig. = 0.000 <0.05).

4.4.2. Independent sample t-test (categories' comparison)

The independent sample t-test was used to compare two independent variables and to examine the differences in perception of Risk Factors (RF) categories between the two countries (Kuwait and Bahrain). In this case, Kuwait and Bahrain were considered independent variables, and the six categories (management, design, finance, material, labour and equipment, and external) were considered dependent variables.

Table 4.9 details the mean scores for each category from each country's perspective, in addition to the standard deviation. Detailed results are presented in [Appendix E-1]. Obviously, there are noticeable differences between mean scores, but it does not show whether it is statistically significant or not.

Table 4.9 Kuwait and Bahrain Statistics

Categories	Country	N	Mean	Std. Deviation
Management	KWT	228	***2.95***	0.63
	BHR	181	***3.46***	0.64
Design	KWT	228	***3.07***	0.80
	BHR	181	***3.39***	0.71
Finance	KWT	228	***3.08***	0.82
	BHR	181	***3.61***	0.85
Material	KWT	228	***2.97***	0.83
	BHR	181	***3.45***	0.76
Labour & Equipments	KWT	228	***2.89***	0.85
	BHR	181	***3.52***	0.77
External	KWT	228	***2.85***	0.86
	BHR	181	***3.33***	0.86

As mentioned in table 4.9, there are differences between Kuwait and Bahrain (independent variables) in all risk categories. However, to determine whether the differences are significant or not, an independent sample t-test was applied.

Table 4.9, presents the result of the t-test; detailed results are presented in Appendix E-2.

Table 4.10 Independent Samples t-Test between Kuwait and Bahrain

Categories and assumptions		Levene's Test for Equality of Variances	t-test for Equality of Means		
		Sig.	Sig. (2-tailed)	95% Confidence Interval of the Difference	
				Lower	Upper
Management	Equal variances assumed	0.40	0.00	0.63	0.38
	Equal variances not assumed	-	-	0.63	0.38
Design	Equal variances assumed	0.13	0.00	0.46	0.16
	Equal variances not assumed	-	-	0.46	0.17
Finance	Equal variances assumed	0.50	0.00	0.68	0.35
	Equal variances not assumed	-	-	0.68	0.35
Material	Equal variances assumed	0.19	-	0.64	0.33
	Equal variances not assumed	-	0.00	0.64	0.33
L&E	Equal variances assumed	0.39	-	0.78	0.47
	Equal variances not assumed	-	0.00	0.78	0.47
External	Equal variances assumed	0.73	-	0.65	0.31
	Equal variances not assumed	-	-	0.65	0.31

From table (4.10), the significant value on the column titled ‘sig’ is greater than 0.05 (Sig > 0.05) There is no difference in the Standard Deviation therefore this can confirm that the sample is withdrawn from the same population and can also be seen in table 4.9.

The significant level is represented by the [Sig (2-tailed)] column. As can be seen from table 4.10, that Sig (2-tailed) < 0.05, which implies that the difference between the Average values of the two groups (Kuwait and Bahrain) are statistically significant.

The Mean differences in the representative sample indicates that there is true differences in the actual population. For example, by checking the Confidence interval column, the

researcher is 95% confident that in a population from which the sample was withdrawn, the main difference, in agreement with the statement of the negative impact of management-related risks category during construction phase, between Kuwait and Bahrain is between 0.63 and 0.38.

Figure 4.4 shows a comparison between responses from Kuwait and Bahrain on the impact on project completion for each category.

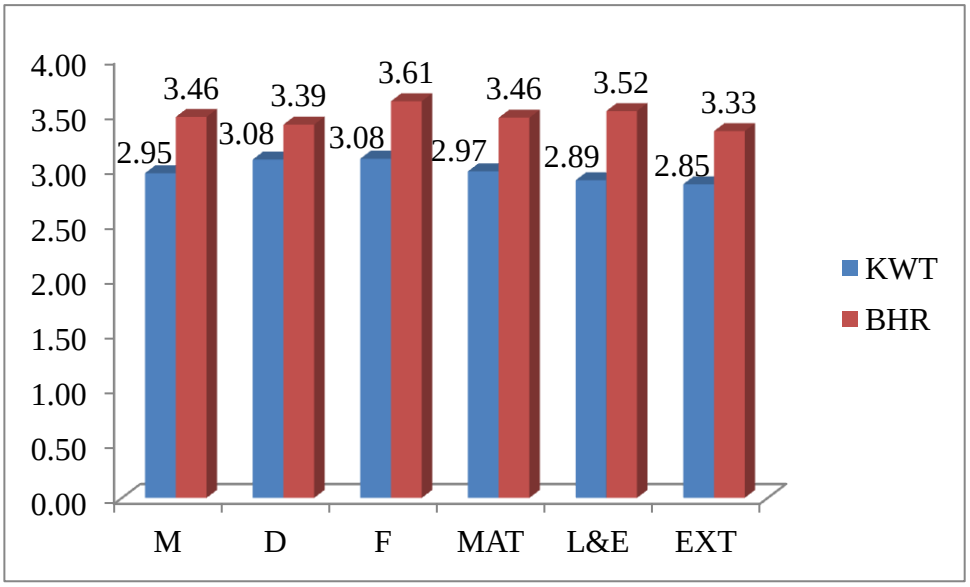


Figure 4.4 Kuwait and Bahrain mean score comparison

According to table 4.9, a high mean score indicates a high negative impact of the category on completion of projects. In this case, the results show that Bahrain perceives that these categories have a higher negative impact on their projects than Kuwait.

Summary

The results of the comparison tests between Kuwait and Bahrain show that there are significant differences in perception of the negative impact of the Risk Factors (RF) and their categories on construction projects completion. Because of these differences, the analysis of the data from Kuwait and Bahrain was carried out separately.

4.5. Stage IV: Kuwait general response analysis

4.5.1. Comparison of categories (Kuwait)

As mentioned earlier in section 4.2.2, the Kuwait sample data has a reliability value of 0.965 and so is ready to be processed. A one-way ANOVA test was applied to compare the perceptions of the Kuwaiti representative sample (clients, consultants, contractors) of the negative impact of the category-related RF on the success of construction projects in Kuwait. Figure 4.5 (below), illustrates the one-way ANOVA test results from [Appendix F-1].

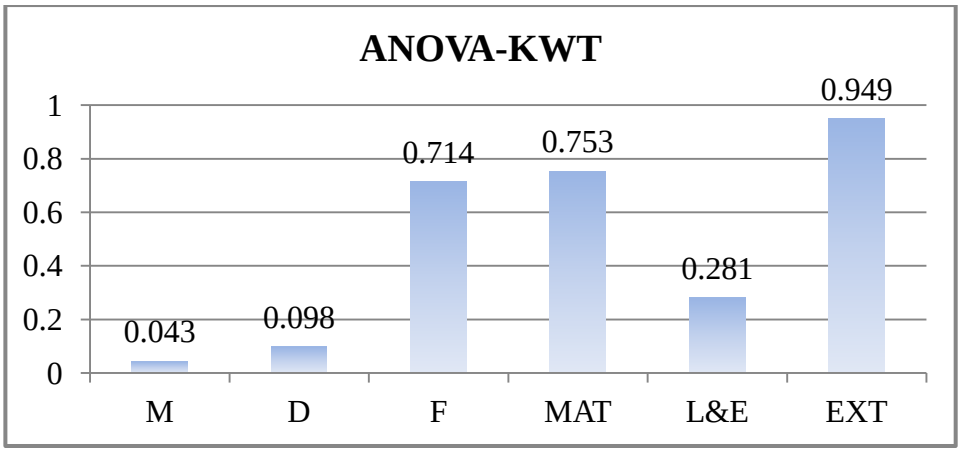
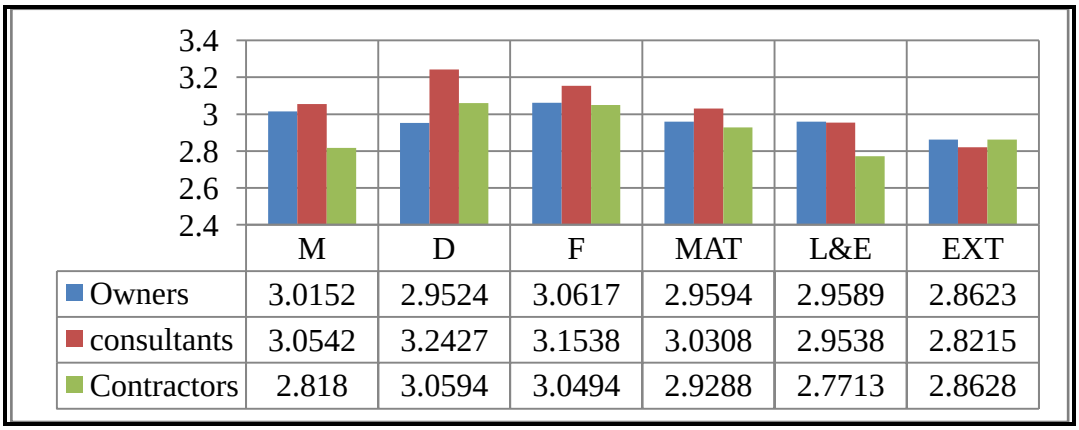


Figure 4.5 Categories negative impact comparison (Kuwait)

Figure 4.5 shows that all P-values of the categories are above 0.05, except for the P-value of the management category ($P = 0.043 < 0.05$). Because of the significant differences in perception between Kuwaiti construction groups (clients, consultants, and contractors) of the negative impact of the RF in the management category, and because we don't know between which groups the differences occurred, further testing was needed – the post hoc Least Significant Difference (LSD) test.

4.5.2. Construction industry parties comparison (Kuwait)

The descriptive analysis [Appendix F-2] is summarised in figure 4.6. Noticeably, there are differences between the parties' mean scores.



	M	D	F	MAT	L&E	EXT
Owners	3.0152	2.9524	3.0617	2.9594	2.9589	2.8623
consultants	3.0542	3.2427	3.1538	3.0308	2.9538	2.8215
Contractors	2.818	3.0594	3.0494	2.9288	2.7713	2.8628

Figure 4.6 Mean scores - Kuwait

To determine the significant degree of the mean differences between the clients, consultants and contractors on the RF categories, a post hoc Least Significant Difference (LSD) test was conducted.

In this test, each group is compared with the other groups (clients, consultants, contractors). The mean differences are flagged with a star, as shown in Appendix F-3, if the P-value in the sig. column is significant.

Table 4.11 illustrates the Least Significant Difference (LSD) scores between the Kuwaiti clients, consultants, and contractors to the Risk Factors (RF) categories.

Table 4.11 Multiple Comparisons (LSD)-Kuwait

Dependent Variable	Group 1	Group 2	Sig.
Management	Clients	Consultants	0.71
		Contractors	**0.04**
	Consultants	Clients	0.71
		Contractors	***0.02***
	Contractors	Clients	0.04
		Consultants	0.02
Design	Clients	***Consultants***	***0.03***
		Contractors	0.39
	Consultants	***Clients***	***0.03***
		Contractors	0.16
	Contractors	Clients	0.39
		Consultants	0.16
Finance	Clients	Consultants	0.50
		Contractors	0.92
	Consultants	Clients	0.50
		Contractors	0.44
	Contractors	Clients	0.92
		Consultants	0.44
Material	Clients	Consultants	0.61
		Contractors	0.81
	Consultants	Clients	0.61
		Contractors	0.45
	Contractors	Clients	0.81
		Consultants	0.45
Labour and equipment	Clients	Consultants	0.97
		Contractors	0.16
	Consultants	Clients	0.97
		Contractors	0.19
	Contractors	Clients	0.16
		Consultants	0.19
External	Clients	Consultants	0.78
		Contractors	0.99
	Consultants	Clients	0.78
		Contractors	0.77
	Contractors	Clients	0.99
		Consultants	0.77

As shown in table 4.11, clients differ significantly from consultants (sig. = 0.04), as well as contractors and consultants (sig. = 0.02). Furthermore, there is a difference in perception between consultants and clients (sig. = 0.03). It should be noted that differences are significant at (sig. <0.05).

The test result shows that there is a strong agreement between clients and consultants, but there is disagreement between contractors and the others on the management category. On

the other hand, there is a significant disagreement between clients and consultants on the design category as the mean difference is less than 0.05.

4.5.3. Kuwaiti ranking of Categories

Figure 4.7 (below) shows the mean scores of the participants' responses to the negative impact of each category on project completion in Kuwait.

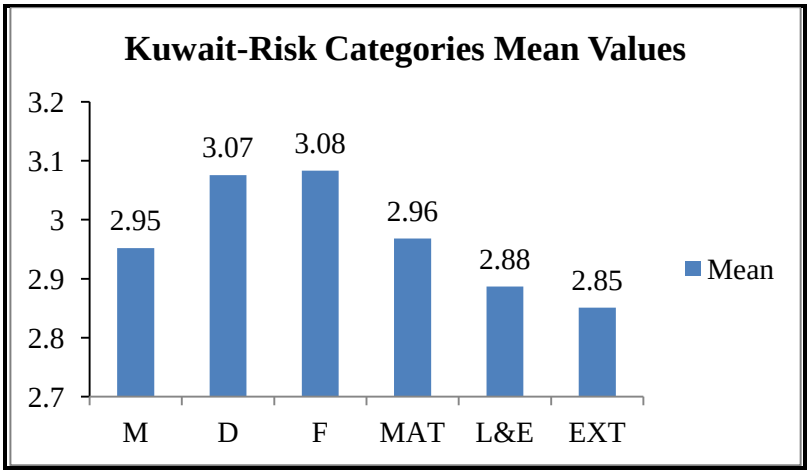


Figure 4.7 Kuwait risk factors (RF) categories mean values

As can be seen, Finance-related risk factors have the highest negative impact on project completion (3.08) and External- related risk factors have the lowest (2.85).

Table 4.12 (below) shows the ranking of Risk Factors categories by their negative impact on project completion. Ranking of categories was based on the mean (Alaghbari et al., 2007).

Table 4.12 Categories ranking based on mean scores- Kuwait

RF Categories	Mean	Rank
Finance	3.08	1
Design	3.07	2
Material	2.96	3
Management	2.95	4
Labour and Equipment	2.88	5
External	2.85	6

The risk factors categories were ranked based on their mean scores and arranged in descending order, as shown in table 4.12. A higher mean score implies the category has a higher negative impact on the completion of a project. Finance-related risk factors (RF)

ranked first in terms of their negative impact on projects with a mean score of 3.08, followed by Design-related RF with a mean score of 3.07. It is worth noting that there is only a very small difference in the mean scores of the RF ranked first and second.

Another method of ranking to check the accuracy of the sequence of categories is to calculate the Relative Importance Index (RII) for the presented RF using equation 3.2, as shown in section 3.10.8. Detailed results can be found in [Appendix G]. The ranking of categories based on the Relative Importance Index (RII) method is shown in table 4.13.

Table 4.13 Ranking of categories based on RII – Kuwait

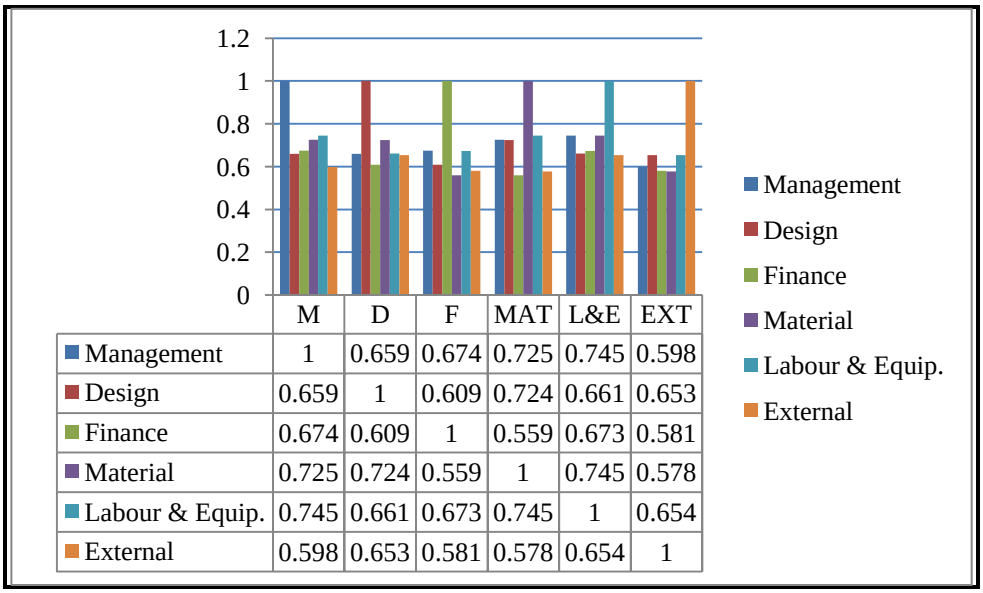
RF Categories	RII	Rank
Finance	61.6	1
Design	61.5	2
Material	59.3	3
Management	59.0	4
Labour and equipment	57.7	5
External	57.0	6

Comparing the ranking of categories based on mean scores and the Relative Importance Index (RII) values, as presented in table 4.12 and table 4.13, one can say that both methods are appropriate for ranking. Both methods ranked finance as the leading category in creating risks in construction projects, and the external category as having the least impact on a project's success from the point of view of Kuwaiti construction parties.

4.5.4. Kuwait Category correlations

The Pearson correlation coefficient (r) test was applied to carry out an in-depth investigation into the correlations between risk categories in the Kuwaiti construction environment.

Figure 4.8 (below) illustrates the correlation between categories. As mentioned in section (3.10.7) , the strength of the relationship between two categories is high if ($0.5 < r < 1.0$). Full details of the test can be seen in [Appendix G3].



	M	D	F	MAT	L&E	EXT
Management	1	0.659	0.674	0.725	0.745	0.598
Design	0.659	1	0.609	0.724	0.661	0.653
Finance	0.674	0.609	1	0.559	0.673	0.581
Material	0.725	0.724	0.559	1	0.745	0.578
Labour & Equip.	0.745	0.661	0.673	0.745	1	0.654
External	0.598	0.653	0.581	0.578	0.654	1

Figure 4.8 Kuwait- Person correlations values

Figure 4.8 indicates that the strongest correlation between all the categories is between management and labour and equipment, and between materials and labour and equipment. The weakest correlation is between finance and materials, but it is still considered strong as r = 0.559.

4.6. The Relative importance index (RII) of factors within categories - Kuwait

The fifty-five risk factors (RF) were coded with reference letters to simplify the presentation and reading of the results. The following category tables show the coding of the risk factors (RF).

Table 4.14 Risk factors (RF) with assigned reference letters

Management-related RF	Reference Letter
Q01 - Decision making process	M01
Q02 - Communication and coordination between parties (clients, consultants and contractors)	M02
Q03 - Unclear responsibility	M03
Q04 - Availability of capable representatives	M04
Q05 - Postponement of work (held orders)	M05
Q06 - Issuance of instructions	M06
Q07 - Availability of project management team members (experience)	M07
Q08 - Information dissemination	M08
Q09 - Site mobilisation and delay in site handover	M09
Q10 – Contractor's experience	M10
Q11 - Availability of competent subcontractors / suppliers	M11
Q12 - Rework due to errors during construction	M12
Q13 - Availability of disputes and claims – comprehensive dispute resolution	M13
Q14 - Conflicts in subcontractor's schedule in execution of project	M14
Q15 - Delays in subcontractor's work	M15
Q16 - Unsatisfactory work of contractor	M16
Q17 - Delay in approving major changes in the scope of the work	M17
Q18 - Long wait for approval of tests and inspection	M18
Q19 - Quality assurance / control	M19
Q20 - Excessive use of contractors / subcontractors	M20
Q21 - Unreasonable risk allocation	M21
Q22 - Frequent change of subcontractors because of their inefficient work	M22
Q23 – Revising / approving design documents, shop drawings and sample materials	M23
Design -related RF	
Q24 - Design team experience	D01
Q25 - Complexity of project design	D02
Q26 - Confusing requirements	D03
Q27 - Design modifications	D04
Q28 - Data collection and survey before design	D05
Q29 - Complete documents and drawings of projects	D06
Q30 - Producing design modification documents	D07
Q31 - Clarity of details in drawings	D08
Q32 - Excessive change order	D09

Finance-related RF	
Q33 - Payment for completed work	F01
Q34 - Financing project by contractor /client	F02
Q35 - Cash flow plan analysis	F03
Q36 - Cost estimation accuracy	F04
Material-related RF	
Q37 - Quality of materials (below standard)	MAT01
Q38 - Availability of construction materials in market	MAT02
Q39 - Change in material types and specifications during construction	MAT03
Q40 - Material delivery	MAT04
Q41 - Manufacturing of special building materials	MAT05
Q42 - Material supplier problems	MAT06
Q43 - Material waste handling	MAT07
Q44 - Compliance of material to specification.	MAT08

L&E-related RF	
Q45 - Labour performance / productivity	L&E01
Q46 - Equipment availability	L&E02
Q47 - Productivity and efficiency of equipment	L&E03
Q48 - Labour and management relations	L&E04
Q49 - Necessity of skills	L&E05
Q50 - Labour strikes and disputes	L&E06
External-related RF	
Q51 - Site's topography is changed after design	EXT01
Q52 - Civil disturbances	EXT02
Q53 - Problems with neighbours	EXT03
Q54 - Government permits	EXT04
Q55 - Changes in regulations	EXT05

4.6.1. Negative impact of Management-related risk factors

Question one of the questionnaire was intended to assess the negative impact of Management-related risk factors (RF) on project completion. Twenty-three risk factors (RF) were presented to evaluate respondents' points of view on the impact of these factors. The responses to the negative impact of these factors are demonstrated as a percentage in fogure 4.9 below.

