Development of a Risk Response Model to handle Delays of Construction Projects in the United Arab Emirates

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Dedication

To my lovely Husband and Children

To my kind mother, father, and brothers

I dedicated this thesis

Acknowledgement

I would like to express my deepest grateful feelings to Allah for granting me patience and ability to accomplish this research. My grateful and deepest thanks to my supervisor Dr. Mohammed Kishk for his continue guidance, valuable comments, prompt response, genuine encouragement and generous support during this study.

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Declaration

This thesis is an original work and it has not previously been submitted for any degree or similar award. The materials in this thesis, to the best of my knowledge and beliefs has not been previously written or published by another person except where due reference is made. However, material that has been published in international peer review journals and as proceedings in conferences has been stated in Appendices D and G.

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Abbreviations

PMI	Project Management Institute
APM	Association of Project Management
KSFs	Key Success Factors
PMBOK	Project Management Body of Knowledge
IRM	Institute of Risk Management
ALARM	Public Sector Risk Management Association
AIRMIC	Association of Insurance and Risk Managers
CMM	Construction Maturity Model
UAE	United Arab Emirates
GDP	Gross Domestic Product
MDRC	Measures for Delays Risk Control
PMMM	Project Management Maturity Model
CMCS	Collaboration, Management and Control Solution
PM	Project Management
PMM	Project Management Maturity
RMMM	Risk Management Maturity Model
EPC	Engineering, Procurement and Construction
MEP	Mechanical, Electrical and Plumping
NBHH	Nael Bin Harmal Hydroexport
AED	Arab Emirates Dirham
TRM	Traditional risk Management
AADC	Al Ain Distribution Company

Abstract

Due to the complex nature of construction projects, delay risks are more widespread in the construction sector than elsewhere. This poses a problem for the industry, since it is already at risk because of the recent global economic recession. Indeed, the financial crisis in late 2008 arrested economic development in the construction sector in the United Arab Emirates (UAE), with the result that investors' confidence in the sector is severely depressed. In this situation, effective risk response is urgently required, since it aims to ensure that all project objectives, including avoiding delays, are met. In itself, the risk response process is a core element of risk management and perhaps the most important area needs to be improved. The aim of the research work that underpins this thesis was to develop a model for effective risk response to help in controlling delay risks.

First, the strengths and weaknesses of current risk response processes have been analysed through a comprehensive critical literature review. Common causes of delay risks have been identified and various traditional measures used for their control have been critically reviewed. The greatest deficiencies in all published measures of delay risks control in construction projects are related to the lack of risk response development and appropriate measures (preventative/mitigating), within the risk management process. From the literature review it was also possible to identify the most appropriate methodology to adopt for the current research. A robust research

methodology was then outlined which involved a questionnaire survey, case studies and interviews to confirm the literature review results and to achieve the research objectives.

The questionnaire was piloted with nine construction professionals in the UAE for its suitability with the envisaged sample. After the pilot the questionnaire was refined then administered in 35 construction, consultancy, and contracting companies, attracting 102 usable responses. The results of the questionnaire confirmed the literature review results.

Accordingly, six case studies from three companies were identified and supplemented by face-to-face interview, documents and direct observations. This strategy allowed the research evidence to be triangulated and thus the researcher to be more confident in testing a particular concept or theory.

From the results it emerged that most organisations have immature project management systems and poor risk response processes. Hence, 22 Key Success Factors (KSFs) of preventative measures and 15 KSFs of mitigation measures were identified to achieve risk response development by maturity levels in the pre-construction stage and in the construction stage, respectively. The analysis of the case studies revealed the great potential for employing five KSFs of mitigation measures in the risk response development to control delay risks.

Having considered these outcomes a risk response development model to control delay risks has been outlined. The model has been carefully validated, both theoretically and in practical terms, through the discussions with interviewees from the selected case studies. The interviewees agreed on the practicality of the model to identify the risk response development, however it is recommended that the project risk event severity and the company capability would need to be taken into account, and the demand to format the test stage for the maturity levels at the transition stages (Disciplinary, Consistency, Integration, and Optimisation) to achieve the effectiveness and the transparency of the model.

Based on the validation, it is anticipated that by developing the risk response model, the process itself will be more objective, particularly in delay risks control.

The study brings forward findings that can be promoted as the means to enhance opportunities to control delay risks, and benefit practitioners in the UAE given that so far, there has been no model of risk response development by maturity levels for delay risks control. Moreover, one of the unique features of the study is the creation of new knowledge by focusing on the UAE. At the same time, the use of maturity modeling to handle construction delay risks provides new knowledge for a wider audience.

Keywords*: Construction Projects Delays, Project Management Maturity, Risk Management, Risk Response, UAE*

Chapter One

Introduction

1.0 Background

Risks that materialise in any type of project can cause losses, increased costs, time delays, and a drop in quality (Hillson and Murray-Webster, 2007), and clearly, any one of these outcomes will result in client dissatisfaction. However, despite the ongoing research in the field of risk management in construction, many areas remain neglected. In providing the theoretical background to the wider issue, the following sections will consider the concept of risk, beginning with a definition, and progressing to discuss its importance, perspectives on risk, how projects perform, and the need for development in the process of risk management.

1.1 Definition of Risk

Risk is defined in many ways. However, one definition is that it is 'an uncertain event', which has positive or negative effects on project objectives, time, cost and scope or quality (Project Management Body of Knowledge [PMBOK] 2004; the Association of Project Management [APM] 2006). Krane *et al.* (2010) make the point that risk can be 'known' or 'unknown', and Chapman and Ward (2003:33-54) note that risk concerns anything whatsoever (objective or subjective) that may have an impact upon the success of a project. Raz *et al.* (2002) highlight that there is no project which is free from risk. Consequently, it is absolutely essential that all risks must be handled effectively, although that in itself does not imply that risks can be removed completely. However, that said, in general project terms, it is understood that the effective management of risk will optimise project performance and success. Within this thesis, the term 'risk' is used in the sense referred to above. Indeed, this is how it is generally interpreted in theory and especially in the practice associated with construction projects.

1.2 Importance of Risk Management to Organisations and Society

Clearly, from what has just been said, risk management is an important skill for project managers to develop, and this applies irrespective of the organisation concerned. Indeed, it is important for society generally that risks are effectively reduced and eliminated where possible. However, risks are part of life, and often projects are extremely complex, producing even more potential for planned activities to go wrong. Consequently, those responsible for managing risk must be capable of identifying risks, assessing their likely impact, and devising response strategies, and once this process is finished, they must be diligent in continually updating and developing their risk strategies, since risks may occur unexpectedly. In such circumstances, projects that have been on time, may fall behind, be completed after schedule, involve cost over-runs, and be considered not to have performed properly (Flyvbjerg *et al.*, 2002). It is noted (Chapman and Ward, 2003: 33-54) that risks are caused by uncertainties, and that uncertainties themselves arise since each project is unique in its structure and therefore, requires a different approach. Consequently, there is new ground to be broken and with this, the potential for mistake. However, despite such an appreciation of the reality of construction projects, and the recent efforts of many construction organisations to influence risk management, it can be observed that several projects have not enjoyed the benefits to be gained from systematic and developed risk management (Simu, 2009).

One way in which a systematic approach can be adopted is for there to be a recognition of the diversity of stakeholders (and implicitly, cultural differences) among the stakeholders in any construction project (Hillson and Murray-Webster, 2007). In construction organisations, the stakeholders (contractors, consultants, project managers, sub-contractors, etc.) are heterogeneous and the client should aim to identify the level of awareness towards risks by all of these stakeholders, and indeed to examine the various policies they have in place in this regard (Yusuwan *et al.*, 2008). In such a situation, it is easy for the client to see the relevance of risk management when making a decision to go ahead with a project, as the risk will be identified in advance, and hence, the need for management will be obvious. Additionally, in circumstances where risks are identified systematically at the start of a project, they can be acknowledged in the formal contract drawn up between the client and the contractor. Clearly, this is common sense, and in fact, organisations and societies at large do engage in risk analysis ahead of large projects, but they all tend to concentrate more on disaster management rather than risk management for effective response, with the result that those risk management strategies that do exist are inadequate (Elkjaer and Felding, 1999). Indeed, such inadequate risk management is very obvious, even in extremely reputable organisations with good financial standing that are involved in major projects. This has led to the importance of research in various dimensions of risk management. Specifically in relation to the construction sector, Al Zarooni *et al*. (2011) have observed that this industry has been responsible for 60% of the gross fixed capital formation during the last three decades. Consequently, it would seem crucial to identify the risks and their effects within the construction sector, and to devise strategies that would enable appropriate, successful and effective responses (Chapman, 1991) that will satisfy both clients/end users as well as all other project stakeholders.

1.3 Risk Management for Construction Projects: the Organisational Perspective

Construction project success requires a certain perspective to be gained by each organisation involved since there is no one way to proceed in terms of developing a risk management strategy. Recognising this situation, organisations usually devise their own approach or standards to manage the risks associated with their projects (IRM, ALARM and AIRMIC, 2002). However, one way of coping more effectively with the many uncertainties abounding in projects, is to seek views from different people; for example, stakeholders and project managers should have a list of project performance indicators that would allow for early corrective action to be taken where the indicators are not being met (Zolin *et al.*, 2012). Clearly, all stakeholders should sharpen their ability to perceive the nature and benefits of risk management, since the complexity of projects is steadily growing. Moreover, internal and external stakeholders themselves influence projects, and their individual satisfaction is important, so it can be understood that they will agitate for the outcome which is best for them (Cleland, 1986). That said, it is noted (Kerzner, 2012) that more recently, stakeholder involvement has improved because stakeholders are learning from risks that occur repeatedly in complex projects and are forecasting the behaviour necessary to deal with these. This is in complete contrast to what used to happen 10 years ago when stakeholders knew very little about the actual process and every single aspect of each part of the project was orientated towards the end result, meaning less involvement for stakeholders in the wider project. In these circumstances they had no means of validating any of the information given to them.

Clearly, risk management awareness can vary from one project, and from one country to another, for a variety of different reasons. In the case of Malaysia, Yusuwan *et al*. (2008) found a low level of risk management awareness in a client organisation, although the desire to learn about it was very encouraging. Collinge (2012) has also found that the stakeholder factor (stakeholder ignorance) constitutes a source of risk in construction projects. Hence, effective stakeholder management is crucial if organisations want their projects to succeed. This requires that stakeholders should be properly informed about their legal and moral obligations and how they themselves are affected by these, in order that they engage to the appropriate extent with all aspects of the projects (Collinge, 2012). It can thus be understood that risk and stakeholder management is an area of research that should be pursued as a tangible theme in the field of project risk management.

1.4 Risk Management and Construction Project Performance

Failure to control project risks throughout the project life-cycle undoubtedly affects the project performance (Ayub *et.al*, 2007). Not surprisingly, research aimed at identifying an effective approach to risk management is, therefore, increasing as the aim of all organisations is to ensure good project performance (Kululanga and Kuotcha, 2009). Risk management must be considered as an integral part of project management if performance is to be achieved and general improvements are to be made to the decision-making process (Tang *et al*., 2007; Siang and Ali, 2012). Therefore, effective risk management was needed in order to increase sustainable value levels within projects. Such value is seen to accrue by avoiding additional and unnecessary costs, by being successful in forecasting accurately, in securing the best tender, and in ensuring that all estimating is well-founded. Additionally, value is placed in keeping a project within its agreed timeframe, ensuring the design process runs smoothly, that the actual construction is properly executed, and that when the project is finished, the resulting building is fit for its purpose. Furthermore, there is a need for a project to meet the required quality, functions and safety, for all the activities associated with it to be stable and free from chaos, for there to emerge a better understanding of the risks that might accrue to a project, for the consequences to be known, and essentially to learn from previous mistakes. Moreover, all identified risks should be reflected in all contracts so that informed decisions can be taken about financial issues, whether indeed a project is financially sounded or otherwise. Obviously, from this comprehensive list of value added features, it can be seen that it is not only the project team that gains benefit from risk management but also all the project stakeholders, be they the client, end users, or customers (APM, 2006; IRM, AIRMIC and ALARM, 2002). In this type of scenario, the risk response can be well-planned.

Measuring the project performance is not an easy undertaking, but as noted by Rasli and Masri (2008) it is possible to use the traditional criteria of cost, time and quality, as a measure of project success during construction. That said, it is advisable for there to be more focus on in-time performance (Atkinson, 1999), since delays are a common cause of failure, resulting in cost over-run and reduced profitability for the construction company. This type of performance is measured simply by establishing the difference between the planned and actual duration (Ahsan and Gunawan, 2010). If a construction project is executed according to the planned sequences and in the anticipated timescale, then it is considered as successful, but in fact, time performance is not only concerned with whether a project is actually completed on time, but also with whether, within the process of construction, deadlines along the way are met, such that progression of work is seen to be in accordance with plans. Research on project performance, and specifically in terms of benchmarking in controlling risks of the construction project delay, and so doing within the overall framework of risk management, remains sparse.

1.5 The Need for Risk Management Process Development

Previous research has identified the slow pace of development of risk management as a managerial discipline, attributing this essentially to immature organisational systems, and to a lack of education and training in risk management, which in real terms is almost non-existent (Simu, 2009). Indeed, Simu (2009) has argued that the prevailing management system is more of an obstacle than a support to the development of efficient and effective risk management. He claims that the use of the informal and traditional management system is not enough to achieve control over risks such as delays. This idea is supported by other researchers who believe that project risk is escalated by poor project management and the lack of integrated systems, an issue picked up also by Ren and Yeo (2009) who observe that risk management requires complete knowledge of the entire project, and an acknowledgement of the need to ensure value creation and profitability so they claim to develop a multilevel framework for the risk management. Burtonshaw-Gunn (2009:8) raise the point that project management in itself is risk-driven, since if there were no risks associated with project execution, there would be no need for project management.

Undoubtedly, there are variations in project phases, depending upon the project, and as indicated previously, all projects are unique. However, despite such variations, the content of the risk management process remains the same in the project lifecycle, and improvements, to it through theoretical analysis, would represent the potential to improve all projects. Smith (1995: 57) notes that the process is comprised of risk identification, analysis and response, and Merna and Al-Thani (2005:2) add that all risks should be properly reported because risk management is a dynamic process of identification and mitigation that should be reviewed regularly. In 2004, the PMI published more information about risk management planning within the project life cycle, discussing aspects such as risk identification, qualitative and quantitative risk analysis, risk response planning, and the monitoring and control of risks. Crawford (2002) has also argued for the need to properly document all information about risk. Hence, it can be appreciated that research that focuses on risk management process development is important in improving the response to risk. In this undertaking it is important to recognise that the more complex a project, the greater possibility that more individuals/organisations will be involved, and in this respect, the owners of each potential risk must be identified, and involved in the planning to ensure suitable risk mitigation by the consideration of several different response options. At that point also, the mitigation strategy for risk response development should be assessed according to its capability, and that may be different from one project to another. Unfortunately, as noted by Sarshar *et al*. (2000), construction organisations have few methodological mechanisms to undertake such assessments within the construction process.

Of those that are available, the Construction Maturity Model (CMM) was developed specifically to help in such investigations within the construction industry. This model was devised by Crawford (2002) to help construction organisations improve their project management processes, tests five levels of maturity (risk identification, risk quantification, risk response development, risk control, and risk documentation) which are considered essential in construction projects. The model was developed by Crawford (2006) suggests a process of continuous improvement orchestrated by a 'maturity' management system, and it is used in the present study to reflect the capability of risk response development particularly to overcome performance-related delays problems. The model is based on the premise that lessons should be learnt and that construction system capabilities should develop accordingly, such that projects of all kinds can be successfully executed and delivered on time and to standard.

1.6 Research Problem and Rationale for the Study

In the Middle East, and more specifically in the United Arab Emirates (UAE), construction projects delay risks have increased, and the traditional project risk management has been seen to fail to meet the expectations of project clients, and indeed, other project stakeholders. This is unfortunate since as part of the development of the UAE, the Abu Dhabi Government is implementing various construction projects/programmes to enhance public living standards in different regions. Included in these programmes are housing developments, hotels (buildings and extensions), government schools, universities, and various other unique buildings funded by Governmental General Services. The reality is that these projects never seem to meet the stakeholders’ expectations, which is a real hindrance to the general development of the UAE given that the Emirates represent one of the most urbanised territories in the Middle East. The outcome is that the general populace and the national development is suffering as a result of poor risk management. Undoubtedly, the need to plan ahead in order to control delay risks is imperative, since many of the behind-schedule programmes experience quite substantial delays.

Such planning must be attempted and effectively implemented in a standardised rather than piecemeal manner. Most of the existing research has focused on identifying and assessing risks using different management techniques, according to the policy and nature of the companies concerned, but overall risk response development measures that can be applied generically, have been neglected, and clearly there is much work required to raise awareness of the need to improve the risk response process, and to ensure that projects are completed on time and within budgets.

That said, it is appreciated that construction work is not straightforward, and that the managerial skills and knowledge possessed by those who are responsible for decision-making within the construction sector, are still limited. Consequently, the professionals involved have many different perspectives on the identification of risk and differing views as to how to manage them. It is important, therefore, to formulate some general guidelines that can be of assistance to all professionals/project stakeholders, and that importance is underlined, when one considers that the UAE construction sector contributes 14% of the national GDP (Faridi and El-Sayegh, 2006), thereby representing an immense percentage. It is also noted that the construction sector contributes about one-tenth of the GDP in the world (Economy Watch, 2010), and again, any general guidance that can be provided for the construction industry, particularly in developing country contexts, will be of value.

It is noticeable that delay risks have been particularly prominent (Construction Management Guide, 2008) since the global financial crisis of 2008-2009; and that despite written agreements between project stakeholders, there has been little willingness for those involved to take responsibility for the risks associated with their own operations. Clients have basically refused to accept any responsibility for risk, thereby leading to the absence of any willingness from the contractors to reduce the capacity for risks on their side before signing the contract. Indeed, Othman (2008) reports that 71% of all clients in his case study research in the UAE expressed dissatisfaction with their finished buildings because of the misdirection and lack of stakeholder co-operation in risk management. This is a common situation, echoed in the fact that records of unsuccessful projects are on the increase. Project stakeholders continue to experience unsuccessful outcomes, with the result that their investment is hardly justified, and their intentions to invest further are depressed. It seems to be the case that even in the top construction organisations, there is an inability to successfully incorporate the risk response process in the overall risk management strategy. This leads to low morale, loss of confidence, and unsecured project promises for both the stakeholders and the project team. It is clear that these outcomes are the fault of a general lack of knowledge and experience in the risk management field in construction.

Furthermore, the literature appears to be short on information regarding the role of risk response in improving performance in construction projects. Again, this seems to be a problem, especially given the potential for project stakeholders to come from different cultural and national backgrounds, and to have varying attitudes towards risk response. Consequently, the researcher believes there is a strong and urgent need to focus on how to improve response, a belief which is also stated by the PMI (2002) in its recommendation to develop the whole area of risk management. Clearly, a greater focus on strategic risk response development within a wider adaptive and mature system in construction projects could result in adding value to project management, since this would contribute towards managing the progress.

1.7 Research Aim and Objectives

The research aims to develop a model for effective risk response to control delay risks effects. In fulfilling this aim, several objectives must be achieved, and these are given as follows:

1- To conduct an extended literature review of construction delay risks.
2- To investigate key success factors (KSFs) of preventative and mitigation measures of risk response for delay risks control in the UAE.
3- To identify the priority of stakeholder capability for handling risk response development.
4- To outline a risk response development model for delays risk control and project success.

1.8 Scope of the Study

From what has been said so far, it can be seen that the present study needs to explore the various practices associated with risk management in construction projects delays. Moreover, as the problems are seen to occur in large projects, there is a need to use high-profile contractors, consultants, and project management companies in the UAE, since these are the organisations largely involved in the problem just outlined. Consequently, the study focuses on:

Risk management theory and practice that is capable of identifying the stakeholders' expectations and needs.

Optimising risk response development Key Success Factors (KSFs) of preventative and mitigation measures to enhance project risk management practice.

Establishing an effective model for ensuring the control of delay risks and risk response development to achieve project goals using a maturity management system.

1.9 Research Questions

Essentially, the objectives are designed to answer the following three research questions:

1- Do construction organisations identify and assess factors that affect time and cost at any stage of the project life cycle post financial crisis in the UAE?

2- Do construction organisations identify any key success factors (KSFs) of preventative and mitigation measures for risk response development for construction project delays?

3- Do construction organisations use any "Maturity" model to measure the levels of risk response development?

1.10 Research Methodology

In order to achieve the objectives outlined above and answer the associated research questions, a mixed methods approach is chosen in which a detailed literature review will be conducted in the first instance to identify the current wisdom on project management practice. From the literature review the very complex nature of risk management will be elicited, and from this understanding, a questionnaire will be devised for distribution among a large sample of professionals in construction organisations in the UAE. Hence, the emphasis will be on quantitative methods of data collection in respect of the empirical work, and likewise on quantitative methods of analysis. The sample will be guided by the criterion stipulated for cases, that being that organisations must have been affected by the recession which began in 2008. After the analysis of all data, the framework will be outlined.

1.11 Significance of the Study

The study is of significance in three main areas:

It will raise the stakeholders' expectations in terms of effective risk management and risk response development strategy.

The findings will guide construction organisations in the UAE and the Middle East, particularly project managers and practitioners to abandon inappropriate risk control processes, and implement better practice.

It will improve and open a new area of risk management research and contribute to enhance knowledge in the profession

1.12 The Structure of the Thesis

A brief review of risk management and its various dimensions has been provided, and the importance of the process within the construction industry has been raised. The issue of risks associated with particular delays has been considered, and as a result a justification has been presented for conducting the study. Having set out the aim and objectives of the study, the research questions which have to be answered in order to meet these are identified in chapter one. Thereafter, details are provided of the scope of the study, how it is to be carried out, and what the following chapters contain. In the next chapter, the literature pertaining to the study is critically reviewed. Chapter Two presents an extensive literature review covering issues such as delay risks, causes and effects, and control measures. From this it is possible to identify a knowledge gap in the risk response development process, and how project management influenced by "maturity" and risk response-maturity relationship.

In Chapter Three, the research methodology adopted to execute the study is detailed. This involves a discussion of the research process and design, the sampling associated with the empirical work, and the way in which data was collected. Issues concerning the validity and reliability of the study and the code of ethics adhered to in carrying it out are also discussed. In Chapter Four the way in which the study was actually undertaken is indicated by real six case studies. Chapter Five presents the data analysis results. Findings, and discusses in Chapter Six. The eventual outcome is the formulation of a model which practitioners can use to minimise delay risks, and simultaneously contributes to theory in the wider area of risk management in the construction sector. Finally, conclusions are drawn and recommendations for further research are introduced in Chapter seven.

Chapter Two

Literature Review

Introduction

This chapter presents a detailed literature review. It begins by considering the stakeholder perspective in the identification of delay risks factors, and presents a tabulated review of 39 studies conducted between 2000 and 2013 that address this issue. It then discusses the measures for delay risks control that have traditionally been used, and highlights their limitations in 34 studies. Indeed, project performance using the traditional criteria is considered in depth (Motaleb and Kishk, 2011a, 2011b). Thereafter, the chapter considers the strategic development of risk response management, before discussing the relationship between the risk response and the maturity of the organisation. The chapter concludes with a short summary.

2.1 Identification of Delays Risk Factors from the Stakeholder Perspective

Projects cannot emerge as successful if the inherent risks are not identified and managed effectively (Bower, 2002). This demands a systematic risk management process which the APM and PMBOK (among other organisations) advocate as one that should be hierarchical, starting from initiation, moving to identification, then to assessment, and finally to planning how to manage the response. Certain delays are commonplace, whilst others are much less frequent, and delays which occur often during one period of time can find themselves virtually disappearing as strategies are developed to prevent these, whereas other delays seem to be resistant to all efforts. Table 2.1 presents a summary of significant risk factors in terms of delays over different time periods, and in different geographical locations.

Table 2.1: Summary of Research (2000-2013)

No	Research	Project	Risk Factors (Groups) causing delay	Effects of delay
1	Al-Momani (2000)	Public buildings, (Jordan), **Public sector**	Designer, Finance, Client, Contractor, Unforeseen	Time over-run
2	Noulmanee *et al*. (2000)	Highway construction, (Thailand), **Public sector**	Resources, Designer	Time over-run
3	Elinwa and Jashwa (2001)	Public works (Nigeria), **Public sector**	Finance, Resources, Designer, Project Manager, Contractor	Time and cost over-run
4	Aibinu and Jagboro (2002)	General construction (Nigeria), **Private and Public sectors**	Client	Time and cost over-run
5	Ellis and Thomas (2002)	Highway (USA), **Public sector**	Project Manager, Contractor, Designer, Unforeseen	Time over-run
6	Manavazhia and Adhikarib (2002)	Highway (Nepal), **Public sector**	Resources	Time over-run
7	Odeh and Battaineh (2002)	General construction (Jordan), **Public-private sectors**	Client, Resources, Project Manager, Contractual, Unforeseen, Consultant	Time and cost over-run
8	Ahmed *et al*. (2003)	Building Project (Florida, US), **Private sector**	Client, Designer, Consultant	Time and cost over-run
9	Frimpong and Oluwoye (2003)	Groundwater Construction (Ghana), **Public sector**	Finance, Contractor, Resources	Cost over-run
10	Choudhury and Phatak (2004)	Commercial construction projects, US, **Private sector**	Client, Contractor, Finance, Design	Time over-run

Table 2.1 : Continue Summary of Research (2000-2013)

No	Research	Project	Risks Factors(Groups) causing Delay	Effect of Delay
11	Koukshi et al. (2004)	Residential (Kuwait), **Private sector**	Resources	Time and cost over-run
12	Sun *et al*. (2004)	Construction projects (UK), **Public**	Client	Time and cost over-run
13	Acharya *et al*. (2005)	Building project (Nepal)/NA	Resources, Unforeseen, Contractor	Time over-run
14	Koushki (2005)	Residential (Kuwait), **Private sector**	Client, Finance, Contractor, Resources	Time and cost over-run
15	Wiguna and Scott (2005)	Buildings projects (Indonesia), **Private sector**	Finance, Client, Designer, Unforeseen, Contractor	Time and cost over-run
16	Abdu-Rahman *et al*. (2006)	Construction Project (Malaysia)	Finance, Resources, Client	Time over-run
21	Othman (2006)	Public project (Malaysia)	Contractor	Time over-run
22	Zaneldin (2006)	Different 124 claims of Const. projects, (UAE), **Public-Private Sector**	Contractual	Time over-run
23	Alaghbari *et al*. (2007)	Building Construction Project (Malaysia)/ NA	Financial, Project Manager	Cost over-run
24	Sambasivan and Yau (2007)	Construction projects (Malaysia)/NA	Contractor	Time and cost over-run
25	Abdel-Razek *et al*. (2008)	Building construction (Egypt), **Private-Public Sector**	Contractual, Financial, Client	Time over-run
26	Long (2008)	Construction project (Vietnam)/NA	Project Manager, Resources, Designer, Financial	Time and cost over-run
27	Sweis *et al*. (2008)	Residential projects(Jordan), **Private Sector**	Client, Finance, Contractor, Resources, Project manager	Time and cost over-run
28	World Bank Iraq Trust Fund (2008)	Schools and Rehabilitation (Iraq), **Public Sector**	Financial, Contractual, Resources, Unforeseen	Time and cost over-run
29	Kaliba *et al*. (2009)	Road construction (Zambia)	Financial, Designer, Project manager	Cost and time over-run
30	Tumi *et al*. (2009)	Construction project (Libya), N/A	Project manager	Time and cost over-run
31	Abdul-Rahman *et al*. (2009)	Construction project (Global Study)/NA	Financial	Time and cost over-run

Table 2.1 : Continue Summary of Research (2000-2013)

No	Research	Project	Risks Factors (Group) causing Delay	Effect of Delay
32	Asnaashari (2009)	Construction Projects (Iran), **Public- Private Sector**	Resource, Financial, Unforeseen	Cost over-run
33	Enshassi *et al*. (2009)	General Construction, (Palestine), **Public-Private Sector**	Resources, Financial, Contractor	Time and cost over-run
34	Al-Nuaimi *et al*. (2010)	Building construction project(Oman), **Public-Private Sector**	Client, Contractual	Time and cost over-run, Disputes
35	Khoshgoftar *et al.* (2010)	Construction Projects (Iran), **Public- Private Sector**	Financial, Project Manager, Contractual	Time over-run
36	United Nation Development (2010)	Construction projects, schools (Iraq), **Public Sector**	Unforeseen	Time over-run and dispute
37	Yang (2010)	BOT projects in Public Construction (Taiwan)/NA	Contractual, Finance, Unforeseen	Time over-run –postponement of project
38	González *et al*.(2013)	Construction buildings/NA	Project Manager	Time over-run
39	Motaleb and Kishk (2013a)	General construction (UAE), **Public- Private Sector**	Client, Project Manager, Finance	Time and cost over-run

As shown from Table 2.1 information has been extracted from the literature by the researcher, and tabulated for ease of communication. From the table it can be seen that both the public and private sector are featured in the review, which includes some interesting stakeholder observations that are placed in particular categories, each of which has been highlighted with either low or high exposure.

The research articles in Table 2.1 are collated and categorised by Type of Project, Sector (Public/Private), Risk Factors (causes of delay), and Effects of Delays Risk. Some of these articles are discussed in more detail to emphasise particular points within them that are relevant for this research, for example the data collection techniques, and questionnaire design.

The sets of factors studied by different authors are gathered and presented in Table 2.1 in order to help in identifying the gap in knowledge, and to inform the primary data collection strategy for this research. Naturally, different authors focus on areas of personal interest.

It can be seen that certain factors have been categorised within *NINE* group-related delays risk factors (Clients, Contractors, Consultants, Designers, Financial, Resources, Contractual, Project Manager, Unforeseen) by different authors. The Unforeseen category includes governmental and external issues, which have been tabulated in detail and discussed in research by Al-Momani (2000 – Jordan), Noulmanee *et al*. (2000 – Thailand), Elinwa and Jashwa (2001 – Nigeria), Ellis and Thomas (2002 – USA), Manavazhia and Adhikarib (2002 – Nepal), Frimpong and Oluwoye (2003 – Ghana), World Bank Iraq Trust Fund (2008), and United Nations Development (2010 – Iraq). These studies were all conducted in the *Public Sector*.

At the same time, studies conducted in the *Private Sector* have identified *EIGHT* common groups as follows: *Financial, Client, Designer, Project Manager, Contractor, Consultant, Resource, Unforeseen factors*. Ahmed *et al*. (2003 – USA), Koushki (2005 – Kwuait), Wiguna and Scott (2005 –

Indonesia), Fong *et al*. (2006 - Hong Kong), Sweis *et al*. (2008 – Jordan). In addition, the review findings show that research by Aibinu and Jagboro (2002 – Nigeria), Odeh and Battaineh (2002 – Jordan), Aibinu and Odeyinka (2006 – Nigeria), Assaf and Al-Hejji (2006- Saudi Arabia), Faridi and El-Sayegh (2006) and Zaneldin (2006) in the UAE, Abdel-Razek *et al*. (2008 – Egypt), Asnaashari (2009 – Iran), Enshassi *et al*. (2009 – Palestine), Al-Nuaimi *et al*. (2010 – Oman), Khoshgoftar *et al.* (2010 – Iran), and Motaleb and Kishk (2013a – UAE) in the *Public-Private* sector have identified *SEVEN* related delays risk factors, these being: *Client, Resources, Project Manager, Contractual, Consultant, Unforeseen, and Financial factors.*

The research by Choudhury and Phatak (2004) in the US, Koukshi et al. (2004) in Kuwait, Sun *et al*. (2004) in the UK, Acharya *et al*. (2005) in Nepal, Abdul-Rahman *et al*. (2006) in Malaysia, Othman (2006) in Malaysia, Sambasivan and Yau (2007) in Malaysia, Alaghbari *et al*. (2007) in Malaysia, Long (2008) in Vietnam, Kaliba *et al*. (2009) in Zambia, Tumi *et al*. (2009) in Libya, Abdul-Rahman *et al*. (2009) in a global study, Yang (2010) in Taiwan, and González *et al*. (2013) in an unknown place, have also identified *SEVEN* group-related delays risk factors, these being: *Client, Contractor, Financial, Designer, Resources, Unforeseen, Project Manager-related factors.* All the group-related factors consider the same factors under different names. For example, Odeh and Battaineh (2002) studied causes of construction delay in Jordan, using a survey approach by questionnaire.

They found that contractors and consultants agreed that *CLIENT* interference and slow decision- making (Client-related), inadequate contractor experience and unrealistic imposed contract duration (Contractor-related), financing and payments (Financial-related), improper planning (Project Manager-related), and were among the top ten most important factors. Consultant-related factors (to include contract management, preparation and approval of drawings, quality assurance/control, and waiting time for approval of test and inspections); Resource-related factors (to include quality of material and shortage in material); Contractual-related factors (to include change orders mismanagement, mistakes, discrepancies in dispute negotiations, inappropriate overall organisational structure linking all parties to the project, lack of communication between the parties); Unforeseen-related factors (to include weather condition, regulatory changes building code, problems with neighbours, and ground conditions). In Africa, Frimpong (2003) focused on Ghana, revealing the main causes of delays in the construction of groundwater projects to be: monthly payment difficulties (Financial-related factor) from agencies, poor contractor management, material procurement (Resource-related factor), and escalation of material prices (Unforeseen-related factor). And in Kuwait, Koushki (2005) identified the main causes of delays in the construction of private residential projects to be: Client-related factors by changing orders, owner's financial constraints (Financial-related factor), and Client-related factor in owner's lack of experience in the construction business, Contractor-related problems, and Resource-related problems. Wiguna and Scott (2005) studied the risks affecting construction delays and cost overruns in building projects in Surabaya and Denpasar, Indonesia. The most critical risks affecting cost overrun and delay as perceived by the building contractors were: high inflation/increased prices of materials (Financial-related factor), Client–related factor in design change, Design–related factor in defective design, Unforeseen-related factor in weather conditions, delayed contractual (Contractual-related) payments, and defective construction work (Contract-related).

In another Asian study, Long (2008) explored the problems in large construction projects, taking Vietnam as a case study. He revealed that the problems could be attributed to five major factors, these being: incompetent designers (Designer-related factor), poor estimation and change management by contractor (Contractor-related), social and technological issues, site-related issues, and improper techniques and tools (Project manager-related). The overall incompetence of project teams emerged in this study by Long (2008) as also in research by other scholars. For example, the poor performance of project managers (Project Manager-related factor) who demonstrate poor planning, poor co-ordination, poor site management, inadequate time estimation, and lack of team communication, was cited by several researchers (see for instance, Alaghbari *et al.*, 2007;

Khoshgoftar *et al.*, 2010; Motaleb and Kishk, 2013a). In respect of delays risk factors in Hong Kong, Fong *et al.* (2006) also identified the risk factors as being associated with project managers (site-co-ordination) and clients, slow decision-making, and government inspection; and this is in partial agreement with causes of delay in Malaysia (Sambasivan and Soon, 2007). In the USA, Ellis and Thomas (2002) found delays resulted from improper project management (Project manager-related) in relocations, procedures and funding programmes (Financial-related). And in the UK, it is reported that excessive change orders by the client (Client-related) added to delays (Sun *et al*., 2004). Bringing forward another point of view from the Middle East, Assaf and Al-Hejji (2006) reporting on Saudi Arabia, identified similar causes to those already mentioned by Koushki *et al*. (2005) in respect of Kuwait. And in another study in Jordan, Sweis *et al*. (2008) concluded that inadequate planning (Project-manager related), scheduling and financing by contractors (Contractor and Financial-related), and excessive change orders by clients (Client-related), were the main risk factors. This level of insight is of value to the current study in guiding the data collection. Moreover, it is of importance in helping to answer the first research question *Do construction organisations identify and assess factors that affect time and cost at any stage of the project life cycle post financial crisis in the UAE,* since it covers the literature concerning construction delays risks factors in general, and specifically in relation to the Middle East, thereby responding to the needs of the first research objective.

In designing their research approaches, most previous authors have used questionnaire surveys comprising individual sets of well recognised causes of delay in group-related factors. However, two studies conducted by Zaneldin (2006) in the UAE, and Koushki (2005) in Kuwait, used a case study approach employing mixed methods to secure their data (personal interviews, questionnaire, case study).

The research studies using questionnaires were designed to evaluate the frequency of occurrence, severity, and the importance of the identified causes of delays risk. In such studies, the questionnaires were distributed to Contractors, Consultants, Clients, and Project Managers, and respondents were asked to indicate the level of importance of each cause using either a three-point, or five-point Likert scale. Not surprisingly, each research has adopted a different approach to his/her questionnaire, using the findings obtained from previous studies, current construction practice, personal experience, and location of the project, to determine the questions. As a result, the literature has grown to produce a consolidated list of factors/causes that support further research efforts using the survey approach, as is used in the current study. Causes of delays risk are categorised in groups (Client, Contractor, Consultant, Project Manager, and

Unforeseen-related factors) and respondents are asked to indicate the level of importance they attach to each cause using by a three-point Likert-scale.

The adoption of this design enables similarities and differences in the causes and effects of risks to be identified in their *GROUPS,* with consideration of the cultural and environmental differences in each country.

From Table 2.1 it can be seen that different projects have addressed different facets of construction delays, for example the socially-related effects of such delays upon the investors/developers, or indeed upon any other stakeholders is one area of interest. The perspectives have been developed according to the cultural context, which explains why one particular set of circumstances relating to a project could be considered as damaging in one environment, yet as inconsequential in another. Clearly, the criteria relating to project success differ depending upon a project's cultural and environmental positioning.

However, despite the varying focus in published studies, it is quite clear that time and cost over-run have shaped the overall body of knowledge in this area, since around 92% of all concerns were related to time delays and the most important factors concerning project delays were found in three main groups, these being: Financial-related factors by 50% in total research with 25% in the Middle East (ME); Client-related factors by 40% with 20% in the ME; Project manager–related factors by 30% with 13% in the ME

Noticeably, there are significant factors related to financial problems, possibly 50%, that coincide with the recession that began in 2008. These include poor cash flow, constraints in funding programmes, payment delays, and debt problems, all of which have emerged as outcomes of the economic depression ranking first in order of frequency in studies conducted between 2000 and 2013. The factors related to the client, such as excessive change orders, lack of experience, and slow-decision making, all resulting in both cost and time over-runs, ranked second.

In the Middle East and the UAE in particular, investors have changed their ideas regarding construction projects (Habibi, 2009), which has placed severe pressure on real estate construction firms to persuade people to sell in regional stock markets. In turn, speculation has depressed the granting of mortgages and many banks have come under financial stress. It is noticeable, that traditional risk management has been pointed out as a failed technique in the aftermath of the financial crisis. Both financial-related project delays (Frimpong and Oluwoye, 2003) and poor risk management (Abdul-Rahman *et al*., 2011) were identified. The literature also pinpointed the need for firms to rethink their risk response strategy to encourage new investment, and to develop effective action plans to ensure the implementation of the risk response (APM, 2006). This is an issue that is believed to be worthy of high concern to knowledge managers in various roles and to decision-makers (Motaleb and Kishk, 2013a).

2.2 Previous Measures for Delays Risk Control (MDRC): Overview of Limitations

To be convinced of the knowledge gap highlighted as a result of research already conducted, the measures of delays risks control (MDRC) have been reviewed and evaluated according to the causes and effects of delays risks, research method, and impact of the MDRC (see Table 2.2).

Table 2.2: Measures for Delay risks Control (MDRC), 2000-2013

No	Study/ Country/ Region	MDRC	Research Method	Causes of Delay Risks	Theoretical Impact
1	Ng *et al*. (2000) Hong Kong (Asia)	A Conceptual Case-Based Decision Model for Construction Delays Mitigation	Quantitative (Questionnaire)	Contractor	Increase knowledge for inexpert planner
2	Odeh and Battaineh (2002) Jordan (Middle East)	Contract performance development	Quantitative by (Questionnaire)	Client, Contractor Financial	Minimise owner interference
3	Aibinu and Jagboro (2002) Nigeria (Africa)	Acceleration of site activities, and contingency allowance	Quantitative (Questionnaire)	Client	Eliminate time over-run
4	Shenhar *et al*. (2002) (N/A)	Risk Identification ,probabilistic risk and trade off	Quantitative (100 Case Projects)	Unforeseen	Improve Risk identification process
5	Fernie *et al*. (2003)	Knowledge sharing	Quantative by observations	Resources	Lesson learned
6	Nguyen (2004) Vietnam (Asia)	Comfort, competence and Commitments (COMs)	Quantitative by (Questionnaire)	Unforeseen	Improve performance knowledge

Table 2.2 : Continue Measures for delay Risks control (MDRC), 2000-2013

No	Study/ Country/ Region	MDRC	Research Method	Causes of Delay Risks	Theoretical Impact
7	Lee *et al*. (August 2005) (N/A)	Dynamic Planning and control management (DPM) for Project change management	Exploratory (Case Study)	Design	Cost and schedule control
8	Lee *et al*. (Novembe r 2005) (USA)	Converted Lost productivity into Delay duration	Quantitative (Case Study)	Resources	Settlement of schedule delay Analysis
9	Arain (2005) Singapore (Asia)	Knowledge-based decision support system (KBDSS)	Mixed (Questionnaire, Interview)	Client, Contractor	Control variation orders and improve decision-making
10	Oliveros (2005) (N/A)	Fuzzy logic model (Group3)	Quantitative (Questionnaire)	Unforeseen	Updating project schedule
12	Wang and Haung (2006) China	Relation/ Guanxi criterion	Quantitative (Questionnaire)	Resources	Maximise Owner and organisation performance
13	Shahaliza deh and Farhadyar (2006) Iran (Middle East)	Knowledge management	Quantitative (Questionnaire)	Resources	Lesson learnt
14	Abdul-Rahman *et al*. (2006) Malaysia (Asia)	Effective management method	Quantitative	Client	Reduce diversions and variations
15	Zaneldin (2006) UAE (Middle East)	The Negotiation used to resolve construction claims	Quantitative (Case Study)	Client	Avoiding disputes in varaitions, lesson learnt

Table 2.2 : Continue Measures for Delay risks Control (MDRC), 2000-2013

No	Study/ Country/ Region	MDRC	Research Method	Causes of Delay Risks	Theoretical Impact
16	Arditi and Pattanakitchamroon(2006) N/A	Selection of proper delay analysis method	Review (20 Research from Literature)	Resources	scheduling data development
17	Oladapo (2007) N/A	Variations management	Mixed (Questionnaire and Case Study)	Resources	Managing variations
18	Luu *et al*. (2008) (N/A)	Bayesian belief networks	Mixed (Questionnaire, Expert Interviews, Case Studies)	Financial, Client, Contractor	Financial and time development for stakeholders
19	Abdul-Rahman *et al*. (2009) Malaysia (Asia)	Cash flow management	Quantitative	Financial, Client	Prompt payment practice
20	Tumi *et al*. (2009) Libya (Africa)	Risk Management	Quantitative (Questionnaire)	Project Manager	Performance knowledge
21	Mulcahy (2009)	Corrective action	Review (Field Experience)	Consultant	Improve project schedule
22	Said (2009) Saudi Arabia (Middle East)	Corrective action optimization	Exploratory (Case Study)	Unforeseen	Control Performance
23	Jallow et al. (2009)	Business Process Management (BPM)	Focus Group and Case Study	Client	Better management to client requirement
24	Preston (2010) Gulf (Middle East)	Liquidated damages for delay	Review (Literature)	Financial	Adjust the contractor finance risk and performance obligations
25	Omran *et al*. (2010) Malaysia	Working drawing stage solve problem	Quantitative – (Questionnaire)	Contractor Client	Pre-construction knowledge
26	Olawale and Sun (2010) UK	Preventive, predictive, corrective and organisational measures	Qualitative (Face-to-Face Interviews)	Designer	Improve the cost and time control

Table 2.2 : Continue Measures for Delay risks Control (MDRC), 2000-2013

No	Study/ Country/ Region	MDRC	Research Method	Causes of Delay Risks	Theoretical Impact
27	Manase (2010) UK	The Private Finance Initiative (PFI) procurement	Review (Literature Review)	Financial	Improve client positioning in terms of risk allocation
28	Hasna and Raza (2010) GCC (Middle East)	Project Portfolio Management (PPM)	Exploratory (Not specified)	Financial	Improve knowledge of financial resources
29	Arditi *et al*. (2010)	Lesson learned system	Mixed–data base	Designer	Lesson learnt-improve knowledge
30	Brendel *et al*. (2010) UAE (Middle East)	Set up qualified civil rights for contractors to assure payment for work	Review (Literature)	Financial, Contractor	Knowledge to civil code, and code provisions
31	Al Tmeemy *et al*. (2010)	Project management , product and market success measures	Quantitative (Postal and E-mail Survey)	Financial	Long-term project success
32	Abdul-Rahaman *et al*. (2011)	Cash flow management	Qualitative (Interviews)	Financial, Client	Prompt payments by client
33	Motaleb and Kishk (2013a) UAE (Middle East)	Developing stakeholders knowledge management	Quantitative (Questionnaire)	Client	Improve decision-making, reduce variations
34	Motaleb (2013c) UAE (Middle East)	Project Management Maturity Model	Quantitative (Questionnaire)	Project Manager	Improve risk response process

Several researchers have undertaken studies in this area as shown in Table 2.2, and after doing so, have identified methods or measures by which to control delays risks in construction projects. In this study, the gap in knowledge relating to such measures is explored. Subsequently, the research methods adopted in previous studies are considered to assess their suitability for the current study. Although of all the MDRCs are often used, they still have serious drawbacks and may yield inconsistent results and absence of validation. Generally, the research studies by Ng *et al*., (2000), Odeh and Battaineh (2002), Aibinu and Jagboro (2002), Nguyen (2004), Oliveros (2005), Wang and Haung (2006), Shahalizadeh and Farhadyar (2006), Abdul-Rahman *et al*. (2006), Abdul-Rahman *et al*. (2009), Tumi *et al*. (2009), Omran *et al*. (2010), Oliveros (2005), Al Tmeemy *et al*. (2010), Motaleb and Kishk (2013a) and Motaleb and Kishk (2013c) were conducted by questionnaire surveys using sampled responses and analysis of data obtained from the responses. Each study has a unique approach and unique results are derived from the questionnaire response data.

The critical review also covers studies by Shenhar *et al*. (2002), Lee *et al*. (August 2005), Lee *et al*. (November 2005), Zaneldin (2006), and Said (2009), who obtained their data using the case study strategy. Additionally, research by Fernie *et al*. (2003), Arain (2005), Koushki (2005), Oladapo (2007) and Luu *et al*. (2008), undertaken using a mixed approach to data collection (interviews, questionnaire, and case studies) is also explored. A few studies were entirely desk-based, conducted purely by examining the literature, and these are represented by the work of Arditi and Pattanakitchamroon (2006), Mulcahy (2009), Preston (2010), Manase (2010), and Brendel *et al*. (2010). One study by Brendel *et al*. (2010) used focus groups and case study, another by Fernie *et al*. (2003) was conducted solely by observation, and two other studies performed by Olawale and Sun (2010) and Abdul-Rahaman *et al*. (2011) used qualitative interviews only. So, it can be seen that of the existing studies, 50% were conducted using a questionnaire survey, and this provides the encouragement to continue in this vein for this study.

The selected Measures of Delays Risk Control (MDRC) were searched and represented practically between 2000 and 2013. In 2000, 3% of the selected research had been identified; this increased by 8% in 2002, and decreased in 2003 and 2004 by 3%. In 2005-2006 this type of research increased by 14%-16% respectively, and decreased again to 6% in 2007, going down to 3% in 2008. In 2009-2010, such studies increased by 19% to 31% (see Figure 2.1) and then dropped again by 6%. The 34 studies considered represent research undertaken around the world, but specifically, studies have been conducted in Asia (25%), the Middle East, and Africa (27%), the UK (6%), the US (3%) and elsewhere (the remaining 39% did not cite their locations) (see Figure 2.2).

The Measures of Delays Risk Control (MDRC) have been analysed as shown in Table 2.2. Odeh and Battaineh (2002) suggested that in order to improve *Performance* on construction projects, it was necessary for clients to enforce liquidated damage clauses, and offer incentives for early completion; at the same time they believed it was essential to develop human resources in the construction industry through proper training and classifying craftsmen. Nguyen (2004) used Comfort, Competence and Commitments (COMs) as a measure of delays risks control (MDRC) in Vietnam. He adopted a questionnaire survey, finding several factors that could be applied as measures with the intention of minimising construction delay. These factors were competent project managers; multidisciplinary/competent project teams; availability of resources; commitment to projects; frequent progress meetings; accurate initial cost estimates; accurate initial time estimates; awarding bids to the right/experienced consultant and contractor; proper emphasis on past experience; community involvement; systematic control mechanisms; comprehensive contract documentation; effective strategic planning; clear information and communication channels; the utilisation of up-to-date technology; and absence of bureaucracy.

As various means of reducing project delays, different researchers have suggested different solutions. For example, a *Knowledge-Based Decision Support System (KBDSS)* measure was suggested by Arain (2005) in Singapore, and a *Working Drawing Stage Solve Problem* measure was proposed by Omran *et al*. (2010) in Malyasia to support *Decision-making* for project stakeholders. The Relation/Guanxi criterion was introduced by Wang and Haung (2006) in China, and the Corrective Action Optimisation method by Said (2009) in Saudi Arabia for project *Performance*.

The Effective Management Method suggested by Abdul-Rahman *et al*. (2006) in Malaysia, and the Negotiation approach used to resolve construction claims by Zaneldin (2006) in UAE, are thought to be helpful in controlling project *Variations* or *Change orders* caused by any of the project stakeholders (Contractor, Clients). Likewise, Oladapo (2007) identified variation management measures, and Jallow *et al.* (2009) claimed that Business Process Management (BPM) would be helpful in adjusting variation in client requirements. Motaleb and Kishk (2013a), researching in the UAE suggested developing stakeholders' knowledge management to improve decision-making, and reduce *Variations.*

Focusing on Nigeria, Aibinu and Jagboro (2002) identified two measures to control delays risks and quite possibly to eliminate *Time* overrun, these being: Acceleration of site activities, and Contingency allowance for direct *Time* control. Luu *et al*. (2008) tested Bayesian Belief Networks to solve *Financial* problems and *Time* development, and Lee *et al*. (August 2005) identified the importance of Dynamic Planning and Control Management (DPM) for Project change management in *Cost* and *Schedule* control. Olawale and Sun (2010) in the UK found that *Preventive, Corrective and*

Organisational Measure was valuable in improving *Time* and *Cost* control. Lee *et al*. (2005) conducted the settlement in *Schedule* delay by *Converted Lost Productivity* measure into Delay duration. They suggested that lost productivity is one of the factors that cause delays in construction projects, and having arrived at that conclusion, they proposed a measure for converting lost productivity into equivalent delay durations. That study focuses on labour productivity, assuming that it represents all kinds of productivity. The methodology used involved several concepts regarding delay and productivity, such as planned and actual work duration, and impact factors. Based on those concepts, a delay analysis process and equations for calculating 'the loss of duration due to lost productivity' were developed. Thereafter, the responsibility for lost duration can be assigned through the use of any other appropriate model. Another example from Oliveros (2005) proposed a fuzzy logic approach for schedule updating and delay analysis. The basis of this approach is the use of fuzzy logic for estimating the impact of activity delays, for calculating revised activities, and for recalculating the project schedule. However, the method presented by Oliveros (2005) is only partly computerised and in order to efficiently analyse the information provided by daily site recordings, it needs to be fully automated. Using *Schedule* control to minimise project delay. Arditi and Pattanakitchamroon (2006) tested a selection of proper delay analysis methods to schedule data development; and Al Tmeemy *et al*. (2010)

suggested Project Management, Product and Market Success measures, for long-term project success.

Particular in respect of GCC projects, *Cash Flow Management* was proposed Abdul-Rahman *et al*. (2009), and Project Portfolio Management (PPM) by Hasna and Raza (2010). In Koushki's (2005) study, it was argued that in order to control time delays and cost over-runs, it was necessary to: ensure an adequate and available source of finance until project completion, allocate sufficient time and money at the design phase, select a competent consultant and a reliable contractor to carry out the work, ensure the proper planning of project tasks and resource needs at the pre-construction phase, hire an independent supervising engineer to monitor the progress of the work, and ensure timely delivery of materials. All of these measures are believed to support problem-solving related to *Financial* risks. Another example of measures is identified by Preston (2010) who focused on the Gulf region, and who suggests liquidating damages, as a means of providing support against both *Performance* and *Financial* risks.

Some MDRCs have an impact upon the project life-cycle in terms of their impact on *Knowledge* and *Lesson Learnt* aspects (see Fernie *et al*., 2003; Arditi *et al*., 2010). In the UAE, Brendel *et al*. (2010) suggested Qualified Civil Rights for contractors to assure payment for work, thereby adding using the country's civil codes as sources of knowledge and lessons learnt. Omran *et al*. (2010) in Malaysia suggested a measure of Working Drawings as a means of solving problems in the pre-construction stage as this would improve *Knowledge.* And in Iran, Shahalizadeh and Farhadyar (2006) suggested an improved Knowledge Management system to accommodate the *Lesson Learnt*. Concentrating specifically on improving knowledge for inexperienced project planners, Ng *et al.* (2000) in Hong Kong, developed a Conceptual Case-Based Decision Model for Construction Delays Mitigation.

Noticeably, measures for *Risk Management* attract less consideration. One method for risk identification improvement has been proposed by Shenhar *et al*. (2002) entitled Risk Identification, Probabilistic Risk and Trade off. In another piece of similar research, Manase (2010) tested the Private Finance Initiative (PFI) procurement to establish its impact on risk allocation, and in their research in Libya, Tumi *et al*. (2009) Libya identified the Risk Management processes required to improve risk knowledge for project teams. In 2013, Motaleb and Kishk suggested the Project Management Maturity Model for risk response improvement as a new knowledge system for the UAE.

Some of the MDRC measures are related to existing measures highlighted in this research that have capabilities to improve many aspects of the risk mitigation process, and others are identified from the pilot survey conducted before the main study. Within the literature, the MDRCs in *Performance* relating to all project stakeholders (but especially the project team) during construction are identified by, for example, Haung (2006) and Said (2009).

The KSFs of preventative measures such as project team performance in risk definition, and bidding re-analysis and contract performance by contractors, have been introduced as KSFs by respondents in the questionnaire survey undertaken in the study. In addition, *Variations* management, covering the ability to respond to client requests, or change order management, is considered as a KSF for mitigation measures in this research. This is in line with the findings of researchers like Oladapo (2007) who identified variation management measures, and Jallow *et al.* (2009) who considered the variation in client requirements. More consideration is given to the *Financial* measures and *Risk Management* process as a relevant MDRC in *Cash Flow Management* as proposed by Abdul-Rahman *et al*. (2009), and in Project Portfolio Management (PPM) as suggested by Hasna and Raza (2010). The study, therefore, agrees that the preventative measures in this respect are the presence of effective funds-budget management, the creation of a project crisis programme (to anticipate financial crisis), and effective cash flow management. However, extra KSFs of preventative measures are introduced in the questionnaire used for this research. And finally, in respect of the relationship between *Knowledge* and *Lesson Learnt*, the previous MDRCs suggested by Fernie *et al*. (2003), and Arditi *et al*. (2010) are all related to knowledge improvement. Such improvement provides the opportunities to identify the KSFs of preventative measures in planners' knowledge such that it can be certain that planners have sufficient understanding to be able to formulate an effective risk plan. Brendel *et al*. (2010) used the MDRCs of the country's civil codes as sources of knowledge and lessons learnt. Using the civil codes enables the development of team knowledge concerning the rules and regulations of the country in which those teams are operating, and this strategy appeared in the questionnaire survey*.* Omran *et al*. (2010), researching in Malaysia, suggested the MDRC of Working Drawings as a means of solving problems in the pre-construction stage as this would improve *Knowledge.* And in Iran, Shahalizadeh and Farhadyar (2006) suggested an improved Knowledge Management system as an MDRC to accommodate the *Lesson Learnt,* concentrating specifically on improving knowledge for inexperienced project planners. Efforts by Shenhar *et al*. (2002), Manase (2010), and Tumi *et al*. (2009) identified MDRCs in *Risk Management*, including the KSFs of preventative measures like Anticipate risk (identification), and share high impact risks with other stakeholders (risk owners). KSFs of mitigation measures as stated in the questionnaire survey in this research include: optimal risk allocation plan, supervision for risk identification, risk transfer (integration in insurance consultation), and new risks reviews (update) in the risk plan.

All in all, the effect of these MDRC measures can be successful as *Preventative* strategies in pre-construction and *Mitigation* of delays risks in construction. The evidence and outcomes of the previous measures will help to develop a *Risk Response Model.* So, the objective of the research can be identified and an answer can be provided to the second research question, that being *Do construction organisations identify any key success factors (KSFs) of preventative and mitigation measures for risk response development for construction project delays?*

As shown in Table 2.2, which demonstrates the current thinking in this field, the cyclical nature of the MDRCs proposed reflects traditional management approaches, with the main focus being on the theoretical impacts upon projects rather than on the practical risk response. Researchers believe that the MDRCs influence the knowledge, experience, owner interference, risk identification, risk assessment, schedule analysis, cost control, variations, decision-making, organisational performance, lessons learnt, and financial and stakeholder management, in a positive way. That said, these researchers have still left 'what' and 'how' questions unanswered, and it is vital for any risk response to address these questions if the response is to be comprehensively developed for genuine use in the practical situation. Essentially, the traditional process has been associated with the measures, as seen by the heavy reliance upon contract documentation between the project stakeholders, and the scant attention paid to the formulation of any practical detailed risk analysis. This argument is supported by Lingard and Rowlinson (2005) who note that due to the traditional process practised in health and safety construction projects, there is a consequent divorce between design and construction. At the same time, it has been noted that a link exists between the implementation of knowledge of similar incidents and the level of construction process maturity (Sarshar *et al*., 2000). From this observation, the differences between mature and immature construction processes become evident. This provides further strong evidence on which to base the answer to the last research question, that being *Do construction organisations use any 'Maturity' model to measure the levels of risk response development?*

Having identified the gap in knowledge by exploring the literature, it is now important to consider the concept of risk response and investigate how to develop such a response to enable projects to be successful. In doing this, the researcher attempts to discover a suitable scale for risk response development in 'mature' practice.