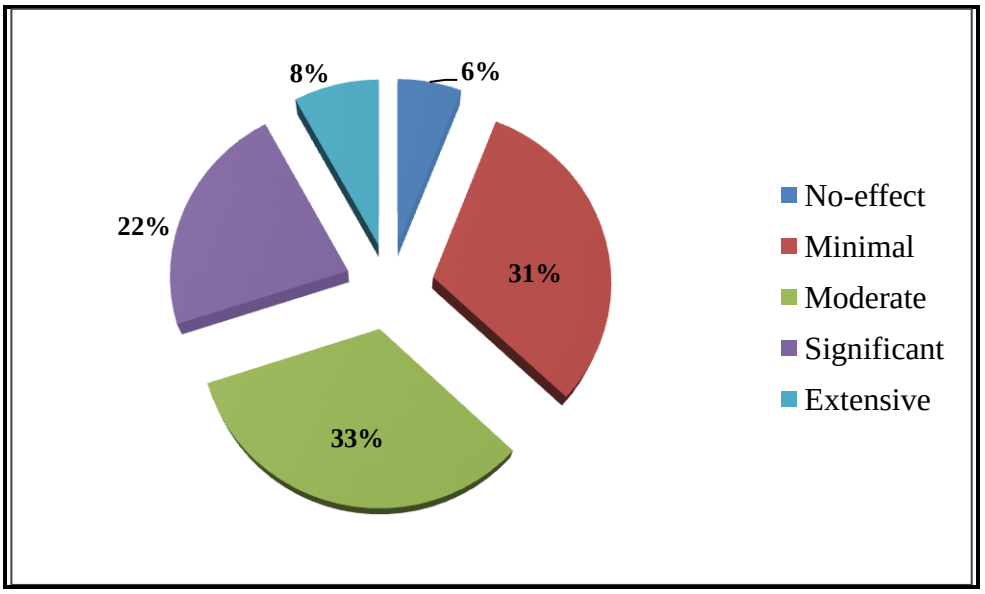


Figure 4.9 Responses to the impact of Management-related RF (%) – Kuwait

Figure 4.9 indicates that the majority of the survayed sample, 55% (335+22%), believe that the related risk factors to the management category have significant to extensive impact on projects completion. On the other hand, 14% (6%+8%) of the surveyed sample believe it has minimal to no effect negative impact. The remaining percentage of 33% considered the Management-related risk factors have a moderate impact on project completion.

Table 4.15 below shows the participants' overall responses to the impact of the Management-related risk factors (RF), the respective percentage of their responses, and their rankings based on the RII scores.

Table 4.15 Management-related RF ranking and responses percentage – Kuwait

Management RF	Rank	RII	Responses percentage				
			0%	25%	50%	75%	100%
M01	4	63.0	3	30	28	28	12
M02	5	62.3	3	33	28	24	13
M03	17	56.9	7	33	31	23	5
M04	21	54.3	9	37	32	15	6
M05	7	60.6	7	25	35	27	7
M06	10	59.9	3	34	33	23	8
M07	14	58.3	7	32	34	18	10
M08	18	56.9	10	28	35	22	5
M09	19	56.3	7	34	36	14	8
M10	3	63.1	5	20	42	21	12
M11	20	56.3	11	30	34	17	8
M12	15	57.7	3	36	35	21	5
M13	6	60.8	4	29	33	28	7
M14	11	59.0	4	32	35	22	7
M15	13	58.6	4	36	32	17	10
M16	8	60.4	6	28	33	25	9
M17	2	64.5	4	25	29	29	13
M18	9	60.4	4	29	35	28	5
M19	16	57.3	8	29	37	21	5
M20	23	51.9	16	34	30	14	6
M21	22	53.6	7	42	32	13	6
M22	12	58.8	7	32	31	18	11
M23	1	66.2	2	20	37	27	14

As demonstrated in table 4.15, the highest risk factor is M23 – 'Revising / approving design documents, shop drawings and sample materials' – with an RII score of 66.2, and the lowest factor is M20 – 'Excessive contractors / subcontractors' – with an RII score of 56.3.

The leading five management-related risk factors (RF) that have a negative impact on project completion in construction projects in Kuwait are:

1. Revising / approving design documents, shop drawings and sample materials.
2. Delay in approving major changes in the scope of the work.
3. Contractor's experience
4. Decision-making process
5. Communication and coordination between parties (clients, consultants and contractors)

4.6.2. Negative impact of Design-related risk factors

Question two of the questionnaire was intended to assess the negative impact of Design-related risk factors on project completion. Nine risk factors were presented to evaluate respondents' points of view on the impact of these factors.

Figure 4.10 (below) illustrates participants' responses to the negative impact of Design-related risk factors (RF) by percentage.

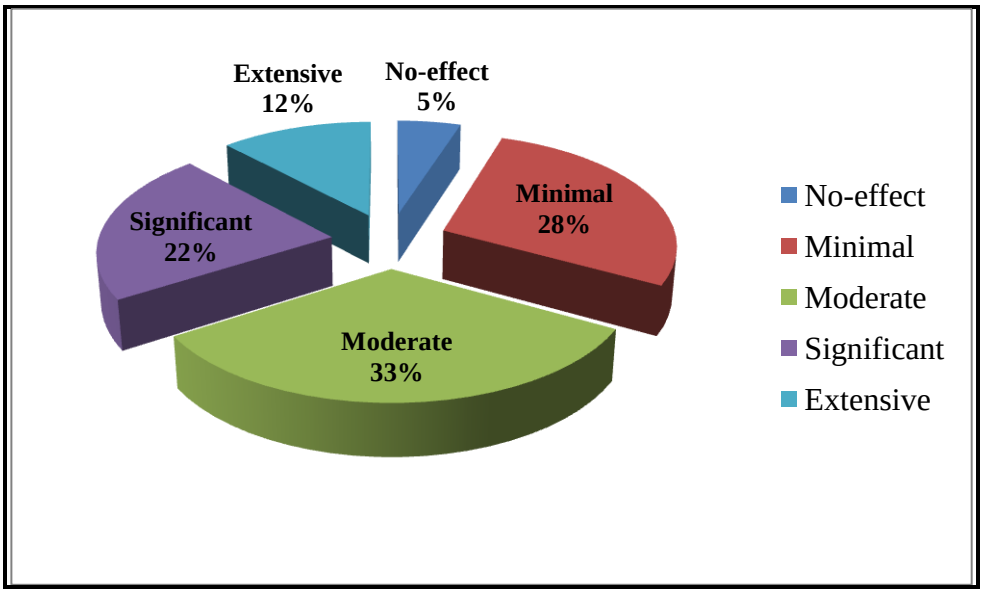


Figure 4.10 Responses to the impact of Design-related RF (%) – Kuwait

Figure 4.10 shows that 34% (12% + 22%) of the surveyed sample believe that design-related factors have a significant or extensive negative impact on project completion. On the other hand, 33% (28% + 5%) consider that the negative impact is minimal to none, and the remaining 33% believe that design-related RF have a moderate effect on project completion.

Table 4.16 presents the percentage of responses to the impact of design-related RF on project completion. Mean scores and RII values were used to rank the Risk Factors (RF).

Table 4.16 Design-related RF ranking and responses percentage-Kuwait

Design RF	Rank	RII	Responses percentage				
			0%	25%	50%	75%	100%
D01	4	62.3	7	23	33	25	12
D02	8	57.4	7	35	31	16	11
D03	9	57.3	7	34	31	21	7
D04	3	62.4	1	27	39	24	9
D05	1	65.6	3	23	33	25	16
D06	2	65.0	6	24	30	20	20
D07	7	60.4	6	30	33	18	13
D08	6	61.2	4	30	32	22	11
D09	5	61.6	5	29	32	23	12

Table 4.16 shows the ranking of the Design-related RF. The highest risk factor is D05 – 'Data collection and survey before design' – with an RII score of 65.6 and the lowest is D03 – 'Confusing requirements' – with an RII score of 57.3.

The leading Design-related risk factors (RF) that have a negative impact on project completion in construction projects in Kuwait are:

1. Data collection and survey before design.
2. Complete documents and drawings of projects.
3. Design modifications.
4. Design team experience.
5. Excessive change order.

4.6.3. Negative impact of Finance-related risk factors

Question three in the questionnaire dealt with finance-related RF and consisted of four risk factors that were presented to the participants in order to measure their responses.

Figure 4.11 (below) illustrates the participants' responses to the negative impact of finance-related RF by percentage.

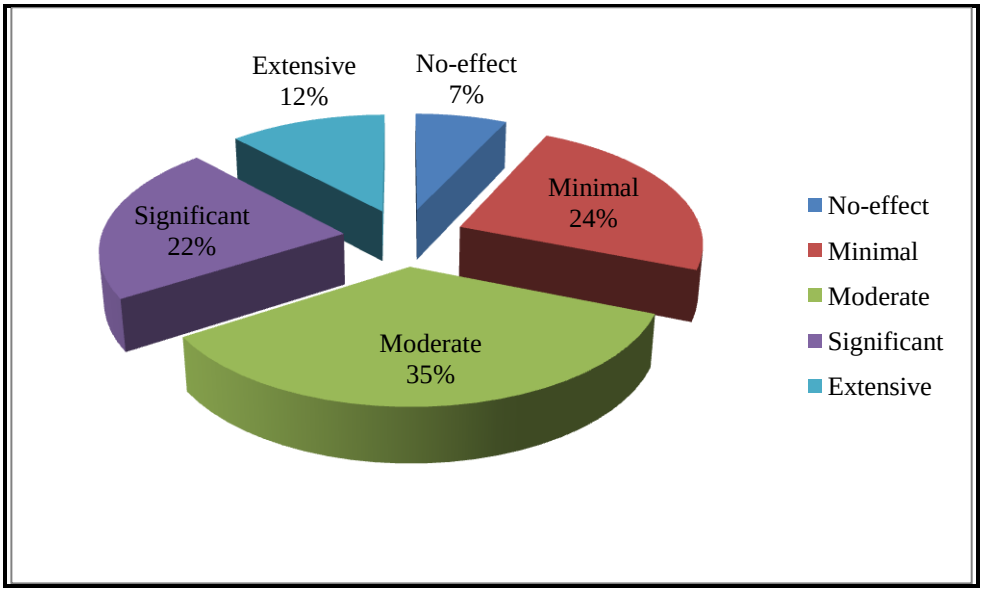


Figure 4.11 Responses to the impact of Finance-related RF (%) – Kuwait

Figure 4.11 indicates that that 34% (22% + 12%) of the surveyed sample believe that design-related factors have a significant or extensive impact on project completion. On the other hand, 31% (7% + 24%) consider that their impact is minimal to none, and the remaining 35% believe that design-related RF have a moderate impact on project completion.

Table 4.17 presents the percentage of responses to the impact of finance-related RF on project completion. Mean scores were used to rank the risk factors.

Table 4.17 Finance-related RF ranking and responses percentage – Kuwait

Finance RF	Rank	RII	Responses percentage				
			0%	25%	50%	75%	100%
F01	4	58.6	9	25	39	18	9
F02	2	62.4	7	26	30	22	15
F03	3	59.0	7	28	39	18	9
F04	1	66.5	4	19	32	30	15

As can be seen from the table above, F04 – 'Cost estimation accuracy' – has the highest impact with an RII score of 66.5, and F01 – 'Payment for completed work' – has the lowest impact on project completion with an RII score of 58.6.

The Finance-related risk factors (RF) were arranged in descending order, as follows:

1. Cost estimation accuracy.
2. Financing project by contractor/client.
3. Cash flow plan analysis.
4. Payment for completed work.

4.6.4. Negative impact of Material-related risk factors

Question four in the questionnaire examined the views of the representative sample on the negative impact of Material-related risk factors (RF). Figure 4.12 (below) illustrates the participants' responses by percentage.

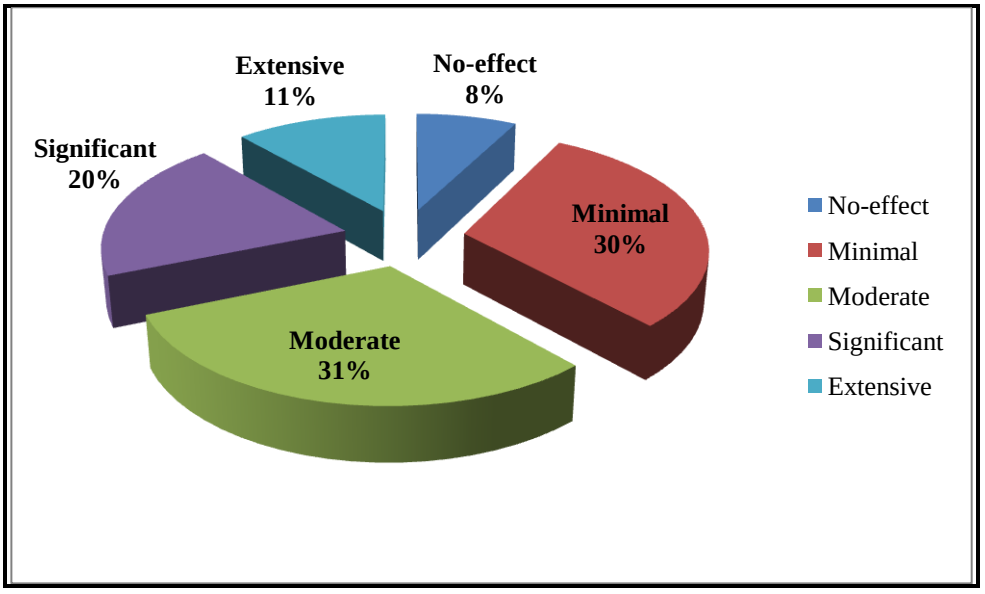


Figure 4.12 Responses to the impact of Material-related RF (%) – Kuwait

Figure 4.12 shows that 31% (20% + 11%) of the surveyed sample believe that material-related factors have a significant or extensive negative impact on project completion. On the other hand, 38% (30% + 8%) consider that the negative impact is minimal or none, and the remaining 31% believe that Material-related risk factors (RF) have a moderate effect on project completion.

Table 4.18 presents the the ranking of the material-related factors, RII scores and the responses percentage for each factor.

Table 4.18 Material-related RF ranking and responses percentage-Kuwait

Material RF	Rank	RII	Responses percentage				
			0%	25%	50%	75%	100%
MAT01	6	58.7	8	29	34	16	12
MAT02	2	62.5	6	31	25	22	16
MAT03	5	60.7	5	30	32	23	10
MAT04	1	65.0	4	25	31	24	17
MAT05	4	61.2	4	28	37	18	13
MAT06	3	61.4	3	30	33	24	10
MAT07	8	46.3	26	36	21	13	4
MAT08	6	58.7	5	36	32	17	11

The factor with the highest negative impact in the Material-related category is MAT04 – 'Material delivery' – with an RII score of 65.0, and the lowest is MAT07 – 'Material waste handling' – with an RII score of 46.3. The leading five Material-related risk factors (RF) are:

1. Material delivery.
2. Availability of construction materials in market.
3. Material supplier problems.
4. Manufacturing special building materials.
5. Change in material types and specifications during construction.

4.6.5. Negative impact of Labour and equipment-related risk factors

Question five of the questionnaire dealt with labour and equipment-related (L&E) RF. This category contains six risk factors. Figure 4.13 (below) illustrates the responses to the negative impact of labour and equipment-related (L&E) to project completion as a percentage.

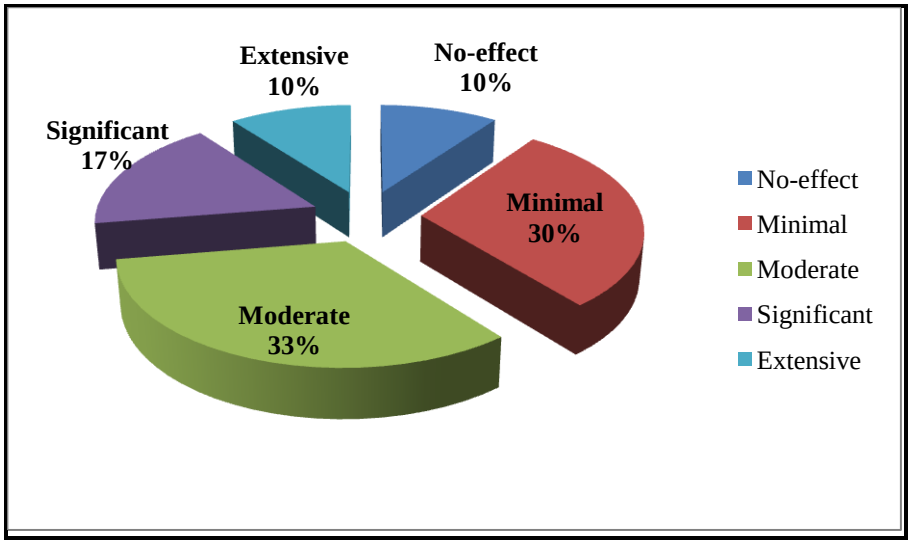


Figure 4.13 Responses to the impact of L&E-related RF (%) – Kuwait

It can be seen from the data in figure 4.13 that 27% (10% + 17%) of the surveyed sample believe that L&E-related risk factors have an extensive or significant negative impact on project completion. On the other hand, 40% (30% + 10%) of the respondents consider that their effect is minimal to none, and the remaining 33% believe that L&E-related RF have a moderate negative impact on the completion of projects.

Table 4.19 (below) illustrates the rank of L&E-related factors, RII scores and responses percentage for each factor.

Table 4.19 L&E-related RF ranking and responses percentage – Kuwait

L&E RF	RANK	RII	Responses percentage				
			0%	25%	50%	75%	100%
L&E01	2	59.1	9	25	38	19	9
L&E02	3	58.6	8	30	34	17	11
L&E03	4	58.2	7	31	35	17	10
L&E04	5	56.4	9	34	30	19	8
L&E05	1	59.3	6	29	37	20	8
L&E06	6	54.6	21	28	25	11	15

Table 4.19 reveals that that the leading negative factor in the L&E category is L&E05 – 'Necessity of skills' – with an RII score of 59.3, and the factor with the lowest negative impact on the completion of projects is L&E06 – 'Labour strikes and disputes' – with an RII score of 54.6.

According to table 4.19, the leading Labour and equipment (L&E) - related risk factors (RF) are:

1. Necessity of skills.
2. Labour performance / productivity.
3. Equipment availability.
4. Productivity and efficiency of equipment.
5. Labour and management relations.

4.6.6. Negative impact of External-related risk factors

Question six in the questionnaire was intended to measure the negative impact of External – related risk factors (RF) on project completion from the participants' point of view. Figure 4.14 (below) shows the responses to external RF impact on projects as a percentage.

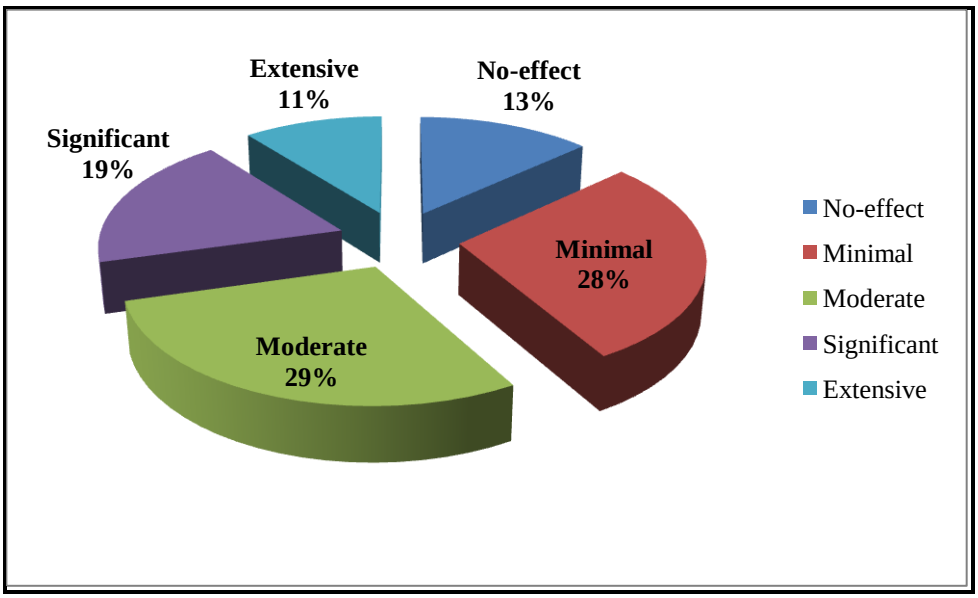


Figure 4.14 Responses to the impact of External-related RF (%) – Kuwait

As illustrated in figure 4.14, 30% (19% + 11%) of the participants believe that external risk factors have a significant or extensive negative impact. However, 41% (13% + 28%) feel that their effect is minimal to none, and the remaining 29% believe that external risk factors have a moderate negative impact.