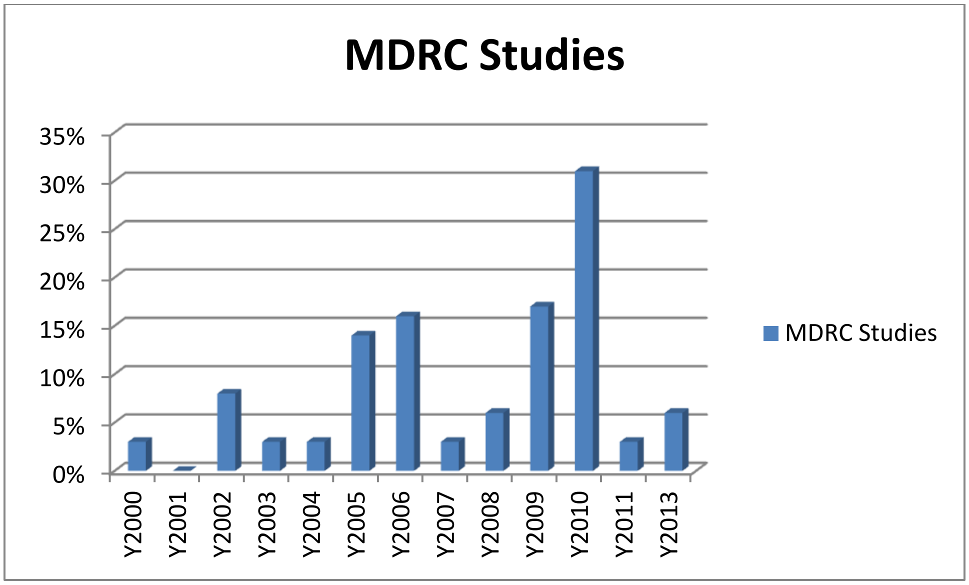


Figure 2.1: Chronological summary of MDRC (2000-2013)

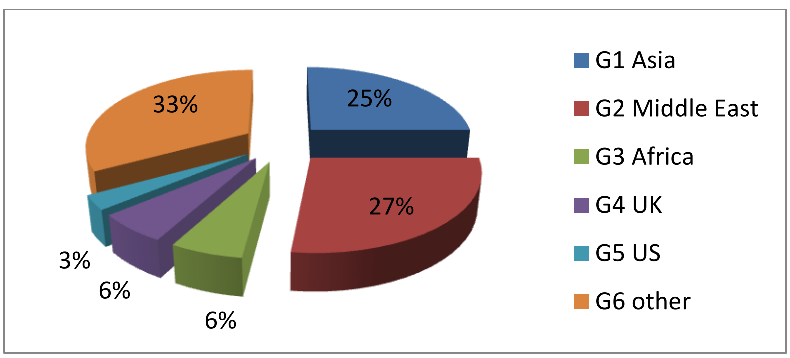


Figure 2.2: Regional summary of MDRC studies.

2.3 Knowledge Gap as Identified in the Literature Review

The risk response is an important process, but it has not yet been neither developed nor fully addressed in the literature in connection with construction project delay risks and effects. Much effort has spent in responding to risks, but the actual discipline of risk response development is totally neglected in risk management (Syedhosini *et al*., 2009). Hence, there is a need to develop a management system and measures for risk response success and to minimise the effects of delay risks. According to Hällgren and Wilson (2011), there are tools and techniques available for managing project risk but there is a lack of risk response research for project success. It is true that models have been developed to study risk identification and risk assessment, in addition to risk analysis, but a risk response model, and in particular one which embodies the preventative and mitigation measures that make risk response a success, is yet to be outlined (Motaleb and Kishk, 2012). Indeed, the researcher has not found any study reported in her in-depth literature review, that has established success measures of risk response. Of course, it is recognised that response success measures may vary from project to project, and clearly measures that could work well in housing projects may not be applicable to schools projects due to their different end usage which may call for different response requirements. That said, in the UAE, it is not known what the project risk response success measures are in construction projects, and to what level of maturity they are scaled. Consequently, there is a gap in knowledge in this respect.

At the same time, a methodological gap exists in risk response development research, since no study has been carried out using a quantitative approach, and as a result, there is an opportunity in this study, to address this shortcoming.

To sum up, it can be argued that:

- The greatest deficiencies in measures of delay risks control in construction projects are related to the lack of risk response development and appropriate measures (preventative/mitigating), as a crucial phase in risk management in the project life-cycle. Indeed, none of the studies explored from 2000 to the present time contribute anything to knowledge in this respect.

- There is another sizeable gap in knowledge, this relating to stakeholders' ability to manage identified risks and control their effects, whilst the response to known risks are typically proactive, managed, planned and budgeted (Burtonshaw-Gunn 2009:28). Only 0.09% of the studies surveyed mentioned this, and none were from the Middle East.
- Measures cited in previous studies were not properly validated because only traditional management approaches, that do not involve the use of a maturity level scale, were used.

Given the predominance of traditional management approaches, it is appropriate to review those approaches as a means of demonstrating their lack of suitability for developing comprehensive risk response process strategies, and this is done in the following section.

2.4 Traditional Project Performance

There is no doubt that the traditional criteria involving the triple constraints of time, cost and quality, are those that are considered to be the main hallmarks of any project success. However, in order to satisfy those criteria, it is crucial to identify the risk dimensions that exist in relation to that project, and clearly this becomes the most important issue in project management. Many researchers have investigated the triple constraints. Shenhar *et al*. (1997) have done this, believing that cost, time and quality are not homogenous because resources constrain time and cost, whereas the quality associated with the final outcome may not be constrained in the same way.

Earlier, De Wit, (1988) tested the project success measures against the overall objectives of a project, and project management success against the routine measures of cost, time and quality, and to some extent, the performance. Projects suffer from poor performance due to risks (Thompson and Perry, 1992; Flangan and Norman, 1993; Tah, 1997). But there is some potential to harmonise the measures of project success by quantifying the time, cost and quality in organisational practice, and by including definitions of performance of the resources produced by the project.

According to the changing nature of building functions and demands, performance is one of the most important aspects in project management and should be tailored and innovated for every project (Toor and Ogunlana, 2010). Being able to satisfy the expectation of clients in the performance of projects is a strategic advantage in a world of hyper-competition, since it is well understood that construction projects suffer from delay risks and budget over-runs, and clients do not want to experience such problems. Clearly, construction organisations need to compete to win the marketplace and create value for their stakeholders (Shenhar, 2004). Consequently, there is a need for research to concentrate in more depth on project performance in a measured way, and to consider how management's perception of risk is actually assessed in each context, so that the practice in the risk response process can be openly evaluated. Landin (2000) considered that in order to retain reputations for good project performance, construction organisations must ensure the satisfaction of their stakeholders; and other researchers have indicated that as part of this, they must be capable of effective communications management (Bakens *et al*., 2005; Young, 2006).

However, the majority of construction projects are still characterised by cost and time over-runs and clients are not satisfied. Projects continue to be unsuccessful as they suffer from increasing delays. It is clear that project success can no longer be evaluated purely on the three traditional criteria (Low and Chuan, 2006), since in themselves they make no mention of efficiency, which is severely damaged by time and cost over-runs. In this respect, Dweiri (2006) has taken a critical look at the need to add efficiency to the basic criteria for project management success.

It is noted, in this connection, that in order for them to begin to approach efficiency, projects should be measured by the degree to which risks are managed within them, and the quality of the risk response strategic plan, since this is what stakeholders are concerned with, and their views on project success and satisfaction are what count both in the short and long term (Bryde and Brown, 2005). Indeed, they have a large amount of influence on a project during its execution, and also on the reputation of the construction company when the project is finished as good reports boost the opportunities for further work. Furthermore, stakeholders can play a key role during the life-cycle of a project in their willingness to accept risks (Mulcahy, 2005), and their presence could help to develop the risk response strategy, as well as to manage and register risks within an innovative model which can itself be used in the continuous building of stakeholder knowledge (William, 2008).

The involvement of stakeholders is also important since observations have shown that investors of construction projects are unable to justify their investment because of numerous project delay risks (Global Real State News Center, 2009), and their involvement and contribution towards the better management of risks may have a favourable effect on such risk response success (Söderholm, 2008, Geraldi *et al*., 2009) and vice versa lack of coordination cause inappropriate risk response (Moe and Pathranarakul, 2006). In the absence of such involvement and given the relative ignorance of stakeholders, who have all been affected by the recent depressed global economy, construction companies could find themselves struggling to survive. Certainly, in the worldwide market, particularly in the Middle East and the UAE, the situation is dissatisfactory, and it could be argued that researchers are not attempting to find a solution or a strategy to minimise delay risks, in any dynamic or coherent way.

Hence, managers themselves must establish efficient risk management systems in order to achieve time and cost targets. Over a decade ago. However, contradictions do exist, and Chan *et al*. (2002) have insisted that the original three key criteria of time, cost, and quality, have showed themselves to be successful in assessing the performance and success of construction projects, although practitioners and organisations have indeed found it hard to agree on this methodology. Dweiri (2006) and Atkinson (1999) both agree on the significance of efficiency as one of the criteria by which to guage effective project management. However, it is worth noting that it is not known exactly how project risks can be controlled to ensure efficiency. What is certain, is that efficiency is crucial otherwise the construction risk response will not be properly enacted when required.

2.5 Risk Analysis Techniques

Risk management is a systematic process of identification, assessment, response to project risks (see Figure 2.3), and control. This includes efforts to maximise the probability of positive events, and minimise the probability of adverse events and effects to project objectives (PMBOK, 2004; APM, 2006). Since construction is a risky undertaking, Project Risk Management must not be ignored due to its criticality in coping with various opportunities (Griffis and Christodoulou, 2000).

Early risk identification and assessment help to keep a project on track and to support the response to risks. As part of this overall identification and assessment of risk, the project schedule, budget, cost, and quality, may all be reviewed, with a view to reducing the risk and keeping a strong and integral focus on the project objectives (Kim and Bajaj, 2000; Krane *et al.*, 2010).

However, despite the ongoing research in the field of risk management in construction, many areas remain neglected, and the analysis of project risk is one such area. The expert recommendation is that project risk analysis is performed with all types of project before any attempt to develop a risk response strategy is made, since most projects involve some degree of risk given the presence of many stakeholders and the associated risk factors that involvement brings in the form of financial, client, contractor, consultant, designer, project management, and unforeseen-related factors.

Figure 2.3: Risk Management Process (PMBOK, 2004)

The process involved in construction project risk management involves challenging the incidence of poor performance in practice. And by using both quantitative and qualitative risk analysis as part of that overall management, the project objectives can be achieved. In this section of the research study, project risk analysis is considered, and regarded as an integral part of construction project management. It is noticeable that in previous research studies, and in all the above case studies, no genuine capability among personnel in respect of techniques used in risk analysis, has emerged. However, much consideration has been given to Risk Analysis Techniques in the literature, as described in the following sections:

2.5.1 Qualitative Risk Analysis

Qualitative risk analysis is a process of risk investigation relating to risks that have been identified as potential, or risks that are actually occurring. Such analysis prioritises risks in a descriptive manner according to their potential effect on project objectives (Jiang *et al*., 2002), and it is useful for risk response planning and for laying the foundation for quantitative analysis. In addition, a review of process documentation from past experience or lesson learnt can be effective as this allows an update to the risk register to be made.

Many researchers use qualitative analysis techniques when analysing construction project risks. In this respect, del Cano and Pillar de la Cruz (2002) considered many types of techniques, one being *Probability and Impact Description,* which investigates the likelihood of each specified risk actually occurring. Another technique called the *Probability-Impact Risk Matrix* represents a method that defines risk-rating, and which can be tailored to a specific project, specifies combinations of probability and impact that lead to rating the risks to be encountered in a project as low, moderate, or high priority (see Figure 2.4) (Dumbravă and Maioresco, 2013). In addition, 'the near-term risk response', sometimes called the 'assessment of risk urgency' can be combined with the *Probability-Impact Risk matrix* to rate a final risk severity rating (PMBOK, 2008).

	IMPACT		
	Low (insignificant, just note)	Medium (reasonable impact, to be monitored)	High (will have a significant impact)
LIKELIHOOD Low (unlikely to occur)	E	D	C
Medium (may occur at a time)	D	C	B
High (likely to occur)	C	B	A

Figure 2.4: Probability-Impact matrix technique (Source: Dumbravă and Maioresco, 2013)

Cause-Effect or Fishbones Diagrams represent another technique that has been used in construction projects to reveal the root causes and effects of a particular risk, or the particular area within a project that requires more attention. Once identified, the potential problems can be designated for immediate risk response, for further analysis, or for later response.

Other qualitative analysis techniques are also helpful in analyzing construction project risks, such as the *Checklist* which is useful for the risk register*, and the Flowchart,* and *Assumption Analysis* which are also effective. However, it is important to note that any type of qualitative analysis of risk requires the collection of unbiased data, and in this respect *Data Precision Ranking* should be performed via the use of the techniques of *Influence Diagram,* and *Event and Fault Trees*. That said, Adams (2008) argues that construction companies have not made significant use of these techniques in their projects since the 1980s. This may, in fact, be the reason behind the huge delays risks in construction projects. Statistically, there are high positive correlations between the level of awareness and the level of utilisation (Adedokun *et al*., 2013)

2.5.2 Quantitative Risk Analysis

Quantitative analysis techniques, based on their sophisticated mathematical, statistical, and scientific background, promise a detailed and thorough identification and assessment of risk, which is very important for designing the response.

The review of various quantitative risk analysis techniques that appear in the literature enabled the researcher to gain an overall understanding of various existing quantitative techniques for construction project risk analysis. The techniques identified are: *Decision Tree Analysis*, *Expected Value Analysis, Sensitivity Analysis*, *and Monte Carlo Simulation Analysis*.

Decision Tree Analysis is a graphic technique that involves different situations and implications within each scenario in a project scenario, and compares them in order to provide options from which the best can be chosen. The considerations include the cost of each option, and the probability of risk occurring within each option, and the values established in these respects will decide the outcome (Olivas, 2007) since they help the analyst to form a balanced picture of what risks are likely to present. Decision Tree Analysis is best suited for sequential activities (Hulett, 2006) (See Figure 2.5)

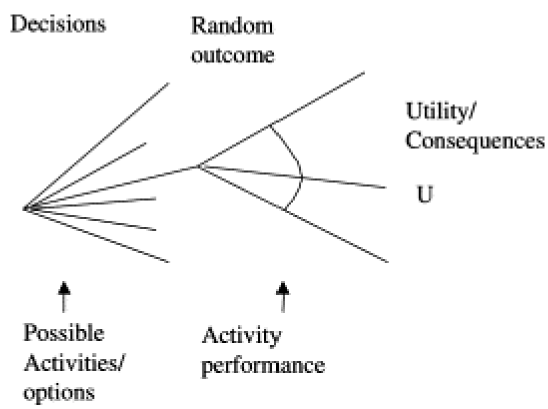


Figure 2.5: Decision Tree Analysis Technique Example (Source: Faber and Stewart, 2003)

Expected Monetary Value Analysis is a statistical concept that quantifies the product of two numbers: risk event probability, and risk event value (Raftery, 1994). The value may be positive for opportunities and negative for threats (Stefanovic and Stefanovic, 2005). However, the technique takes into account all the probabilities of each decision, then multiplies each possible outcome value with its probability, and adding all the results together to obtain the total result.

Sensitivity Analysis is a study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be apportioned to different sources of uncertainty in its inputs (Saltelli, 2008, PMBOK, 2008) and it helps in determining which risks have the most potential impact on the project. It is used to establish the sensitivity of a model to the parameters associated with a project, and to the effect of any structural change (Saltelli, 2004). This type of analysis can be performed by varying the values of one parameter input and observing which of the outputs change, and what degree of that change affects the project objectives. Hence, it provides a ranking of the model inputs based on their contributions to the variability of the model and uncertainty. The technique as defined by Saltelli (2000), is "the study of how the variation in the output of a model can be apportioned, qualitatively or quantitatively, among model inputs".

Monte Carlo Simulation is a numerical procedure to reproduce random variables that preserve the specified distributional properties (Carmel *et al.,* 2009). It is a technique of investigating the effect of the main risks on a strategy, bearing in mind that such risks when simultaneous cause a non-linear interaction which may have an influence upon the otherwise nominal or already settled results (Hulett, 2004) (see example in Figure 2.7). This technique was not used frequently until computer technology and power increased (Pengelly, 2002).

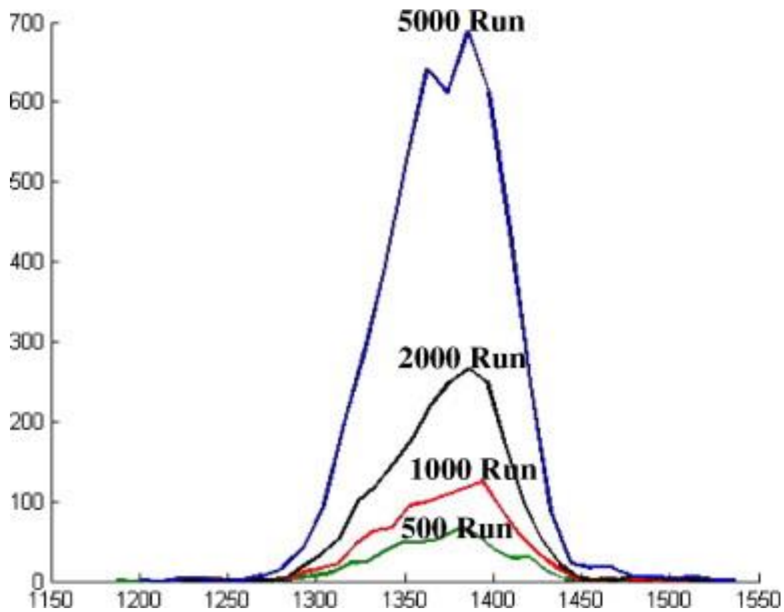


Figure 2.6: Monte Carlo Simulation Technique Example (Source: Rezaie *et al.*, 2007)

All the above techniques are beneficial in a risk analysis, since they help to define preventative measures to reduce the probability of any risk factors from occurring (Adedokun *et al*., 2013). However, the major problem when trying to use any of these risk analysis techniques, as identified in previous studies, is the difficulty in obtaining information about the variability of the risk factors. In addition, construction projects are generally unique, and design and construction teams change from project to project. Moreover, in the UAE, construction project records are not usually kept in a properly-functioning retrievable project management system, as noted by Abraham and Rafael (2004), who observe differences in the technical practice of different project teams. The development of risk response model will help to implement the strategy of risk analysis to choose the most appropriate plan of response.

2.6 Risk Response

Having reviewed the literature relevant to risk management, it appears that risk response is the most important stage in the process of risk management since this determines the ability of managers to enhance opportunities and reduce threats in projects (Motaleb and Kishk 2012). More specifically, the risk response plan has the potential to create the essential conditions for optimal risk identification and assessment therefore risk response action should be prepared, categorized and rationalized on regular basis (Syedhosini *et al*., 2009).

Risk response has been discussed and classified in systematic management standards to be of the '*acceptance*' type or the '*reduction*' type, it being suggested that '*acceptance*' should be the strategy if the risk impact is relatively insignificant (using a contingency plan) and it is possible for mitigation in new risks reviews and update the risk plan (Flanagan and Norman, 1993, APM, 2006), and that '*reduction*' should be adopted where immediate action is required, and that in this reduction activity, the costs, savings and benefits should be compared. One further option exists, that being to '*transfer'* the risk to another party (APM, 2006), and in this case it should be transferred to the party most capable of managing it. Hillson (1999) suggested warranties and guarantees as effective risk transfer measure for response. Alternative research by Zhi (1995), who observes risk response to be dealt with through the three channels of: response by contracts, by retention, and by insurance. Elimination of risks is obviously preferable where such risks are unacceptable, hence to define responses in advance may have desirable impact on the project outcome (Chapman and Ward, 2003) but in reality it is impossible to totally remove such risks.

On the other hand, risk response is not usually cost effective because projects face unexpected changes varying from simple to chaotic changes or variations (De Meyer *et al*., 2002). One further option exists, that being to manage the risk response with matured systems, and in this case it should be developed and then managed by the party most capable of managing it. This act of management is seen in the work undertaken by Turnerb and VIEL (2000) when they claimed the concept of project management (PM) in construction organizations generally includes the notion that management actually focus on a single project, a single location, and on project output and input rather than on the actual project process and hence, there is no attention paid to '*PROCESS MATURITY'*. 'Maturity' in this sense refers to the level of organizational development, and the degree to which it operates in perfect conditions (Andersen and Jessen, 2003; Cooke-Davis, 2005), and works according to best practice benchmarks (PMI, 2002). Clearly, the formal identification and discussion of these aspects of risk response indicate the importance of the issue within the United Arab Emirates (UAE) since the costs associated with delay risks of construction projects have reached $767billion, and 60% of such projects are on hold as a result of the recession that began in 2008-2009 (Motaleb and Kishk, 2013a). In fact research in the area of risk response is still neglected (Syedhosini *et al*., 2009), and this is a situation that should be redeemed since *reduction, protection, contingency*, *acceptance,* and *transfer* types (Risk Management Guidelines, 2003) are all known to affect the overall strategy of the project, albeit in limited areas of risk (APM, 2006).

2.7 Project Management Influenced by 'Maturity'

Shi et al. (2001) have concluded that unsuccessful projects occur because of the accumulated effects of individual activities that are enacted without any project management maturation. They observed that the maturity concept is being used increasingly to map out logical ways to improve an organisation's services and resources. In their research, conducted in the 1990s, Shi et al. (2001) examined several maturity models, and concluded that different kinds of project management maturity models (PMMM) with common features were in existence, specifically to provide organisations with a methodology for assessing and improving the capability of their project management team. It has been found that productivity increases between 10% to 20% and that the capability of enterprises to assess and control their project performance increased by 40% to 50% on average, through their adoption of PMMM (Yuming *et al*., 2005). A comparison between mature and immature organisations is sensible when seeking to develop a process like risk management, since this requires an understanding of the differences between these organisations (see Table 2.3).

Table 2.3: Comparison between Mature and Immature Construction Organisations

Mature	Immature
-Have planned processes which are precisely communicated to the project team. In addition, maintenance activities are managed by wide ability alongside a supportive organisational culture (Sarshar *et al.*, 2000). - Roles and responsibilities are definite and apparent for projects and the organisation (Sarshar *et al*., 2000). - Besides, product quality and client satisfaction are monitored (Sarshar *et al*., 2000).	-Immature organisations may conduct projects with efforts of a dedicated team with no planning rather than repeating systematic and proven methods (Humphrey, 1989) -Construction processes are unambiguous and formed by project managers and practitioners during project execution (Sarshar *et al.*, 2000). -There is no objective basis for quality and solving product and process problems (Sarshar *et al.*, 2000). -It is reactionary and dealing with the problems as they arise (Sarshar *et al*., 2000).

More mature PM practices are definitely seen to deliver better project performance. For example, in Table (2.3) matured organization have planned processes which are precisely communicated to the project team whereas immature organisations may conduct projects with efforts of a dedicated team with no planning rather than repeating systematic and proven methods. Besides, product quality and client satisfaction are monitored in mature organisations compared with no objective basis for quality and solving product and process problems in immature project organisations. It has been demonstrated in many studies that companies with more mature practices deliver projects on time and on budget, whereas less mature companies may miss their scheduled targets by 40% and their cost targets by 20% (Collaboration, Management and Control Solution [CMCS], 2007). Furthermore, the good PM companies have lower direct project costs than poor PM companies. In addition, highly mature companies have PM costs in the 6-7% range, while their counterparts average 11% (and in some cases reach 20%). This is just the direct cost spent on project management (PM). Moreover, organisations with low project management maturity (PMM) face other undesirable events such as increased indirect costs, late project deliveries, missed market opportunities, and dissatisfied customers. PMM has assisted in improving the organisational use of technology by providing guides for the most important processes to achieve high PM maturity levels (Kwak and Ibbs, 2002). In addition, capabilities and personal skills like leadership, and labour, can be observed when issues are reflected by team leaders in mature systems (Willis and Rankins, 2009). Furthermore, construction companies with developed project management techniques are able to acquire good market positions (Polish Construction Companies Report, 2012). Another benefit is that project team development is actively engaged to provide reviews and input to the project execution in level 3 of maturity (Kwak and Ibb, 2002). Hence, in the "maturity" scenario, there is an emphasis on the effective performance of the team members. (Rad and Levin, 2003:138). For instance, performance improvement may change knowledge in risk definition. In terms of the performance, the technology utilisation suffers from inadequate expertise among personnel, and consequently, there is an inability to minimise the potential technical problems, and hence, the technology-related risks, and their impact on project success (Yeo and Ren, 2009).

2.8 Risk Response-Maturity Relationship

From the review of the literature relevant to risk management, it appears that risk response is the most critical process in the risk management loop since this determines the ability of managers to enhance opportunities and reduce threats in projects. However, although mitigation measures are indeed commonly used in the development of the risk response process, the mitigation route is identified as the most expensive (Cooper and Dale, 2005). Hence, it is advisable for clients to take responsibility for each agreed risk response (Burtonshaw, 2009), and deal effectively with risk severity for cost effective, time success, positive procurement, quality, and schedule plan outcomes (Sanghera, 2010). Consequently, it can be understood that in order to assist risk response development, it is essential to implement a maturity scale, and to conduct practical research to make an assessment of its potential usefulness. According to Loosemore *et al*. (2006), maturity is the knowledge of how to mitigate risks; it is a continuity system for any form of business that needs to cope with, and recover from, risk events. In addition, Loosemore *et al*. (2006) confirm these arguments, claiming that risk-mature organisations encourage those within the supply chain to take responsibility for the own risks. Furthermore, organisations with risk-mature systems tend to have a permanent risk management team, are continuously communicating and coordinating with each other, and reviewing risks for the slightest change. So, it can be said that the phenomenon of project management maturity (PMM) emerged as an indication of company/organisation competency in the ability to deliver projects successfully (Adenfelt, 2010; Isik *et al*., 2009), and that it is crucial in culture orientations for project-based organisation performance (Yazici, 2009). However, few studies in construction project management maturity have concerned themselves with exploring how a more mature approach to risk management, rather than the traditional one, could be more valuable, particularly in risk response. Certainly, it is reasonable to expect that all stakeholders in construction projects should possess sufficient knowledge to enable their effective participation in decision-making, yet their experience of contributing to risk management efforts is limited because of the emphasis on the traditional approach that excludes them. Therefore, risk response in a maturity system is the vital and workable process in risk management and appears to be the most important tool for project success. In addition, the review of KSFs of preventative and mitigating measures for risk response, as discussed in the literature, supports the contention that both types of measure are adapted when considering project risk response development in ‘maturity’ levels (see Figure 2.7).

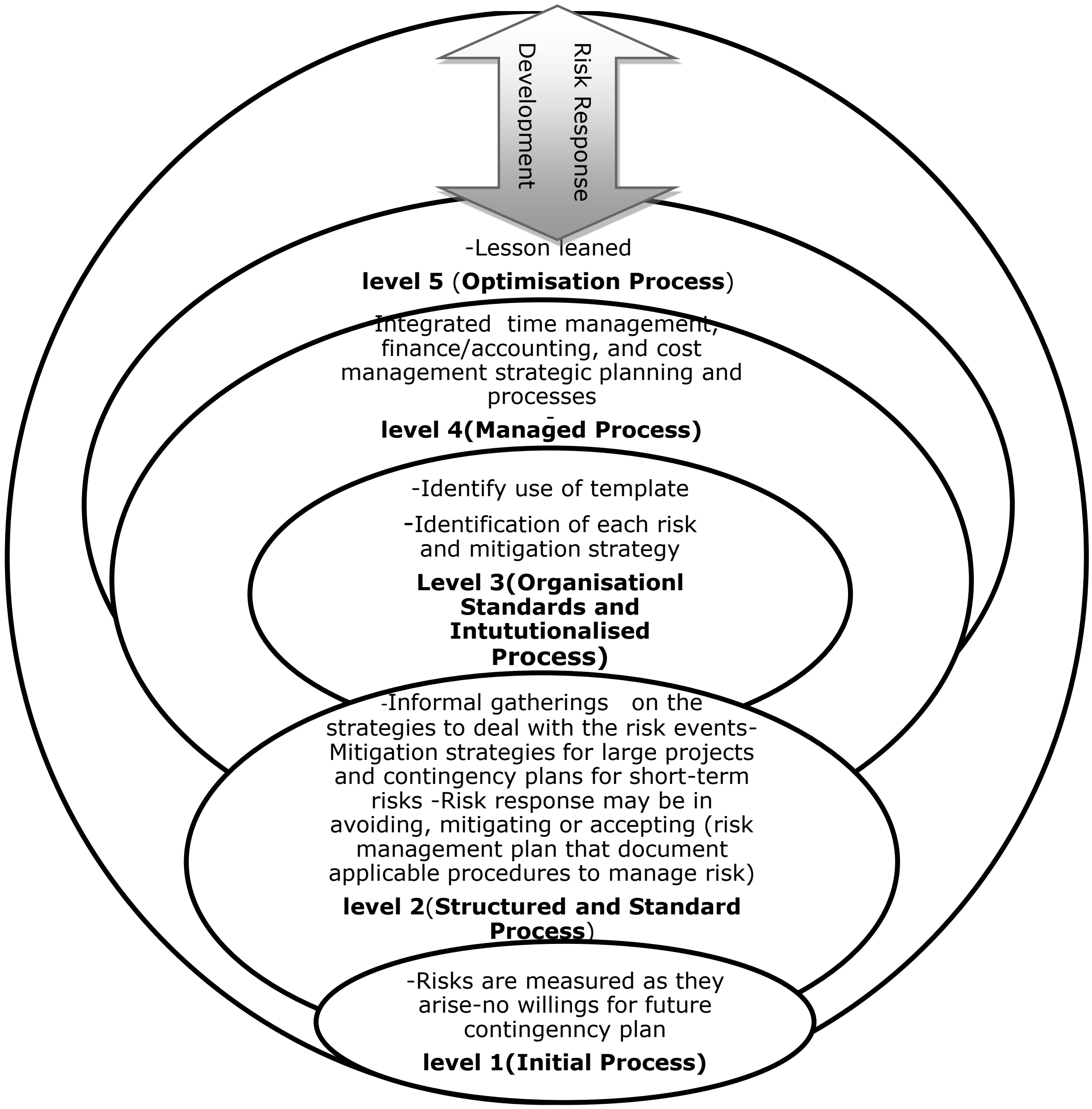


Figure 2.7: PMMM for risk response development (Source: Crawford, 2006)

In Figure 2.7, scales for risk response development are indicated and tested by one of the Risk Management Maturity Models (RMMM) called the Project Management Maturity Model (PMMM), which has five levels: level 1 - initial process, level 2 - structured process and standards, level 3 - organisational standards and institutionalised process, level 4 - managed process, and level

5 - optimising process. The components of risk response development within the overall framework of risk management have been provided for complete definition and benchmarking by the previous five levels, as outlined by Crawford (2006: 165-180). So, the suitability of the test model for risk response development has been confirmed since detailed descriptions are provided for each component. At levels 1 and 2, Crawford identified the problem as lack of knowledge since the risk is treated as it has arisen with no intention to make a contingency plan for the future. In addition, there are no mitigation strategies for large projects nor contingency plans, except for short-term risks. In instances where the risk response is not within the company's control, the risk response strategy should reflect the effective structured and standard process. In level 3, the use of the template is vital as the identification of each risk and mitigation strategy evolves and shapes the organisational standards and institutionalisation process. In level 4, the integration of time management, finance/accounting, and cost management strategic planning and processes, is expected, thus producing a maturation of the management process. The fifth level is the lesson learned, and for process optimisation this level is absolutely crucial for future projects since it includes detail of what was done correctly or incorrectly, and this can refer to activities in both technical and managerial aspects, thereby indicating maturity in both dimensions. In particular, in this study, efforts to explore what occurs at each risk response development maturity level will answer

the question of WHY risk response for delay risks control is the least studied among all project management components in the knowledge area, and HOW and WHEN it can achieve the sensible goals for project success.

2.9 Risk Response Development: KSFs of Preventative and Mitigation Measures

Having reviewed the literature relevant to risk management, it appears that risk response is the most important process since this determines the ability of managers to enhance opportunities and reduce threats in projects. More specifically, the risk response development has the potential to create the essential conditions for optimal delay risks control in respect of the identification and assessment of risks. This would allow managers to determine whether a risk has changed in nature, increased or decreased. The risk response development in terms of delay risks is a crucial process within the wider field of risk management, but as already intimated, it has not yet been fully implemented in many construction companies in the United Arab Emirates (UAE). Furthermore, few studies provide evidence of the usefulness of risk response practice in controlling delay risks. That said, risk response is known as a guiding process in decision-making to reduce conflicts and increase co-operation among the project stakeholders. This has encouraged construction companies to focus more on the development of risk response process to avoid such delays through risk mitigation.

Demonstrating a close-fit view with past and recent research as published in the literature, this part discusses key success factors (KSFs) of preventative and mitigating measures for risk response development from several options. In general, the top gap of knowledge in risk response is noticeable early in this research. Risk identification and assessment have been carried out in many projects by construction professionals and stakeholders in the field of risks factors occurrence, but actually these two stages do not remove the risk. Although, such development has generally been considered to ensure comprehensive identification and assessment of risks through project planning in risk management (Cooper and Dale, 2005), identification and assessment will be worthless in the risk management process unless risk response can be developed and defined.

As already mentioned, delay risks response in construction has not yet been fully addressed, but over the years, many studies have been undertaken in quite different environments, and have critically reviewed the issue of delays in order to determine the causal factors. From these studies, as indicated earlier in this thesis, significant factors related to the client and project managers, the contractors, and financial problems, have emerged. In particular, the quantified risks like change orders, on-time performance, would benefit from such inputs of this research since the traditional project management approach omits these completely, and hence, does not consider the potential for change nor the way to deal with it. Additionally, the traditional management technique has failed to ensure that the most appropriate tools for evaluating the way to respond to risk are used. Consequently, it can be appreciated that the management of the outcomes from each category-related delay risk may require risk response maturation in its development rather than the traditional management, and accordingly, there would be a need to make certain priorities in preventative and mitigating measures KSFs for risk response (Motaleb and Kishk 2013c). In addition, since it is not possible to provide a comprehensive list of preventative and mitigation measures KSFs, the researcher claimed the commitment for specific risk preventative and mitigation measures by assessing effective preventative and mitigation measures KSFs in Project Management Maturity Model (PMMM) levels. A study by Motaleb and Kishk (2013c) showed significant findings for construction projects performance by the development in the KSFs of preventative measures in project team training, project team performance for risk definition, workers' personal skills, technology utilisation for risk information control, stakeholder participation and communication, construction techniques efficiency, knowledge for planners for effective contingency planning, and developing management by PMO then connected with Project Management Maturity Model (PMMM). These findings of the previous research indicate improvements in: i) senior management support for project delivery, ii) the tools, technology and techniques performance required for the process, iii) project risk planning, and iv) the levels of project management through PMO development, since there were improved personal skills and maintained experience.

Demonstrating a close-fit view with past and recent research as published in the literature, selective KSFs of mitigating measures for risk response development from several options are discussed. For instance, the core technique of overlapping activities for time-reduction or time-integration (Bogus *et al*., 2005) is considered for effective risk response in the early stage of the project depending upon the nature of the project and the historical project data (lesson learnt) (Bogus *et al*., 2006; Lin *et al*., 2009), whereas Robert (2001) has suggested in earlier research, that the lesson learned should evolve with the project risk management and its ever-maturing needs in the optimisation process. In addition, Gerk and Qassim (2008) developed the overlapping activities as a KSF of mitigation measure with resource constraint substitution, whereas Wang and Lin (2009) developed it to assess the schedule risks of the project. On the other hand, companies ignore the updates in the delay analysis that is conducted after and during the various construction activities (Lin *et al*., 2009). In addition, many companies are measuring risks as they arise, conducting new risks reviews, and updating their contingency plans, since these strategies are crucial for effective risk response (Flanagan and Norman, 1993). Earlier research has encouraged the risk response through contingency plans that should be provided and developed by the project manager (Risk Management Guidelines, 2003). In fact, not all contingency plans are successful because the nature and sources of risks are different and not all risks can be identified and assessed for risk response in the project planning phase.

The issuing of change orders is one of the top factors causing delay in the UAE (Motaleb and Kishk, 2013a). In particular, change orders are considered to be a major cause of construction projects delay and cost over-run (Miranda, 2004, Office of Government Commerce, 2007b). There are many models for the management of change requests in construction projects aimed at risk response as a KSF of mitigation measure. In this respect, Maciaszek (2007) emphasises information tracking over a long period of time, and Roy et al. (2005) propose an ontological framework to facilitate requirements flow. In addition, the alignment of organisation culture with change request management is suggested by Price and Chahal (2006).

Delay analysis is a crucial KSF of mitigation measure for risk response, and in this connection, Carmichael and Murray (2007) argue that there are inaccuracies in the analysis of delays in the UK and the US because of the method of keeping records. They reveal that there are fewer rigours in the record-keeping practice in the construction contract and criticise the contractor for a lack of reliability and accuracy in this matter. Recent studies also demonstrate inadequate record-keeping in respect of risks identification, noting that this leads to delays, and subsequently to EOT claims (Kumaraswamy and Yogeswaran, 2003).

However, in order to create the essential conditions for the risk response process, there is a need for maturity, since it is this that allows managers to determine whether a risk mitigation measure has changed in nature or not (Motaleb and Kishk, 2014). Consequently, it can be appreciated that the management of the outcomes from each group-related delay risk may require risk response maturation rather than traditional management, and accordingly, there would be a need to adopt certain priorities in the risk response process. In this undertaking, it is important to recognise that the more complex a project, the greater possibility that more individuals/organisations will be involved, and in this respect, the owners of each potential risk must be identified, and involved in the planning to ensure suitable risk mitigation by different response options. At that point also, the mitigation strategy for risk response should be assessed according to its capability, and that may be different from one project to another. Unfortunately, as noted by Sarshar *et al*. (2000), construction organisations have few methodological mechanisms to undertake such assessments within the construction process, and therefore, construction project organisations need innovation in order to compete and focus in the global market, and it is believed that 'maturity' in this respect constitutes best practice (Alonso *et al*., 2008).

2.10 Chapter Summary

The extant literature provides initial guidance regarding how to determine the most frequent causes and effects of delay risks in global construction projects have been critically reviewed. This has been explored especially with reference to the Middle East. Measures of delay risks control have been established from a detailed review of the literature, and the theoretical gaps in the risk response development process have been identified. It has been shown that this is the most important process within the overall risk management process but that little research has been undertaken in this area and that the traditional management approach is in evidence in daily practice.

From the literature review it was also possible to identify the most appropriate methodology to adopt for the current study, and to test one of the maturity models with five levels as a potential model to test risk response development attracting KSFs of preventative and mitigation measures in the actual case study organisations featuring within the study. In the following chapter, the research methodology is introduced both from a theoretical and practical aspect.

Chapter Three

Research Methodology

3.0 Introduction

Having determined the scope of the study, and its aim and objectives, it is important to outline the methodology adopted to pursue the issues relating to the research questions. This involves indicating the particular research philosophy and strategic approach assumed by the researcher, and these matters are discussed in this chapter.

For many years, philosophers have given thought to the ways to undertake research. Generally, they have proposed what is referred to as a 'nested' research methodology comprising assumptions about ontology, epistemology and axiology. Essentially, this is concerned with the nature of values, and how the knower goes about the task of knowing, generating theory, testing that theory, and the techniques used in that process for data collection (Kagioglou, 1998). Within the literature, there are many suggestions regarding the choice of method but all of these are influenced by several different assumptions. On the one hand, there are epistemological assumptions about how we obtain and accept knowledge about the world; then there are ontological assumptions which refer to how we perceive the nature of reality; and finally there are the research questions themselves and their effect on the developing research (Easterby-Smith *et al*., 2002; Panas and Pantouvakis, 2010).

Ideas about research methodology are continuously evolving. In this respect, Saunders *et al*. (2003) have twice improved the 'onion' model proposed by Kagioglou et al. (1998). They did this firstly, when they added a further two layers (concerned with 'research strategy', and 'time horizon and data approach') within the research process as shown in Figure 3.1 and they made their second improvement more recently in 2007, when they expanded the research onion to include a layer concerned with 'research choice' that covers thoughts about mono-methods, mixed-methods and multi-methods (Saunders *et al*, 2007:132).

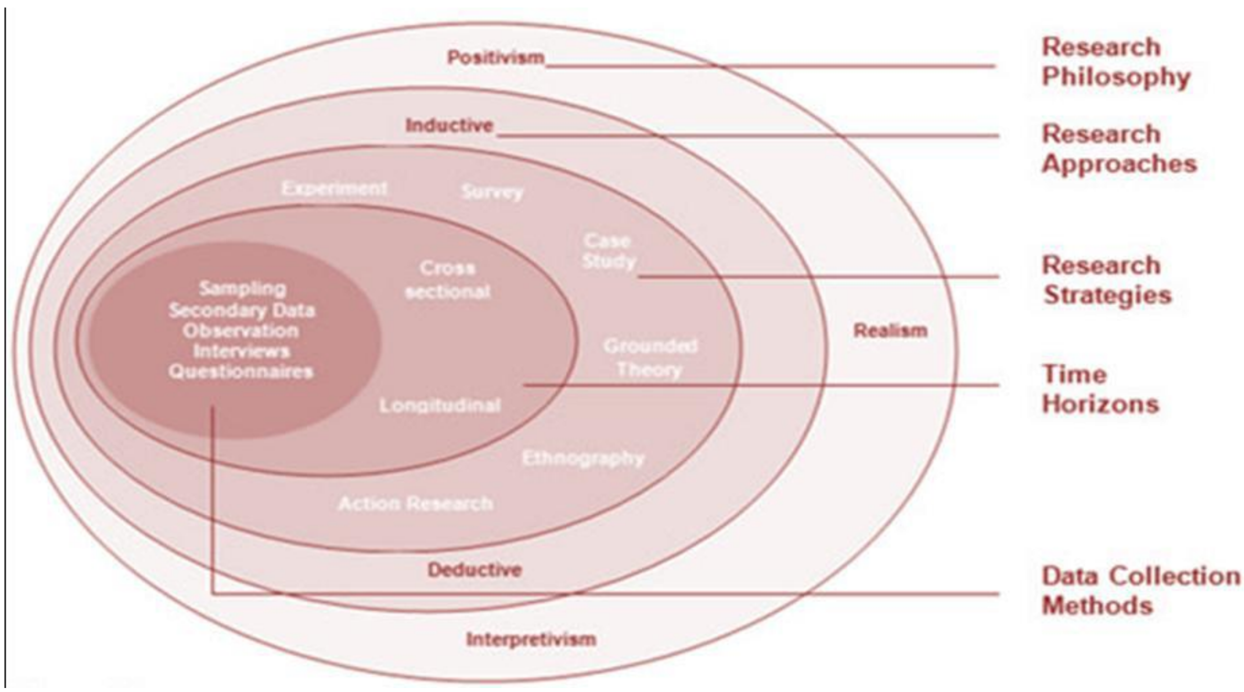


Figure 3.1: Research Methodology Process – The Onion model (Source: Saunders *et al*., 2003)

Among the issues considered by research philosophers is that relating to the type of data to collect and the way to analyse that data. Essentially, the options to consider relate to whether the researcher favours quantitative or qualitative data and means of analysis. The approach entitled logical positivism, uses quantitative methods to test and explain causation, to reduce the whole into simpler elements. On the other hand, the approach entitled phenomenology usually adopts qualitative methods to understand a phenomenon. Such an approach rejects the notion of positivism and its emphasis on quantitative data gathering and analysis, on the grounds that the object of experience is an independent event (Easterby, 1991; Remenyi *et al*., 1998). Knight and Ruddock (2009), however, perceive the benefit of both standpoints, and consider the potential for mixed methodologies, stating that the use of different research paradigms can yield deeper insight into the research problem being studied, and that a variety of strategies may be more useful for understanding the way management practitioners operate in the construction sector. In fact, Then (1996) suggests that in the consideration of research design, the issue is not whether one of the methods (either phenomenology or logical positivism) is a natural preference of the researcher, but whether a logical and sensible decision is made. And in making this decision it is the purpose of the study, the questions being investigated, and the availability of the data sources which are identified as important factors, since only by taking account of these, can the researcher arrive at a sensible way forward. However, it is suggested by Knight and Ruddock (2009) that the use of several different approaches together is a valuable strategy and that this would move construction management research towards a more balanced methodological outlook, since the use of a single paradigm has proved itself not to be effective, giving only a partial view of events. Consequently, this study of important issues within the construction industry employs a mixed methods strategy in which the emphasis is on quantitative data collection (through a questionnaire survey), which is supported by qualitative methods (through interviews in case study organisations). The researcher's belief is that this approach provides a more balanced methodological outlook.

Knight and Ruddock (2009) do stress that the most important consideration for researchers is the need to be aware of the influence of the methodology they choose and that they must also highlight their own philosophical preference. They also discuss the arguments presented by Richard Rorty (1931-2007) about the varying perspectives that exist about the world, and investigate the mediation between language and culture, concluding that knowledge is most probably relative to interests, and is largely fixed in cultures. This is an important point to acknowledge in respect of this particular study, since it is conducted in a multicultural environment, the data being collected in the United Arab Emirates where the language is Arabic, and the culture is different to that of the UK.

Having discussed the researcher's philosophical stance and the underlying assumptions, the following sub-sections will address all the elements of the study, these being: the chosen research strategy and design, the research process, the scope of the literature review, the methods adopted to collect the data, the actual administration of the questionnaires and the interviews in the case study organisations, the sampling adopted, and the data analysis methods. The way in which the research aim (of constructing a framework of risk response development for delay risks control) progressed is evident in these sub-sections.

3.1 Research Strategy and Design

The research strategy, which follows a mixed methods approach as already mentioned, but which is predominantly quantitative, involved four main stages as follows:

(1) A review of the literature review to establish the knowledge gap.

(2) An interview exercise with seven consultants and two project managers from the public and private sectors in Abu Dhabi and Dubai Emirates to explore the current problem.

(3) The development of a questionnaire as an outcome of the literature review and the interviews and the distribution of this questionnaire to a large population of people working on projects within the construction industry.

(4) The exploration of six case studies involving interviews with project managers and the distribution of the same questionnaire as in (3) to staff within those companies, to validate the survey outcomes.

The survey strategy which formed the activity in (3) above, was chosen because of the multinational nature of the stakeholders in the United Arab Emirates (UAE), these being contractors, clients, consultants, project managers, engineers, and developers, many of whom are expatriates. Consequently, a survey was believed to be the most appropriate method to learn about perceptions of the job in question, and stakeholders' behaviour (Rea and Parker, 1997), and to demonstrate any differences between target groups (Burns, 2000).

In this research, differences in attitudes and experiences among owners/clients and contractors and their project managers were of most interest.

The research design describes the way in which data is collected and analysed in order to answer the research questions (Bryman and Bell, 2003). Given the nature of the topic, aim and objectives, the criteria proposed by Gill and Johnson (2002: 71), that states "the researchers should be able to outline deductive logic and define independent (causes), dependent (effects) and extraneous (rival hypotheses to the one(s) being tested) variables”, Creswell (2007: 39) who believes in emergent design stated “the change of initial plan for the research after the researchers enter the field and begin to collect data, for example questions may change, the idea behind is to learn about the problem or issues from participants” and Yin (2003: 34) claimed on the important innovation to deal with case studies by four tests, the constructive validity (use multiple sources of evidence for data collection), internal validity (use logic model for data analysis), external validity (use replication logic in multiple-case studies) and reliability (develop case study data base) were particularly useful in the design of the research methodology.

3.2 Research Process

In order to answer the research questions, the study was conducted by using a similar process to that suggested by Field (2009: 3) (see Figure 3.2).

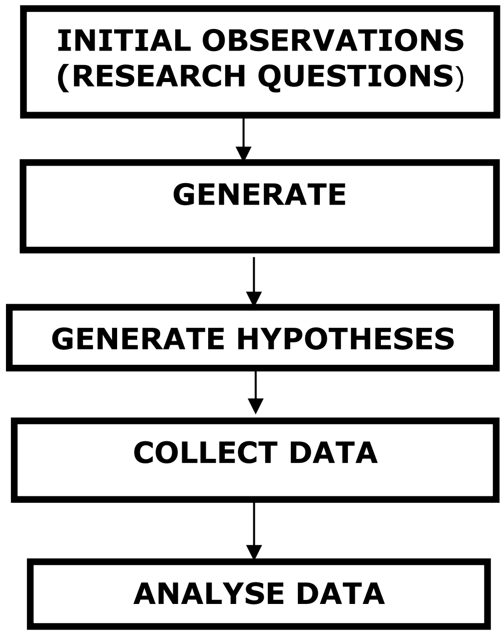


Figure 3.2: The Research Process (Source: Field, 2009)

As shown in Figure 3.2. The process begins with an observation based on some data, namely the huge number of delayed projects, which it should be understood, form the main issue for investigation. From initial observations, explanations are generated which allow predictions/hypotheses to be developed. Initially, some data relevant to the problem of delays in projects were gathered, and from an examination of this information, the need to identify and measure this phenomenon became apparent. An analysis of that data helped to support the researcher's personal observations and beliefs about the phenomenon. In this respect it can be seen that the explanation/theories of those observations, data collection, and analysis are all linked. The generation of explanation/theories leads to data collection and analysis and these two activities then feed back into the explanation/theories, adding to what already exists or simply confirming it.

3.3 Literature Review

A critical literature review was undertaken during the first stage of the research process, essentially to compare the research idea with the existing knowledge, to check the viability of the proposed research (thus avoiding repetition), to learn how to develop an appropriate methodology, to suggest routes for advancing knowledge, and to help in refining the objectives and research questions (Fellows and Liu, 2003). The survey of the literature and specifically, risk management theory, helped the researcher to understand the requirements, benefits and problems associated with delay risks. This survey consisted of a careful review of textbooks, specialist journals, newspaper publications, and electronic sources, and the secondary data gathered via these means provided the ability to make useful comparisons with the primary data collected during the questionnaire survey and interviews.

In reviewing the literature, the researcher focused on risk management in the construction industry, this being precisely pertinent to the aim and objectives of the study. The strategy followed that used by Dainty (2007: 143) in his examination of the methodological positions and research methods adopted by construction project management researchers. An analysis was carried out of thirty-six research papers (see Table 2.2) published between 2000-2011 to identify the efforts of previous measures to control delay risks including the causes and effects of delay risks in construction projects internationally, and particularly in the Middle East. Each paper was scrutinised to establish the methodological position of the author and the research strategy employed, and resulting from this activity, four broad classifications were identified, these being: (i) Quantitative, (ii) Qualitative, (iii) Mixed, and (iv) Review. The classifications presented in Table 2.2 give an overview of the methods used in the previous research, and from these it is clear that most studies have used quantitative methods. The others can be seen to combine qualitative and quantitative methods, or to focus entirely on a review of the literature rather than engaging in some form of empirical research. In a very small number, exploratory methods were used. Resulting from this exercise, the researcher was guided to use the quantitative method as the main approach as already indicated in section 3.1 (3). However, the use of exploration has also featured in the initial work conducted by the researcher via personal interviews and her attendance at workshops and seminars related to risk management in construction projects in the Municipality of Abu Dhabi Emirate (UAE), and in particular companies. Hence, in developing the research methodology, two major phases were evident in this study, each one making a positive input to the whole related epistemology. These two phases can be seen as firstly, the exploratory survey incorporating personal interviews with practitioners in the field, and workshop attendance, both of which highlighted the challenges to successful outcomes in construction projects and provided remarks, comments, and insights which were then considered by the researcher (referred to in section 3.1(2); and secondly, the development of a questionnaire to be administered with a large population in the UAE (as indicated in section 3.1 (3) - see Appendix B).

3.4 Design and Administration of Interviews

The interview is a popular method that enjoys widespread use. The nature of an interview can vary from the highly structured face-to-face type used in quantitative studies, to the open–ended encounter that is intended to generate concepts as seen in qualitative research. As noted by Knight and Ruddock (2009), this latter type relies heavily on a good relationship being developed between the interviewer and the interviewee, but if that is successful then the interview can yield highly detailed and rich qualitative data. There are four ways of interviewing, which encompass a continuum of control on the part of the interviewer, and the methods range from the highly structured interview in which the potential answers from the interview are restricted, the structured interview which contains open questions with structured answers, the interview which contains open questions with no direction for the answers, and the completely unstructured interview which is more like a discussion (Bogdan and Bicklen, 1992). The more standardised and structured the interview, the more the researcher is able to obtain quantitative data, reduce the interviewees variances, more reliable data, obtain codes and quick interpretation and improve a formal relationship between the researcher and respondent (Knight and Ruddock, 2009). Weaknesses and critics of structured interviews have observed by Knight and Ruddock (2009) in restrictive questions that lead to restrictive answers, it is argued that questions are difficult to examine opinions, issues and details in depth. Whereas, the less structured the interview, the more the researcher will secure qualitative data, and consequently, it can be understood that each type of interview has its own uses and the researcher's chosen approach will dictate the structure she/he adopts, natural and relax, high details, explore the subject and cover the lack in empirical evidence. However, some of the weaknesses of the unstructured are primarily resulted of difficult generalistions of findings to wider population, possibley "Bias" and spontaneous questions and very time consuming to analyse data (Knight and Ruddock, 2009).

In this study, as already indicated, the initial stages followed an exploratory approach, and therefore, the form of interview adopted was the 'unstructured' one since the aim was to collect wide-ranging information from nine professionals. There was no desire to force the participants into particular categories of response; rather, the interviews were intended to expand the researcher's own understanding of the greater issue. Therefore, a qualitative stance was taken, and open questions were asked in recognition of the scope and nature of the problem. This strategy makes it possible to help clarify certain information (Patton, 1990, Creswell, 2007). In addition, it allowed the interviewees to deliver the answers they believed were right. The interview results are reported as follows:

(1) Two governmental consultants, with more than 30 years' experience, explored the importance of properly classifying delay risks according to lessons learnt from the past. They mentioned having made some suggestions to help remedy managerial defects, but said that so far there had been no practical application validating these ideas. In fact, they felt that both the public and the private sectors needed to evaluate their existing knowledge in respect of risk management through developing technological applications to control risk information. Furthermore, they believed that experience in quantitative and qualitative risk analysis, efficiency, and the performance of other stakeholders (consultants, contractors and developers etc.) should be monitored.

(2) Two consultants from the private sector agreed on the significance of budget forecasting in risk management efforts considering the excessive change orders requested by clients. Moreover, they felt that the effect on time and cost of change orders should be given due consideration. They also

pointed out that in recent times, insufficient monthly payments had affected the flexibility required for making effective project progress.

(3) One project manager criticised the lack of co-related technical (immature system) financial details. He added that full stakeholder knowledge can prevent/treat the unexpected delay risks and help clients to make decisions faster. He commented on stakeholders' inadequacy in anticipating and identifying risks.

(4) Another consultant, with 25 years' experience, criticised the premature risk response in construction projects, and cultural influences that prevent the development of any scientific pattern in searching for appropriate risk control approaches. In this respect, he said "a very important point is that a positive percentage of prequalified or interested users, who apply the same approach, does not exceed 5%".

(5) Two consultants from the architecture and value chain built environment sections agreed that projects became complex because of immature bidding analysis, and emphasised the critical requirement to ensure the proper construction of contracts in the first place so that there were procedures in place within those contracts for managing the response to risks.

(6) Another project manager criticised the recent client attitude towards the recent financial crisis, witnessed in clients sacking some members of the workforce and leaving projects with insufficient numbers of staff to work on them.

(7) 90% of the interviewees agreed that by developing a knowledge base for planners to refer to when contemplating the problem of delay risks in a crisis situation, and improving the competency of the project team through appropriate training, clients would realise improvements in project performance.

(8) It was noticed that a great percentage of the interviewees recognised the significance of interactions between risk and stakeholder management (risk owner) as well as management's knowledge of the civil codes of the country.

It can be seen from these outcomes that the first stage in the qualitative approach was very useful. The initial analysis of the exploratory interviews (Details in Appendix A) revealed several issues, mostly related to risk management, which pointed to the need for in-depth and more empirical investigations, particularly in respect of the delay risks facing projects since the financial crisis that began in 2008. This general feeling expressed by the interviewees helped the researcher to develop the research questions. Moreover, as noted by Creswell (2003), face-to-face interviews allow observations and interactions to be made of natural human reactions, and the researcher was able to confirm by such observations the interviewees' true feelings. That said, some answers indicated biased opinions, and were also long-winded, therefore prolonging the time of the interviews. However, from the information gained during the interviews, the researcher was able to design the questionnaire.