Table 4.20 (below) shows the responses percentage to the five External-related risk factors (RF), with their rankings based on the RII scores.

Table 4.20 External-related RF ranking and responses percentage - Kuwait

External RF	Rank	RII	Negative impact level				
			0%	25%	50%	75%	100%
EXT01	1	63.0	3	29	32	24	13
EXT02	4	52.9	25	26	19	20	11
EXT03	5	50.7	21	36	21	13	9
EXT04	3	58.8	10	27	33	21	10
EXT05	2	59.4	7	25	40	17	11

As mentioned earlier (section 4.5.3), External – related risk factors were ranked as having the lowest impact amongst all the categories. However, the impact of the factors within the category itself is ranked in table 4.20. The leading External-related risk factors (RF) are:

1. Site's topography is changed after design.
2. Changes in regulations.
3. Government permits.
4. Civil disturbances.
5. Problems with neighbours.

4.6.7. Further data analysis- Kuwait

In this section, the leading risk factors from the percpective of the clients, consultants and contractors in each category are presented along with the share of responsibility of each party for these factors based on practitioners point of view.

Table 4.21 lists the key risk factors in construction projects and the share of responsibility.

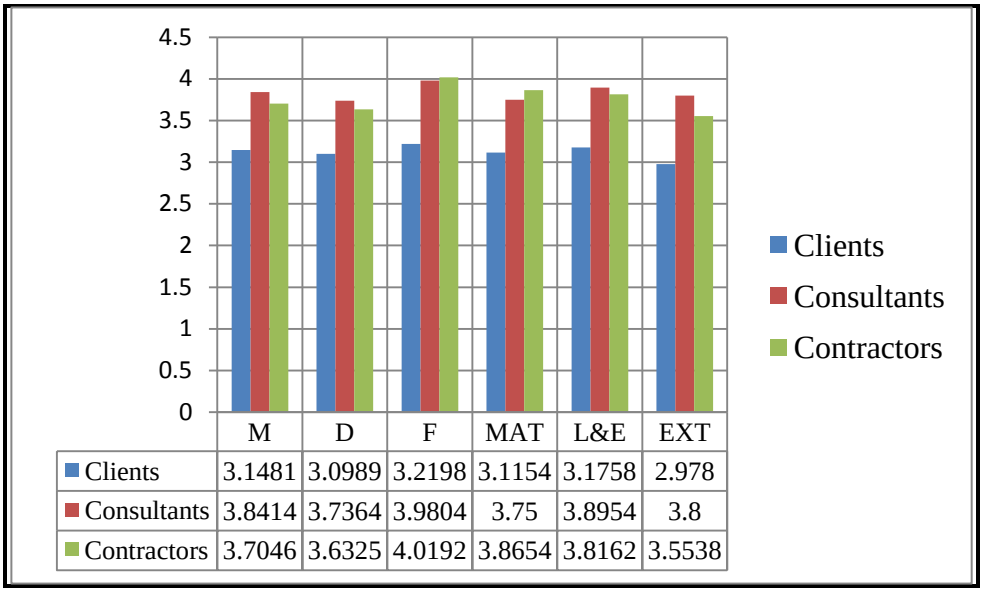
Table 4.21 Shares of responsibility for each party – Kuwait

Risk factor		Responsibility share (%)		
		Client	Consultant	Contractor
Management	Revising / approving design documents, shop drawings and sample materials	10	65	25
	Delay in approving major changes in the scope of the work	10	65	25
	Contractor's experience	0	30	70
	Decision making process	15	60	25
	Communication and coordination between parties (clients, consultants, and contractors)	10	45	45
Design	Data collection and survey before design	20	60	20
	Complete documents and drawings of projects	20	60	20
	Design modifications	30	40	30
	Design team experience	0	80	20
	Excessive change order	50	40	10
Finance	Cost estimation accuracy	10	60	30
	Financing project by contractor / client	0	15	85
	Cash flow plan analysis	5	20	75
	Payment of completed work	20	70	10
Material	Material delivery	0	10	90
	Availability of construction materials in market	2.5	17.5	80
	Material supplier problems	0	0	100
	Manufacturing special building materials	7.5	7.5	85
	Change in material types and specifications during construction	10	60	30
Labour & Equipment	Necessity of skills	2.5	27.5	70
	Labour performance / productivity	0	10	90
	Equipment availability	0	0	100
	Productivity and efficiency of equipment	0	0	100
	Labour and management relations	0	0	100
External	Site's topography is changed after design	0	90	10
	Changes in regulations	0	30	70
	Government permits	5	35	60
	Civil disturbances	0	0	100
	Problems with neighbours	20	10	70

4.7. Stage V: Bahrain general response analysis

4.7.1. Bahrain construction industry parties comparison

The data reliability of the Bahraini representative sample is 0.932 which means it is ready to be processed. A descriptive statistics provided a summary of the Bahraini representative sample [Appendix H-1] and the mean scores are illustrated in figure 4.15 below.



	M	D	F	MAT	L&E	EXT
Clients	3.1481	3.0989	3.2198	3.1154	3.1758	2.978
Consultants	3.8414	3.7364	3.9804	3.75	3.8954	3.8
Contractors	3.7046	3.6325	4.0192	3.8654	3.8162	3.5538

Figure 4.15 Bahrain construction industry parties comparison

It can be seen that there are differences in perceptions between clients, consultants and contractors of the negative impact of the risk factors (RF) categories in Bahrain.

A one-way ANOVA test was applied [Appendix H-2] to determine if there are mean differences between the Bahraini representative sample (clients, consultants and contractors). The results show that in all cases P-values equal zero, which means that there are mean differences between the three groups; to check whether the mean differences are significant or not, a post hoc Least Significant Difference (LSD) test was applied. The detailed results of the test can be found in [Appendix H-3].

In the post hoc LSD test, the significant mean differences were as shown in [Appendix H-3], and the summarised results are presented in table 4.22 below.

Table 4.22 Multiple Comparisons (LSD)-Bahrain

Dependent Variable	Type 1	Type 2	Sig.
Management	Clients	Consultants	.00
		Contractors	.00
	Consultants	Clients	.00
		Contractors	.25
	Contractors	Clients	.00
		Consultants	.25
Design	Clients	Consultants	.00
		Contractors	.00
	Consultants	Clients	.00
		Contractors	.45
	Contractors	Clients	.00
		Consultants	.45
Finance	Clients	Consultants	.00
		Contractors	.00
	Consultants	Clients	.00
		Contractors	.81
	Contractors	Clients	.00
		Consultants	.81
Material	Clients	Consultants	.00
		Contractors	.00
	Consultants	Clients	.00
		Contractors	.43
	Contractors	Clients	.00
		Consultants	.43
Labour and equipment	Clients	Consultants	.00
		Contractors	.00
	Consultants	Clients	.00
		Contractors	.59
	Contractors	Clients	.00
		Consultants	.59
External	Clients	Consultants	.00
		Contractors	.00
	Consultants	Clients	.00
		Contractors	.14
	Contractors	Clients	.00
		Consultants	.14

Response differences are significant at sig. < 0.05 level. Table 4.22 indicates that there are strong differences in perceptions of the impact of various categories between clients and the other parties, however there are not many differences between consultants and contractors in all categories.

The highest agreement between consultants and contractors was in the finance category (Sig. = 0.81), and the lowest was in the external category (Sig. = 0.14).

Refrence to [Appendix H-1] show that there is no difference in mean scores between consultants (3.98) and contractors (4.02).

4.7.2. Bahraini Categories ranking

Figure 4.16 below presents the mean scores of the Bahraini representative sample for each category.

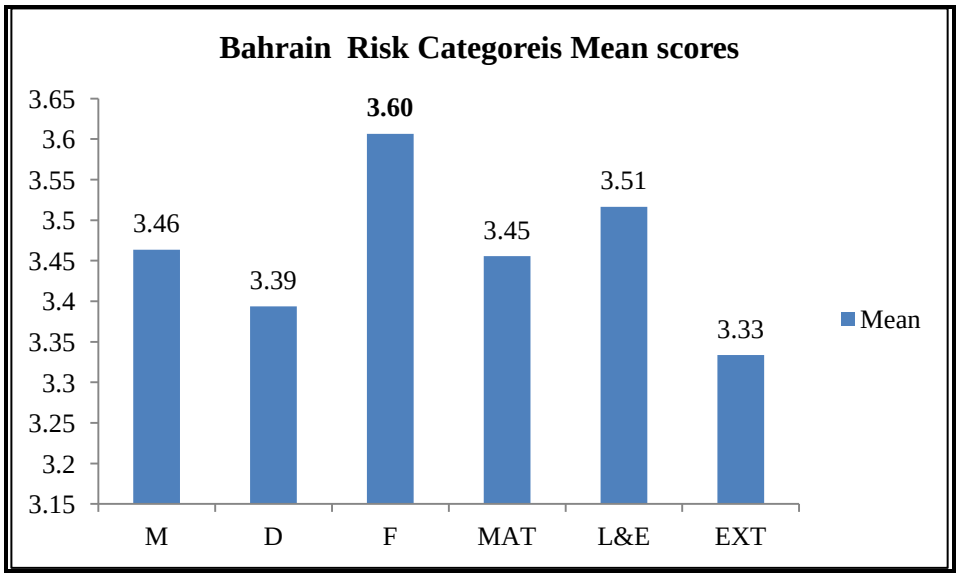


Figure 4.16 Bahrain risk factors (RF) categories mean values

Figure 4.16 indicates that Finance-related risk factors (RF) have the highest negative impact (3.60) on project completion and external RF have the lowest (3.33). The risk factors (RF) categories can be arranged in descending order, as shown in table 4.23.

Table 4.23 Bahrain categories' ranking

RF Categories	Mean	Rank
Finance	3.60	1
L&E	3.51	2
Management	3.46	3
Material	3.45	4
Design	3.39	5
External	3.33	6

The leading risk category is finance with a mean score of 3.60, followed by labour and equipment (L&E) with a mean score of 3.51. External-related risk factors (RF) have the lowest impact on projects amongst the six categories, with a mean score of 3.33.

The Relative Importance Index (RII) was applied to check whether ranking based on RII is valid or not, and was compared with table 4.23. Table 4.24, shows the category rankings based on RII scores.

Table 4.24 Categories' ranks based on RII – Bahrain

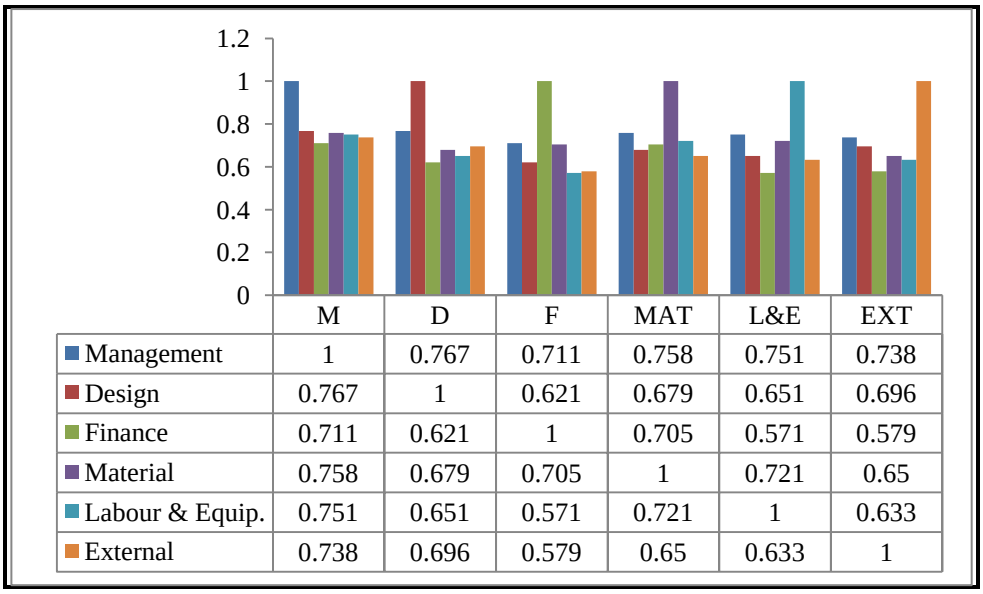
RF Categories	RII	Rank
Finance	72.1	1
L&E	70.3	2
Management	69.3	3
Material	69.2	4
Design	67.9	5
External	66.8	6

The category ranking based on the RII scores is similar to the ranking based on the mean scores shown in table 4.2. The finance category scored 72.1, making it the leading category in its impact on project completion, followed by labour and equipment (L&E).

4.7.3. Bahrain categories' correlations

The Pearson correlation test was applied to examine the correlation between categories in the Bahraini construction environment, as mentioned in Chapter 3, (section 3.10.7). Detailed results can be seen in [Appendix I-2].

Figure 4.17 shows the strength of the relationship in the Bahraini construction environment.



	M	D	F	MAT	L&E	EXT
Management	1	0.767	0.711	0.758	0.751	0.738
Design	0.767	1	0.621	0.679	0.651	0.696
Finance	0.711	0.621	1	0.705	0.571	0.579
Material	0.758	0.679	0.705	1	0.721	0.65
Labour & Equip.	0.751	0.651	0.571	0.721	1	0.633
External	0.738	0.696	0.579	0.65	0.633	1

Figure 4.17 Bahrain – Pearson correlations test

As revealed in figure 4.17, the highest significant relationship is between the management and Design-related risk factors (RF) categories, and the lowest correlation is between finance and design.

4.8. Relative importance index (RII) of factors with categories - Bahrain

The Bahraini representative sample was given the questionnaire to assess the negative impact of the six categories (management, design, finance, material, L&E, and external RF) on project completion.

4.8.1. Negative impact of Management-related risk factors

The management category consisted of twenty-three risk factors (RF). Figure 4.18 below, shows the percentage of responses for these factors.

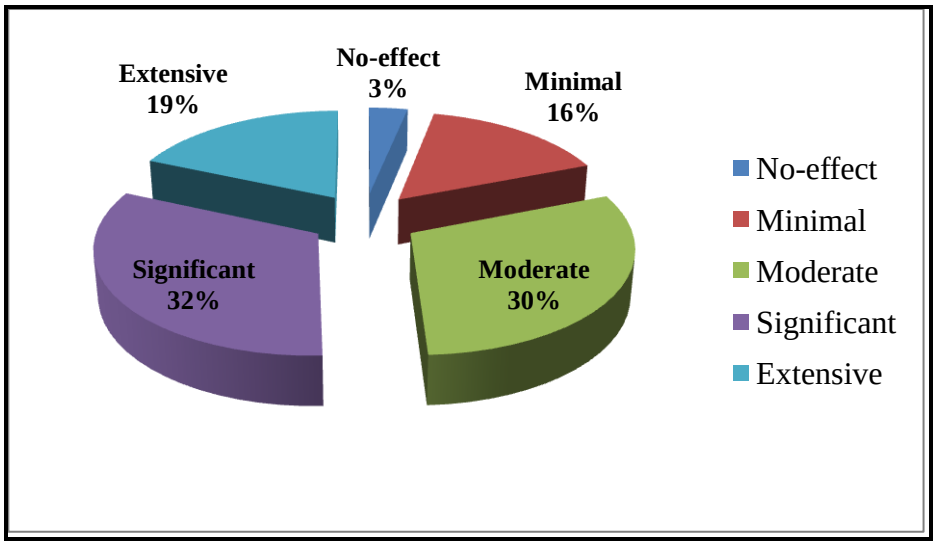


Figure 4.18 Responses to the impact of Management-related RF (%) – Bahrain

As demonstrated in figure 4.18, the responses that 109 of the representative sample, making up 51% (32% + 19%), believe that Management-related factors have a significant to extensive negative impact on projects. Furthermore, the results indicate that 19% (16% + 3%) consider that the negative impact is minimal to none, and the remaining 30% believe that Management-related risk factors (RF) negative impact is moderate.

Table 4.25 (below) presents the responses percentage to each scale in addition to the ranks based on the RII scores for the Management-related risk factors.

Table 4.25 Bahrain Management-related RF ranking and responses percentage

Management RF	RANK	RII	Negative impact level				
			0%	25%	50%	75%	100%
M01	2	74.1	1	18	21	30	30
M02	3	73.7	2	14	26	31	27
M03	13	68.2	4	17	30	33	17
M04	15	67.9	2	23	28	27	20
M05	7	71.1	2	15	25	42	16
M06	8	70.5	2	18	28	33	20
M07	4	72.7	3	14	27	27	29
M08	14	68.0	2	15	39	29	15
M09	16	66.5	6	15	34	30	14
M10	1	76.2	2	7	24	42	25
M11	9	69.9	5	12	29	35	18
M12	13	68.2	3	14	36	33	14
M13	15	66.8	3	18	35	30	14
M14	11	68.7	2	17	31	35	15
M15	12	68.6	2	18	31	34	15
M16	7	71.1	2	13	32	31	21
M17	6	71.7	3	14	24	38	21
M18	13	68.2	4	18	27	36	15
M19	17	65.8	7	15	29	38	10
M20	18	63.9	9	16	35	24	15
M21	19	60.3	7	24	40	18	10
M22	10	69.8	4	17	28	29	22
M23	5	72.3	1	10	35	34	20

According to table 4.25, the top five Management-related risk factors (RF) that have a negative impact on project completion in Bahrain are:

1. Contractor’s experience.
2. Decision making process.
3. Communication and coordination between parties (client, consultants & contractors).
4. Availability of project management team member) experience).
5. Revising / approving design documents, shop drawings and sample materials.

4.8.2. Negative impact of Design-related risk factors

The aim of the second part of the questionnaire was to assess the negative impact of the Design-related risk factors (RF) on project completion. Figure 4.19 (below) illustrates the responses of the Bahraini representative sample to the Design-related factors as a percentage.

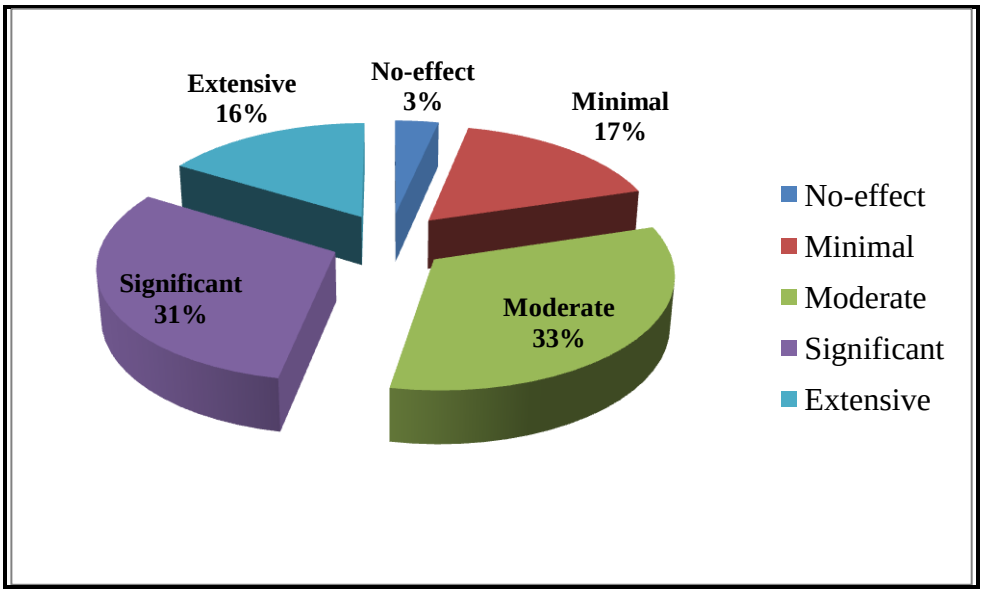


Figure 4.19 Responses to the impact of Design-related RF (%) – Bahrain

Figure 4.19 indicates that the majority of the surveyed sample, 47% (31% + 16%), believe that the design category has a significant to extensive negative impact on project completion, 33% consider that it has moderate effect, and the remaining 20% think it has minimal to no effect.