3.5 Design and Administration of the Questionnaire

Questionnaires are popular research instruments, but they require careful design to ensure that the data generated can be analysed in the way the researcher wishes, which is often through a statistical approach (Knight and Ruddock, 2009). Moreover, the questions included must be constructed to ensure reliability and validity of the information obtained, and be worded in a common sense manner (Peterson, 2000: 15-16). This demands that they should be brief, relevant to the topic, clear and unambiguous, specific, and objective (Peterson, 2000:15-16). The entire exercise should be cost effective, meaning that only questions for which answers are definitely needed should be included. Once formulated, a draft questionnaire should be pre-tested since this procedure is vital to its success as a research instrument. Initially, the pilot should be with another knowledgeable and academic person (the supervisor of a research project), and with professionals and experts in the field. This exercise may be in two stages, the first one focusing purely on short questions rather than the whole instrument, and the second one to consider all the questions together in the particular sequence that they will appear in the questionnaire. This exercise is carried out to obtain feedback to inform the final instrument. Short questions can be asked verbally, face-to-face to gain immediate feedback, and then the final questionnaire can be constructed. In this study the questionnaire was designed carefully and then given to three experts: a project manager in the governmental public sector, a consultant in the private sector, and a university associated professor in statistics for refinement. This procedure was in accordance with the best practice advocated in the literature, which requires that a questionnaire should be checked thoroughly before being employed so that the researcher is certain the instrument is easy to read and understand and is not likely to prevent any confusion to respondents (De Vaus, 2002; Baker, 2003). The piloting was done by asking brief questions in a face-to-face situation in order to gain opinion about the wording and the scope of the questions (see Appendix A), and then the questionnaire was refined such that it was of a manageable length. This was important since most individuals in the working environment have no time to devote to research and it was essential not to cause impatience amongst the respondents. Consequently, it was decided to administer the questionnaire electronically and where possible, to distribute it by hand through colleagues to increase the completion rate.

Clearly, the time factor is one of the great considerations in survey research. Bearing this in mind, the questionnaire was constructed of multiple choice and closed questions, using a Likert scale, and it was divided into three main parts (see Appendix B). As noted by Knight and Ruddock (2009), it is most important to establish the framework for analysis before collecting any data, and in this respect, the questionnaire was developed to quantify the significant index for:

(1) Risk factors of delays (causes and effects) and how they are managed according to the traditional method.

(2) Key Success Factors (KSFs) of Preventative measures for risk response development to control delays.

(3) Key Success Factors (KSFs) of Mitigation measures for risk response development to control delays.

In respect of (2) and (3) the researcher asked the respondents to refer to real examples from their work and to consider the relationship between top KSFs for risk response development from their professional position. At the end of the questionnaire, space was provided for the respondent to add any comments s/he felt s/he wanted to make.

One way of ensuring co-operation from potential respondents to a questionnaire is to promise feedback on the results of survey and the overall research outcome (Knight and Ruddock, 2009). The provision of feedback is made much easier nowadays by the use of IT, since respondents who are interested in receiving such information can simply be asked to provide their email addresses at the end of the questionnaire, and this was indeed done in this study. However, no strategy guarantees a 100% response rate, and in assessing the minimum number of responses for statistical analysis to be possible, the researcher must also determine the likely number of questionnaires to distribute in order to allow for non-completion and spoilt questionnaires (Knight and Ruddock, 2009). In brief, the questionnaire was clustered into four sections (see Appendix B) as follows:

- Part I: Background information including name, title, sector, experience, duration of last completed project (five questions)
- Part II: Antecedents Delay factors
- Part III: Risk Management including KSFs of Preventative and Mitigation measures and Risk response development
- Part IV: The level of contribution that can be achieved by one of the project stakeholder(s) for risk response development

3.6 Design and Administration of the Case Studies

The case study technique is valuable in that it enables a study to be set in a particular context, and for research to be undertaken in various phases (Knight and Ruddock, 2009), that often involve the collection of many different combinations of data, such as through interviews and documentary review (Fellows and Liu, 2003). This strategy allows the researcher to triangulate his/her evidence and thus be more confident in testing a particular concept or theory (Yin, 2003a). Commonly, the case study technique uses a certain amount of quantitative data to reinforce the qualitative primary data.

The researcher followed the advice offered by Yin (2003a) and Knight and Ruddock (2009) in respect of case study investigation, using this to validate the results of the questionnaire survey. In deciding to explore particular cases, the researcher gave consideration to several factors, these being: (i) the time available to carry out the investigation, (ii) the availability of documentary information, (iii) access to persons involved for interviewing purposes, (iv) the aim of the investigation, and (v) the number of cases. In addition to the identification and selection of the cases involved, it is also important to determine the exact unit of analysis, and in this study that unit was the construction project. In this regard, it was decided to adopt a multiple case approach in which six different cases in projects from different organisations were explored. On the matter of the number of cases to examine, Yin (2003a) argues that a multiple case approach (involving two or more cases) strengthens the validity and generalisability of results, providing the researcher with more confidence about the outcomes. Moreover, he points out that several cases can be chosen in order to demonstrate distinct characteristics or similarities/differences. Clearly, where the cases confirm similarities, the results will always be more compelling, and, therefore, easier to defend.

All the information collected in this study was of interest to the researcher, despite it varying in both relevance and reliability. As observed by Knight and Ruddock (2009), a case study affords the opportunity to incorporate different kinds of evidence, which Gillham (2000: 43) and Yin (2003a) have generally grouped into: (i) documents, (ii) archival records, (iii) interviews, (iv) direct observations, (v) participant observation, and (vi) physical artifacts. In consideration of the potential means of data, four sources have been used in this study to capture the overall circumstances of the case projects (which themselves were set within high scale contracting companies in the UAE), these being: interviews with project managers, project directors, contractors and engineers, questionnaires to staff, documentary evidence, and direct observations.

The interview represented a very important aspect of the case studies since the questions were asked in order to establish as much as possible about the management of project risks. This meant that the researcher used a combination of direct questions to obtain precise factual information, and also allowed the interviewees to explain some issues and discuss with her at length, where it was appropriate. The questionnaire which was the same questionnaire used in the earlier survey, was also valuable since it offered the opportunity to expand the overall number of respondents to the survey.
The documents were letters to and from project managers to consultants and municipalities in respect of approvals, drawings, contractual documentation, and time management charts, and this type of

documentation was valuable in helping to lay the foundations for the study. The direct observations were made by the researcher to establish exactly how individuals behaved in respect of their projects rather than relying on their accounts of how they behaved. As noted by Harries and McCaffer (2001: 103), this might involve observing construction operatives in a similar way to that employed in work-study techniques.

Having identified the opportunity presented by case studies for the collection of different types of data, Yin (2003a: 150) argues strongly that case studies should indeed be designed so as to encompass a variety of methods of data collection and to expect all of these to figure in the final report about the case. In this respect, Yin (2003a: 150) indicates that "the larger study's overall report would then be based on the pattern of evidence from both case study and the other methods". He also makes the point (Yin, 2003a: 150) that "the questions for the case study might only have emerged after the survey and the selection of the cases might have come from the pool of those surveyed or contained within the archival records". In this scenario, the case study questions as Yin (2003a: 150) argues, are likely to be closely co-ordinated with those of the other methods. And indeed, it did occur that the case study organisations provided another avenue for obtaining additional questionnaire respondents to swell the numbers achieved in the earlier survey.

In conducting the case studies, the researcher has used three main data gathering techniques. These are: 1) face-to-face and e-mail interviews with project managers, project directors, contractors and engineers, 2) documentary evidence, and 3) direct observations. As noted by Yin (2003a:150), such an approach allows for triangulation of data as there are several sources of evidence. Additionally, the questionnaire to staff used earlier in the study has produced yet more data to help to validate the findings. The objective of this entire approach was to elicit views from the stakeholders in the risk management process for delay risks control. Opinions on key risk factors influencing stakeholders' performance and decision-making in risk response were gathered through the various questions.

The applicability of the risk response development by 'maturity' was tested through six ongoing case studies with the interviewees. The construction companies concerned were all operating within the UAE, and mainly in Abu Dhabi Emirate (Al Ain district). They were selected according to their reputation, volume of business, number of employees, and company turn over (section 3.7). The other criterion for selection was their willingness to participate in the study. Each of the companies had an annual turnover of more than 5 million USD, and employed more than 140 people, and had at least 20 years of experience in building construction projects. Two of the companies are ranked at the top of local and regional contractors. All of the respondents were professionals, holding important positions in their companies. The particular characteristics of each company are described in the following sections. The interviews and questionnaire survey were conducted between 7th June 2011, and 15th May, 2013. Initially, all participants were given an introduction to the research aim and objectives, and to risk management theory. This involved the researcher mentioning the processes, tools, and measures of risk response integration with other project management areas. This background detail was helpful for respondents in enabling them to have a clearer picture of the topic and to consider their point of view. As this was a pilot survey (interviews), with limited time, a major aim of this case study research was to scope the field of investigation before embarking upon a larger, and more detailed study. Yin (2003a) suggests that a pilot enquiry can be used to improve conceptualisation of the research domain. Consequently, ultimately, a pilot will save time and ensure clarity of responses. Data was collected by interviews and a questionnaire involving the same candidates, the sixteen participants in case study A. The use of both an interview and questionnaire with each respondent allowed for comparisons to be made between the responses gained on a face-to-face basis, and those written down in a different set of circumstances. Together, these two measures helped in building up evidence from multiple sources, as advocated by Yin (2003a:3).

Chapter Five reports the outcome of the interviews and the questionnaire exercise for each case study, and conducts certain comparisons between the six case studies.

3.7 Sampling

Selecting a sample from the sampling frame can be conducted by using either probability or non-probability sampling methods. A probability sample assumes that every person/organisation in the overall research population has an equal chance of being selected, but in a non-probability sample the researcher bases his/her selection on other criteria, for example, on whether s/he knows the person/organisation, on whether access can be gained, on whether the person/organisation is considered to be an expert or ideal case (Knight and Ruddock, 2009). In this study, the researcher used a non-probability sampling frame since the focus was narrow and it was necessary to involve construction companies/organisations with great experience in risk management, which is generally absent in the UAE construction companies. Therefore, a list of construction organisations of different sizes in Abu Dhabi and Dubai Emirates was compiled randomly in order to form the sample population for the questionnaire survey. This list was divided into four categories (public and private), contractor, consultant, construction project management, and government (municipalities) organisations and companies, according to the severity of delay risks in their recent construction projects and accessibility. The combination of purposive and quota sampling has been described by Patton (1990). In this study the sample was drawn up according to the sampling combination theories by construction professionals like contractors, consultants, project managers, construction stakeholders, and academics. However, the selection was based on a need to ensure that the outcomes covered the total experience in the field. The questionnaire underwent some refinement after its initial pilot and was then administered in 35 construction, consultancy, and contracting companies, attracting 73 usable responses.

The same questionnaire was then administered in three of these 35 organisations with a further 29 participants, as a means of increasing the initial response. Accordingly, the 73 initial responses from the survey were supplemented with the 29 questionnaires making a total of 102.

However, this number of questionnaire was insufficient to validate the research results, and consequently, it was decided to study six case studies of high scale companies registered in Abu Dhabi Emirate, specialised and involved in large construction projects (see Table 3.1).

Table 3.1: Case Study Companies

Company Name	No. of Employees	Turnover	Company Size	No. of Case Studies
Nael General Contracting	5000+	Over $5 million	Large	2
Nael Bin Harmal	5000+	Over $5 million	Large	2
Al Fara'a	20,000	Over $5 million	Very Large	2

3.8 Data Collection

The point is made by Field (2009) that researchers must use accurate measures in order to acquire good data, and Panas and Pantouvakis (2010) echo this, saying that the validity of data is dependent upon the measures used. There are two main types of data survey - correlation or cross-sectional, and experimental. Cross-sectional data is collected on relevant variables and provides a very natural view of the answers being searched for, but there is some influence over what happens and it is possible for the researcher to be biased in the measurement of the variables, so the researcher must be careful to be completely impartial. The experimental survey involves collecting data over a long time, by manipulating one variable to see its effect on another (Knight and Ruddock, 2009; Field, 2009).

The data for this study are obtained from questionnaires and interviews undertaken in two stages, the first before the case study organisations were entered, and the second within the case study organisations. The questionnaire survey was self-administered, using e-mail, fax, and hand-delivered questionnaires. Interviews were held in a face-to-face situation (Burns, 2002; Creswell, 2003).

The process and content of data collection is illustrated in Figure 3.1. The questionnaire was designed after the literature review and feedback from the exploratory interviews was gained, and it was addressed to the selected construction companies and project stakeholders as mentioned in the questionnaire administration section. Although the extensive list of factors and measures to control delay risks (both KSFs of preventative and mitigating measures for risk response development) were identified from the literature review and exploratory interviews, respondents were also invited to add any factor/s that they considered to be significant and that were not included in the questionnaire. It was also decided to present the questionnaire in Arabic rather than English since it was recognised that not all clients would possess the required standard of English to complete the questionnaire properly. Moreover, the questionnaire was refined to produce answers to questions applicable to the research objectives outlined in Chapter One, section 1.9. A Likert scale was used to identify the level of importance of variables under consideration, since this method is acknowledged as the most appropriate for obtaining information from respondents on opinion-based questions (Baker, 2003). Two-hundred questionnaires were distributed by hand and e-mail, targeting contractors, project managers, developers, municipalities' directors in the strategic planning organisations, risk management sections, and clients and consultants in the public and private construction companies in the UAE (Abu Dhabi and Dubai Emirates).

As mentioned earlier, in order to validate the research findings, six case studies were selected from high scale companies registered in Abu Dhabi Emirate, specialised and involved in large-scale construction works. Data was collected through four channels in the case studies: (i) interviews, (ii) questionnaire, (ii) documents, and (ii) direct observations. Approval for site visits and capturing photos, and for reviewing documentation was secured by the researcher in all instances.

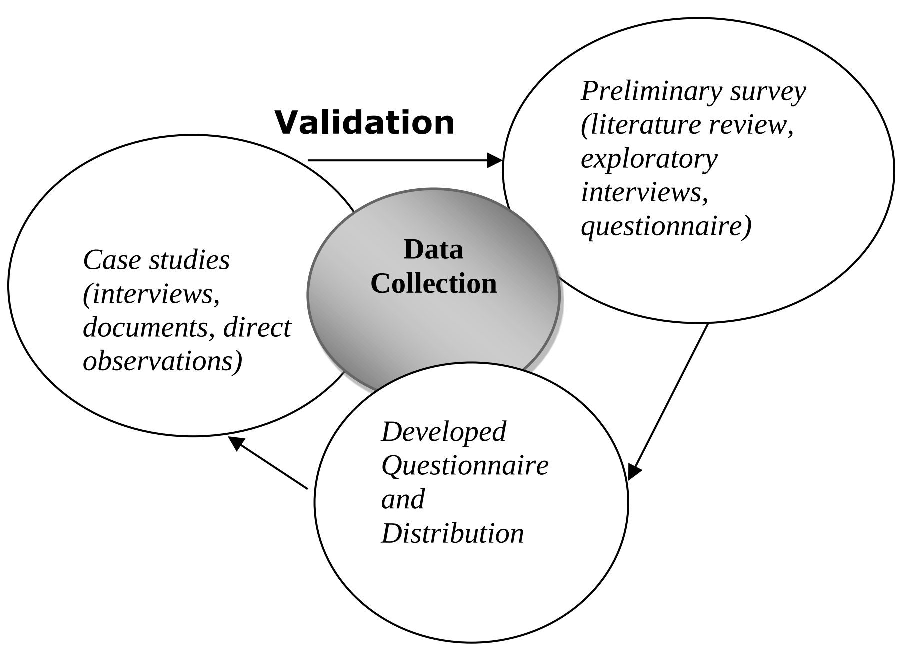


Figure 3.3: Data Collection Process

3.9 Data Analysis

At this stage, the researcher must demonstrate capability in the art of data analysis, be aware of how to present the data, and how to explain it without introducing any bias or distortion. At the same time, the researcher should present it in such a way so that it induces the reader to think about what is being provided. Presenting many numbers that have very little relationship to each other and producing large data sets should be avoided, unless they encourage the reader to compare different pieces of data and reveal other findings. Panas and Pantouvakis (2010) note the need to continually evaluate and re-evaluate results and to be sensitive in data analysis in order to gain an in-depth perspective of a study's implications. In addition, having a good understanding of statistical analysis is a requirement for many researchers who choose to analyse their data using statistical techniques. Most researchers deal with inferential statistics, which indicate whether the alternative hypothesis is likely to be true, thereby helping to confirm or reject predictions (Field, 2009) as well as whether the model fits the obtained data. If a model fits the data well, then it can be assumed that the initial prediction is true. So, we gain confidence in the alternative hypothesis. SPSS is the most used statistical analysis software and is extremely powerful, being able to perform the full range of statistical procedures with chart drawing facilities. Additionally, it is straightforward to set up data entry and to analyse the results (Knight and Ruddock, 2009).

This study has used descriptive analysis for:

- Part I (descriptive): Background information, name, title, sector, experience, duration of last completed project (five questions) and the F-test one-way ANOVA technique. This technique can be used for numerical data only (Howell, 2002). In addition, it is typically used to test the differences among at least three groups, and the variance in F-test ANOVA is used to assess whether the expected value of a quantitative variable within several pre-defined groups differ from each other . This test technique has suited the research case. Firstly, a comparison is made between four groups (project managers, contractors, consultants and others). Secondly, one-way ANOVA tests the null hypothesis of the samples in these four groups. All candidates were asked the same questions, and asked to choose answers from among the same set of alternatives either on a three-point or five-point Likert-scale. Therefore, hypotheses are based on the questionnaire and case studies (see Appendix B) and presented as follows for the required analysis:

H_1: There is no significant difference between project managers, contractors, consultants and others with:

- Part II: The identified factors causing delay risks and the consequent effect on time and cost.

- Part III: Informant's ranking of KSFs of preventative and mitigation measures in order of the priority given in delays risk response development.
- Part IV: Level of contribution of the party(s) in risk response development.

H_2: There are agreements between the interviewees in the six case studies in respect of the important connection of the KSFs of mitigation measures and risk response in PMMM for development.

H_3: At least one from the above factors is different from the others

3.10 Validation and Reliability

For any given research problem and outcome, it is important that validity can be demonstrated as this is a concept that allows an audience to be convinced that the research questions have been answered using appropriate methods (Then, 1996). If validity is assured, it can be accepted that the concepts in use do actually describe the reality of a situation, and that they provide the best fit in that circumstance. In aiming to secure validity, the researcher conducted face-to-face interviews with four professionals (senior project manager, two project managers, and a project office manager) in which she introduced the model and asked for their feedback in evaluating this for use in the construction project scenario. Both structured (closed), and open questions were asked of the participants (see

Appendix C), As mentioned earlier in this chapter, it is noted by Knight and Ruddock (2009), that this type of interview promotes the acquisition of quantifiable and more reliable data, and that as a result there is more opportunity for the generalisation of results. This means that the data is useful and powerful in terms of making a formative assessment of a situation. The interview involves a formal relationship between the researcher and respondent and brings the advantage that if the respondent is unable to answer the researcher can help the situation by clarifying questions. There are, however, disadvantages in that some answers may be restricted by the closed questions and that interviewees may feel unhappy in these circumstances (Knight and Ruddock (2009), The researcher sought to minimise such outcomes by leaving as many questions as possible, open, whilst acknowledging that closed questions are often a more satisfactory way of creating data (Fowler, 2002), since sometimes respondents can perform more reliably by answering such questions. Confidentiality was considered in the interview by responses given in the interview. Reliability is considered to be an essential feature of all research, and this is found when the answers would be the same if the research were repeated in similar conditions but using different individuals (Yin, 1994). In this study, the same people were involved in the interviews as were involved in the case studies, but they were asked whether any new issues had arisen. The researcher repeated the previous survey questions and ensured the consistency of answers among the participants, and then continued the individual interviews to validate the research model.

3.11 Chapter Summary

This chapter has presented the research methodology applied in the study, discussing the theoretical underpinnings to the approach, and the practicalities of actually conducting the research. A mixed methods approach has been adopted, using a qualitative strategy in the initial stages where interviews were performed, to gain opinions (and hence, data) from practitioners regarding how their projects have been affected by the delay risks occasioned by the recent financial crisis which began in 2008. From that exercise, information was obtained that allowed the researcher to develop a questionnaire for distribution as a survey exercise, thereby introducing a quantitative aspect to the study. The questionnaire was developed to quantify the significant index for risk factors of delays (causes and effects) and how they are managed according to the traditional method, and both KSFs of preventative measures and mitigation measures for risk response development to control delay. In addition, the level of contribution that can be achieved by one of the project stakeholder(s) for risk response development.

In order to widen the data collection even further, a case study approach has subsequently been used and in this stage of the study, interviews, a questionnaire survey, documentation review, and observations have been included so that all the data gathered in the study can be triangulated and add validity and reliability to the outcomes. Indeed, the case studies will help capture a more complete contextual portrayal of the cases, revealing the differences in the way in which delay risks are handled. Additionally, the means of data analysis have been identified. F-test ANOVA is typically used to test the differences among four groups (project managers, contractors, consultants and others). Hence, one-way ANOVA tests the null hypothesis of the samples in these four groups. The variance in F-test ANOVA is used to assess whether the expected value of a quantitative variable within several pre-defined groups differ from each other.

Chapter Four

Case Studies: Content and Method

4.0 Case studies - Scoping Content

The construction industry in the United Arab Emirates offers its services to clients, customers and end users. In this respect, government organisations (municipalities) have significantly driven change in construction policy as they continue to demand the best services from construction stakeholders, and implicitly, success of the projects in which they are involved. A key factor in the achievement of project success is effective time and cost management and the nature of the relationship between the project stakeholders. This relationship must be one that allows parties to make the right decisions in respect of delay risks in projects, and to make them at the appropriate time. Furthermore, the client needs to feel satisfaction with the construction company as early as possible in a project's lifecycle. Hence, it is important to explore the way in which projects are organized and executed, and how important it is for a construction company to achieve success in delivering projects. Clearly, the presence of risks acts to hinder success, and therefore, the root causes of any risks must be known. In fact, these causes are strongly related to WHAT is practiced in the actual work environment. Consequently, the impact of these is explored in the following case studies which consider these companies' own risk management (through the use of a Maturity test) in respect of the root causes of delays and evaluate their risk response. Yin (2003a:13) describes the case study as an "empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". Jankowicz (1995:172) supports the use of case study researching, stating that "a case study explores issues both in the present and in the past, as they affect a relatively complete organisational unit". In order to explore all those issues, case studies can include the collection of data from several different sources, to allow for triangulation, and in this research project, the case studies involved the researcher conducting personal interviews and then collecting additional data from participants via a questionnaire that was analysed quantitatively. The focus of the case study research is illustrated in Figure 4.1 which indicates that the idea is to establish how risks within construction projects are dealt with, and the importance of on-time delivery of projects. The researcher believes that where companies adopt a risk response development approach then it is likely they will think beyond the 'maturity' of processes. The PMMM for Risk Response Development considered in Chapter Two (Figure 2.3) is used to test the level of maturity throughout the five levels identified by Crawford (2006), of one or more projects in each case study. It is recognised in doing this, that each project company must carefully analyse its risk response development in terms of the impact of the risk on its own bottom-line construction project business.

The case studies aim to investigate how risks are identified (causes of delays) and assess the consequences of these risks in terms of both simple, unexpected delay risks, and epistemic unexpected delay risks since the financial crisis began in 2008. This whole idea is shown in Figure 4.1. The risk response strategy of each company will be illustrated from on-site (direct) observation, and from investigating company documents. The risk response development from the project stakeholders' and company practitioners' viewpoints will be considered, specifically in terms of how its implementation affects risks outcomes, and then this will be tested for maturity at the different levels, by reference to the preventative and mitigation measures used.

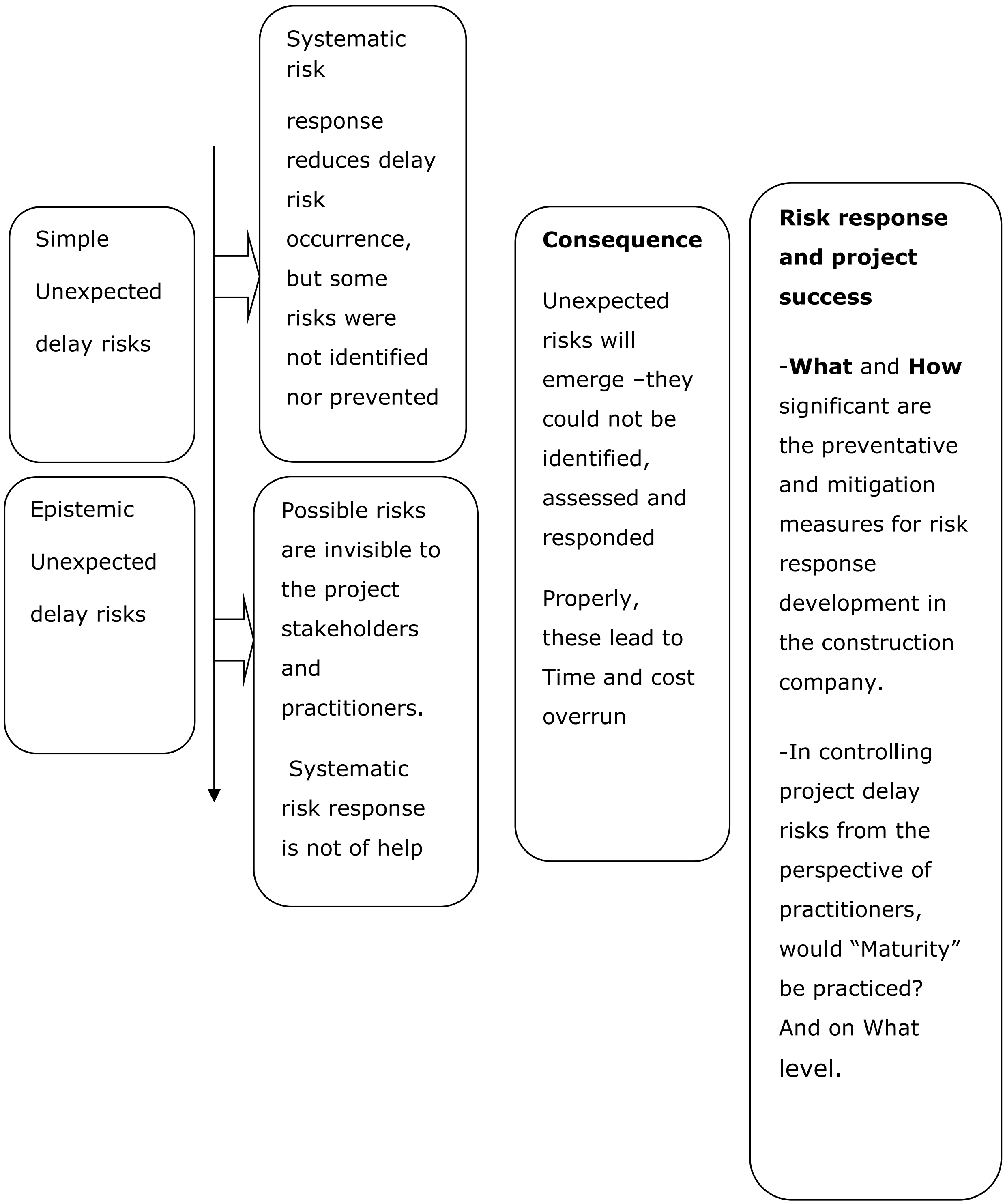


Figure 4.1: Focus of the Case Study Research

4.1 Case Study A

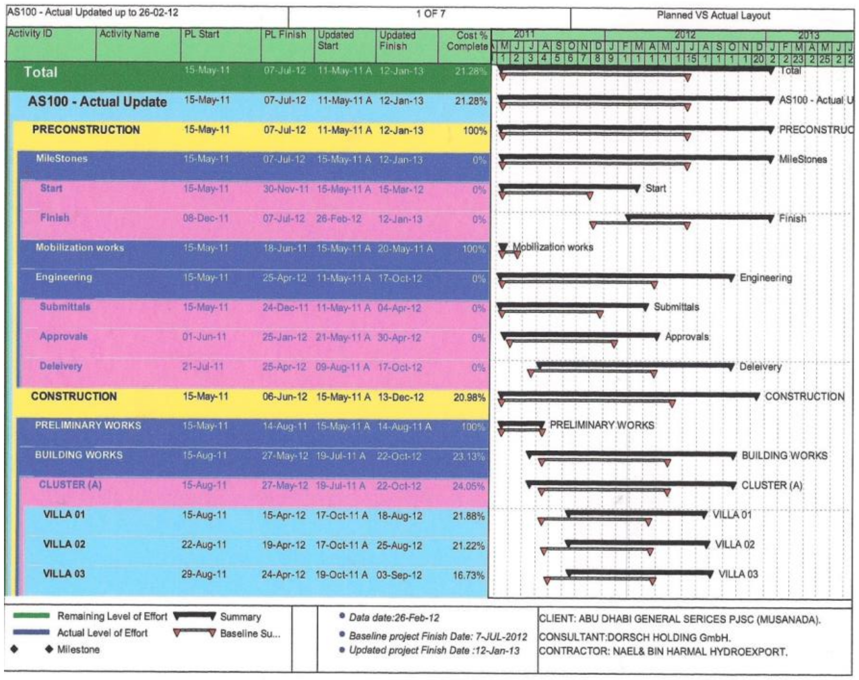
Case study A was of the Nael Bin Harmal Hydroexport (NBHH) contracting company. This is a reputable company in the UAE domestic market. It has a strong financial structure and specialist workforce and was founded in 1991 at Al Ain city in Abu Dhabi Emirate. Since that time it has become one of the leading national contracting companies with many diverse projects such as: (i) building civil works (high-storey buildings, villas, shopping malls); (ii) Road works (bridges, underpasses); (iii) Water works (Municipal pipeline, pumping station); (iv) Mechanical works (irrigation pipelines, landscaping, district cooling); (v) Waste water (sewage, plants and pumping stations, storm water); and (vi) Environmental projects (integrated waste management, handling works).