Table 4.26 (below) shows the ranking of Bahraini Design-related risk factors (RF) based on RII scores.

Table 4.26 Bahraini Design-related RF' ranking and responses percentage

Design RF	Rank	RII	Negative impact level				
			0%	25%	50%	75%	100%
D01	2	71.3	3	9	35	33	20
D02	7	66.5	3	20	30	32	14
D03	8	63.8	5	22	35	27	12
D04	6	67.8	1	17	36	35	11
D05	5	68.4	3	17	34	25	20
D06	1	71.4	4	14	25	33	24
D07	8	63.8	5	19	38	27	11
D08	3	69.2	4	14	33	30	19
D09	4	68.6	2	19	27	36	15

As shown in table 4.26, the top five Design-related risk factors (RF) in the Bahraini construction environment are:

1. Complete documents and drawings of projects;
2. Design team experience.
3. Clarity of details in drawings.
4. Excessive change order.
5. Data collection and survey before design.

4.8.3. Negative impact of Finance-related risk factors

The aim of the third part of the questionnaire was to assess the Finance-related risk factors (RF) from the point of view of the Bahraini representative sample. Figure 4.20 shows the responses to the negative impact of these factors on project completion as a percentage.

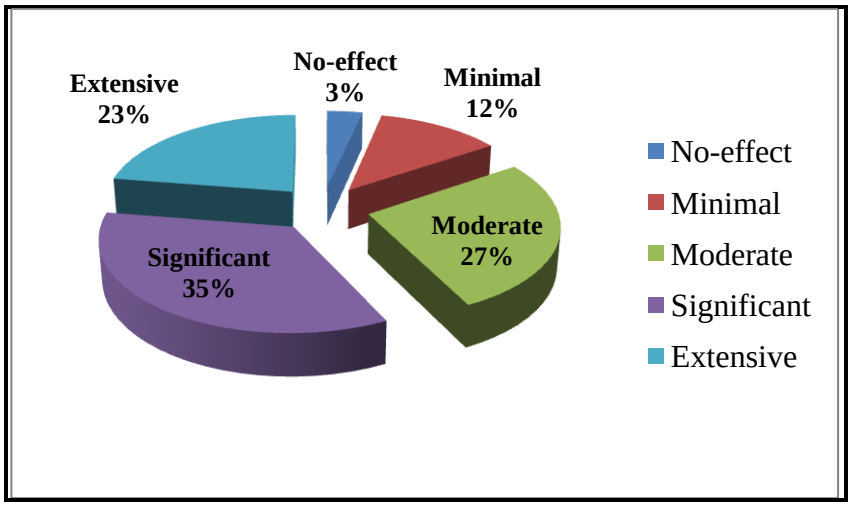


Figure 4.20 Responses to the impact of Finance-related RF (%) – Bahrain

Figure 4.20 indicates that the majority of the surveyed sample, 58% (35% + 23%), believe that the finance category has a significant to extensive negative impact on project completion, 27% believe that it has a moderate effect, and the remaining 15% think that it has minimal to no effect.

Table 4.27 (below) illustrates the Bahraini Finance-related risk factors (RF) rankings based on RII scores.

Table 4.27 Bahraini Finance-related RF rankings and responses percentage

Finance RF	Rank	RII	Negative impact level				
			0%	25%	50%	75%	100%
F01	3	71.2	4	13	26	36	21
F02	2	71.6	3	12	34	28	24
F03	4	69.8	4	13	30	35	18
F04	1	75.9	2	12	18	40	28

The results, as shown in table 4.27, indicates factor F04 – 'Cost estimation accuracy' – has the highest impact with an RII score of 75.9. According to table 4.27, the rankings of Finance-related risk factors (RF) are as follows:

1. Cost estimation accuracy.
2. Financing project by contractor / client.
3. Payment of completed work
4. Cash flow plan analysis.

4.8.4. Negative impact of Material-related risk factors

The aim of the fourth part of the questionnaire was to assess the impact of Material-related risk factors (RF) on project completion in Bahrain. Figure 4.21 (below) shows the responses to these factors as a percentage.

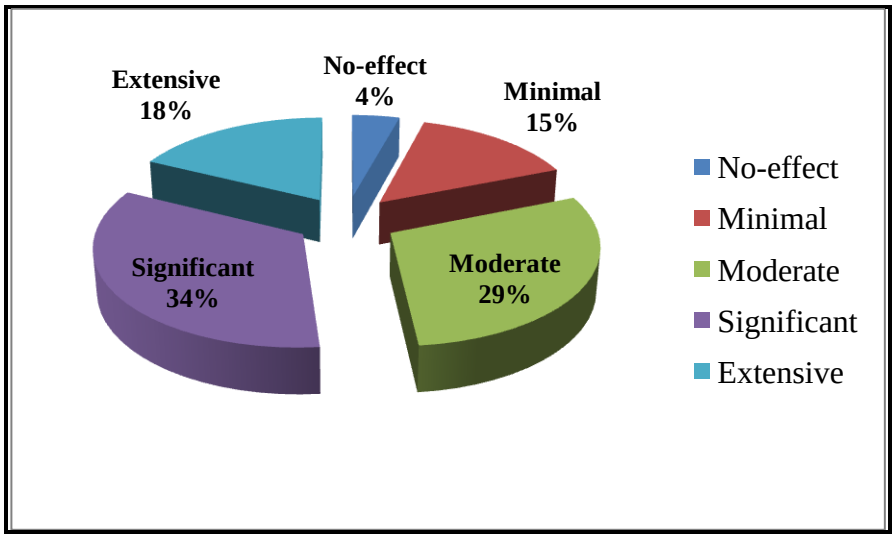


Figure 4.21 Responses to the impact of Material-related RF (%) – Bahrain

Figure 4.21 indicates that the majority of respondents, 34%, believe that Material-related risk factors (RF) have a significant negative impact on project completion, and 18% think that their negative impact is extensive.

Table 4.28 shows the ranking of Material-related risk factors (RF) with relative importance index (RII) scores, in addition to the responses percentage for each factor.

Table 4.28 Bahraini Material-related RF rankings and responses percentage

Material RF	Rank	RII	Negative impact level				
			0%	25%	50%	75%	100%
MAT01	3	71.9	4	10	30	30	24
MAT02	2	75.3	3	11	23	33	30
MAT03	6	68.1	2	17	29	40	11
MAT04	1	75.5	3	7	24	39	27
MAT05	7	65.7	5	12	41	33	9
MAT06	5	68.4	3	14	35	33	14
MAT07	8	59.0	11	26	29	25	9
MAT08	4	69.3	3	19	24	36	18

The results, as shown in table 4.28, indicate that 'Material delivery' ranked top amongst Material-related risk factors (RF) for negative impact. The top Material-related risk factors (RF), as listed in table 4.28 are:

1. Material delivery.
2. Availability of construction materials in market.
3. Quality of materials (below standards).
4. Compliance of material to specifications.
5. Material supplier problems.

4.8.5. Negative impact of Labour and equipment - related risk factors

The aim of the fifth part of the questionnaire was to evaluate the negative impact of Labour and equipment-related (L&E) risk factors (RF) on project completion. Figure 4.22 illustrates the responses to these factors as a percentage.

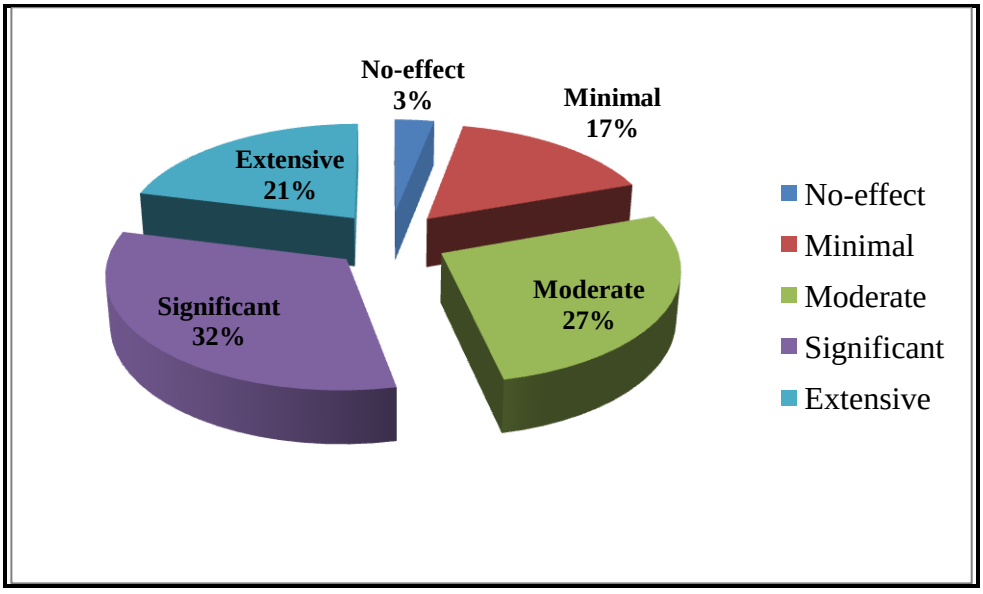


Figure 4.22 Responses to the impact of L&E-related RF (%) – Bahrain

As illustrated in figure 4.22, a significant share of respondents, 53% (32% + 21%), believe that L&E-related factors have a significant to extensive negative impact on project completion. On the other hand, 20% (3% + 17%) believe that they have minimal to no effect, and the remaining 27% think that the negative impact is moderate.

Table 4.29 shows Labour- and equipment-related risk factors (RF) rankings based on RII scores, in addition to the responses percentage.

Table 4.29 Bahraini L&E-related RF rankings and responses percentage

L&E RF	Rank	RII	Negative impact level				
			0%	25%	50%	75%	100%
L&E01	3	71.6	3	14	26	35	22
L&E02	1	72.1	3	14	25	33	24
L&E03	2	71.8	2	15	25	35	22
L&E04	4	69.7	4	17	26	33	20
L&E05	5	69.6	1	18	30	33	18
L&E06	6	67.1	5	19	31	24	20

Table 4.29 shows that L&E02 – 'Equipment availability' – was ranked as the leading factor with an RII score of 72.1, followed by L&E03 – 'Productivity and efficiency of equipment' – with an RII score of 71.8. The leading Labour- and equipment-related risk factors (RF) in Bahrain are:

1. Equipment availability;
2. Productivity and efficiency of equipment;
3. Labour performance / productivity;
4. Labour and management relations;
5. Necessity of skills.

4.8.6. Negative impact of External-related risk factors

The aim of the final part of the questionnaire was to assess the negative impact of External-related risk factors (RF) on project completion. Figure 4.23 represents the responses to these factors as a percentage.

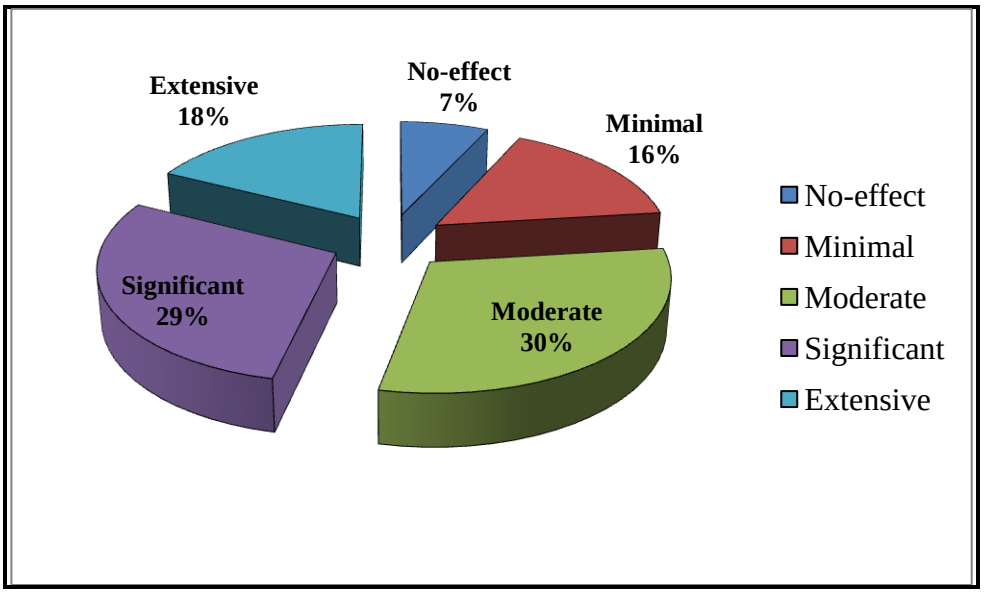


Figure 4.23 Responses to the impact of External-related RF (%) – Bahrain

As revealed in figure 4.23, 47% (18% + 29%) of respondents believe that external factors have a significant to extensive negative impact on project completion. 30% think that the impact is moderate, and the remaining 23% (7% + 16%) consider the effect to be minimal to none.

Table 4.30 (below) presents the External-related risk factors (RF) rankings in addition to the RII scores and the percentage of responses.

Table 4.30 Bahrain External-related RF rankings and responses percentage

External RF	Rank	RII	Negative impact level				
			0%	25%	50%	75%	100%
EXT01	2	68.7	4	21	24	28	23
EXT02	4	64.0	12	15	27	31	14
EXT03	5	62.8	9	18	32	31	9
EXT04	1	70.7	3	9	40	25	22
EXT05	3	67.7	6	17	29	29	19

Table 4.30 reveals that EXT04 – 'Government permits' – is the leading risk factor within the external category with an RII score of 70.7, and EXT03 – 'Problems with neighbors' – was ranked last with an RII score of 62.8.

The External-related risk factors (RF) are ranked as follows:

1. Government permits;
2. Site's topography is changed after design;
3. Changes in regulations;
4. Civil disturbances;
5. Problems with neighbours.

4.8.7. Further data Analysis –Bahrain

The key risk factors for each category gathered from the Bahrain study are listed in table 4.31, along with share of responsibility for these factors based on the practitioners' points of view.

Table 4.31 lists the key risk factors to the completion of construction projects and the shares of responsibility carried by each party. The results show that consultants carry the most responsibility for the risk factors related to the design and management categories. On the other hand, contractors are mainly responsible for the material and labour and equipment categories. However, responsibility is shared between consultants and contractors for finance-related and external risk factors.

Table 4.31 Leading risk factors and parties' share of responsibility – Bahrain

Risk factor		Responsibility share (%)		
		Client	Consultant	Contractor
Management	Contractors' experiences	0	30	70
	Decision making process	15	60	25
	Communication and coordination between parties (Owner, Consultants, & Contractors).Decision making process	10	45	45
	Availability of project management team members)experience).	5	75	20
	Revising/approving design documents, shop drawings and sample materials.	10	65	25
Design	Complete documents and drawings of projects	20	60	20
	Design-team experience	0	80	20
	Clarity of details in drawings.	5	75	20
	Excessive change order.	50	40	10
	Data collection and survey before design.	20	60	20
Finance	Cost estimation accuracy.	10	60	30
	Financing project by contractor/client.	0	15	85
	Payment of completed work.	20	70	10
	Cash flow plan analysis.	5	20	75
Material	Material delivery	0	10	90
	Availability of construction materials in market	2.5	17.5	80
	Quality of Materials (Below standards).	2.5	27.5	70
	Compliance of material to specifications.	0	10	90
	Materials Supplier's Problem.	0	0	100
Labour & Equipment	Equipment availability.	0	0	100
	Productivity and efficiency of equipment.	0	0	100
	Labour performance/productivity	0	10	90
	Labours and management relations.	0	0	100
	Necessity skills.	2.5	27.5	70
External	Government permits.	5	35	60
	Site's topography is changed after design.	0	90	10
	Changes in regulations.	0	30	70
	Civil disturbances.	0	0	100
	Problems with neighbours	20	10	70

4.9. Stage VI: Further Data Analysis

4.9.1. Kuwait- overall rankings and responsibilities

The overall survey results for Kuwait rankings are shown below in table 4.32.

Table 4.32 Kuwait ranking

Reference Letter	Rank	RII	Reference Letter	Rank	RII
M01	8	63.0	**D06**	5	65.0
M02	13	62.3	**D07**	22	60.4
M03	44	56.9	**D08**	17	61.2
M04	50	54.3	**D09**	15	61.6
M05	21	60.6	**F01**	35	58.6
M06	25	59.9	**F02**	11	62.4
M07	38	58.3	**F03**	29	59.0
M08	44	56.9	**F04**	1	66.5
M09	47	56.3	**MAT01**	33	58.7
M10	7	63.1	**MAT02**	10	62.5
M11	47	56.3	**MAT03**	20	60.7
M12	40	57.7	**MAT04**	4	65.1
M13	19	60.8	**MAT05**	17	61.2
M14	29	59.0	**MAT06**	16	61.4
M15	35	58.6	**MAT07**	55	46.3
M16	22	60.4	**MAT08**	33	58.7
M17	6	64.5	**L&E01**	28	59.1
M18	22	60.4	**L&E02**	35	58.6
M19	42	57.3	**L&E03**	39	58.2
M20	53	51.9	**L&E04**	46	56.4
M21	51	53.6	**L&E05**	27	59.3
M22	31	58.8	**L&E06**	49	54.6
M23	2	66.2	**EXT01**	8	63.0
D01	13	62.3	**EXT02**	52	52.9
D02	41	57.4	**EXT03**	54	50.7
D03	42	57.3	**EXT04**	31	58.8
D04	11	62.4	**EXT05**	26	59.4
D05	3	65.6			

Table 4.32 shows the overall rankings for the negative impact of each of the fifty-five risk factors (RF) based on the relative importance index (RII) scores.

The leading five risk factors (RF) in the Kuwaiti construction environment are:

1. Cost estimation accuracy;
2. Revising / approving design documents, shop drawings and sample materials;
3. Data collection and survey before design;
4. Material delivery;
5. Complete documents and drawings of projects.

Table 4.33 (below) shows the leading risk factors (RF) in the Kuwaiti construction environment with their rankings based on RII scores, in addition to the construction parties' share of responsibility.

Table 4.33 Leading RF and share of responsibility – Kuwait

Reference Letter	Rank	RII	Responsibility %		
			Clients	Consultants	Contractors
F04	1	66.5	10	60	30
M23	2	66.2	10	65	25
D05	3	65.6	20	60	20
MAT04	4	65.1	0	10	90
D06	5	65.0	20	60	20

From table 4.33, it is worth noting that consultants have the highest share of responsibility – between 60% and 65% – for these leading factors. On the other hand, contractors have the highest share of responsibility for factor MAT04 – 'Material delivery' – with a responsibility share of 90%.

4.9.2. Bahrain - overall rankings and responsibilities

The overall survey result for Bahrain in this section is shown in table 4.34 below. The fifty-five risk factors (RF) were ranked based on their relative importance index (RII) scores.

Table 4.34 Bahrain ranking

Reference Letter	Rank	RII	Reference Letter	Rank	RII
M01	5	74.1	**D06**	15	71.4
M02	6	73.7	**D07**	51	63.8
M03	25	68.2	**D08**	28	69.2
M04	40	67.9	**D09**	31	68.6
M05	18	71.1	**F01**	17	71.2
M06	21	70.5	**F02**	13	71.6
M07	7	72.7	**F03**	23	69.8
M08	39	68.0	**F04**	2	75.9
M09	45	66.5	**MAT01**	10	71.9
M10	1	76.2	**MAT02**	4	75.3
M11	22	69.9	**MAT03**	38	68.1
M12	35	68.2	**MAT04**	3	75.5
M13	44	66.8	**MAT05**	48	65.7
M14	29	68.7	**MAT06**	33	68.4
M15	31	68.6	**MAT07**	55	59.0
M16	18	71.1	**MAT08**	27	69.3
M17	12	71.7	**L&E01**	13	71.6
M18	35	68.2	**L&E02**	9	72.1
M19	47	65.8	**L&E03**	11	71.8
M20	50	63.9	**L&E04**	25	69.7
M21	54	60.3	**L&E05**	26	69.6
M22	23	69.8	**L&E06**	43	67.1
M23	8	72.3	**EXT01**	29	68.7
D01	16	71.3	**EXT02**	49	64.0
D02	45	66.5	**EXT03**	51	62.8
D03	51	63.8	**EXT04**	20	70.7
D04	41	67.8	**EXT05**	42	67.7
D05	33	68.4			

As revealed in table 4.34, the leading five risk factors (RF) in the Bahraini construction environment are:

1. Contractor’s experience.
2. Cost estimation accuracy.
3. Material delivery.
4. Availability of construction materials in market.
5. Decision making process.

Table 4.35 below shows the leading risk factors (RF) in the Bahraini construction environment with their rankings based on RII scores, in addition to the construction parties' share of responsibility.

Table 4.35 Leading RF and share of responsibility – Bahrain

Reference Letter	Rank	RII	Responsibility %		
			Clients	Consultants	Contractors
M10	1	76.2	0	30	70
F04	2	75.9	10	60	30
MAT04	3	75.5	0	10	90
MAT02	4	75.3	2.5	17.5	80
M01	5	74.1	15	60	25

From table 4.35, it is clear that clients have the least share of responsibility for the main risk factors (RF) in Bahrain; contractors, on the other hand, have the highest share of responsibility.