As part of its national development, the Abu Dhabi Government is implementing various projects/programmes to enhance public living standards in the different regions of Abu Dhabi, the capital of the UAE. The focus has been on housing development projects undertaken by a governmental general services company (MUSANADA) and NBHH, both with over 140 employees, an annual turnover of more than $5 million, a contract value of $30 million, and a two-year duration of the project. The work involved is the construction of 60 villas. An exploratory interview was initially conducted with the General Manager and the Office Project Manager who agreed to allow the researcher to collect data via a questionnaire with other project participants, in addition to consulting the company's database (drawings, project planning, photos). Sixteen questionnaires (from a total of 30 distributed) were returned to the researcher via the Office Project Manager.

It is noted that the client (the government) changed the specification for the rooms within these villas after securing more information concerning the size of the families that are expected to occupy this accommodation. This meant that all of the villas had to be internally modified so that the rooms could be enlarged, and this had to be done when more than 50% of the work on the villas had already been completed. Hence, the risk was categorized as an epistemic unexpected delays risk. The process requires that after the client's approval is gained, the relevant documents must be submitted to the appropriate authority to obtain approval for the amendments and to gain a building permit (for the second time). The company used a traditional risk management extract from its strategic plan, and a theoretically-based solution for risk response as presented in Table 4.1. The risk response was poor and the organisation's Change Request Management, Overlapping activities and Contingency plan for the new risk as KSFs of mitigation measures have been assessed by PMMM levels in level 2, by the interviewees, as being poor, inadequate and incomplete consequently, and the main source of delay risks during construction, since there was a need to approve substantial modifications when over 50% of the work on the villas had already been completed (delayed approval affected work progress). The progress of work as shown in Figure 4.2 indicates an updated completion schedule, using the Overlapping Activities as KSF of mitigation measure (12th January 2013, compared with the original 7th July 2012), and with the second completion update (27th March 2013) and last update (10th August 2013) (see Figure 4.3) that encountered delay in handover through unforeseen causes of delay (weather changes resulting from sandstorms and rain in April 2013). Because of these delays, every single activity involved with the asphalt work for the roads and road marking, external painting, interlock laying works, and external electrical fittings and light installation, was delayed and huge affected on time and cost.

Table 4.1: The Traditional Risk Management (TRM) and Test of 'Maturity' Extract for Case Study A

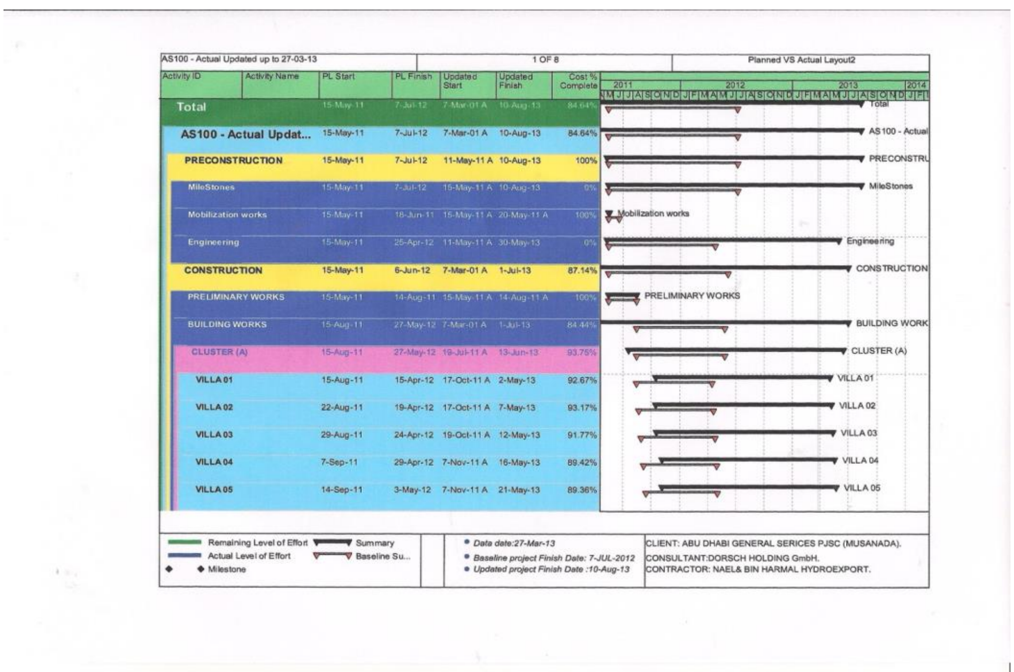
Delays Factor	Effects of Delay	Traditional Risk Response	KSFs of Preventative Measure	KSFs of Mitigation Measures	PMMM Level of Risk Response
-Change order by client -Weather	Time and Cost Overrun	-Client and Consultant should approach the relevant Authorities in order to expedite building permit sanction (Reduction) -It is a major risk, Client has to co-ordinate with the end user requirement before proceeding with the building permit (Acceptance)	None	-Poor Change Request Management -Inadequate Overlapping Activities -Incomplete Contingency Plan for any new risk Item	-Informal gatherings on the strategies to deal with the risk events (level 2) -Contingency plans for near-term risks and mitigation strategies only for larger projects (level 2)



AS100 - Actual Updated up to 26-02-12 | 1 OF 7 | Planned VS Actual Layout

Activity ID	Activity Name	PL Start	PL Finish	Updated Start	Updated Finish	Cost % Complete
Total		15-May-11	07-Jul-12	11-May-11 A	12-Jan-13	21.28%
AS100 - Actual Update		15-May-11	07-Jul-12	11-May-11 A	12-Jan-13	21.28%
PRECONSTRUCTION		15-May-11	07-Jul-12	11-May-11 A	12-Jan-13	100%
MileStones		15-May-11	07-Jul-12	15-May-11 A	12-Jan-13	0%
Start		15-May-11	30-Nov-11	15-May-11 A	15-Mar-12	0%
Finish		08-Dec-11	07-Jul-12	26-Feb-12	12-Jan-13	0%
Mobilization works		15-May-11	18-Jun-11	15-May-11 A	20-May-11 A	100%
Engineering		15-May-11	25-Apr-12	11-May-11 A	17-Oct-12	0%
Submittals		15-May-11	24-Dec-11	11-May-11 A	04-Apr-12	0%
Approvals		01-Jun-11	25-Jan-12	21-May-11 A	30-Apr-12	0%
Deleivery		21-Jul-11	25-Apr-12	09-Aug-11 A	17-Oct-12	0%
CONSTRUCTION		15-May-11	06-Jun-12	15-May-11 A	13-Dec-12	20.98%
PRELIMINARY WORKS		15-May-11	14-Aug-11	15-May-11 A	14-Aug-11 A	100%
BUILDING WORKS		15-Aug-11	27-May-12	19-Jul-11 A	22-Oct-12	23.13%
CLUSTER (A)		15-Aug-11	27-May-12	19-Jul-11 A	22-Oct-12	24.05%
VILLA 01		15-Aug-11	15-Apr-12	17-Oct-11 A	18-Aug-12	21.88%
VILLA 02		22-Aug-11	19-Apr-12	17-Oct-11 A	25-Aug-12	21.22%
VILLA 03		29-Aug-11	24-Apr-12	19-Oct-11 A	03-Sep-12	16.73%

Figure 4.2: Case Study A- Progress Report 1



AS100 - Actual Updated up to 27-03-13 | 1 OF 8 | Planned VS Actual Layout2

Activity ID	Activity Name	PL Start	PL Finish	Updated Start	Updated Finish	Cost % Complete
Total		15-May-11	7-Jul-12	7-Mar-01 A	10-Aug-13	84.64%
AS100 - Actual Updat...		15-May-11	7-Jul-12	7-Mar-01 A	10-Aug-13	84.64%
PRECONSTRUCTION		15-May-11	7-Jul-12	11-May-11 A	10-Aug-13	100%
MileStones		15-May-11	7-Jul-12	15-May-11 A	10-Aug-13	0%
Mobilization works		15-May-11	18-Jun-11	15-May-11 A	20-May-11 A	100%
Engineering		15-May-11	25-Apr-12	11-May-11 A	30-May-13	0%
CONSTRUCTION		15-May-11	6-Jun-12	7-Mar-01 A	1-Jul-13	87.14%
PRELIMINARY WORKS		15-May-11	14-Aug-11	15-May-11 A	14-Aug-11 A	100%
BUILDING WORKS		15-Aug-11	27-May-12	7-Mar-01 A	1-Jul-13	84.44%
CLUSTER (A)		15-Aug-11	27-May-12	19-Jul-11 A	13-Jun-13	93.75%
VILLA 01		15-Aug-11	15-Apr-12	17-Oct-11 A	2-May-13	92.67%
VILLA 02		22-Aug-11	19-Apr-12	17-Oct-11 A	7-May-13	93.17%
VILLA 03		29-Aug-11	24-Apr-12	19-Oct-11 A	12-May-13	91.77%
VILLA 04		7-Sep-11	29-Apr-12	7-Nov-11 A	16-May-13	89.42%
VILLA 05		14-Sep-11	3-May-12	7-Nov-11 A	21-May-13	89.36%

Figure 4.3: Case Study A - Progress Report 2

Figure 4.4: A sample of villa construction (initial survey, Case study A) (Source: NBHH 17th November 2011)

Figure 4.5: Villas Completion (Case Study A)

4.2 Case Study B

Case study B was conducted with the same interviewees as in Case study A. The work detailed in the infrastructure must also be provided by the NBHH and the Government General Services (MUSANADA), so all activities associated with site grading/levelling, sewage works, storm water works, potable water works, electrical work (including the building of a sub-station, and street lighting), road works (including road signs and road marking etc.) are included within the scope of the work. The cost and durations as planned were: site Grading – 5,792,918 AED with a duration of 90 days, Sewer Line – 16,113,926 AED with a duration of 110 days, Potable water line – 4,483,704 AED with a duration of 120 days, Storm water line – 8,634,283 AED with a duration of 60 days, and Road works – 21,543,675 AED with a duration of 130 days. Additionally, there were planning, procurement management, execution, and stakeholder management to be considered. Table 4.2 shows the traditional risk management extract in delay risks for Case study B and the traditional risk response plan only by *avoidance* type, (theoretically only). The problem in respect of these works emerged from the change of the sewerage line, which was deeper than the utilities. Obviously, the sewerage line was obstructed by the villas that were already erected because the drain work being done so close to them so the owners complained and resisted the ongoing site work. So, this problem was classified as epistemic unexpected delay risks by site project manager. From the stakeholders' point of view, inadequate site management by the project manager caused delays, then affected time and cost. The traditional risk management extract as presented in Table 4.2, indicates the causes and consequences of the delay, and again, a poor and immature use of KSFs of mitigation measure in contingency plan for design change as plan B for risk response is documented, risk response was evaluated in level 2 in PMMM. A Combined Photo of Case Study A and B is provided in Figure 4.6.

To sum up, Case studies A and B provided the scoping nature of the whole project, but at different periods. This information was useful in identifying the research objectives, investigating project delays, the risk response, and the real level of 'maturity'. The company was very much affected and had to place much effort in overcoming the chronic delays, by making changes to the organisation's strategy for risk management (see Table 4.2).

Table 4.2: The Traditional Risk Management (TRM) and Test of 'Maturity' Extract for Case Study B

Delay Factor	Effects of Delay	Traditional Risk Response	KSFs of Preventative Measure	KSFs of Mitigation Measures	PMMM Level of Risk Response
Lack of site management by Project manager in mobilization	Time and Cost Overrun	Early communication with end users-(Avoidance)	None	Incomplete contingency plan for design change (plan B) should be provided on time	Contingency plans for near-term risks and mitigation strategies only for larger projects provided (level 2)

Figure 4.6: A Combined Photo of Case Study A and B (Source: NBHH company 29th April 2012)

4.3 Case Study C

Case study C was a recent large project involving a hotel extension (the New Chalets of Rotana Hotel in Al Ain district in the UAE) (Figure 4.7) constructed by Al Fara'a General Contracting Company. The company was founded in 1980, and is active in a broad range of construction projects. It is one of the prestigious companies in the Gulf and stands as the national group leader in Civil Engineering, Procurement and Construction (EPC), and Mechanical, Electrical and Plumbing (MEP) in the UAE. The approximate annual turnover of the company is over $3 billion and employs about 20,000 people. The group has been committed to diverse projects such as hospitals, bridges, towers, heritage sites, malls and residential villas, and it is certified with ISO 9001, 14001. This case study was of a project undertaken by Al Fara'a with an original contract value of 63,862,000 AED and construction duration of 410 days. The client was a public-private sector body. The consultant was nominated by the client as well as the contractor. The design was undertaken by the nominated private consultant (Al Medan Company). Once the contractor was appointed, a partnering relationship was established between all of the project participants. The case study survey included interviews with the Senior Project Manager, a Regional Project Manager, and an Engineer to investigate the risk management programme and the company 'maturity' level (see Table 4.3). The questionnaire was distributed to senior project managers, engineers and managers from Al Fara'a (the contractor) and Al Medan (the consultant), and a total of six responses were gained involving the same survey mentioned earlier in this research. Copies of documents, letters from the consultant to the contractor, and from the project director to the consultant and the client, and other internal communications in the contractor company were provided and consulted, and direct observations were made of the project progress.

The original duration of the project was 410 days starting on 12th September 2011 and expected to finish on 15th January 2013. However, the project faced delay risks twice; the first delay was due to a change order in the design, dated 10th February, 2011 (delay in Municipality approval for the update design, Mechanical and Electrical and Plumbing (MEP) and swimming pool drawings not yet approved by the consultant). The consequent delay caused disruption to the contract construction programme, and subsequently lead to the contract period over-running by 86 days, and the associated impact on cost (as shown in the progress report in Figure 4.8).

The second delay dated 8th March 2012 was due to Mock-up finalisation, with 8,709,736 AED as the amount of the second change order, and a further time extension with the revised completion date as 31st January 2013. Documents are provided in Appendix F.

From the interviewees' point of view, the problem emerged because of lack of communication between internal and external stakeholders in the project. The main issue was related to the external stakeholder (the end user) who has a major interest in the project success, and the project sponsors. In this case, delay risks could be classified as simple unexpected risks because the end user was not involved at the milestones and this prevented problems being identified at the appropriate stages. Additionally, the interviewees evaluated risk response by level 1 and 2 in PMMM levels when they dealt with the case study contingency plan as KSFs of mitigation measure for risk response, but it is incomplete. Determination of contingency plans for the future was infrequent, and there were no informal strategies in place to deal with (foresee) the risk events.

Table 4.3: The Traditional Risk Management (TRM) and Test of 'Maturity' Extract for Case Study C

Delay Factor	Effects of Delay	Traditional Risk Response	KSFs of Preventative Measure	KSFs of Mitigation Measures	PMMM level of Risk Response
-Change order by client -Municip-ality approval delay	Time and Cost Overrun	Contract Time extension (Reduction)	None	Incomplete contingency Plan for any new risk Item	Determination of contingency plans for the future was infrequent(level 1) , and there were informal strategies in place to deal with (foresee) the risk events (level 2).

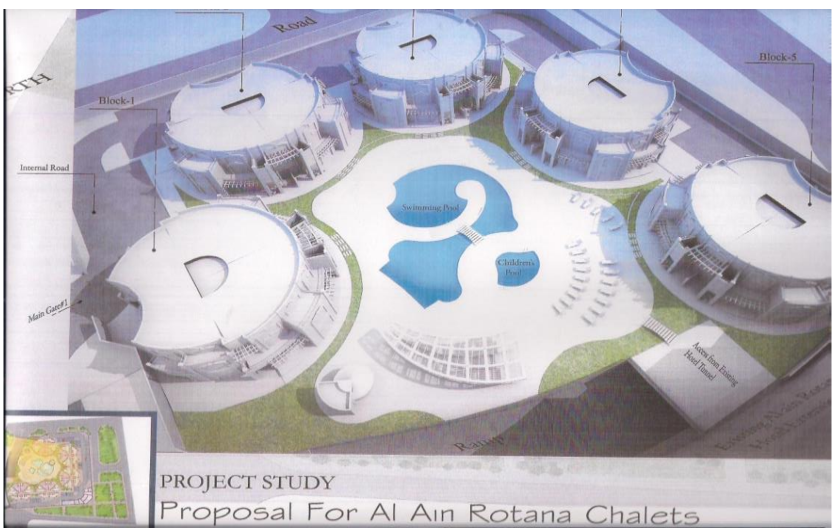
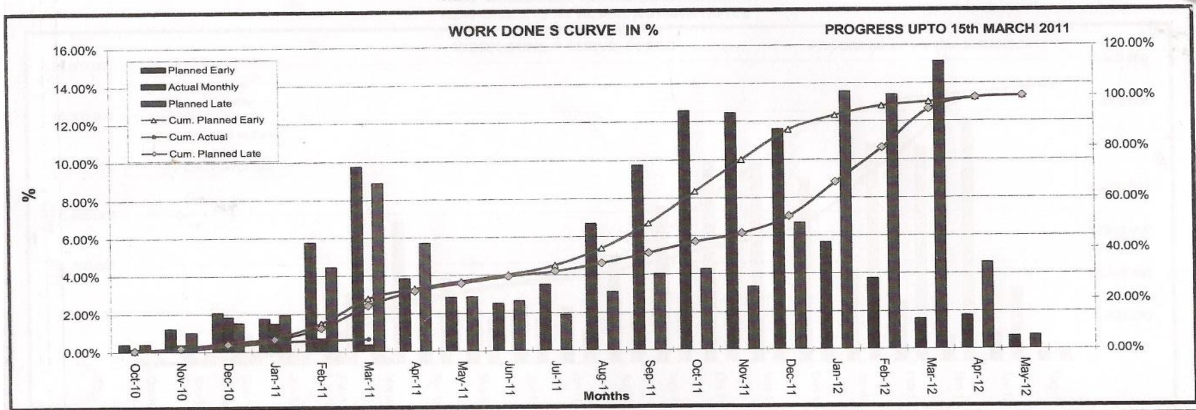


Figure 4.7: The proposed New Chalets (Al Ain Rotana) (Source: Al Fara'a Company 2012)

NEW CHALETS AT AL AIN ROTANA HOTEL



Month	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11
Planned Early	0.39%	1.21%	2.07%	1.74%	5.76%	9.76%	3.84%	2.83%	2.51%	3.49%	6.69%	9.75%
Planned Late	0.39%	1.01%	1.51%	1.95%	4.44%	8.88%	5.69%	2.86%	2.63%	1.91%	3.10%	4.01%
Actual Monthly	*0.13%*	*0.37%*	*1.83%*	*1.47%*	*0.68%*	*0.35%*						
Cum. Planned Early	0.39%	1.60%	3.67%	5.42%	11.17%	20.93%	24.77%	27.60%	30.11%	33.60%	40.29%	50.04%
Cum. Planned Late	0.39%	1.40%	2.91%	4.86%	9.29%	18.18%	23.87%	26.73%	29.37%	31.27%	34.37%	38.38%
Cum. Actual	*0.13%*	*0.50%*	*2.33%*	*3.80%*	*4.48%*	*4.83%*						

Month	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12				
Planned Early	12.56%	12.44%	11.57%	5.64%	3.73%	1.58%	1.77%	0.67%				
Planned Late	4.27%	3.32%	6.67%	13.56%	13.40%	15.13%	4.56%	0.72%				
Actual Monthly												
Cum. Planned Early	62.60%	75.04%	86.61%	92.25%	95.98%	97.56%	99.33%	100.00%				
Cum. Planned Late	42.65%	45.97%	52.63%	66.19%	79.59%	94.72%	99.28%	100.00%				
Cum. Actual												

Figure 4.8: The Progress Report of Al Ain Rotana Chalets

4.4 Case Study D

Case study D was conducted with the Regional Project Manager by face-to-face interview. The contractor was Al Fara'a General Contracting Company, the same pioneer company used in Case study C. As previously indicated, the company undertakes major projects of various kinds. In the case in question, the project was a governmental school (Phase 3), and the client was Abu Dhabi Educational Council in the Emirates of Abu Dhabi, UAE (Al Ain City). With its original contract of 230,000,000 Dh ($63 million) and a duration of 420 days, the project had a start date of 6th May 2012 and a finish date of 29th June 2013. However, the project was affected by many delays, mainly because of Shading Structure Foundation conflicting with infrastructure after securing 60% of the construction work (see Figure 4.9). Other delays factors are shown in Table 4.4. The risk response was exclusively in the form of a technical solution with minimum cost, which was developed on a critical path as Delay Analysis mitigation measure, then classified as a simple unexpected delay risk during execution. This was acknowledged by the senior Regional Project Manager. The traditional risk response suggested that he should: i) inform all senior managers to discuss the available options, and ii) inform all the stakeholders of the identified risk factor, plan the risk response, and then see what impact occurred on time and cost. When the Regional Project Manager was asked whether the company used the lessons learned from previous projects or delivering any training, he said that whilst there was a 'lesson learned' template within the company, it was impractical to apply lesson learned, and was merely just an archival document that had been in the company for many years. He also blamed the lack of knowledge in risk management training because of inefficient trainers or instructors. In addition, there was no co-ordination between the project team, particularly during the Shading Structure Foundation construction. The delay was classified as a simple unexpected risk because of negligence, shortage of resources, long lead items, and change orders, but as a high level of risk because of the limited time of the contract which had been designed to ensure completion of the work in time for the start of the school academic year. So, the risk response was a theoretical one by *acceptance* and *avoidance* types.

At the end of the interview evaluation was done by the researcher with the interviewee. From among the company's documents, a full weekly report was given to the researcher by the interviewee in order to facilitate the investigation of the case. Table 4.4 presents the results the Delay analysis Template is weak as a KSF of mitigation measure for risk response since there was no development on the way. 'Maturity' level test showing that there is low levels for maturity within the company strategy in mitigation risks. The interviewer accepted the evaluation by the researcher and then acknowledged that the overall levels within his organization were possibly at level 1 and 2 (see Table 4.4) and that these could reach higher levels if the risk response within the suggested preventative and mitigation measures in the questionnaire were to be developed.

Table 4.4: The Traditional Extract of Risk Management (TRM) and Test of 'Maturity' Extract for Case Study D

Delay Factor	Effects of Delay	Traditional Risk Response	KSFs of Preventative Measures	KSFs of Mitigation Measures	PMMM level of Risk Response
-Delays in Canopies & Sky Lights by Sub-contractor - Delay of Tower Crane to be dismantled at the earliest by site and project managers - Delay in MEP Clearances & Roof Works by project manager - Delay in Fabric & Acoustic Panels activity by Designer	time and cost overrun	-To comply with agreed program by any means-(Acceptance) - Obtain Shop drawings approval ASAP-(Avoidance)	Lesson learned in the company data base (not used) -Risk management training (ineffective because of inefficient trainer)	Delay Analysis Template (very weak and not used)	-Risks are measured as they arise (level 1). - Informal gatherings on the strategies to deal with the risk events (level 2).

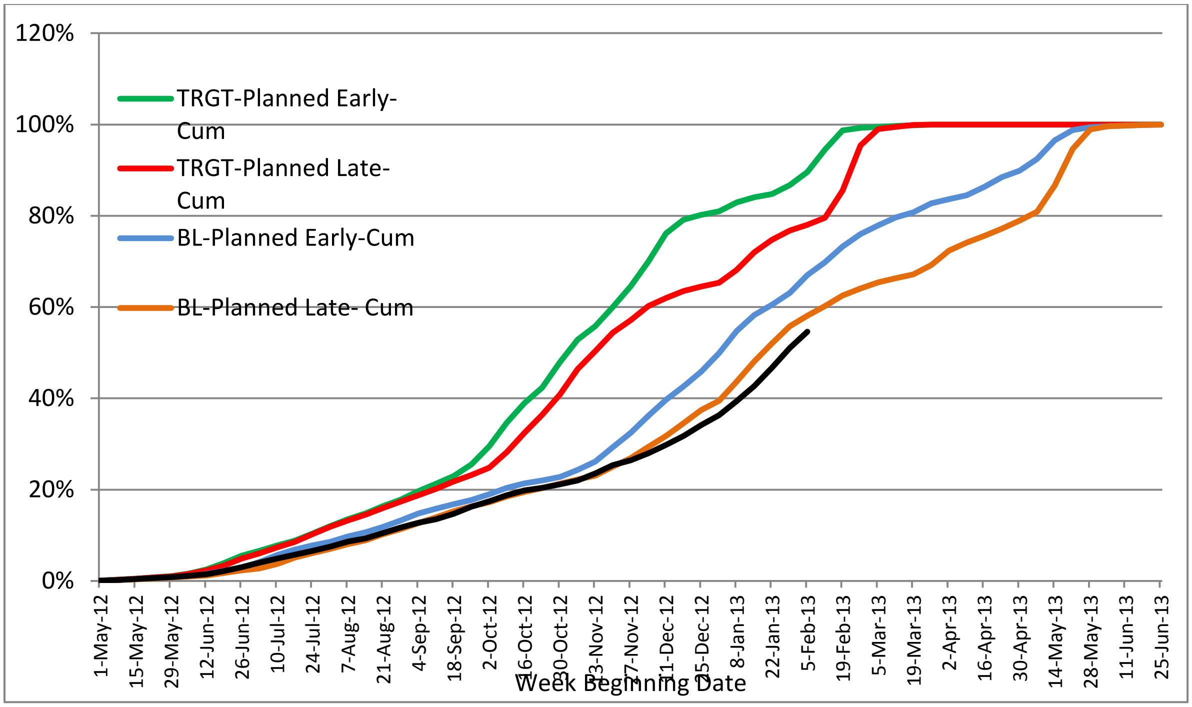


Figure 4.9: A Sample from the Weekly Report-Case study C (Source: Al Fara'a Company, 16th Feb. 2013)

4.5 Case Study E

Case study E was conducted with the Manager and the Project Manager by face-to-face interview in two stages, and four individuals completed the questionnaire. The first interview was with the Manager to brief him on the research, and the next was with the Project Manager in more detail. Contact with the Project Manager was ongoing, as he facilitated the researcher's access to company documentation, to the site, and to photographs at the various project stages. After the project was completed, the case was evaluated, a final assessment was made, and feedback given.

The contractor in Case Study E was Nael General Contracting Establishment, which was founded in 1998. It began with an ambitious vision of becoming one of the members of the pioneer Nael and Bin Harmal group of companies in the UAE, and to date it has employed more than 5,000 people. The company has completed a number of prestigious projects within the agreed project completion periods and has a good reputation. Its key areas of operation are civil and MEP infrastructure, building projects, irrigation, steel structure and interior fit-outs. The project involved in the case was the "UAE university new campus PPP development Infrastructure works contract Package 3 – Contract 1,2,3" (see Figure 4.10) which consisted of the construction of buildings and infrastructure works. The main scope of the building work was as follows:

- Multi storey car park buildings (1D and 1E)
- Mosque (8A)
- Bus drivers' rest area building
- Substations (6)
- Warehouse buildings (10A, 10B, 10C and 10D)
- Guard house

The main scope of the infrastructure works were as follows:

- Sewerage network
- Storm water network
- Water network

- Fire-fighting network
- Electrical network
- Street lighting network
- Soft and hard landscaping works
- Roads and parking network

The infrastructure works also included an 800mm diameter water networks connection, a new roundabout construction in Al Jamaih Street and related utilities diversions, water features and connection of the infrastructure services to the external networks. The client was the Municipalities and Agriculture Department, Al Ain Municipality, and the contract value was 272,860,729.62 AED ($75 million). The starting date was 1st March 2011 and the project duration was agreed as 16 months. However, this case experienced delays during construction stage activities but the company overcame it in the handover because of effective risk response as stated in the Risk Management Extract (Table 4.5). The discussion was concentrated on the main cause of delay, that being delay in the approval of the material shop drawing by the authority (municipality) which was classified as a simple unexpected delay risk. Risk response was found traditionally in the reduction type but KSF of mitigation measures are introduced and more developed in *optimal resources allocation plan* (adopt fast track of activities, provide service detection equipment (electrical cable), estimation of resources during planning stage after discussing with Project manager) which is addressed in the one of KSFs of mitigation measures in this research. In addition, there are KSF of preventative measures of *project team performance in risk definition* by continuous follow-up of Material & Shop drawings in weekly meetings and fund-budget management by previous experience personnel. In this case, it is clear risk response is more matured compared with the previous cases. Although, the company was trying to find out practical solutions for delay risks minimization, KSFs of preventative and mitigation measure strategy was effective and developed the risk response. Maturity for risk response is evaluated in level 2 and 3 as shown in Table 4.5.

Table 4.5: The Traditional Extract of Risk Management (TRM) and Test of 'Maturity' Extract for Case Study E

Delay Factor	**Effects of Delay**	**Traditional Risk response**	**KSFs of Preventative Measures**	**KSFs of Mitigation Measures**	**PMMM level of Risk Response**
Existing services which are not in as built drawings, Difficult access to the existing buildings (Project manager mis-management)	Time and Cost Overrun	Reinvestigate the site work but there was no risk analysis	Project team performance in risk definition	Optimal resources allocation plan (effective)	-Risk management plan that document applicable procedures to manage risk (level 2) -Identification of each risk and mitigation strategy (level 3)

Figure 4.10: UAE university- case study E (Source: Nael General Contracting Establishment)

4.6 Case Study F

Case study F was conducted with the Project Manager by face-to-face interview and by undertaking the questionnaire survey with six professionals (manager, planning manager, MEP manager, divisional manager, construction manager, and procurement manager). The project involved was 3 proto-type kindergartens in three locations (Phase 2), which included the construction of 18 classrooms, an administration building, library courtyard, playground, service block and car parks (company's document programme sheet). The contractor was the Nael General Contracting Establishment, and the client was Abu Dhabi Educational Council in the Emirate of Abu Dhabi, UAE (Al Ain City). The original contract was for 87,565,992 *Dh* ($24 million) and the duration was agreed to be 245 days. The project start date was 22nd March 2012 and the finish date 21st November 2012. This case encountered delay at the completion stage and was managed throughout in a better way compared with the last five case studies. It was affected by delays risk in delivery of long lead items, MEP ceiling clearance, and succeeding activities, and the Building completion certificate for Power ON (see Table 4.6). The main delay issue was related to Al Ain Distribution Company (AADC) for power supply (Authority) that delayed the completion certificate approval for the power test and commissioning (see Figure 4.11). The delay risks were managed by the company benefitting from the lesson learnt as KSF of preventative measures from previous projects that experienced the same problem, and this assisted in classifying the delay as a simple unexpected risk. In addition, the company contingency plan for any risk item in future project was used as a KSF of mitigation measure. The Project Manager discussed the case in a professional manner and in confidence. The project was completed on date because the company rented an electrical capacitive generator, costing 50,000 Dh ($14,000) on a monthly basis for testing (thereby decreasing its profit). Hence, the project was ready for handing over at the right time (Reduction type in risk response). After evaluating the project, the project has been assessed as functioning at 'maturity' level 3 for risk response development (- Regular use of templates - Identify Contingency plans and mitigation strategies are for each risk item). The interviewee agreed on the evaluation, then acknowledged the overall outcome at level 3 which was hopefully, to be developed to levels 4 and 5. Figure 4.12 shows the photograph of the proto-type kindergartens in progress. The case study will be analysed in the next chapter according to the interview and questionnaire outcomes.

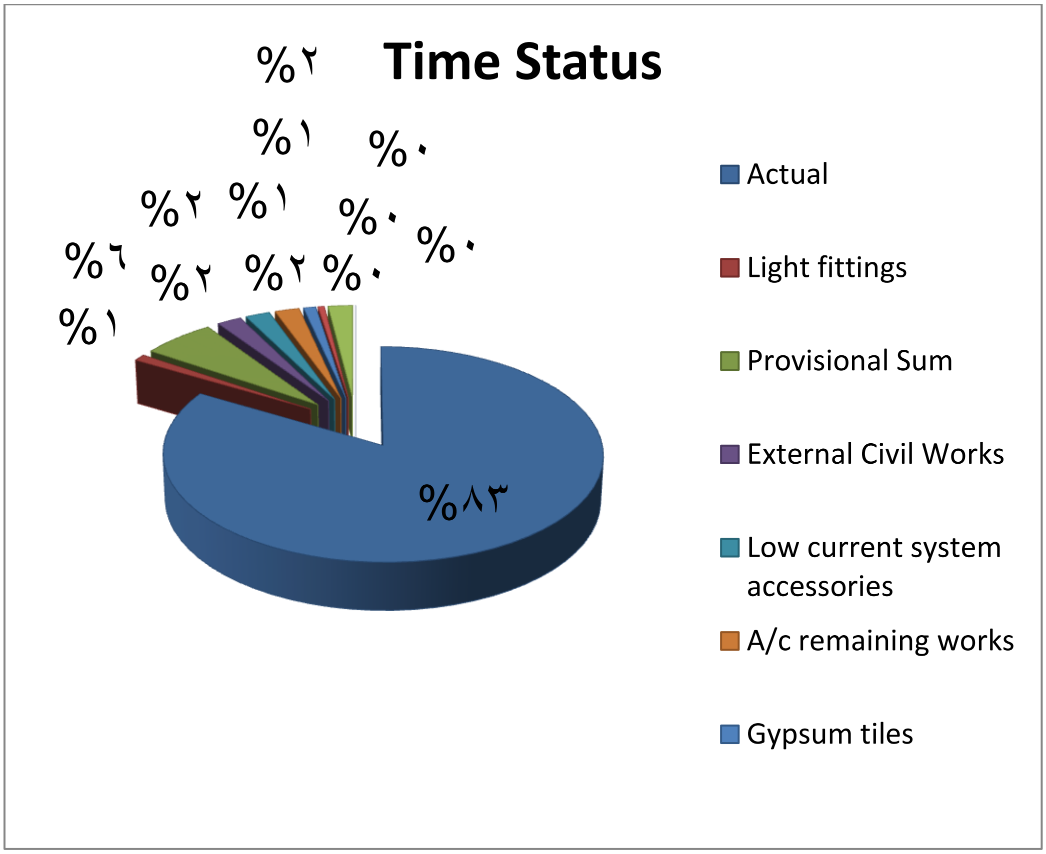


Figure 4.11: Time status up to completion date of Case Study F

(Source: Nael General Contracting Establishment, September 2012).

Figure 4.12: A Proto-type Kindergarten –Case Study F (Source: Nael General Contracting Establishment, September 2012)***.***

Table 4.6: The Traditional Extract of Risk Management (TRM) and Test of 'Maturity' Extract for Case Study F

Delay Factor	Effects of Delay	Traditional Risk Response	KSF of Preventative Measure	KSF of Mitigation Measures	PMMM level of Risk Response
Electricity and Power supply by authority	Time and Cost Overrun	The company rented an electrical capacitive generator, costing 50,000 Dh ($14,000) on a monthly basis for testing, thereby decreasing its profit (**Reduction**)	Lesson learned practical use	Contingency Plan for any new risk Item is used practically.	-Regular use of templates (level 3) -Identify Contingency plans and mitigation strategies are for each risk item (level 2)

4.7 Comparison between the Six Case Studies in 'Maturity' Levels

In order to determine whether there were differences in terms of 'maturity' between the case study organisations, each one was given a score on the basis of the information obtained from the face-to-face interviews, documents reviewed, and direct observations made (see Table 4.7), then according to the corresponding level in PMMM by Crawford (2006).

Table 4.7: A Comparison between the Six Case Study Organisations

Case Study	Delay Risk Classification	Maturity Level (Minimum)	Maturity Level (Maximum)
A	Epistemic Unexpected	Level 2	Level 2
B	Epistemic Unexpected	Level 2	Level 2
C	Simple Unexpected	Level 1	Level 2
D	Simple Unexpected	Level 1	Level 2
E	Simple Unexpected	Level 2	Level 2
F	Simple Unexpected	Level 3	Level 3

The initial results as shown in Table (4.7) gained from the interviewees were helpful in learning about the estimated delay risks classification and its maturity level and thereby in assisting the development of the maturity levels in the future. Case studies A, B and E scored level 2 for their company risk response; Case studies C and D both scored level 1 (minimum) and level 2 (maximum); Case study F scored level 3. In the Analysis and Results chapter, the findings of the questionnaire will confirm whether the risk response in project management of each of the case study organisations can be developed by the PMF and MMF maturation or not. Based on the eventual results from the cumulative findings of the interviews, documents analysis, and questionnaire responses, a framework will be outlined.

4.8 Limitation of the Multiple Case Study Strategy

The constraints on the time available with the interviewees, and the data availability, represented limitations to the multiple case study strategy, creating certain impossibilities. For example, it was impossible to access certain financial information because of the sensitivity surrounding the operations of the companies since the financial crisis began in 2008. However, care was taken in the research design to overcome these limitations and to ensure validity of the resultant research findings (Fellows and Liu, 2003) by using four methods of data collection (interview, questionnaire, documentary review, and observation) within the case studies, which were in themselves real examples of the construction industry in the UAE.

4.9 Dubai and Abu Dhabi Clients: Overview and Crisis Recovery

In 2008, the UAE was exposed to extremely high risk as the global financial crisis had its impacts everywhere, and investment in the UAE was affected in a major way. The construction sector in particular, felt the weight of the crisis and projects were subject to major delays. Numerous factors had an influence during this crisis period, ranging from features of the business environment to financial factors, and it is necessary to analyse these factors to establish the trajectory of risk and recovery in the country.

The UAE is ranked as the most developed country in West Asia and it is, in fact, the wealthiest territory in the world, resulting entirely from its mixed free market economy based on oil and natural gas production.

Abu Dhabi has the largest oil and gas reserves in the UAE, producing 94% from of the total amount of UAE oil (Hamdan, 2012). Dubai's oil production was severely affected by the recession which brought a very sharp decline in prices decline. This resulted in a decrease in the value of state-owned global assets, and negatively influenced the investment in what had previously been a booming construction sector. The reduction and deceleration in investment in construction projects in Dubai meant that many such projects suffered delays, and many others were placed on hold, with no movement forward whatsoever. In this situation, the government rushed into action to help stabilise the economy immediately after the crisis, and in doing so increase public expenditure sharply by 14% ($71.8 billion in 2008 to $81.5 2010). Abu Dhabi helped Dubai by providing $10 billion to support its economy at the start of the crisis and then subsequently increased this amount to a total of $20 billion in the aftermath of the crises, lending this sum of money at a cheaper interest rate in order to boost the country's economic growth (Kassem, 2014). However, the UAE was able to recover in 2010 due to the sharp rise in oil prices which helped to solve the debt problem, and enabled the UAE to show the fastest recovery of all nations.

After this recovery, Dubai was able to show off its unique construction projects such as Burj Khalife, the tallest building in the world, and the Jumeira Palm Island, although it is true that when the crisis began in 2008, Dubai struggled to gain funding for these projects. At that time, the stock market was down by 60% and property prices had decreased by 40% (Hamdan, 2012). Dubai found itself in a state of collapse because of huge debts that provided the government with only two options – either to sell its assets or to ask for financial support from Abu Dhabi.

So, it can be seen that the UAE, and more particularly, Dubai, experienced all kinds of risk related to investment once the financial crises occurred. In fact, for the UAE, the financial difficulties were rated as *MODERATE* on the grounds that Dubai was experiencing the greatest risk among all the Emirates. Nonetheless, Dubai's International Financial Centre (DIFC), which represents a free zone for financial trade and which is regulated by the Dubai Financial Services Authority, sustains this *MODERATE* risk level (Hamdan, 2012).

4.10 Chapter Summary

This chapter has concentrated on the main empirical work conducted through six real-life case studies. In approaching each case study organisation, the researcher indicated the purpose of the researcher and sought participation of the appropriate personnel. The methods of data gathering in each were: 1) interviews with experts such as senior project managers, managers, and office managers, ii) questionnaires with appropriate personnel, iii) documentary review (including correspondence between parties), iv) direct observations of project work in progress and on completion interview, and v) follow-up until handover. From these methods of data collection, it was seen that the major factors causing delay could be identified, and the response to that delay by the company, measured according to its maturity. It emerged in the chapter that the major risks were: i) change order by the client, ii) Authority, iii) site management, iv) project management, v) sub-contractor, and vi) design. Any one, or a combination of these factors, whether during the period of construction or at the hand-over, had serious effects upon the duration of the construction project. The traditional risk management appeared as the most favoured method of dealing with risk by the case study companies during their implementation of construction projects. Accordingly, it was shown that there was no proper risk response proper planning. Indeed, the results reveal that the risk response demonstrated related mostly to REDUCTION, AVOIDANCE and ACCEPTANCE types. At the same time, the level of maturity in risk response in all six cases, did not exceed level 3, and was predominantly at levels 1 and 2. It can be argued, that by testing the maturity of the risk response, weaknesses can be highlighted, thereby showing how the overall risk response can be developed until it reaches an acceptable level that allows the company to achieve a high standard of project execution. The results of the analysis of the six cases are reported in Chapter 5. In addition, financial situation was exposed in Dubai construction sector post the financial crisis then comparison between both clients in Abu Dhabi and Dubai is identified.

Chapter Five

Results

5.0 Introduction

This chapter deals with data analysis, a process which Adèr (2008:334-335) describes as critically examining the data collected in the research field. It is undertaken in order to answer the research question (Adèr, 2008:363). As shown in the research methodology in Chapter Three, a total of 200 questionnaires were personally administered to 35 construction, consultancy, and contracting companies, attracting 102 (51%) usable responses. In addition to administering the questionnaire in these 35 companies, six case studies in three companies were undertaken, in which ten face-to-face interviews were held, direct observations were made, and certain company documents read. The interview data is analysed qualitatively.

In the next section, the analysis of the questionnaire survey is presented. This is followed by the analysis of the interviews conducted in the case studies. As mentioned earlier in the thesis, the literature survey identified the successful use of survey in this type of study, and because of the similarities between this study and previous efforts, a questionnaire was chosen to collect data, and the same means of analysis that had been demonstrated to be suitable in other studies, were used. In most such studies, the SPSS was used to establish analyses of variance, and the F-Test ANOVA facility has been shown to be appropriate for this. In most studies, attitudes were obtained using three or five-point Likert scales, the MAEN was used for Ranking factors, and the F-test ANOVA with p-value was used for establishing significant differences in group opinions since this is an advanced technological technique. For example, the Mean and Standard Deviation used in a study by Tumi *et al*. (2009) in Lybia and in a sudy by Kaliba et al. (2009) in Zambia, One-way ANOVA used in a study by Sweis *et al*. (2008)in Jordan.

Differences were also found in other research using other data analysis methods like the Relative Importance Index (RII) used in a study by Frimpong and Oluwoye (2003), and the Frequency Index by Assaf and Al-Hejji (2006). Each of the studies reviewed has had a different scope and drawn different conclusions. Hence, different approaches have been used and the data have been analysed using different method. More details of the method of analysis used in this study now follows.

5.1 Analysis of the Questionnaire Survey

5.1.1 Descriptive Analysis of General Respondents' Background Information

The research participants were professional individuals with good experience, and qualifications ranging from Bachelors' degrees, to Masters' degrees, and Doctoral degrees. These individuals worked in two Emirates (regions) within the United Arab Emirates, namely Abu Dhabi (the capital), and Dubai (the second largest emirate) (see Figure 5.1).

- **Work Location of Respondents**

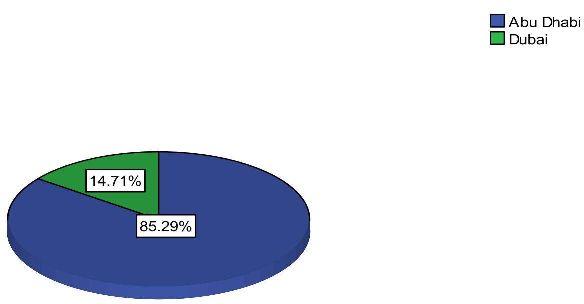


Figure 5.1: Work Location of Respondents

As already indicated, a total of 200 questionnaires were administered to 35 construction projects companies in Dubai and Abu Dhabi with invitations to participate in the survey. Of these, 102 (51%) were returned, and from this sample, 87 (85.29%) worked in the Abu Dhabi Emirate (the Capital), and 15

(14.71%) worked in Dubai Emirate (see Figure 5.1). They represented a wide spectrum of construction organisations of disparate size in the UAE, but in general, they came from public-private, private consultancy, and contracting companies (see Figure 5.2). Noticeably, most respondents came from Abu Dhabi (85%) because the survey focused on the area where the researcher lives for ease of access to the case study organisations that were mostly in the Al Ain District of Abu Dhabi Emirate.

- **Type of Organisation**

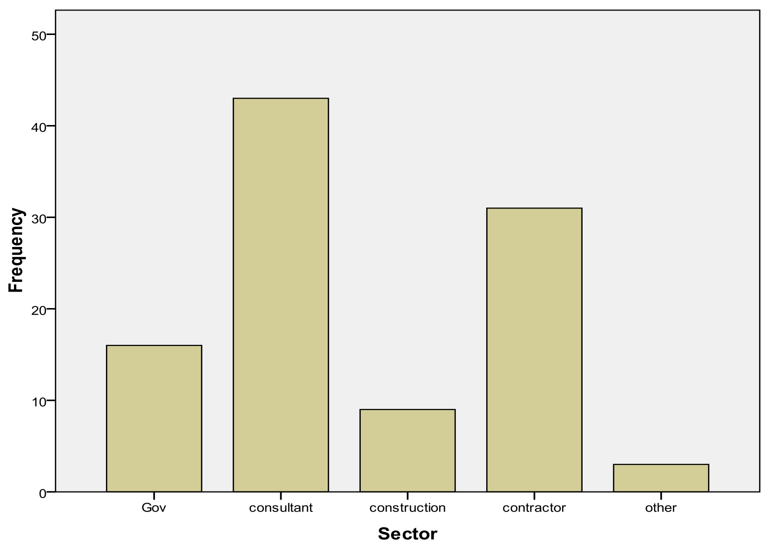


Figure 5.2: Type of Organisation

Figure 5.2 shows that 16 organisations (15.7%) were governmental, 43 (42.2%) were private consultancy companies, 9 (8.8%) were private construction companies, 31 (30.4%) were private contractors companies, and 3 (2.9%) were developers and financial organisations in construction.

For all of these organisations, it is necessary to practise effective risk management to prevent delays in projects and thereby ensure their business success.

- **Professional Roles**

The research participants themselves all held responsible positions in their organisations as indicated in Table 5.1.

Table 5.1: Analysis of Professional Respondents

	Profession	Frequency	Valid Percent
Valid	Project Manager	37	36.3
	Contractor	16	15.7
	Consultant	23	22.5
	Other	26	25.5
	Total	102	100.0

From Table 5.1, it can be seen that the respondents were professionals, who theoretically were capable of providing answers that reflected their knowledge and overall professionalism. The table shows that the majority of the sample were project managers (36%), and that consultants comprised the next largest group (almost 23%), contractors accounted for 16%, and other professionals for the remaining 26% of the sample. All the participants had an interest in exploring risk response development in practice with a view to improve their ability to control the effects of delay, and hence improve the performance of their construction projects.

➢ Companies' Annual Turnover

In Table (5.2) turnover figures varied from small-medium to big, serving as a reflection of company size, the resources possessed by the company, and its overall profits.

Table 5.2: Analysis of Companies' Annual Turnover

	Turnover	Frequency	Valid Percent	Company Size
Valid	Less than $5 million	15	15.2	Small or Medium - Sized
	More than $5 million	84	84.8	Large-Sized

As shown in Table 5.2, 15 (15.2%) respondents worked for small or medium-sized companies (with turnover less than $5 million) whereas the vast majority of participants (84 representing 84.8% of the sample) were employed in large-sized companies in the UAE (with turnover more than $5 million). This information demonstrates the market position of the companies involved, and can be used to assess the capability of those companies in dealing with significant difficulties such as stability of employees.

➢ **Number of Employees**

In Figure 5.3, the number of employees in the 35 construction companies in the two Emirates (Dubai and Abu Dhabi) is presented.

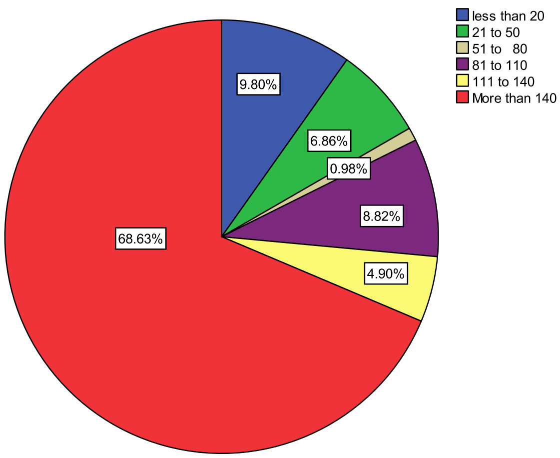


Figure 5.3: Number of Employees

The pie chart provides a helpful cross-reference to the information concerning company size, since from this it can be seen only a small minority (10%) of the companies had less than 20 employees. Another small percentage (7%) had between 21 and 50 employees, just 1% of companies had between 51 and 80 employees, 9% of companies had between 81 and 110 employees, 5% of companies had between 111 and 140 employees, and a massive 70% of companies had more than 140 employees. This reflects the turnover statistics shown in Table 5.2, revealing that companies employing more than 140 employees experienced the largest turnover.

➢ Respondents' Years of Experience

In this section respondents were analysed according to their practical experience in construction projects (Figure 5.4).

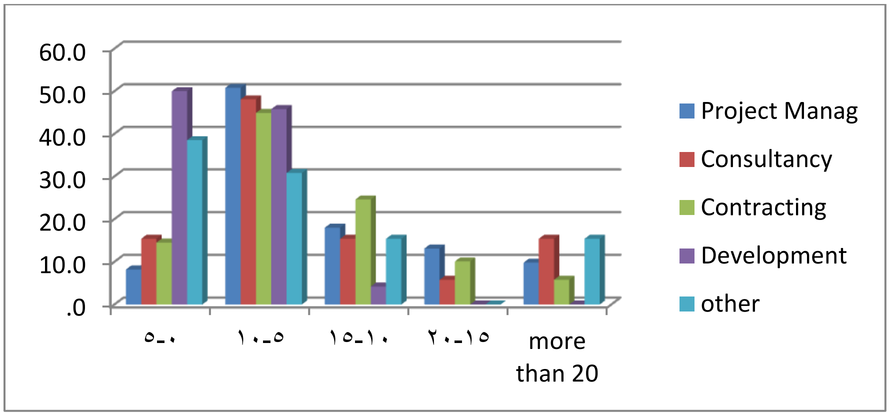


Figure 5.4: Respondents' Experience

Noticeably, more than 50% of all types of respondent had experience of between 5-10 years only. Surprisingly, in respect of developers, almost 50% had experience either of 0-5 or 5-10 years, and no developers at all had more than 20 years' experience (see Figure 5.4). In a country like the UAE which is ranked as the most developed country in West Asia, and which is among the wealthiest nations of the world, it would be expected that more experienced developers would be hired.

➢ Project Type

The illustrative data in Figure 5.5 classifies the construction projects in the UAE according to their type. It can be seen that the diversity of respondents resulting from different types and sizes of company, and from their experience of different kinds of project, reflects the ability of the construction companies to undertake different types of project.

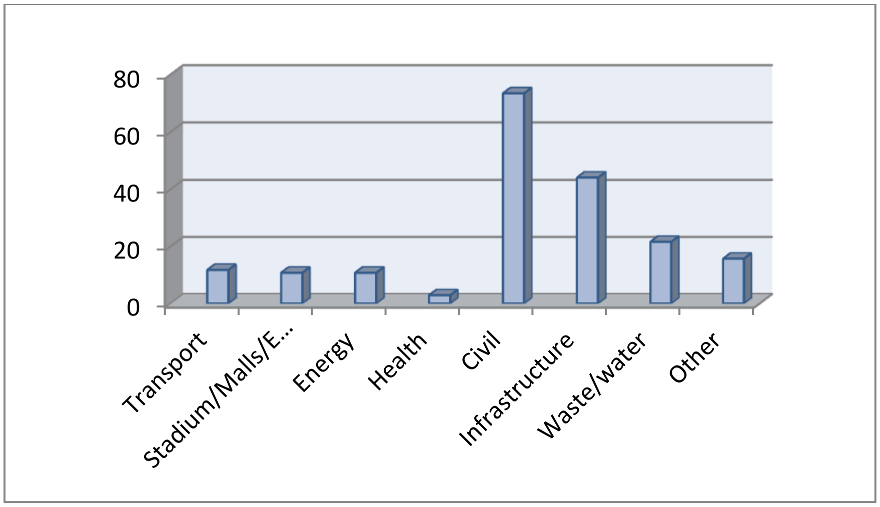


Figure 5.5: Project Types

In particular, companies are capable of working on civil engineering (more than 70% of projects), and infrastructure (more than 40% of projects) projects (see Table 5.5). Indeed, the UAE is considered to be the most developed country in the Gulf area by 2020 (EXPO) and consequently, the potential for more civil engineering and infrastructure projects is high.

Table 5.3: Respondents' involvement by Project Type

Project Type	Respondents involved
Transport projects	11.8%
Stadium/Exhibition projects	10.8%
Energy/Power projects	10.8%
Health projects	2.9%
Civil projects	73.5%
Infrastructure projects	44.1%
Waste/Water projects	21.6%
Other	15.7%

As shown in Table 5.3, civil projects and those concerned with infrastructure represent the highest percentage of the sample. It can be understood that the diversity encountered in company type, company size, and experience in different kinds of project, reflects the fact that the construction project companies involved have the facilities to undertake a wide range of projects, but that they are particularly capable in the realms of civil engineering and infrastructure projects.

- **Estimated and Actual Duration of Latest Projects Executed**

  As shown in Figure 5.6, the estimated and actual duration of projects varies from one project to another.

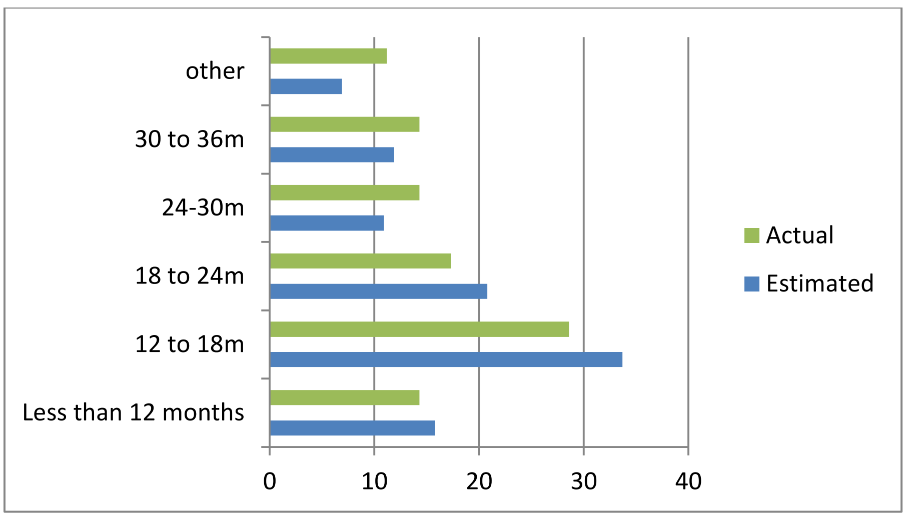


Figure 5.6: Estimated and Actual Duration of Projects

It can be seen from Figure 5.6, that projects with an estimated duration of less than 12 months, between 12-18 months, and between 18-24 months did not encounter delays and were finished ahead of time. However, projects with duration between 24-30 months, 30-36 months, and projects with duration more than 36 months all encountered delays and were eventually finished behind schedule. It is noticeable, therefore, that management appears not to be capable of controlling delays risks in projects of longer than 24 months' duration.

- **Delay Risk Factors Affecting Time and Cost**

Various causes of construction project delays were identified through a literature review (in the first stage), personal interviews, and the questionnaire conducted with the four identified groups (Project managers, Consultants, Contractors, and others) (see Table 5.4). Many researchers have used this type of approach, and subsequently opted to use non-parametric methods of analysis (mean, standard deviation), yielding ranks, scores, or categories, in an effort to avoid making assumptions (Garth and Hallam, 2008). The data were categorised by using the "variable label" option for each Group-related factor. Hence, descriptive analysis was performed twice and given a statistical output. The first analysis indicates the number of cases (N=6: Client, Contractors, Consultants, Project managers, Unforeseen), and the second indicates the number of sub-factors (N=46) related to each GROUP. The *MEAN* values indicate the RANK of the groups and the related factors. This helps in gaining the RANK of the factors (from the higher to lower value). The Standard deviation gives a numerical indication of how the data are spread.

Forty-six major causes of construction delays were found to have an impact on the UAE construction sector and these causes were classified into six groups as follows: Client, Financial, Contractor, Consultant, Project Manager, Unforeseen-related factors.