4.9.3. Differences between Kuwait and Bahrain

As shown earlier in table 4.9 and table 4.10, there is a significant difference in perception between Kuwait and Bahrain on the negative impact of risks on project completion during the construction phase. Bahrain perceives a higher impact on its projects than Kuwait.

In Kuwait, construction parties (clients, consultants, contractors) are in general agreement of the risk impact during the construction phase, however, clients have different opinions on the impact of the Management and Design related risks.

In Bahrain, Consultants and contractors share the same opinion towards the impact of the the presented risks, however, clients held a different view.

In both countries, it is noted that consultants and contractors share the same opinion towards risk that impacts on project completion during the construction phase. On the other hand, clients are having different opinions.

On the categories level, both countries ranked Finance-related risk as having the highest negative impact, whilst External-related risks had the lowest impact on project completion. By comparing the current study with the study of El-Sayegh (2008) on United Arab Emirates, one can conclude that finance related risks have the most significant impact on project completion in the Gulf region.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

Chapter 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

Construction projects in the Gulf region face several challenges during the building phase. Because of the cooperation between the Gulf countries and their strategy of encouraging foreign investment into the region, it is easy to establish business between countries. The overall research aim arose because of the high percentage of projects that were failing to complete on time and within budget.

This chapter presents the survey findings as set out in previous chapters, provides answers to the research objectives, and offers a conclusion based on the interviews, questionnaires and literature review. Furthermore, it presents the limitations of the study, bias and errors, and the contribution of the research to the knowledge. In addition to recommendations for future researches.

5.2. Review and answer to the research objectives

The research objectives (section 1.4) are:

1. To identify risk factors associated with construction projects and find an appropriate approach to categorise them by reviewing the relevant literature.

2. To evaluate the practitioners perception of categories' relative weight (C.R.W) and allocation of responsibility using interviews.

3. To investigate the construction environment in the Gulf region by comparing responses from participants in the State of Kuwait and Kingdom of Bahrain to the negative impact of the presented risk factors (RF) using questionnaires.

4. To rank the categorised risk factors (RF) based on their relative importance index (RII) values for their negative impact on project completion from the construction parties' perspective by using a mathematical equation (3.2) section 3.10.8.

5. To identify the direction and the strength of the relationships between risk factors (RF) categories by applying the Pearson product-moment correlation coefficient (r) test.

6. To conduct further data analysis to:
   - Rank the Risk Factors (RF) for the State of Kuwait.
   - Rank the Risk Factors (RF) for Kingdom of Bahrain.
   - Allocate risks to the most significant Risk Factors (RF) for both countries in the region.

5.2.1. To identify risk factors associated with construction projects and find an appropriate approach to categorise them by reviewing the relevant literature.

The first research objective was to identify the relevant risk factors in construction projects. The risk factors were identified and categorised through a process of reviewing the relevant literature followed by exploratory interviews. 128 risk factors were identified from the literature review and were classified based on their sources. A total of fifty-five risk factors (RF) were grouped under six categories, namely: management, design, finance, material, labour and equipment, and external risk factors (Appendix B - 7).

5.2.2. To evaluate the practitioners perception of (C.R.W) and allocation of responsibility using interviews.

A six category classification was presented to the practitioners in order to evaluate their perceptions of the categories' relative weight (C.R.W) and to allocate responsibility for each risk. The result revealed in section 4.3.1, showed that the highest relative weight assigned by practitioners was on Management-related risk factors (45%), followed by Design-related factors (17%). Finance-related factors scored 11%, followed by Material-related factors at 15%. However, Labour and equipment and External-related factors scored the lowest relative weight among the six categories (6%).

To allocate responsibilities, the results in section 4.3.2, showed that contractors have the highest share of responsibility for the presented risk factors (RF) (57%), followed by consultants (36%), and finally clients with the lowest share (7%).

5.2.3. To investigate the construction environment in the Gulf region

To investigate the constructionenvironment by comparing responses from practitioners in the State of Kuwait and Kingdom of Bahrain to the negative impact of the presented risk factors (RF) using questionnaires.

The general linear model multivariate test was used to compare responses from Kuwait and Bahrain on the negative impact of the fifty-five risk factors (RF) on project completion. The result showed that there were differences in perception of the presented risk factors (RF) (Wilks' Lambda = 0.000) as mentioned in (section 4.4). A further test was applied (independent sample t-test) to examine the perception agreement for the categories, and the findings showed that there were differences in perception of the negative impact of the categories on project completion between the two countries. Tests result revealed that Bahraini participants perceived a higher negative impact of the risk factors (RF) on their projects than Kuwait. Based on these results, the mathematical and statistical analysis was carried out separately on the data from Kuwait and Bahrain.

5.2.4. To rank the categorised risk factors (RF).

To rank and cateorised the presented risk factors based on their relative importance index (RII) values for their negative impact on project completion from the construction parties' perspective by using a mathematical equation (3.2) section 3.10.8.

State of Kuwait leading risk factors

As indicated in section 2.9, the risk factors (RF) were grouped into six categories. Kuwait ranked the finance category highest, followed by design, material, managementand labour and equipement. However, the external category was ranked last.

To measure the differences in perceptions toward these factors, a post-Hoc Least Significant Difference (LSD) test was carried out, where the P-value is significant below 0.05. The results indicated that there were differences in perceptions between clients and contractors (P = 0.047) and between consultants and contractors (P = 0.023) on the negative impact of the management category. Furthermore, there were differences in perception between clients and consultants (P=0.033) on the impact of the design category. There was also disagreement between contractors and others on the management category,

but there were no differences in responses on the finance, material, labour and equipment and external categories, as all P-values were above 0.05.

Kingdom of Bahrain leading risk factors

Bahrain construction parties ranked finance as the category with the highest negative impact on construction projects completion, followed by labour and equipment- related risk factors, management, material,design and the external category was perceived to have the lowest negative impact on project completion.

The Bahrain study results show that there was no difference in perception between consultants and contractors for all risk categories, as all P-values were above 0.05, but there is a significant difference between clients and the other construction parties – consultants and contractors – ($P = 0.00 < 0.05$) on the impact of each category on project completion.

In conclusion, the representative sample of both countries ranked the finance-related risk factors category as having the greatest negative impact on construction projects, and the external category as having the lowest negative impact.

5.2.5. To identify the direction and the strength of the relationships

To investigate the strength and direction of the relationship between the presented risk factors (RF's) categories by applying the Pearson product-moment correlation coefficient (r) test.

The Pearson product-moment correlation coefficient (r) test was applied to examine the direction and strength of the relationships between categories. The results showed a significant correlation between all categories in each country. The strongest positive correlation in the Kuwaiti data was between management and L&E ($r = 0.745$) and between materials and L&E ($r = 0.745$). The weakest correlation was between finance and materials ($r = 0.559$). On the other hand, the Bahraini data showed the strongest correlation between management- and design-related factors ($r = 0.711$) and between management and materials ($r = 0.758$). The weakest correlation was between finance and design ($r = 0.621$). The overall results show that all correlations between categories are significant, as a correlation is considered strong when it is between 0.5 – 1.0.

5.2.6. To conduct further data analysis:

To rank the presented risk factors (RF) for Kuwait and Bahrain and allocate risks to the most significant risk factors in the region.

State of Kuwait top five risk factors

The leading risk factor in the Kuwaiti construction environment was in the finance category – 'Cost estimation accuracy'. 34% of the surveyed sample believe that Finance-related risk factors (RF) have a significant or extensive negative impact. Consultants have the highest share of responsibility for the accuracy of cost estimation at 60%. A Management - related risk factor – 'Revising / approving design documents, shop drawings and sample materials' – was ranked second, and 30% of the surveyed sample agree that Management - related factors have a significant or extensive negative impact on project completion. Consultants also have the highest share of responsibility for 'Revising / approving design documents, shop drawings and sample materials' at 65%. Two factors from the design category – 'Data collection and survey before design' and 'Complete documents and drawings of projects' – were ranked third and fifth respectively. 34% of the surveyed sample believe that Design - related risk factors have a significant or extensive negative impact on project completion. Once again, consultants hold most responsibility for managing these factors, at 60%. The fourth highest risk factor – 'Material delivery' – is in the materials category. 31% of the surveyed sample think that Material - related factors have a significant or extensive negative impact on project completion, and contractors hold 90% of the responsibility for managing this factor.

Kingdom of Bahrain top five risk factors

The Bahraini study revealed that 'Contractor's experience', a risk factor from the management category, ranked first among the top five risk factors (RF). 51% of the surveyed sample believe that Management - related risk factors (RF) have a significant to extensive negative impact on the completion of projects. Contractors carry 70% of the responsibility and consultants have the rest (30%), which leaves clients with no responsibility for the top ranked risk factors. 'Cost estimation accuracy', which is in the finance category, was ranked second, and 58% of the respondents believe this category has a significant to extensive negative impact on project completion. Consultants have the highest share of responsibility for managing the presented risk (60%), followed by

contractors (30%), which leaves clients with 10% of the responsibility. 'Material delivery' and 'Availability of construction materials in market', both in the materials category, were ranked as the third and fourth leading factors in Bahrain. Moreover, 52% of the surveyed sample believe that the material category has a significant to extensive impact on project completion. Obviously, contractors have the highest share of responsibility for Material - related risks in general. The 'Decision making process' risk factor in the management category ranked fifth overall, and consultants carry 60% of the responsibility for managing this risk.

By comparing the top five risk factors in Kuwait and Bahrain, we can see that 'Cost estimation accuracy' was ranked first in Kuwait but second in Bahrain. Furthermore, 'Material delivery risk' ranked fourth in Kuwait and third in Bahrain. This proves that these two factors are significant to both countries in the field of risk management.

5.3. Conclusion based on the questionnaire results

The questionnaire results of the State of Kuwait and Kingdom of Bahrain are shown below.

5.3.1. Kuwait Conclusion based on the questionnaire results

- There was partial disagreement on the impact of the risk categories on completion of construction projects during the construction phase.
- The perceptions of Kuwaiti clients, consultants and contractors of the negative impact of the risk factors (RF) categories showed that contractors held different views from clients and consultants about the risk factors (RF).
- In the management category, there is strong agreement between clients and consultants.
- In the management category, clients and contractors held different views on the impact of the presented risk factors.
- In the design category, there is disagreement between clients and consultants.

- The finance category has the highest negative impact on construction projects during the construction phase.

- The external category has the lowest negative impact on construction projects during the construction phase.

- The labour and equipment category has a strong positive correlation with the other categories.

5.3.2. Bahrain Conclusion based on the questionnaire results

- Bahrain perceives a higher negative impact of the presented risk factors (RF) on construction projects than Kuwait.

- There is strong agreement between consultants and contractors in all risk categories.

- Clients have significant differences in perception in all categories from consultants and contractors.

- The finance category has the highest negative impact on project completion.

- The external category has the lowest negative impact on construction projects during the construction phase.

- The management category has a strong positive correlation with the design and material categories, and this can be considered the most significant relationship amongst other categories.

5.4. Conclusion from literature review

The literature review revealed a lack of studies related to the construction environment of construction projects in the Gulf region specifically during the construction phase, and assisted in establishing a research gap which shaped the aim and objectives of this research. It also helped in the first stage of this investigation, which was to identify the risk factors related to construction projects and categorise them into six categories based on interviews with the professional practitioners. Furthermore, the literature review assisted in

designing the questionnaire, which has been evaluated mathematically and statistically to measure the research objectives and draw a conclusion for the research aim.
The literature review provided evidence that the Gulf countries are supporting the construction sector and encouraging foreign investment by modifying the investment strategy for foreigners, and by providing a fixed percentage of their annual gross domestic product (GDP) to enhance construction activities (MOP,2012), (EDB,2013) and (Al-Zayani, 2012).

Various surveys reported that multinational companies investing in this region believe that financial risks are a major source of uncertainty, that financial overruns are linked to disputes that arise between parties, and that project completion times suffer because of this (Han et al., 2005). This statement is supported by the outcome of the research, whereby Kuwait and Bahrain ranked the financial category as the leading area of risk for construction projects. Furthermore, El-Sayegh (2008) reports that economic risks pose a significant threat to international and local companies in the United arab Emirates (UAE).

Kartam et al. (2001) stated that contractors bear 97% of the responsibility for the availability of materials, and clients bear no responsibility, and it is a shared responsibility between contractors and clients, which is supported by the research outcome that ranked the 'Material delivery' risk fourth in Kuwait and third in Bahrain, and allocated 90% of responsibility to the contractor, 10% to consultants and 0% to clients, which means it is a shared responsibility between the contractors and consultants who represent the clients.

5.5. Review and answer to the research aim

Review of the research aim:

The overall aim of the research was *to identify and assess risk factors during the construction phase of construction projects in the Gulf region focusing on two countries of the Gulf region – the State of Kuwait and Kingdom of Bahrain.*

Answer to the research aim:

Kuwait and Bahrain have different perceptions of the risk factors related to projects during the construction phase. However, both countries ranked the Finance - related risk factors

(RF) as a leading risk category during the construction phase, and the external category as having the lowest negative impact.

The research outcome proves that the Gulf construction environment is not suitable for designing a standard risk management model due to the limitations of the research. However, the result of the study shows that, with slight modification of the research constants and variables, the outcome will lay the basic foundations for designing a standard risk management model for construction projects in the Gulf region.

5.6. Limitation of the research

The investigation of the study was carried out under several limitations. For example, the study was limited to the construction phase of construction projects and only six categories of risk factors were included in the study. Furthermore, the investigation was carried out in the State of Kuwait Kuwait and Kingdom of Bahrain only from the Gulf region. Moreover, the Kuwaiti contractors' population was from Grade I and II only and the Bahraini contractors' population was from Grade AA and A only.

Clients were nominated by consultants and contractors. Furthermore, the study suffered from bad timing because Bahrain was experiencing domestic unrest (the Arab Spring) at the time of field work.

This research was based on practitioners and participants opinions rather than actual occurrences on projects.

5.7. Bias and error

As mentioned in the literature review, identifying and avoiding bias in data collection is an important step to ensure the collection of unbiased data from respondents. According to (Raftery, 1999), most decision makers base their judgments on their expectations, assumptions and predictions. Since the future is always uncertain, construction projects face the possibility of delays, which introduces costs that were not anticipated by either the contractor or client (Thomas et al., 2004).

The judgment of decision makers might be affected by two common biases that have been identified by psychologists. These biases might affect the way people interpret the past, predict the future and make decisions in the present: availability bias, and illusion of

control bias. Availability bias is defined as the ability of decision makers to judge the probability of a future situation occurring if the data for that situation is available. Illusion of control bias describes the decision makers when they overestimate the impact of a situation on the project outcome (Flanagan, 1993).

In general there are three types of bias, namely, pre-trial bias, during-trial bias and after-trial bias. Pre-trial bias might appear during the study design or method selection phase. On the other hand, during-trial bias might occur during the interview process (interviewer bias). Finally, after-trial bias could be spotted at the data analysis phase and is also known as data analysis bias,(Pannucci and Wilkins, 2010).

According to Bell (1999), it is difficult to overcome these biases, and it is easier to acknowledge the fact that bias can creep in. Gavron (1966, cited in (Bell, 1999)) stated that it is difficult to avoid biases when carrying out researches; however, awareness of these bias problems and continous control over the research can help.

As no study is without bias, the researcher attempted to reduce the bias to its lowest level by applying several techniques. In this research many methods and steps were adopted to avoid bias throughout the study. For example, during the distrubution of the questionnaire, the researcher might have missed participants due to their absence, which might affect the randomness of the representative sample selection. For this reason, additional questionnaires were distributed in different modes (web based, personal addministra, Skype) to obtain a high response rate. It is worth mentioning that using different types of measuring scales, response modes and different locations for data collection does not change the conceptual meaning of the measures (Podsakoff et al., 2012).

Another example of a method used to avoid and minimise bias is that prior to the study, the aim and objectives were clearly defined (section 1.3 and 1.4), which led to a proper research design and method selection for data colletion (chapter 3). The protocol of interviewing to collect data was applied to avoid and minimise the bias. For example, a semi-structured interview was designed based on leaving the interview with a set of respondents with a checklist to tick for easy analysis, in addition to recording the interviews, then transcribing it and verifying it with the practitioners. Furthermore, a set of validation steps were followed during the implementation of the selected methods to collect the data (section 3.10.2).

Another form of bias called selection bias might occur during the selecting and choosing of the representative sample, and that was dealt with by clearly defining the population and the equation for calculating the representative sample (section 3.6).

5.8. Contribution to knowledge and Recommendations for further research

The research contributes to knowledge in various ways. The research is the first to be studied in the Gulf region considering Clients, Consultants and Contractors (CCCs) perspectives on the negative impact of the presented risk factors (RF) during the construction phase of construction projects on projects succes.

Studying the relationship between categories and the correlation between risk factors (RF) formed a solid foundation to design a standard risk management model for construction projects in the construction phase and it can assist in decision-making about risk management for multinational companies interested in working in the Gulf region. Furthermore, the study illustrates where responsibilities lie when a problem arises. Moreover, to design a standard risk management model, there is no need for further study into the relative weight of the risk categories and their impact on project completion in construction projects in the Gulf region.

The research outcome can be used to design a standard risk management model.

This research investigated the construction phase only. Further investigation can be conducted on different phases

The study reveals that Kuwait's significant risk factors during the construction phase are different than Bahrain. For example, the most significant risk in Kuwait is "Cost estimation accuracy". However, in Bahrain is "Contractors' experience".

Furthermore, Kuwait and Bahrain ranked the Finance-related risks as the leading risk category in impacting the construction phase, which comes in agreement with the study of El-Sayegh (2008) on the United Arab Emarites (UAE). Although Kuwait , Bahrain and UAE have different perceptions on significant risk affecting their projects, they are all in agreement on Finance category, which is the most significant, whilst External risks are the least important.

Recommendations for future researchers

In general, the future researcher can benefit from the result of the research by launching it as the basic foundation towords designing conceptual standard risk management model for managing risk factors related to the construction phase of the construction projects in the Gulf region.

The researcher followed the research found in the literature review and did not follow the contractual form in contracts. Future reseachers could use existing labels of classification schemes used in standard forms of contracts.

Recommendations for practitioners

This research identifies and assesses the negative impact of risks during the construction phase of the construction project.

There is a significant differences in perceptions of clients,consultants, and contractors in both countries (Kuwait and Bahrain) on the negative impact of the presented risk factors on project completion.

With the data limitation, it can be concluded that the risk factors with significant negative impact on project completion in Kuwait in case of occurence are:

- Cost estimation accuracy.
- Revising / approving design documents, shop drawings and sample materials.
- Data collection and survey before design.
- Material delivery.
- Complete documents and drawings of projects.

In Bahrain leading risk factors are:

- Contractor’s experience.
- Cost estimation accuracy.
- Material delivery.
- Availability of construction materials in market.
- Decision making process.

On the next page a simple set of guidelines for managing risk by praticioners in both Kuwait and Bahrain is given based on the research in this thesis.

Guide lines for managing risk in Kuwait and Bahrain

1. Identify risks and assess their negative impact on the project and prioritise them based on the relative importance index values.

2. Identify moderate risks to minimise by taking immediate management action and identify significant risks with extensive impact for risk management plan action.

3. Maintain good communications between construction parties (clients, consultants, and contractors).

4. Allocating risks can minimise the impact.

5. Be certain that construction parties are aware of their responsibilities.

6. Minimise risks to contractors at the designing stage.

7. Financial assessment is significant. The result of the research shows that finance related risk factors (cost estimation accuracy and cash flow analysis) are the leading factors have significant impact on construction project in both countries (Kuwait and Bahrain).

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Appendices

Appendix (A) Request Letters:

- A-1 Kuwait Society of Engineers (KSE) request letter.
- A-2 Bahrain Society of Engineers (BES) request letter.

Appendix (B) Practitioners Semi-structure interview

- Evaluation of Management-related risk factors.
- Evaluation of Design-related risk factors.
- Evaluation of Finance -related risk factors.
- Evaluation of Material-related risk factors.
- Evaluation of Labour and equipment-related risk factors.
- Evaluation of External-related risk factors.

Appendix (B-7) : Identified and categorised risk factors

Appendix (C) Categories relative weight (C.R.W) and Responsibility shares.

Appendix (D) Main Questionnaire

Appendix (E) Kuwait and Bahrain comparison

- E-1 General Linear Model tests
- E-2 Independent sample t-tests

Appendix (F) Kuwait data analysis

- F-1 ANOVAs tests
- F-2 Descriptive analysis
- F-3 Post-Hoc test

Appendix (G) Kuwait results

- G1 Number of respondents to risk factors.
- G2 Risk factors Relative Importance Index (RII).
- G-3 Kuwait categories correlations.

Appendix (H) Bahrain data analysis

- H-1 descriptive data analysis.
- H-2 ANOVAs tests
- H-3 Post-Hoc test

Appendix (I) Bahrain results

- I-1 Number of respondents to risk factors.
- I-2 Bahrain categories correlations.

Appendix (J) Kuwait and Bahrain overall ranking

- J-1 Risk factors codes.
- J-2 the State of Kuwait overall ranking.
- J-3 Kingdom of Bahrain overall ranking.

Appendix (A) Request Later

Appendix A-1

Dear/ President of the Kuwait Society of Engineers

Engineer / Talal Alqahtani

Subject: Approval of proving information

Presently, I am a Post-graduate student at the University of Manchester conducting a study on investigating the construction environment which focuses on assessing the construction risk in construction projects in the State of Kuwait. Field survey is one of the significant requirements to complete the study. Kuwait society of engineers' role in providing the engineering related information is highly recognised. For such reason I appreciate your support by providing me with the following information:

1. Consultant firms contacts
2. Contractors firms contacts
3. Information related to construction projects

I also would like to schedule a meeting for an interview to discuss the risk environment associated with construction projects in the State of Kuwait.

Best Regards;

Eng. Anood Altoryman
Anood.altoryman@postgrad.manchester.ac.uk

Appendix (A) Request Later

Appendix A-2

Dear/ President of the Bahrain Society of Engineers

Mr / A.Majeed Al Gassab

Subject: Approval of proving information

Presently, I am a Post-graduate student at the University of Manchester conducting a study on investigating the construction environment which focuses on assessing the construction risk in construction projects in the Kingdom of Bahrain. Field survey is one of the significant requirements to complete the study. Bahrain society of engineers' role in providing the engineering related information is highly recognised. For such reason I appreciate your support by providing me with the following information:

4. Consultant firms contacts
5. Contractors firms contacts
6. Information related to construction projects

I also would like to schedule a meeting for an interview to discuss the risk environment associated with construction projects in the Kingdom of Bahrain.

Best Regards;

Eng. Anood Altoryman
Anood.altoryman@postgrad.manchester.ac.uk

Appendix (B)

Practitioners' Semi-structure interview

Dear Sir,

I have the pleasure to introduce myself as a postgraduate student at University of Manchester and currently working on a research related to identification and assessment of construction risks in the Gulf region.

The goal of the study is to identify the major risks in construction industry in the Gulf region, classify them according to their nature and resources with referring to the proper allocation of risk to the construction parties (Client, Consultant, and Contractor).

The questionnaire might take 20-25 minutes to be completed. All is the answers given in this form will be held strictly confidential and will be used entirely for my research work.
Thank you very much in advance for your valuable time spent answering the attached questionnaire.
Equipment

Yours Sincerely;
Eng. Anood Altoryman
E-mail: anood.altoryman@postgrad.manchester.ac.uk

Appendix B-1

Evaluation of Management-related risk factors

No.	Management Risk Factors	Accept	Adjust	Reject
1.	Lack of strategic management			
2.	Slowness in decision making process			
3.	Unrealistic contract duration imposed.			
4.	Lack of capable representatives			
5.	poor contract management			
6.	Poor communication and coordination between parties			
7.	Improper project feasibility study			
8.	Inadequate review			
9.	Unclear responsibility			
10.	Lack of experience in the construction business			
11.	Late in revising and approving design documents			
12.	Delay in approving shop drawings and sample materials			
13.	Delay in work approval			
14.	Improper planning and scheduling			
15.	Postponement of work			
16.	Late issuance of instruction			
17.	Inadequate supervision and project management assistance.			
18.	Poor information dissemination			
19.	Slow and delay in site mobilization			
20.	Unavailability of incentives for contractor for finishing ahead of schedule			
21.	Inadequate contractor experiences.			
22.	Inadequate modern equipments.			
23.	In accurate time estimation			
24.	In accurate cost estimation			
25.	Lack of competent subcontractors/suppliers			
26.	Improper monitoring and control			
27.	Incompetent project team			
28.	Sever overtime			
29.	Inadequacy of site inspections			
30.	Poor site management and supervision.			
31.	Conflicts in sub-contractors schedule in execution of project.			
32.	Lack of necessary skills			
33.	Inexperienced personnel			
34.	Insufficient number of staffs.			

Continue….Appendix B-1

No.	Management Risk Factors	Accept	Adjust	Reject
35.	Subcontractors Problems			
36.	Rework due to errors during construction.			
37.	Disputes and Claims (Lack of comprehensive dispute resolution).			
38.	Mistake during construction			
39.	Improper construction methods implemented			
40.	Different attitude between the consultant and contractors			
41.	Conflicts b/w contractor and other parties (consultant and owner).			
42.	Spend some time to find sub-contractors company who is appropriate for each task.			
43.	Delays in sub-contractors work.			
44.	Inadequate contractor's work.			
45.	Poor qualification of the contractor's technical staff.			
46.	Poor Contract Management and Unrealistic Scheduling.			
47.	Shortage of Training.			
48.	Controlling decision-making mechanism			
49.	Long wait for approval of tests and inspection.			
50.	Delay in approving major changes in the scope of work.			
51.	Quality assurance/control.			
52.	Slow response.			
53.	Lack of involvement through project life.			
54.	Frequent change of sub-contractors because of their inefficient work.			
55.	Major disputes and negotiations during construction			
56.	Excessive contractors/subcontractors			
57.	Inappropriate type of contracts used			
58.	Unreasonable risk allocation			
59.	Mistakes and discrepancies in contract documents.			
60.	Inflexibility (rigidity) of consultant			

Appendix B-2

Evaluation of Design-related risk factors

No.	Design Risk Factors	Accept	Adjust	Reject
61.	Insufficient data collection and survey before design.			
62.	Design Modifications.			
63.	Incomplete drawing			
64.	Unclear and inadequate details in drawings.			
65.	Inadequate design-team experience			
66.	Misunderstanding of requirements			
67.	Decision during Development Stage			
68.	Lack of standardization design			
69.	Impractical design.			
70.	Changes in Drawings			
71.	Confusing requirements			
72.	Excessive change order			
73.	Change orders during construction			
74.	Incomplete Documents.			
75.	Changes in Specifications			
76.	Variation orders			
77.	Delays in producing design documents.			
78.	Complexity of project design.			

Please add any comments:

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Appendix B-3

Evaluation of Finance -related risk factors

No.	Finance Risk Factors	Accept	Adjust	Reject
79.	Financial difficulties			
80.	payment of competed work			
81.	Delay in progress payments			
82.	Difficulties in financing project by contractor/clients			
83.	Timing of availability funds does not match cash flow forecast			
84.	Labour cost is higher than predicted			
85.	Incomplete cost plan			
86.	Inflation			
87.	Delay payments of completed work			
88.	Slow payment by owners due to dispute			
89.	Financial problems due to errors in estimating			
90.	Loss due to default of contractor, sub-contractor, supplier or owner			
91.	Material cost is higher than predicted			

Please add any comments:

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Appendix B- 4

Evaluation of Material-related risk factors

No.	Material Risk Factors	Accept	Adjust	Reject
92.	Quality of material (Below standard)			
93.	Material damage during transportation			
94.	Material damage during storage			
95.	Material procurement (escalation of material prices).			
96.	Shortage of construction materials in market.			
97.	Changes in material types and specifications during construction.			
98.	Delay in material delivery			
99.	Delay in manufacturing special building materials			
100.	Non compliance of material to specification			
101.	Materials suppliers problems			
102.	Proposed material are not proved			
103.	Material waste			
104.	Late in selection of finishing material due to availability of many types in the market.			

Please add any comments:

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Appendix B-5

Evaluation of Labour and equipment-related risk factors

No.	Labour and Equipment Risk Factors	Accept	Adjust	Reject
105.	Lack of skilled labour			
106.	Lack of labour			
107.	Labour low productivity			
108.	Frequent job change by skilled labour			
109.	Unable to understand drawings			
110.	Strike and labour disputes			
111.	Lack of high-technology mechanical equipment.(insufficient technology)			
112.	Inadequate, Inappropriate and old equipment			
113.	Need to import from another country			
114.	Equipment Breakdown			
115.	High maintenance cost			
116.	Unavailability of spare parts or cost is high			
117.	Poor technical performances			
118.	Low productivity and efficiency of equipment.			
119.	Equipment availability (Shortage of equipment).			

Please add any comments:

_____

_____

_____

_____

Appendix B-6

Evaluation of External-related risk factors

No.	External Risk Factors	Accept	Adjust	Reject
120.	Site's topography is changed after design			
121.	Changes in regulations			
122.	Labour dispute and strikes			
123.	Civil disturbances			
124.	Problems with neighbours			
125.	Regulations and Laws of Municipality			
126.	Building Permits Approval			
127.	Slow government permits			
128.	Site conditions			

Please add any comments:

_____
_____
_____
_____
_____

Appendix B-7

Identified and categorised risk factors

Management RF
1. Decision making process
2. Communication and coordination between parties (Clients Consultants, and Contractors).
3. Unclear responsibility
4. Availability of capable representatives
5. Postponement of work (Held Orders).
6. Issuance of instruction.
7. Availability of project management team members (experience).
8. Information dissemination.
9. Site mobilization and delay in site handover
10. Contractors' experiences.
11. Availability of competent subcontractors / suppliers.
12. Rework due to errors during construction.
13. Availability of Disputes and Claims- comprehensive dispute resolution.
14. Conflicts in sub-contractors schedule in execution of project.
15. Delays in sub-contractor's work.
16. Unsatisfactory work of contractor
17. Delay in approving major changes in the scope of the work.
18. Long waiting for approval of tests and inspection.
19. Quality assurance/control.
20. Excessive use of contractors / subcontractors.
21. Unreasonable risk allocation.
22. Frequent change of sub-contractors because of their inefficient work
23. Revising/approving design documents, shop drawings and sample materials.

Continue - Appendix B-7

Design RF
1. Design-team experience.
2. Complexity of project design.
3. Confusing requirements.
4. Design Modifications.
5. Data collection and survey before design.
6. Complete documents and drawings of projects.
7. Producing design modification documents.
8. Clarity of details in drawings.
9. Excessive change order.

Finance RF
1. Payment of completed work.
2. Financing project by contractor/owner.
3. Cash flow plan analysis.
4. Cost estimation accuracy.

Material RF
1. Quality of Materials (Below standards).
2. Availability of construction materials in market.
3. Change in material types and specifications during construction.
4. Material delivery.
5. Manufacturing special building materials.
6. Materials Supplier's Problem.
7. Material wastes handling.
8. Compliance of material to specifications.

Continue - Appendix B-7

L&E RF
1. Labour performance/productivity
2. Equipment availability.
3. Productivity and efficiency of equipment.
4. Labours and management relations.
5. Necessity skills.
6. Labour strikes and disputes.

External RF
1. Site's topography is changed after design.
2. Civil disturbances.
3. Problems with neighbours.
4. Government permits.
5. Changes in regulations.

Appendix (C)

Categories relative weight (C.R.W) and Responsibility shares.

Please assign responsibility share percentage of each risk to one or more of the construction project parties and relative weight to each category

Management-Related Factors		Responsibility %		
Category Relative weight	45%	Client	Consultant	Contractor
1	Decision making process	15	60	25
2	Communication and coordination between parties (Clients, Consultants, and Contractors).	10	45	45
3	Unclear responsibility.	30	20	50
4	Availability of capable representatives.	15	50	35
5	Postponement of work (Held Orders).	2.5	22.5	75
6	Issuance of instruction.	20	60	20
7	Availability of project management team members) experience).	5	75	20
8	Information dissemination.	10	70	20
9	Site mobilization and delay in site handover	5	85	10
10	Contractors' experiences.	0	30	70
11	Availability of competent subcontractors / suppliers.	0	10	90
12	Rework due to errors during construction.	0	10	90
13	Availability of Disputes and Claims-comprehensive dispute resolution.	10	80	10
14	Conflicts in sub-contractors schedule in execution of project.	0	30	70
15	Delays in sub-contractor's work.	10	20	70
16	Unsatisfactory work of contractor	0	10	90
17	Delay in approving major changes in the scope of the work.	10	65	25
18	Long waiting for approval of tests and inspection.	2.5	67.5	30
19	Quality assurance/control.	2.5	27.5	70
20	Excessive contractors / subcontractors.	0	20	80
21	Unreasonable risk allocation.	30	10	60
22	Frequent change of sub-contractors because of their inefficient work.	0	10	90
23	Revising/approving design documents, shop drawings and sample materials.	10	65	25

Continue, **Appendix (C)**

Categories relative weight (C.R.W) and Responsibility shares

Design-Related Factors		Responsibility %		
Category Relative weight	**17%**	**Client**	**Consultant**	**Contractor**
24	Design-team experience.	0	80	20
25	Complexity of project design.	5	75	20
26	Confusing requirements.	5	35	60
27	Design Modifications.	30	40	30
28	Data collection and survey before design.	20	60	20
29	Complete documents and drawings of projects.	20	60	20
30	Producing design modification documents.	5	80	15
31	Clarity of details in drawings.	5	75	20
32	Excessive change order.	50	40	10

Finance Related Factors		Responsibility %		
Category Relative weight	**11%**	**Client**	**Consultant**	**Contractor**
33	Payment of completed work.	20	70	10
34	Financing project by contractor/client	0	15	85
35	Cash flow plan analysis.	5	20	75
36	Cost estimation accuracy.	10	60	30

Material Related Factors		Responsibility %		
Category Relative weight	**15%**	**Client**	**Consultant**	**Contractor**
37	Quality of Materials (Below standards).	2.5	27.5	70
38	Availability of construction materials in market.	2.5	17.5	80
39	Change in material types and specifications during construction.	10	60	30
40	Material delivery.	0	10	90
41	Manufacturing special building materials.	7.5	7.5	85
42	Materials Supplier’s Problem.	0	0	100
43	Material wastes handling.	2.5	7.5	90
44	Compliance of material to specifications.	0	10	90

L&E Related Factors		Responsibility %		
Category Relative weight	6 %	Client	Consultant	Contractor
45	Labour performance/productivity	0	10	90
46	Equipment availability.	0	0	100
47	Productivity and efficiency of equipment	0	0	100
48	Labours and management relations.	0	0	100
49	Necessity skills.	2.5	27.5	70
50	Labour strikes and disputes.	0	10	90

External Related Factors		Responsibility %		
Category Relative weight	6 %	Client	Consultant	Contractor
51	Site's topography is changed after design.	0	90	10
52	Civil disturbances.	0	0	100
53	Problems with neighbours.	20	10	70
54	Government permits.	5	35	60
55	Changes in regulations.	0	30	70

Appendix (D) Questionnaire

Dear Sir/Madam,

One of the partial requirements for the PhD Degree in Civil Engineering (Project Management) at the University of Manchester – UK, is to complete my research on investigating the construction environment specifically on risks associated to construction projects in the Gulf Region, for which I am carrying out a field study related to the subject.

The work includes a field survey to be filled for a selected number of companies. Your company has been chosen, amongst others, based on a scientific preference adopted in the research methodology.

The purpose of this survey is to identify the negative impact level of each potential risk factor from your point of view.

The collected data and information through this questionnaire will represent one of the main sources for my research work and its finding. Your response, therefore, is highly appreciated. Data given in this questionnaire will be treated with the utmost confidentiality (agreement attached). It will be recorded for statistical purposes and will be used for scientific research only.

The questionnaire will take no more that 20 minutes and your input will be a valuable contribution towards this research. Please feel free to contact me if you need any clarification or to request that the survey be collected.
Thank you very much in advance.

Eng. Anood Altoryman
Anood.altoryman@postgrad.manchester,ac,uk

من ضمن متطلبات الحصول علي درجة الدكتوراه بجامعة مانشستر بكلية الهندسة بقسم الهندسة المدنية وإدارة المشاريع - المملكة المتحدة أن يقوم الباحث بإعداد بحث عن أحد الموضوعات ذات الأهمية في ميدان دراسته وفى هذا الشأن أقوم بدراسة ميدانيه كجزء من المتطلبات المادة بعنوان "أهم عوامل المخاطر الإنشائية في منطقة الخليج العربي".

وتشمل هذه الدراسة الميدانية استبيان يتعين استيفاء أسئلته بواسطة مؤسستكم المختارة بمملكة البحرين وذلك ضمن منهجية البحث المستخدمة والهدف من أسئلة الاستبيان هو تحديد مدي الأهمية النسبية للعوامل المؤثرة علي مجال إدارة المخاطر.

وستمثل البيانات التي سيتم تجميعها من إجابات الاستبيان أحد المصادر الأساسية للبحث وما يتمخض عنه من نتائج، لذلك فإن تجاوبكم المشكور مع هذا البحث بالإجابة على الأسئلة بدقة سيكون له أكبر الأثر في نجاح البحث، لذلك سأكون ممتنا لتعاونكم وتأكّدوا إن جميع المعلومات والبيانات المعطاة والآراء المسجلة سيكون لها صفة السرية المطلقة وان أجوبتكم ستسجل فقط بشكل معلومات إحصائية مجمّعة وتستخدم لأغراض البحث العلمي وغير مسموح بتداولها أو نشرها.

ومع تقديري التام لمدى انشغالكم إلّا إنّي أطمح في إعطاء بعض الوقت للمشاركة في هذا المسح الميداني العلمي ،وأشكركم مقدّما على حسن تعاونكم وصادق اهتمامكم بالبحث العلمي وأرجو الاتصال من خلال البريد الإلكتروني لأي استفسار أوفي حالة الانتهاء من الإجابة حتى يتسنى لي جمعها.

وتفضلوا بقبول فائق التقدير والاحترام,

أسئلة عامة

Section I: Personal information

□ مالك □ مقاول □ استشاري ☐Owner ☐Contractor ☐Consultant

سنوات الخبرة الفعلية:

□ 17 فأكثر
□ 9 - 7
□ 8 – 3
□ 2 – 0

Years of Experience:

□ 17 years and above
□ 9 – 7
□ 3 - 8
□ 0 - 2

اختياري

Optional

الاسم : Name:

المسمى الوظيفي : Job Title:

البريد الإلكتروني: E-mail:

1- The purpose of this part is to identify management related risk factors impact on the project completion.

1- الغرض من هذا الجزء هو التعرف على تأثير العوامل الإدارية على نجاح المشروع.

Please select the appropriate impact level of each risk factor from your viewpoint by ticking ((√ the right box.

جاء تحديد مدى الأهميّة النسبيّة للعوامل التالية من وجهة نظرك بوضع علامة (√) في المربع المناسب.

The negative impact scale

درجة الأهمية النسبية كالتالي

1	2	3	4	5
0 % No effect	25 % Minimum	50 % Moderate	75 % Significant	100 % Extensive

	Management Factors	1	2	3	4	5	العـــــــوامل	
1	Decision making process.	□	□	□	□	□	سرعة اتخاذ القرارات.	1
2	Communication and coordination between parties (Clients, Consultants, and Contractors)	□	□	□	□	□	الاتصال والتنسيق بين الأطراف المعنية.	2
3	Unclear responsibilities	□	□	□	□	□	عدم وضوح المسئولية.	3
4	Availability of capable representatives.	□	□	□	□	□	توفّر المندوبين الأكفاء.	4
5	Postponement of work (Held Orders).	□	□	□	□	□	تأخير إنجاز المهام.	5
6	Issuance of instruction.	□	□	□	□	□	إصدار التعليمات.	6
7	Availability of project management team members) experience).	□	□	□	□	□	توافر الكوادر التخصّصيّة المطلوبة بفريق إدارة المشروع.	7
8	Information dissemination.	□	□	□	□	□	توزيع المعلومات.	8
9	Site mobilization and delay in site handover	□	□	□	□	□	التأخّر باستلام الموقع وتجهيز الموقع.	9
10	Contractors' experiences.	□	□	□	□	□	خبرة المقاولين.	10
11	Availability of competent subcontractors / suppliers.	□	□	□	□	□	توافر المقاولين أوالموردين.	11

12	Rework due to errors during construction.	☐	☐	☐	☐	☐	عمل تعديلات أثناء المراحل الإنشائية .	12
13	Availability of Disputes and Claims-comprehensive dispute resolution.	☐	☐	☐	☐	☐	توافر الحلول للنزاعات والمطالبات.	13
14	Conflicts in sub-contractors schedule in execution of project.	☐	☐	☐	☐	☐	التعارض بين أعمال المقاولين الباطن أثناء تنفيذ المشروع.	14
15	Delays in sub-contractor's work.	☐	☐	☐	☐	☐	التأخير في أعمال المقاولين الباطن.	15
16	Unsatisfactory work of contractor.	☐	☐	☐	☐	☐	إيفاء المقاولين بالأعمال المتفق عليها.	16
17	Delay in approving major changes in the scope of the work.	☐	☐	☐	☐	☐	التأخير في الموافقة على تغييرات أساسية في مجال العمل.	17
18	Long waiting for approval of tests and inspection.	☐	☐	☐	☐	☐	الانتظار الطويل للموافقة على بدء الفحص والتفحص.	18
19	Quality assurance/control.	☐	☐	☐	☐	☐	عمليات الرقابة النوعية وضبط الجودة.	19
20	Excessive contractors / subcontractors.	☐	☐	☐	☐	☐	كثرة عدد المقاولين والمقاولين الباطن.	20
21	Unreasonable risk allocation.	☐	☐	☐	☐	☐	توزيع المخاطر بشكل غير صحيح خلال المشروع.	21
22	Frequent change of sub-contractors because of their inefficient work.	☐	☐	☐	☐	☐	التغيير المتكرر للمقاولين الباطن بسبب عدم كفاءة الأعمال.	22
23	Revising/approving design documents, shop drawings and sample materials.	☐	☐	☐	☐	☐	مراجعة واعتماد التصاميم الفعلية للمشروع المقام واعتماد المواد المستخدمة به.	23

2- The purpose of this part is to identify Design related risk factors impact on the project completion.

Please select the appropriate impact level of each risk factor from your viewpoint by ticking ((√ the right box.

2-الغرض من هذا الجزء هو التعرف على مدي تأثير مخاطر التصميم على نجاح المشروع.

جاء تحديد مدي الأهمية النسبية للعوامل التالية من وجهة نظرك بوضع علامة (√) في المربع المناسب.

The negative impact scale

درجة الأهمية النسبية كالتالي

1	2	3	4	5
0 % No effect	25 % Minimum	50 % Moderate	75 % Significant	100 % Extensive

	Design Factors	1	2	3	4	5	العـــــــوامل	
1	Design-team experience.	□	□	□	□	□	خبرة فريق التصميم.	1
2	Complexity of project design.	□	□	□	□	□	صعوبة وتعقيد تصاميم المشاريع.	2
3	Confusing requirements.	□	□	□	□	□	المتطلبات التصميميّة ألمربكة والمشوشة.	3
4	Design Modifications.	□	□	□	□	□	تعديلات في التصميم.	4
5	Data collection and survey before design.	□	□	□	□	□	تجميع بيانات المطلوبة للمشروع قبل البدء بالتصميم.	5
6	Complete documents and drawings of projects.	□	□	□	□	□	اكتمال وثائق وتصاميم المشروع.	6
7	Producing design modification documents.	□	□	□	□	□	إبراز الوثائق التصميمية.	7
8	Clarity of details in drawings.	□	□	□	□	□	وضوح التفصيلات في التصاميم.	8
9	Excessive change order.	□	□	□	□	□	الأوامر التغيرية المفرطة.	9

3- The purpose of this part is to identify Finance related risk factors impact on the project completion..

3- الغرض من هذا الجزء هو التعرف على مدى تأثير العوامل المالية على نجاح المشروع.

Please select the appropriate impact level of each risk factor from your viewpoint by ticking ((√ the right box.

جاء تحديد مدي الأهمية النسبية للعوامل التالية من وجهة نظرك بوضع علامة (√) في المربع المناسب.

The negative impact scale

درجة الأهمية النسبية كالتالي

1	**2**	**3**	**4**	**5**
0% No effect	25 % Minimum	50 % Moderate	75 % Significant	100 % Extensive

	Finance Factors	1	2	3	4	5	العـــــــوامل	
1	Payment of completed work.	□	□	□	□	□	دفعات الأعمال المنجزة.	1
2	Financing project by contractor/client.	□	□	□	□	□	تمويل المقاول أو المالك للمشروع.	2
3	Cash flow analysis.	□	□	□	□	□	تحليل التدفق المالي للمشروع.	3
4	Cost estimation accuracy.	□	□	□	□	□	دقّة تقدير تكلفة المشروع.	4

4- The purpose of this part is to identify Material related risk factors impact on the project completion.

4- الغرض من هذا الجزء هو التعرف على عوامل المواد ومدى تأثيرها على نجاح المشروع.

Please select the appropriate impact level of each risk factor from your viewpoint by ticking ((√ the right box.

الرجاء تحديد مدي الأهمية النسبية للعوامل التالية من وجهة نظرك بوضع علامة (√) في المربع المناسب.

The negative impact scale

درجة الأهمية النسبية كالتالي

1	2	3	4	5
0 % No effect	25 % Minimum	50 % Moderate	75 % Significant	100 % Extensive

	Material Factors	1	2	3	4	5	العـــــــوامل	
1	Quality of Materials (Below standards).	□	□	□	□	□	جودة المواد.	1
2	Availability of construction materials in market.	□	□	□	□	□	توافر مواد البناء في السوق.	2
3	Change in material types and specifications during construction.	□	□	□	□	□	التغيير في مواصفات وأنواع المواد خلال فترة تنفيذ المشروع.	3
4	Material delivery.	□	□	□	□	□	وصول المواد لموقع العمل.	4
5	Manufacturing special building materials.	□	□	□	□	□	صناعة المواد الخاصة للمشروع.	5
6	Materials Supplier's Problem.	□	□	□	□	□	إيفاء الموردين للطلبات المتفق عليها.	6
7	Material wastes handling.	□	□	□	□	□	التخلص من نفايات المواد الإنشائية.	7
8	Compliance of material to specifications.	□	□	□	□	□	مطابقة المواد للمواصفات المتفق عليها.	8

5- The purpose of this part is to identify Labour and Equipment related risk factors impact on the project completion.

5- الغرض من هذا الجزء هو التعرف على العوامل المالية ومدى تأثيرها على نجاح المشروع.

Please select the appropriate impact level of each risk factor from your viewpoint by ticking ((√ the right box.

جاء تحديد مدي الأهمية النسبية للعوامل التالية من وجهة نظرك بوضع علامة (√) في المربع المناسب.

The negative impact scale

درجة الأهمية النسبية كالتالي

1	2	3	4	5
0% No effect	25 % Minimum	50 % Moderate	75 % Significant	100 % Extensive

	Labours & Equipments	1	2	3	4	5	العـــــــوامل	
1	Labour performance/productivity.	□	□	□	□	□	مدى إنتاجية العمالة وأداؤهم.	1
2	Equipment availability.	□	□	□	□	□	توفّرالمعدات.	2
3	Productivity and efficiency of equipment.	□	□	□	□	□	إنتاجية وكفاءة المعدات.	3
4	Labours and management relations.	□	□	□	□	□	العلاقة بين العمالة والإدارة.	4
5	Necessity skills	□	□	□	□	□	المهارات الأساسية الضرورية.	5
6	Labour strikes and disputes	□	□	□	□	□	إضراب العمالة ونزاعاتهم.	6

6- The purpose of this part is to identify External related risk factors impact on the project completion.

6- الغرض من هذا الجزء هو التعرف على العوامل الخارجيه ومدى تأثيرها على نجاح المشروع.

Please select the appropriate impact level of each risk factor from your viewpoint by ticking ((√ the right box.

جاء تحديد مدي الأهمية النسبية للعوامل التالية من وجهة نظرك بوضع علامة (√) في المربع المناسب.

The negative impact scale

درجة الأهمية النسبية كالتالي

1	2	3	4	5
0 % No effect	25 % Minimum	50 % Moderate	75 % Significant	100 % Extensive

درجة الموافقة

	External Factors	1	2	3	4	5	العـــــــوامل	
1	Site's topography is changed after design.	□	□	□	□	□	تغير حالة الموقع بعد التصميم.	1
2	Civil disturbances.	□	□	□	□	□	الإضرابات المدنية.	2
3	Problems with neighbours.	□	□	□	□	□	الخلافات مع الجيران.	3
4	Government permits.	□	□	□	□	□	الموافقات الحكومية على رخص البناء.	4
5	Changes in regulations.	□	□	□	□	□	القوانين والأنظمة أثناء فترة المشروع.	5

CONFIDENTIALITY AGREEMENT

Dear Sirs,

We confirm that in consideration of the disclosure of certain information by you to us, we undertake:-

1. Not to disclose to any third party any confidential information which we receive from you relating to the project or otherwise, other than to those of our officers and employees to whom such disclosure is necessary to fulfil our obligations to you. We will ensure that any such persons to whom such information is disclosed are made aware of the contents of this letter and abide by its terms.

2. The term "confidential information" shall not include information which was in the public domain prior to receipt of the same from you, information which subsequently becomes part of the public domain other than through a breach of this agreement, or information which was known to us prior to the disclosure of the information by you.

3. In the event that we become legally compelled to disclose any of the information, we shall provide you with as much notice as is practicable to avoid, if you so desire, such disclosure by such legal proceedings as may be available, but without prejudice to our duties to submit to such disclosure.

4. We expressly agree that no right or licence is granted to us in relation to any information disclosed pursuant to this letter, except as expressly set out herein.

5. This letter shall be governed by and construed in accordance with United Kingdom, State of Kuwait and Kingdom of Bahrain law and we hereby submit to the jurisdiction of the relevant courts of United Kingdom, State of Kuwait and Kingdom of Bahrain for the purpose of its interpretation and enforcement.

Yours faithfully;

Anood Saleh Altoryman
PhD Researcher
Management of Projects
School of MACE
The University of Manchester,
Oxford Road, Manchester, M13 9PL
United Kingdom

Appendix (E) Kuwait and Bahrain comparison

Appendix E-1: General Linear Model- Multivariate Tests

Group Statistics					
CATEGORY	**COUNTRY**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Management	1	228	2.9519	.63506	.04206
	2	181	**3.4634**	.64856	.04821
Design	1	228	3.0755	.80603	.05338
	2	181	**3.3935**	.71189	.05291
Finance	1	228	3.0833	.82109	.05438
	2	181	**3.6064**	.85437	.06350
Material	1	228	2.9682	.83087	.05503
	2	181	**3.4558**	.76939	.05719
Labour &equipment	1	228	2.8867	.84981	.05628
	2	181	**3.5166**	.77102	.05731
External	1	228	2.8509	.86205	.05709
	2	181	**3.3337**	.86334	.06417

Appendix (E) Kuwait and Bahrain comparison

Appendix E-2: Independent sample t-test

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
total_M	Equal variances assumed	.701	.403	-8.013	407	**.000**	-.51142	.06382	-.63688	-.38596
	Equal variances not assumed			-7.994	382.553	**.000**	-.51142	.06398	-.63721	-.38564
total_D	Equal variances assumed	2.228	.136	-4.170	407	**.000**	-.31796	.07624	-.46783	-.16808
	Equal variances not assumed			-4.230	402.356	**.000**	-.31796	.07516	-.46572	-.17020
total_F	Equal variances assumed	.454	.501	-6.285	407	**.000**	-.52302	.08322	-.68662	-.35942
	Equal variances not assumed			-6.256	379.114	**.000**	-.52302	.08361	-.68741	-.35863
total_MAT	Equal variances assumed	1.678	.196	-6.090	407	**.000**	-.48760	.08007	-.64499	-.33020
	Equal variances not assumed			-6.144	397.445	**.000**	-.48760	.07936	-.64362	-.33158
total_LE	Equal variances assumed	.714	.399	-7.755	407	**.000**	-.62988	.08123	-.78955	-.47020
	Equal variances not assumed			-7.842	399.767	**.000**	-.62988	.08032	-.78779	-.47197
total_EXT	Equal variances assumed	.119	.731	-5.622	407	**.000**	-.48282	.08588	-.65164	-.31401
	Equal variances not assumed			-5.621	385.968	**.000**	-.48282	.08589	-.65170	-.31395

Appendix (F) Kuwait analysis

Appendix F-1: ANOVAs test-Kuwait

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
M	Between Groups	2.531	2	1.265	3.199	**.043**
	Within Groups	89.018	225	.396		
	Total	91.549	227			
D	Between Groups	3.007	2	1.504	2.342	.098
	Within Groups	144.470	225	.642		
	Total	147.477	227			
F	Between Groups	.458	2	.229	.338	.714
	Within Groups	152.583	225	.678		
	Total	153.042	227			
MAT	Between Groups	.394	2	.197	.284	.753
	Within Groups	156.313	225	.695		
	Total	156.707	227			
L&E	Between Groups	1.839	2	.920	1.276	.281
	Within Groups	162.095	225	.720		
	Total	163.934	227			
EXT	Between Groups	.078	2	.039	.052	.949
	Within Groups	168.612	225	.749		
	Total	168.690	227			

Appendix F-2

Descriptive analysis-Kuwait

Descriptive									
Category	Party	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
M	1	77	3.0152	.52624	.05997	2.8958	3.1347	1.57	4.35
	2	65	3.0542	.67632	.08389	2.8866	3.2218	1.57	4.52
	3	86	2.8180	.67473	.07276	2.6733	2.9627	1.65	4.52
	Total	228	2.9519	.63506	.04206	2.8691	3.0348	1.57	4.52
D	1	77	2.9524	.59520	.06783	2.8173	3.0875	1.11	4.22
	2	65	3.2427	.84890	.10529	3.0324	3.4531	1.67	5.00
	3	86	3.0594	.91667	.09885	2.8629	3.2560	1.44	5.00
	Total	228	3.0755	.80603	.05338	2.9704	3.1807	1.11	5.00
F	1	77	3.0617	.68243	.07777	2.9068	3.2166	1.25	4.75
	2	65	3.1538	.89780	.11136	2.9314	3.3763	1.50	5.00
	3	86	3.0494	.87852	.09473	2.8611	3.2378	1.25	5.00
	Total	228	3.0833	.82109	.05438	2.9762	3.1905	1.25	5.00
MAT	1	77	2.9594	.71991	.08204	2.7960	3.1228	1.00	4.38
	2	65	3.0308	.78126	.09690	2.8372	3.2244	1.25	4.88
	3	86	2.9288	.95708	.10320	2.7236	3.1340	1.25	5.00
	Total	228	2.9682	.83087	.05503	2.8598	3.0766	1.00	5.00
LE	1	77	2.9589	.77524	.08835	2.7829	3.1348	1.00	4.67
	2	65	2.9538	.85823	.10645	2.7412	3.1665	1.17	5.00
	3	86	2.7713	.90281	.09735	2.5778	2.9649	1.00	5.00
	Total	228	2.8867	.84981	.05628	2.7758	2.9976	1.00	5.00
EXT	1	77	2.8623	.68307	.07784	2.7073	3.0174	1.20	4.60
	2	65	2.8215	.78670	.09758	2.6266	3.0165	1.00	5.00
	3	86	2.8628	1.04904	.11312	2.6379	3.0877	1.40	5.00
	Total	228	2.8509	.86205	.05709	2.7384	2.9634	1.00	5.00

Appendix F-3

Post-Hoc test descriptive statistics

Multiple Comparisons LSD							
Dependent Variable	(I) TYPE	(J) TYPE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
M	1	2	-.03893	.10595	.714	-.2477	.1698
		3	.19725*	.09868	**.047**	.0028	.3917
	2	1	.03893	.10595	.714	-.1698	.2477
		3	.23618*	.10338	**.023**	.0325	.4399
	3	1	-.19725*	.09868	**.047**	-.3917	-.0028
		2	-.23618*	.10338	**.023**	-.4399	-.0325
D	1	2	-.29035*	.13497	**.033**	-.5563	-.0244
		3	-.10705	.12572	.395	-.3548	.1407
	2	1	.29035*	.13497	**.033**	.0244	.5563
		3	.18330	.13170	.165	-.0762	.4428
	3	1	.10705	.12572	.395	-.1407	.3548
		2	-.18330	.13170	.165	-.4428	.0762
F	1	2	-.09216	.13871	.507	-.3655	.1812
		3	.01227	.12920	.924	-.2423	.2669
	2	1	.09216	.13871	.507	-.1812	.3655
		3	.10443	.13535	.441	-.1623	.3711
	3	1	-.01227	.12920	.924	-.2669	.2423
		2	-.10443	.13535	.441	-.3711	.1623
MAT	1	2	-.07135	.14039	.612	-.3480	.2053
		3	.03064	.13077	.815	-.2271	.2883
	2	1	.07135	.14039	.612	-.2053	.3480
		3	.10199	.13699	.457	-.1680	.3719
	3	1	-.03064	.13077	.815	-.2883	.2271
		2	-.10199	.13699	.457	-.3719	.1680
L&E	1	2	.00503	.14297	.972	-.2767	.2868
		3	.18756	.13317	.160	-.0749	.4500
	2	1	-.00503	.14297	.972	-.2868	.2767
		3	.18253	.13950	.192	-.0924	.4574
	3	1	-.18756	.13317	.160	-.4500	.0749
		2	-.18253	.13950	.192	-.4574	.0924
EXT	1	2	.04080	.14581	.780	-.2465	.3281
		3	-.00045	.13582	.997	-.2681	.2672
	2	1	-.04080	.14581	.780	-.3281	.2465
		3	-.04125	.14228	.772	-.3216	.2391
	3	1	.00045	.13582	.997	-.2672	.2681
		2	.04125	.14228	.772	-.2391	.3216
*. The mean difference is significant at the 0.05 level.							

Appendix (G) Kuwait results

Appendix G-1: Number of respondents to risk factors-Kuwait

No	RF	No. of responses				
		100%	75%	50%	25%	0%
1	Decision making process	27	63	63	68	7
2	Communication and coordination between parties (Clients, Consultants, & Contractors).	30	54	63	75	6
3	Unclear responsibility.	11	53	71	76	17
4	Availability of capable representatives.	14	34	74	85	21
5	Postponement of work (Held Orders).	16	61	80	56	15
6	Issuance of instruction.	18	52	75	77	6
7	Availability of project management team members) experience).	22	41	77	72	16
8	Information dissemination.	11	51	80	64	22
9	Site mobilization and delay in site handover	18	33	83	77	17
10	Contractors' experiences.	27	49	96	45	11
11	Availability of competent subcontractors / suppliers.	18	39	78	69	24
12	Rework due to errors during construction.	11	48	80	82	7
13	Availability of Disputes and Claims- comprehensive dispute resolution.	15	63	76	65	9
14	Conflicts in sub-contractors schedule in execution of project.	15	51	79	74	9
15	Delays in sub-contractor's work.	23	39	74	83	9
16	Unsatisfactory work of contractor	20	56	75	63	14
17	Delay in approving major changes in the scope of the work.	30	66	67	56	9
18	Long waiting for approval of tests and inspection.	12	63	79	66	8
19	Quality assurance/control.	12	48	84	66	18
20	Excessive contractors / subcontractors.	13	33	68	77	37
21	Unreasonable risk allocation.	13	29	74	96	16
22	Frequent change of sub-contractors because of their inefficient work.	26	42	70	73	17
23	Revising/approving design documents, shop drawings and sample materials.	32	62	84	45	5

Appendix G-1: Number of respondents to risk factors-Kuwait

No	RF	No. of responses				
		100%	75%	50%	25%	0%
24	Design-team experience.	27	57	76	52	16
25	Complexity of project design.	24	37	70	80	17
26	Confusing requirements.	16	48	70	78	16
27	Design Modifications.	20	55	89	61	3
28	Data collection and survey before design.	36	57	76	53	6
29	Complete documents and drawings of projects.	46	46	68	55	13
30	Producing design modification documents.	30	41	75	68	14
31	Clarity of details in drawings.	26	51	73	68	9
32	Excessive change order.	27	52	73	65	11
33	Payment of completed work.	21	41	88	57	21
34	Financing project by contractor/owner.	34	50	69	60	15
35	Cash flow plan analysis.	20	42	88	63	15
36	Cost estimation accuracy.	34	68	74	43	9
37	Quality of Materials (Below standards).	27	37	78	67	19
38	Availability of construction materials in market.	37	51	57	70	13
39	Change in material types and specifications during construction.	23	53	72	69	11
40	Material delivery.	39	54	70	56	9
41	Manufacturing special building materials.	29	40	85	64	10
42	Materials Supplier's Problem.	22	55	76	68	7
43	Material wastes handling.	8	30	48	82	60
44	Compliance of material to specifications.	25	39	72	81	11
45	Labour performance/productivity	21	44	87	56	20
46	Equipment availability.	26	38	77	68	19
47	Productivity and efficiency of equipment.	22	39	80	71	16

No	RF	No. of responses				
		100%	75%	50%	25%	0%
48	Labours and management relations.	18	43	68	78	21
49	Necessity skills.	19	46	85	65	13
50	Labour strikes and disputes.	35	26	57	63	47
51	Site's topography is changed after design.	30	54	72	65	7
52	Civil disturbances.	24	45	43	59	57
53	Problems with neighbours.	21	29	49	81	48
54	Slow government permits.	22	48	75	61	22
55	Changes in regulations.	24	38	91	58	17

Appendix G-2

Risk factors (RF) relative importance index (RII)-Kuwait

No	RF	RII
1	Decision making process	63.07
2	Communication and coordination between parties (Owner, Consultants, & Contractors).	62.37
3	Unclear responsibility.	56.93
4	Availability of capable representatives.	54.30
5	Postponement of work (Held Orders).	60.61
6	Issuance of instruction.	59.91
7	Availability of project management team members) experience).	58.33
8	Information dissemination.	56.93
9	Site mobilization and delay in site handover	56.32
10	Contractors' experiences.	63.16
11	Availability of competent subcontractors / suppliers.	56.32
12	Rework due to errors during construction.	57.72
13	Availability of Disputes and Claims- comprehensive dispute resolution.	60.88
14	Conflicts in sub-contractors schedule in execution of project.	59.04
15	Delays in sub-contractor's work.	58.60
16	Unsatisfactory work of contractor	60.44
17	Delay in approving major changes in the scope of the work.	64.56
18	Long waiting for approval of tests and inspection.	60.44
19	Quality assurance/control.	57.37
20	Excessive contractors / subcontractors.	51.93
21	Unreasonable risk allocation.	53.60
22	Frequent change of sub-contractors because of their inefficient work.	58.86
23	Revising/approving design documents, shop drawings and sample materials.	66.23

Appendix G-2
Risk factors (RF) relative importance index (RII)-Kuwait

No	RF	RII
24	Design-team experience.	62.37
25	Complexity of project design.	57.46
26	Confusing requirements.	57.37
27	Design Modifications.	62.46
28	Data collection and survey before design.	65.61
29	Complete documents and drawings of projects.	65.00
30	Producing design modification documents.	60.44
31	Clarity of details in drawings.	61.23
32	Excessive change order.	61.67
33	Payment of completed work.	58.60
34	Financing project by contractor/owner.	62.46
35	Cash flow plan analysis.	59.04
36	Cost estimation accuracy.	66.58
37	Quality of Materials (Below standards).	58.77
38	Availability of construction materials in market.	62.54
39	Change in material types and specifications during construction.	60.70
40	Material delivery.	65.09
41	Manufacturing special building materials.	61.23
42	Materials Supplier's Problem.	61.49
43	Material wastes handling.	46.32
44	Compliance of material to specifications.	58.77
45	Labour performance/productivity	59.12
46	Equipment availability.	58.60
47	Productivity and efficiency of equipment.	58.25
48	Labours and management relations.	56.40

No	RF	RII
49	Necessity skills.	59.39
50	Labour strikes and disputes.	54.65
51	Site’s topography is changed after design.	63.07
52	Civil disturbances.	52.98
53	Problems with neighbours.	50.70
54	Slow government permits.	58.86
55	Changes in regulations.	59.47

Appendix G-3: Kuwait Categories correlations

Correlations							
		Management	**Design**	**Finance**	**Material**	**Labour**	**External**
Management	Pearson Correlation	1	.659**	.674**	.725**	.745**	.598**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	228	228	228	228	228	228
Design	Pearson Correlation	.659**	1	.609**	.724**	.661**	.653**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	228	228	228	228	228	228
Finance	Pearson Correlation	.674**	.609**	1	.559**	.673**	.581**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	228	228	228	228	228	228
Material	Pearson Correlation	.725**	.724**	.559**	1	.745**	.578**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	228	228	228	228	228	228
Labour	Pearson Correlation	.745**	.661**	.673**	.745**	1	.654**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	228	228	228	228	228	228
External	Pearson Correlation	.598**	.653**	.581**	.578**	.654**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	228	228	228	228	228	228

** Correlation is significant at the 0.01 level (2-tailed)

a. COUNTRTY = Kuwait

Appendix (H) Bahrain results: **(Appendix H-1: Bahrain descriptive data analysis)**

Descriptive									
Category	Party	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Mini-mum	Maxi-mum
						Lower Bound	Upper Bound		
Management	1	91	3.1481	.59523	.06240	3.0242	3.2721	1.57	4.78
	2	51	3.8414	.37631	.05269	3.7356	3.9473	2.57	4.70
	3	39	3.7046	.69100	.11065	3.4806	3.9286	2.39	4.87
	Total	181	3.4634	.64856	.04821	3.3682	3.5585	1.57	4.87
Design	1	91	3.0989	.69772	.07314	2.9536	3.2442	1.11	5.00
	2	51	3.7364	.44387	.06215	3.6115	3.8612	2.89	4.89
	3	39	3.6325	.75107	.12027	3.3890	3.8759	1.89	5.00
	Total	181	3.3935	.71189	.05291	3.2891	3.4979	1.11	5.00
Finance	1	91	3.2198	.75354	.07899	3.0628	3.3767	1.25	5.00
	2	51	3.9804	.65544	.09178	3.7960	4.1647	1.00	5.00
	3	39	4.0192	.90935	.14561	3.7245	4.3140	1.00	5.00
	Total	181	3.6064	.85437	.06350	3.4810	3.7317	1.00	5.00
Material	1	91	3.1154	.78974	.08279	2.9509	3.2799	1.00	5.00
	2	51	3.7500	.52321	.07326	3.6028	3.8972	1.38	4.63
	3	39	3.8654	.63310	.10138	3.6602	4.0706	2.25	4.88
	Total	181	3.4558	.76939	.05719	3.3430	3.5686	1.00	5.00

L&E	1	91	3.1758	.72664	.07617	3.0245	3.3272	1.83	5.00
	2	51	3.8954	.45211	.06331	3.7683	4.0226	3.00	5.00
	3	39	3.8162	.85652	.13715	3.5386	4.0939	1.33	5.00
	Total	181	3.5166	.77102	.05731	3.4035	3.6297	1.33	5.00
External	1	91	2.9780	.79244	.08307	2.8130	3.1431	1.00	4.80
	2	51	3.8000	.71889	.10066	3.5978	4.0022	1.00	5.00
	3	39	3.5538	.84786	.13577	3.2790	3.8287	2.00	5.00
	Total	181	3.3337	.86334	.06417	3.2071	3.4603	1.00	5.00
RF	1	91	3.1227	.62276	.06528	2.9930	3.2524	1.39	4.83
	2	51	3.8339	.37101	.05195	3.7296	3.9383	2.73	4.72
	3	39	3.7653	.62862	.10066	3.5615	3.9691	2.43	4.93
	Total	181	3.4615	.65796	.04891	3.3650	3.5581	1.39	4.93

Appendix H-2

One-Way ANOVA applied to compare the perspective of Bahrain sample (Clients, Consultants and contractors).

ANOVA						
Category		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Management	Between Groups	18.603	2	9.301	28.990	**.000**
	Within Groups	57.111	178	.321		
	Total	75.714	180			
Design	Between Groups	16.121	2	8.061	19.105	**.000**
	Within Groups	75.100	178	.422		
	Total	91.221	180			
Finance	Between Groups	27.382	2	13.691	23.431	**.000**
	Within Groups	104.008	178	.584		
	Total	131.390	180			
Material	Between Groups	21.502	2	10.751	22.501	**.000**
	Within Groups	85.050	178	.478		
	Total	106.553	180			

Continue Appendix H-2

One-Way ANOVA applied to compare the perspective of Bahrain sample (Clients, Consultants and contractors).

ANOVA						
Category		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
L&E	Between Groups	21.388	2	10.694	22.233	**.000**
	Within Groups	85.618	178	.481		
	Total	107.006	180			
External	Between Groups	24.491	2	12.246	19.875	**.000**
	Within Groups	109.673	178	.616		
	Total	134.164	180			
RF	Between Groups	21.121	2	10.560	33.092	**.000**
	Within Groups	56.804	178	.319		
	Total	77.924	180			

Appendix H-3

Post-HOC Least Significant Difference (LSD) Test –Bahrain

BHR-Multiple Comparisons							
LSD							
Dependent Variable	(I) TYPE	(J) TYPE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Management	1	2	-.69332*	.09908	**.000**	-.8888	-.4978
		3	-.55646*	.10841	**.000**	-.7704	-.3425
	2	1	.69332*	.09908	**.000**	.4978	.8888
		3	.13686	.12049	.258	-.1009	.3746
	3	1	.55646*	.10841	**.000**	.3425	.7704
		2	-.13686	.12049	.258	-.3746	.1009
Design	1	2	-.63748*	.11362	**.000**	-.8617	-.4133
		3	-.53358*	.12432	**.000**	-.7789	-.2883
	2	1	.63748*	.11362	**.000**	.4133	.8617
		3	.10390	.13817	.453	-.1688	.3766
	3	1	.53358*	.12432	**.000**	.2883	.7789
		2	-.10390	.13817	.453	-.3766	.1688

Continue: Appendix H-3

Post-HOC Least Significant Difference (LSD) Test –Bahrain

BHR-Multiple Comparisons							
LSD							
Dependent Variable	(I) TYPE	(J) TYPE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Finance	1	2	-.76061*	.13371	**.000**	-1.0245	-.4968
		3	-.79945*	.14630	**.000**	-1.0882	-.5107
	2	1	.76061*	.13371	**.000**	.4968	1.0245
		3	-.03884	.16260	.811	-.3597	.2820
	3	1	.79945*	.14630	**.000**	.5107	1.0882
		2	.03884	.16260	.811	-.2820	.3597
Material	1	2	-.63462*	.12091	**.000**	-.8732	-.3960
		3	-.75000*	.13230	**.000**	-1.0111	-.4889
	2	1	.63462*	.12091	**.000**	.3960	.8732
		3	-.11538	.14704	.434	-.4055	.1748
	3	1	.75000*	.13230	**.000**	.4889	1.0111
		2	.11538	.14704	.434	-.1748	.4055

Labour and Equipment	1	2	-.71960*	.12131	**.000**	-.9590	-.4802
		3	-.64042*	.13274	**.000**	-.9024	-.3785
	2	1	.71960*	.12131	**.000**	.4802	.9590
		3	.07919	.14753	.592	-.2119	.3703
	3	1	.64042*	.13274	**.000**	.3785	.9024
		2	-.07919	.14753	.592	-.3703	.2119
External	1	2	-.82198*	.13730	**.000**	-1.0929	-.5510
		3	-.57582*	.15023	**.000**	-.8723	-.2794
	2	1	.82198*	.13730	**.000**	.5510	1.0929
		3	.24615	.16697	.142	-.0833	.5757
	3	1	.57582*	.15023	**.000**	.2794	.8723
		2	-.24615	.16697	.142	-.5757	.0833
RF	1	2	-.71127*	.09881	**.000**	-.9063	-.5163
		3	-.64262*	.10812	**.000**	-.8560	-.4293
	2	1	.71127*	.09881	**.000**	.5163	.9063
		3	.06865	.12017	.569	-.1685	.3058
	3	1	.64262*	.10812	**.000**	.4293	.8560
		2	-.06865	.12017	.569	-.3058	.1685
*. The mean difference is significant at the 0.05 level.							

Appendix (I) Bahrain results

Appendix I-1: Number of respondents to risk factors - Bahrain

No	RF	No. of responses				
		100%	75%	50%	25%	0%
1	Decision making process	54	55	38	33	1
2	Communication and coordination between parties (Clients, Consultants, & Contractors).	49	57	47	25	3
3	Unclear responsibility.	30	59	55	30	7
4	Availability of capable representatives.	36	49	51	41	4
5	Postponement of work (Held Orders).	29	76	46	27	3
6	Issuance of instruction.	37	59	50	32	3
7	Availability of project management team members) experience).	52	49	48	26	6
8	Information dissemination.	27	53	70	28	3
9	Site mobilization and delay in site handover	26	55	62	28	10
10	Contractors' experiences.	45	76	44	13	3
11	Availability of competent subcontractors / suppliers.	33	64	53	22	9
12	Rework due to errors during construction.	26	59	65	26	5
13	Availability of Disputes and Claims- comprehensive dispute resolution.	25	55	63	33	5
14	Conflicts in sub-contractors schedule in execution of project.	27	63	57	30	4
15	Delays in sub-contractor's work.	28	61	56	33	3
16	Unsatisfactory work of contractor	38	57	58	24	4
17	Delay in approving major changes in the scope of the work.	38	68	43	26	6
18	Long waiting for approval of tests and inspection.	28	65	49	32	7
19	Quality assurance/control.	19	69	52	28	13
20	Excessive contractors / subcontractors.	28	43	64	29	17
21	Unreasonable risk allocation.	19	33	73	44	12
22	Frequent change of sub-contractors because of their inefficient work.	40	53	51	30	7
23	Revising/approving design documents, shop drawings and sample materials.	36	62	63	18	2

No	RF	No. of responses				
		100%	75%	50%	25%	0%
24	Design-team experience.	36	59	64	16	6
25	Complexity of project design.	25	58	55	37	6
26	Confusing requirements.	22	48	63	39	9
27	Design Modifications.	20	64	65	31	1
28	Data collection and survey before design.	37	45	62	31	6
29	Complete documents and drawings of projects.	43	59	46	25	8
30	Producing design modification documents.	20	48	69	35	9
31	Clarity of details in drawings.	35	54	59	26	7
32	Excessive change order.	28	65	49	35	4
33	Payment of completed work.	38	65	47	23	8
34	Financing project by contractor/owner.	43	50	62	21	5
35	Cash flow plan analysis.	32	64	54	23	8
36	Cost estimation accuracy.	50	73	33	21	4
37	Quality of Materials (Below standards).	44	55	55	19	8
38	Availability of construction materials in market.	55	59	42	20	5
39	Change in material types and specifications during construction.	20	73	53	31	4
40	Material delivery.	48	70	44	13	6
41	Manufacturing special building materials.	16	60	74	22	9
42	Materials Supplier's Problem.	26	60	64	26	5
43	Material wastes handling.	16	46	52	47	20
44	Compliance of material to specifications.	32	66	43	35	5
45	Labour performance/productivity	39	64	47	25	6
46	Equipment availability.	44	60	45	26	6
47	Productivity and efficiency of equipment.	40	63	46	28	4

No	Labour and equipment s RF	No. of responses				
		100%	75%	50%	25%	0%
48	Labours and management relations.	37	59	47	31	7
49	Necessity skills.	32	60	54	33	2
50	Labour strikes and disputes.	37	44	56	35	9
51	Site's topography is changed after design.	41	51	43	38	8
52	Civil disturbances.	26	57	48	28	22
53	Problems with neighbours.	17	57	58	33	16
54	Slow government permits.	40	46	72	17	6
55	Changes in regulations.	35	52	53	30	11

Appendix I-2
Categories correlation

Correlations							
		Management	**Design**	**Finance**	**Material**	**Labour**	**External**
Management	Pearson Correlation	1	.767**	.711**	.758**	.751**	.738**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	181	181	181	181	181	181
Design	Pearson Correlation	.767**	1	.621**	.679**	.651**	.696**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	181	181	181	181	181	181
Finance	Pearson Correlation	.711**	.621**	1	.705**	.571**	.579**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	181	181	181	181	181	181
Material	Pearson Correlation	.758**	.679**	.705**	1	.721**	.650**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	181	181	181	181	181	181
Labour	Pearson Correlation	.751**	.651**	.571**	.721**	1	.633**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	181	181	181	181	181	181
External	Pearson Correlation	.738**	.696**	.579**	.650**	.633**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	181	181	181	181	181	181

Correlation is significant at the 0.01 level (2-tailed).

COUNTRY = Bahrain

Appendix (J)

Kuwait and Bahrain overall ranking

Appendix J-1: Risk factors (RF) codes

Management RF	Reference Letter
Q01 - Decision making process	M01
Q02 - Communication and coordination between parties (Clients, Consultants, and Contractors).	M02
Q03 - Unclear responsibility	M03
Q04 - Availability of capable representatives	M04
Q05 - Postponement of work (Held Orders).	M05
Q06 - Issuance of instruction.	M06
Q07 - Availability of project management team members (experience).	M07
Q08 - Information dissemination.	M08
Q09 - Site mobilization and delay in site handover	M09
Q10 - Contractors' experiences.	M10
Q11 - Availability of competent subcontractors / suppliers.	M11
Q12 - Rework due to errors during construction.	M12
Q13 - Availability of Disputes and Claims- comprehensive dispute resolution.	M13
Q14 - Conflicts in sub-contractors schedule in execution of project.	M14
Q15 - Delays in sub-contractor's work.	M15
Q16 - Unsatisfactory work of contractor	M16
Q17 - Delay in approving major changes in the scope of the work.	M17
Q18 - Long waiting for approval of tests and inspection.	M18
Q19 - Quality assurance/control.	M19
Q20 - Excessive contractors / subcontractors.	M20
Q21 - Unreasonable risk allocation.	M21
Q22 - Frequent change of sub-contractors because of their inefficient work	M22
Q23 - Revising/approving design documents, shop drawings and sample materials.	M23
Design RF	
Q24 - Design-team experience.	D01
Q25 - Complexity of project design.	D02
Q26 - Confusing requirements.	D03
Q27 - Design Modifications.	D04
Q28 - Data collection and survey before design.	D05
Q29 - Complete documents and drawings of projects.	D06
Q30 - Producing design modification documents.	D07
Q31 - Clarity of details in drawings.	D08
Q32 - Excessive change order.	D09

Continue... Appendix J-1: Risk factors (RF) codes

Finance RF	
Q33 - Payment of completed work.	F01
Q34 - Financing project by contractor/client.	F02
Q35 - Cash flow plan analysis.	F03
Q36 - Cost estimation accuracy.	F04

Material RF	
Q37 - Quality of Materials (Below standards).	MAT01
Q38 - Availability of construction materials in market.	MAT02
Q39 - Change in material types and specifications during construction.	MAT03
Q40 - Material delivery.	MAT04
Q41 - Manufacturing special building materials.	MAT05
Q42 - Materials Supplier's Problem.	MAT06
Q43 - Material wastes handling.	MAT07
Q44 - Compliance of material to specifications.	MAT08

L&E RF	
Q45 - Labour performance/productivity	L&E01
Q46 - Equipment availability.	L&E02
Q47 - Productivity and efficiency of equipment.	L&E03
Q48 - Labours and management relations.	L&E04
Q49 - Necessity skills.	L&E05
Q50 - Labour strikes and disputes.	L&E06
External RF	
Q51 - Site's topography is changed after design.	EXT01
Q52 - Civil disturbances.	EXT02
Q53 - Problems with neighbours.	EXT03
Q54 - government permits.	EXT04
Q55 - Changes in regulations.	EXT05

Appendix J-2: Kuwait overall ranking

Reference Letter	Rank	RII	Reference Letter	Rank	RII
M01	8	63.07	D06	5	65.00
M02	13	62.37	D07	22	60.44
M03	44	56.93	D08	17	61.23
M04	50	54.30	D09	15	61.67
M05	21	60.61	F01	35	58.60
M06	25	59.91	F02	11	62.46
M07	38	58.33	F03	29	59.04
M08	44	56.93	F04	1	66.58
M09	47	56.32	MAT01	33	58.77
M10	7	63.16	MAT02	10	62.54
M11	47	56.32	MAT03	20	60.70
M12	40	57.72	MAT04	4	65.09
M13	19	60.88	MAT05	17	61.23
M14	29	59.04	MAT06	16	61.49
M15	35	58.60	MAT07	55	46.32
M16	22	60.44	MAT08	33	58.77
M17	6	64.56	L&E01	28	59.12
M18	22	60.44	L&E02	35	58.60
M19	42	57.37	L&E03	39	58.25
M20	53	51.93	L&E04	46	56.40
M21	51	53.60	L&E05	27	59.39
M22	31	58.86	L&E06	49	54.65
M23	2	66.23	EXT01	8	63.07
D01	13	62.37	EXT02	52	52.98
D02	41	57.46	EXT03	54	50.70
D03	42	57.37	EXT04	31	58.86
D04	11	62.46	EXT05	26	59.47
D05	3	65.61			

Appendix J-3: Bahrain overall ranking

Reference Letter	Rank	RII	Reference Letter	RII	RII
M01	5	74.14	D06	15	71.49
M02	6	73.70	D07	51	63.87
M03	25	68.29	D08	28	69.28
M04	40	67.96	D09	31	68.62
M05	18	71.16	F01	17	71.27
M06	21	70.50	F02	13	71.60
M07	7	72.71	F03	23	69.83
M08	39	68.07	F04	2	75.91
M09	45	66.52	MAT01	10	71.93
M10	1	76.24	MAT02	4	75.36
M11	22	69.94	MAT03	38	68.18
M12	35	68.29	MAT04	3	75.58
M13	44	66.85	MAT05	48	65.75
M14	29	68.73	MAT06	33	68.40
M15	31	68.62	MAT07	55	59.01
M16	18	71.16	MAT08	27	69.39
M17	12	71.71	L&E01	13	71.60
M18	35	68.29	L&E02	9	72.15
M19	47	65.86	L&E03	11	71.82
M20	50	63.98	L&E04	25	69.72
M21	54	60.33	L&E05	26	69.61
M22	23	69.83	L&E06	43	67.18
M23	8	72.38	EXT01	29	68.73
D01	16	71.38	EXT02	49	64.09
D02	45	66.52	EXT03	51	62.87
D03	51	63.87	EXT04	20	70.72
D04	41	67.85	EXT05	42	67.73
D05	33	68.40			