Table 5.4: Construction Projects' Delay Risk Factors

No	Group/Delay Risk Factor	Number of Respondents	Mean	Standard Deviation
	Client			
1	Change orders	101	2.29	0.726
2	Lack of capability of client representative	96	1.78	0.684
3	Slow decision-making by client	99	2.24	0.686
4	Lack of experience of client in construction	96	1.45	0.596
5	Unreasonable constraint by client	95	1.81	0.867
	Financial			
6	Inflation/prices fluctuation	99	1.72	0.686
7	Fund approval delay	99	2.17	0.756
8	High interest rate	96	1.41	0.625
9	Client's financial difficulties	96	2.09	0.834
10	Developer financial difficulties - crisis effect	98	2.01	0.855
11	Contractor payment (delayed approval)	99	2.03	0.735
	Contractor			
12	Inappropriate construction methods	99	1.71	0.643
13	Late delivery of materials	99	2.00	0.795
14	Inaccurate cost estimating by contractor	99	1.74	0.708
15	Unskilled labour	99	1.73	0.697
16	Technical difficulties	98	1.64	0.662
17	Commitment by contract to changes agreement	95	1.67	0.675
18	Lack of dedication/reliability of sub-contractors	101	1.88	0.725
19	Poor technical performance	98	1.67	0.654
	Consultant			
20	Inadequate consultant experience	98	1.59	0.686
21	Poor design and delays in design	100	1.88	0.742
22	Slow response and poor inspection	99	1.78	0.648
23	Designers not incorporating client's Requirements	99	1.70	0.735
24	Inaccurate documentation	99	1.44	0.575
25	Poor awareness of cultural design	98	1.42	0.759

Table 5.4: Continue Delay Risk Factors

No	Group/Delay Risk Factor	Number of Respondents	Mean	Standard Deviation
	Project Manager			
26	Poor site management and supervision	99	1.76	0.757
27	Incompetent project team	100	1.74	0.733
28	Unqualified project managers	101	1.82	0.740
29	Misdirection of team members	98	1.62	0.696
30	Improper project planning/ scheduling	99	1.97	0.721
31	Inaccurate time estimating	99	2.03	0.749
32	Improper feasibility studies	100	1.71	0.743
33	Lack of team communication/ co-ordination	99	1.78	0.736
34	Lack of site safety	99	1.42	0.608
35	Outdated site information	98	1.48	0.613
36	Inadequate team knowledge	99	1.58	0.640
37	Irregular project reporting	99	1.38	0.634
38	Inadequate fund allocation	96	1.73	0.657
39	Lack of project team formal training	96	1.61	0.655
	Unforeseen			
40	Weather conditions	99	1.64	0.721
41	Lack of technology	101	1.50	0.673
42	Late approval starting/completion certificate	100	1.96	0.803
43	Difficulties in supply of electricity and water	101	1.83	0.825
44	Problems with neighbours	99	1.32	0.550
45	Increased cost of materials	99	1.79	0.760
46	Financial crisis effects (deduct salary, accommodation, etc)	101	1.63	0.689

From Table 5.4 the major delays risks relating to each of the groups identified can be seen, together with their rankings according to their mean value. It is clear that most of the factors identified are mentioned in the literature, and this validates the research methodology in this context. The *SIX* group-related delays factors matched the groups identified in previous research, for example (but not exclusive to) Odeh and Battaineh (2002) in respect of the Client, Financial, and Project Manager-related factors, Koushki (2005) in Kuwait in respect of the Client, Financial, and Contractor-related factors, Frimpong (2003) in respect of the Financial and Unforeseen-related factors, and Ahmed *et al*. (2003) in respect of the Consultant and Client-related factors. The Designer factor does not exist as a separate group, and therefore issues relating to design are considered under the Consultant-related factor. The Resources-related group is also modified in this study and is placed within the grouping of Unforeseen-related factors, together with some other sub-factors. So, the factors related to each group are both similar yet different to some extent from their reporting in the literature.

It is significant that a focus on the Client, and the Financial-related factors has emerged in this research, but not surprising since the global financial crises of late 2008. Both of these factors are ranked at the TOP of the six group as can be seen in Table 5.5, which also shows the most affected Emirate to be Dubai. However, in 2010 the effects of the financial crisis began to show recovery, as the Clients in Dubai received help from Abu Dhabi, and this enabled the Financial factor to obtain a better ranking.

In Table 5.5 a further analysis is conducted in respect of the Delay Risk Factors concerning Time and Cost, and in Table 5.6 the factors are detailed and ranked by *GROUP*.

Table 5.5: RANK of the Group

Group	N	Mean	Std. Deviation	Rank
Client	94	1.9106	0.42766	1st
Financial	91	1.8810	0.49459	2nd
Contractor	90	1.7444	0.44655	3rd
Consultant	93	1.6943	0.45302	4th
Unforeseen	97	1.6701	0.48109	5th
PM	84	1.6582	0.41518	6th

As shown in Table 5.5, the number of respondents in each group (N number) is shown together with the MEAN of their answers in respect of their opinions regarding the Group-related delays risks in the UAE. It is clear that not all the respondents gave their opinions regarding the causes and effects of group-related factors, since the total number of respondents was 102, yet this figure was not reached in any group. Obviously, some respondents were reluctant to provide opinions, and others were conservative about what they said for security reasons. However, already mentioned, the substantial help from the Abu Dhabi Government enabled the financial factor to be ameliorated.

Table 5.6: Top 20 Delays Factors Affecting Time and Cost

Group	Delay Factor	Number of Respondents	Mean	Standard Deviation	Rank
Client	Change orders	101	2.29	0.726	1st
Client	Slow decision-making	99	2.24	0.686	2nd
Financial	Fund approval delay	99	2.17	0.756	3rd
Financial	Client's financial difficulties	96	2.09	0.834	4th
Financial	Contractor payment (delayed approval)	99	2.03	0.735	5th
PM	Inaccurate time estimating	99	2.03	0.749	5th
Financial	Developer financial difficulties - crisis effect	98	2.01	0.855	7th
Contractor	Late delivery of materials	99	2.00	0.795	8th
Unforeseen	Late approval starting/completion certificate	100	1.96	0.803	9th
Consultant	Poor design and delays in design	100	1.88	0.742	10th
Contractors	Lack of dedication/reliability of sub-contractors	101	1.88	0.725	10th
Unforeseen	Difficulties in supply of electricity and water	101	1.83	0.825	12th
PM	Unqualified project managers	101	1.82	0.740	13th
Client	Unreasonable constraint by client	95	1.81	0.867	14th
Unforeseen	Increased cost of materials	99	1.79	0.760	15th
Client	Lack of capability of client representative	96	1.78	0.684	16th
PM	Lack of team communication/ co-ordination	99	1.78	0.736	16th
Consultant	Slow response and poor inspection	99	1.78	0.648	16th
PM	Poor site management and supervision	99	1.76	0.757	19th
PM	Incompetent project team	100	1.74	0.733	20th

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In Tables 5.5 and 5.6 above, and according to Group RANK, the causes of delay risks have been identified within the group as follows:

- **Clients**

All respondents perceived the Clients to be the greatest cause of risk (see Table 5.5), purely because of change orders requested by them. Such change orders can occur for several reasons, and can be related to the client needs or the actual needs of the construction as it progresses. From Table 5.6, two top factors concerning client-related delays can be seen as being among the top twenty most important causes of delays; these are change orders (ranked first) and slow decision-making (ranked second).

- **Financial**

Referring to Table 5.5, it can be seen that Financial factors were ranked second, a finding which confirmed the impact of the relatively recent financial crisis. Delays in receiving approval for funds from banks or governmental financial institutions appeared as the third factor related to funding shortages, financial difficulties being faced by the client appeared as the fourth factor, and delays occasioned by the contractor in payment for the completed work ranked fifth (see Table 5.6).

- **Contractor**

The Contractor Group was ranked third as shown in Table 5.5. The factors identified in relation to this group are: the late delivery of materials (ranked 8^{th}), and the lack of dedication/reliability of sub-contractors (ranked 10^{th}) as shown in Table 5.6). However, the remaining factors as shown in Table 5.4 are also important, and these include problems such as: inaccurate cost estimating by the contractor, the contractor's use of unskilled labour, and the contractor's use of inappropriate construction methods. Each of these can have great negative impacts upon project completion and basically they should not occur if the contractor is doing his job properly. However, in the case where it is known they will occur, then these risks must be appreciated and incorporated within the project planning, scheduling, and controlling programme. Contractors must ensure that all resources, such as materials and workers, are available throughout the project whenever needed, and that they are capable of making accurate time estimations in respect of materials delivery. However, such estimations require that contractors are in possession of accurate project information, and this is an issue that runs throughout the project, involving client, contractor, and supplier. Hence, the information flow, especially concerning the availability and supply of resources must be unhindered.

Additionally, whilst contractors were perceived to be guilty of inaccurate estimating, it was clear that clients were also responsible since excessive change orders produced difficulties for contractors in making estimations of materials and time needed for construction. Excessive change orders ranked first, and were seen to be the result of many reasons such as unclear project objectives and scope from the clients. Obviously, the continual requirement for contractors to incorporate change to their schedules can cause significant disruption to projects and, consequently, disturb planned schedules, increase costs through rework, and decrease labour efficiency. Project objectives that are not clear result in unexpected design changes, and issues concerning the constructability of designs lead to many changes during the construction stage. Poor estimation and change management reflect a lack of efficient and effective project management procedures resulting from project parties not being proactive in their roles to ensure that projects run smoothly.

- **Consultant**

As revealed in Table 5.5, the Consultant group occupied the fourth rank in the assessment of parties impacting upon project delay. Poor design and delays in producing designs ranked 10th in the hierarchy, and the slow response of consultants couples with their poor inspection, were cited in 19th place. At the same time, it has to be remembered that consultants also play a part in estimating the time and cost of a project together with project managers, and therefore, whilst they appear fairly low down the ranking, their involvement elsewhere demonstrates that they have a major role to play.

- **Project Manager**

Interestingly, Table 5.5 reveals that project managers ranked bottom but as shown in Table 5.6, inaccurate time estimation has a negative effect upon project completion, and project managers are themselves contributors towards this problem. It is worth commenting that unqualified project managers ranked 13^{th}, and the lack of team communication/co-ordination, and effective site management ranked 19^{th}. Moreover, it should be remembered that Project Managers and Consultants are mainly concerned with technical and management factors that impinge upon project completion, such as inaccurate time estimation, inaccurate cost estimation, poor site management and supervision, improper project planning and scheduling, and incompetent project team-working.

- **Unforeseen**

Other causes were ranked fifth rank and considered as Unforeseen factors. Among the top twenty, the most important ones perceived as contributing to the causes of delays in construction project were: late approval from Municipalities in respect of the issue of starting/completion certificates, which was ranked 9^{th}, and difficulties in obtaining the supply of electricity and water that rank 12^{th}. In addition, the increased costs of materials featured in the 15^{th} rank and this was seen as particularly important in causing delays in site activities, which could come to a standstill if materials could not be provided. Other risk factors also affect the project completion, such as site management, and it was indicated that comprehensive site investigation has visible and considerable benefits. Furthermore, unforeseen weather conditions could cause delay. Another issue raised was the attention required to environmental and social impact assessments since it is necessary to conduct detailed investigations into any implications for the immediate surroundings of a proposed project, and to properly inform residents about potential projects and to offer satisfactory compensation for their properties/losses should any be involved. At the same time, sudden economic crises like that in 2008, have impacts upon salaries and wages, and in the UAE workers found a drop in salaries without any accompanying decrease in living expenses. All of these apparently extraneous factors need to be considered as contributors to delays risks as they impact upon the smooth-running of projects, causing interruptions during the construction phases.

As shown in Table 5.6, and when compared with other cases in the literature, there are huge similarities, but more particularly in the Client and Financial-related factors. For example (but not limited to), research by Sweis *et al*. (2008) concluded that Financial-related, and excessive change orders by clients (Client-related), were the TOP risk factors. Another example of research by Sweis *et al*. (2008) concluded that inadequate planning (Project-manager related), scheduling and financing by contractors (Contractor and Financial-related), and excessive change orders by clients (Client-related), were the main risk factors. These studies coincided with the financial crisis.

5.1.2 Significant Difference between Respondents' Opinions on the Effect of Delay Risk Factors on Time and Cost

The purpose of this analysis is to establish the participants' viewpoints regarding the greatest causes of delays risks after the financial crisis of 2008-2011. One-way ANOVA compares three or more unmatched groups, based on the assumption. The ANOVA F-test was applied to the data from the questionnaire survey (see Table 5.7) to obtain significantly different attitudes among the various stakeholders in construction projects (clients, contractors, consultants, project managers, financial, unforeseen) regarding the factors causing delays risks. Alpha (α) or p-value answers the question. The P value is computed from the F ratio which is computed from the ANOVA table. The level of the p-value describes the case and is set at 0.05. The F ratio is the ratio of two mean square values. If the null hypothesis is true, F is expected to have a value close to 1 most of the time. A large F ratio means that the variation among group means is more than might be expected by chance. A large F ratio occurs when the null hypothesis is wrong. The P value is determined from the F ratio and the two values for degrees of freedom shown in the ANOVA table.

The most critical factor in the group (if there is significant difference, $\alpha<0.05$) will yield to a multiple comparison between the respondents (e.g. Contractors vs Consultants, Project Managers vs Contractors, etc.).

Table 5.7: Significance Differences between the Opinions held by the Groups on the Effect of the Delays Factors on Time and Cost

Group cause delay risk	Analysis of variance	
	F	p-value
Client	1.746	0.163
Financial	2.581	0.059
Contractor	1.006	0.394
Consultant	2.702	0.050
Project Manager	0.857	0.467
Unforeseen	0.362	0.781

* Significant at 0.05 level.

The ANOVA F-test can be explained as the "Existence of differences between professionals (Project managers, Contractors, Consultants, Other) with regard to their opinion on the effect of delays factors (group) on time and cost". This test was performed with significance p- value more than 5% (0.05). Any p-value>5% is considered to represent no significant difference between the professionals' opinions.

The following results show the outcome:

- ❖ Clients ($F=1.746$, $P=0.163>\alpha=0.05$)
- ❖ Financial ($F=2.581$, $P=0.059>\alpha=0.05$)
- ❖ Contractors ($F=1.006$, $P=0.394>\alpha=0.05$)
- ❖ Consultants ($F=2.702$, $P=0.050=\alpha=0.05$)
- ❖ Project Managers ($F=0.857$, $P=0.467$ almost corresponding to $\alpha=0.05$)
- ❖ Unforeseen ($F=0.362$, $P=0.781>\alpha=0.05$)

5.1.3 KSFs of Preventative Measures Priority for Risk Response Development

It is crucial to identify the KSFs of preventative measures that are susceptible for risk response development. The analysis is based on the average score on a Likert scale of 1 to 3, where 1= Less likely, 2=Likely, 3= Highly likely (see Table 5.8).

Table 5.8: KSFs of Preventative Measures for Risk Response Development

No	KSFs of Preventative Measure	Number of Respondents	Mean	Std. Deviation
1	Planners' knowledge for effective risk plan	101	2.21	0.697
2	Bidding re-analysis and Contract performance	99	2.04	0.653
3	Anticipate risk (identification)	101	2.45	0.655
4	Technology utilization	99	2.23	0.697
5	Stakeholder competency (communication)	101	2.03	0.640
6	Share high impact risks with other stakeholders -risk owner	100	2.01	0.732
7	Decision support system (decision-making)	100	2.03	0.731
8	Funds-budget management by experience personnel	100	2.19	0.734
9	Project team performance in risk definition	97	2.02	0.692
10	Quantitative and Qualitative risk analysis template	100	2.04	0.680
11	Risk assessment	97	2.10	0.684
12	Labourers' personal skills	98	1.80	0.657
13	Contingency plans review	100	2.04	0.665
14	Risk management training	100	2.00	0.696
15	Project management office (PMO)	99	2.03	0.692
16	Update project management training	102	1.92	0.685
17	Construction techniques update	100	2.00	0.682
18	Project crisis programme (financial crisis)	100	2.10	0.704
19	Team Knowledge in civil codes of the country	100	1.94	0.763
20	Product positioning (market success)	98	1.79	0.579
21	Cash flow management	99	2.17	0.640
22	Municipality process for new design approval (Gov. issue)	99	2.11	0.754

The results in Table 5.8 reveal the candidates' interest in the factors which are absent in the pre-construction stage and which they believe are capable of preventing risks. A total of 22 such factors were identified and ranked according to their perceived MEAN score in Table 5.9.

Table 5.9: Top 16 KSFs of Preventative Measures for Risk Response Development

KSFs of Preventative Measure	**No. of Respondents**	**Mean**	**Std. Deviation**	**RANK**
Anticipate risk (identification)	101	2.45	0.655	1st
Technology utilization	99	2.23	0.697	2nd
Planners' knowledge for effective risk plan	101	2.21	0.697	3rd
Funds-budget management by experience personnel	100	2.19	0.734	4th
Cash flow management	99	2.17	0.640	5th
Municipality process for new design approval (governmental issue)	99	2.11	0.754	6th
Project crisis programme (financial crisis)	100	2.10	0.704	7th
Bidding re-analysis and Contract performance	99	2.04	0.653	8th
Decision support system (decision-making)	100	2.03	0.731	9th
Project management office (PMO)	99	2.03	0.692	9th
Project team performance in risk definition	97	2.02	0.692	11th
Share high impact risks with other stakeholders (risk owner)	100	2.01	0.732	12th
Risk management training	100	2.00	0.696	13th
Team Knowledge in civil codes of the country	100	1.94	0.763	14th
Update project management training	102	1.92	0.685	15th
Labourers' personal skills	98	1.80	0.657	16th

It can be seen from Table 5.9 that the most important KSFs of preventative measures in the pre-construction stage are: *Anticipate risk (identification)-*

1st, Technology Utilisation, Planners' knowledge for effective risk plan-2nd, Funds-budget management by experienced personnel-3rd, Cash flow management-4th, Municipality process for new design approval (governmental issue)-5th, Project crisis programme (financial crisis)-6th. These factors indicate that two particular aspects are very important in this type of measure, these being the knowledge and ability to anticipate risks and crisis, and to overcome whatever crisis cannot be averted by such anticipation, and the performance of the technology employed in the whole process of project construction. The remaining factors also indicate deficiencies in many other areas of UAE construction project work. For instance, the processes undertaken by the Municipalities are criticised, there is poor contract performance, there is no project management office (PMO), team performance is weak, risk management training is non-existence, there is poor knowledge of civil codes since all practitioners are foreigners, and the personal skills of labourers are weak. All of these factors are strongly related to delays, as they represent risk factors, as identified in the first stage in this research

5.1.4 Significant Difference between Respondents' Opinions on KSFs of Preventative Measures for Risk Response Development

Table 5.10 shows the analysis of the data using the F-Test (ANOVA) and reveals the perspectives of the respondents in respect of the strength of their agreement concerning the KSFs of preventative measures on risk response development.

Table 5.10: Significant Differences between Groups in KSFs of Preventative Measures

No.	KSFs of Preventative Measures	Analysis of variance	
		F	p-value
1	Planners' knowledge for effective risk plan	0.682	0.565
2	Bidding re-analysis and Contract performance	0.701	0.554
3	Anticipate risk (identification)	1.265	0.291
4	Technology utilization	0.322	0.809
5	Stakeholder competency (communication)	0.245	0.865
6	Share high impact risks with other stakeholders	1.068	0.367
7	Decision support system (decision-making)	0.342	0.795
8	Funds-budget management by experienced personnel	0.829	0.481
9	Project team performance in risk definition	0.944	0.423
10	Quantitative and Qualitative risk analysis template	0.401	0.753
11	Risk assessment	1.067	0.367
12	Labourers' personal skills	1.115	0.347
13	Contingency plans review	0.728	0.538
14	Risk management training	1.003	0.395
15	Project management office (PMO)	0.648	0.586
16	Update project management training	0.117	0.950
17	Construction techniques update	0.853	0.468
18	Project crisis programme (financial crisis)	1.423	0.241
19	Team Knowledge in civil codes of the country	0.190	0.903
20	Product positioning (market success)	0.393	0.758
21	Cash flow management	0.037	0.991
22	Municipality process for new design approval (Gov.)	2.764	0.046

* Significant at 0.05 level

It is clear that from the results presented in Table 5.10, there is full agreements between all groups of respondents (Project Managers, Contractors, Consultants, and others) since there is no significant difference in the p-values achieved (all p-value ≥ 0.05 level). Hence, their prioritisation of KSFs of preventative measures required to obtain on-time project completion, and hence, avoid the risk of delays, is the same.

5.1.5 KSFs of Mitigation Measure Priority for Delays Risk Response Development by Professional Group

Analysis of KSFs of mitigation measures based on the average score on a Likert-scale of 1 to 3, where 1= Less likely, 2=Likely, 3= Highly likely, is presented in Table 5.11 which shows 15 KSFs and their prioritisation. The top KSFs of mitigation measures have been considered as appropriate for risk response development, although only four of these are addressed in the literature. The remaining factors are addressed in the questionnaire.

Table 5.11: KSFs of Mitigation Measures for Risk Response Development

No	KSFs of Mitigation Measure	Number of Respondents	Mean	Std. Deviation
1	Lesson learned practical use	98	2.38	0.696
2	Contingency plan for each new risk item	100	2.17	0.739
3	Practice and learning in the field	100	1.98	0.752
4	Delay analysis template	100	2.10	0.689
5	Overlapping activities management	96	2.02	0.649
6	Optimal risk allocation plan	98	2.21	0.677
7	Co-ordination with sub-contractors development	101	2.32	0.662
8	Project team productivity optimization	99	2.20	0.700
9	Construction method technique	100	1.76	0.653
10	Municipality approval process	99	1.88	0.659
11	Supervision for risk identification	102	2.10	0.668
12	Incentives and rewards adequateness	101	1.98	0.707
13	Change request management	98	2.19	0.741
14	Risk transfer-integration in insurance consulting	101	1.94	0.719
15	New risks reviews (update) in the risk plan	99	2.07	0.759

As shown in Table 5.11, the results obtained in respect of the KSFs of Mitigation Measures reveal all to be significant for effective risk response development during the construction stage. Table 5.12 ranks the top ten KSFs according to the priority given to them.

Table 5.12: Top 10 KSFs of Mitigation Measures for Risk Development

KSFs of Mitigation Measure	No. of Respondents	Mean	Std. Deviation	RANK
Lesson learned practical use	98	2.38	0.696	1st
Coordination with sub-contractors development	101	2.32	0.662	2nd
Optimal risk allocation plan	98	2.21	0.677	3rd
Project team productivity optimization	99	2.20	0.700	4th
Change request management	98	2.19	0.741	5th
Contingency plan for each new risk item	100	2.17	0.739	6th
Delay analysis template	100	2.10	0.689	7th
Supervision for risk identification	102	2.10	0.668	8th
New risks reviews (update) in the risk plan	99	2.07	0.759	9th
Overlapping activities management	96	2.02	0.649	10th

Table 5.12 reveals the most important KSFs as: Lesson learned practical use - 1st, Co-ordination with sub-contractors development - 2nd, Optimal risk allocation plan - 3rd, Project team productivity optimisation - 4th, Change request management -5th, Contingency plan for each new risk item - 6th, Delay analysis template - 7th, Supervision for risk identification - 8th, New risks reviews (update) in the risk plan - 9th, and Overlapping activities management - 10th. These top KSFs of mitigation measures have been considered as appropriate for risk response development, although only four

of these are addressed in the literature, these being: Contingency plan for each new risk item, Change request management, Delay analysis template, and Overlapping activities. That said, there was an attempt to measure the actual gap between theory and practice. In addition, a test for any significant difference between respondents in their opinions regarding KSFs mitigation measures for risk response development was performed, and the results appear in the next section and in Table 5.13a.

5.1.6 Significant Difference between Respondents in KSFs of Mitigation Measures for Risk Response Development

The F-Test (ANOVA) was conducted to establish differences in respondents' perspectives concerning the KSFs of mitigation measures and their impact on risk response development (see Table 5.13a). The results of this test are helpful in further exploring the practicality of the model of risk response development. As identified previously, the KSFs are the most important during the construction stage. Some of the KSFs will be selected from case study practice, and tested for their effect within a *MATURITY MODEL* for risk response development.

Table 5.13a: Significant Difference between Groups in KSFs of Mitigation Measures

No.	KSFs of Mitigation Measures	Analysis of variance	
		F	p-value
1	Lesson learned practical use	1.328	0.270
2	Contingency plan for each new risk item	1.014	0.390
3	Practice and learning in the field	0.288	0.834
4	Delay analysis template	1.129	0.341
5	Overlapping activities management	0.822	0.485
6	Optimal risk allocation plan	0.341	0.796
7	Co-ordination with sub-contractors development	2.084	0.107
8	Project team productivity optimization	0.482	0.696
9	Construction method technique	0.972	0.409
10	Municipality approval process	2.200	0.093
11	Supervision for risk identification	3.364	0.022
12	Incentives and rewards adequateness	1.571	0.201
13	Change request management	1.703	0.172
14	Risk transfer (integration in insurance consulting)	0.437	0.727
15	New risks reviews (update) in the risk plan	0.596	0.619

* Significant at 0.05 level

In the Table 5.13a, there is no significant difference between respondents in the KSFs of Mitigation Measures except in the supervision for risk identification ($p=0.022 <0.05$). Multiple comparison was used to determine which pairs of groups were different in this respect (see Table 5.13b).

Table 5.13b: Multiple Comparison between the Groups of Respondents in Supervision for Risk Identification

KSFs of Mitigation Measure	Professional Role		p-value	95% Confidence Interval	
				Lower Bound	Upper Bound
Supervision for risk Identification	Project manager	Contractor	0.624	-0.27	0.74
		Consultant	0.232	-0.77	0.12
		Other	0.678	-0.25	0.62
	Contractor	Project manager	0.624	-0.74	0.27
		Consultant	0.044	-1.11	-0.01
		Other	0.995	-0.58	0.49
	Consultant	Project manager	0.232	-0.12	0.77
		Contractor	0.044	0.01	1.11
		Other	0.033	0.03	0.99
	Other	Project manager	0.678	-0.62	0.25
		Contractor	0.995	-0.49	0.58
		Consultant	0.033	-0.99	-0.03

A multiple comparison was used to further discover which pairs of groups differ in respect of 'supervision for risk identification', and the finding was that there was a clear significant difference between the consultants and the contractors, and between the consultants and the others indicated by the upper and the lower figures, since there is no ZERO between the pairing of

Contractor and Consultant (-1.11, -0.01), (0.01, 1.11), and Consultant and others (0.03, 0.99), (-0.99, -0.03). Therefore, the supervision for risk identification was fully accepted by the project manager, thus indicating this to be an important factor for mitigation measure success. However, *Stakeholder Involvement* with high levels of user and client engagement is also shown to be critical for the success of any model. The next analysis, as shown in Figure 5.7, identifies the contribution of the various stakeholders to effective risk response development.

5.1.7 Professionals' Contribution in Risk Response Development

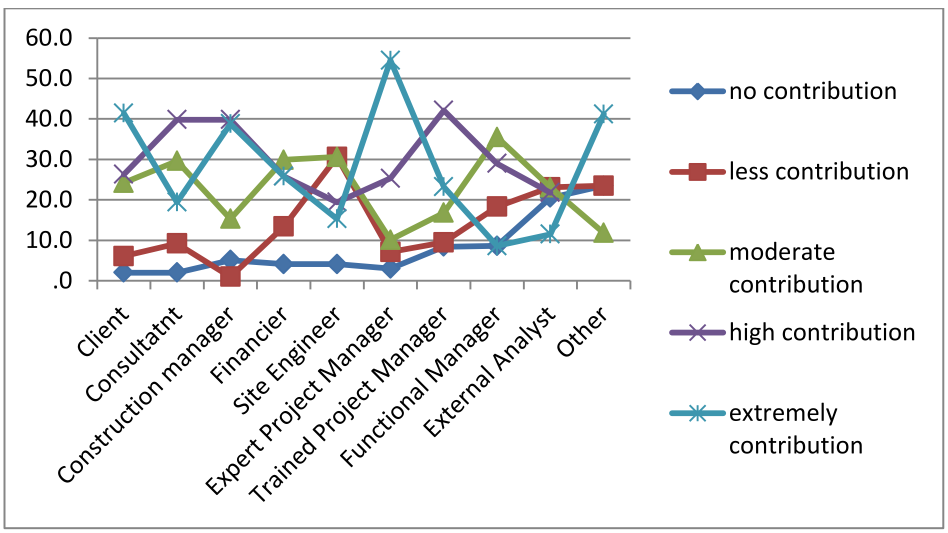

Figure 5.7: Professionals' Contribution in Risk Response Development

As shown in Figure 5.7, more than 50% of respondents agreed on the need for an Expert Project Manager in the risk response development to control delays and they believed that this person should have an extremely high input into the process. At the same time between 40%-45% of respondents agreed on the need for a high contribution to be made by Clients, Consultants, Construction Managers, and Trained Project Managers.

Clearly, in construction organisations, the project stakeholders are heterogeneous, but the client should still aim to identify the level of awareness towards risks and risk response development, and indeed to examine the various policies are in place in this regard. In such a situation, it is easy for the client to see the relevance of risk management when making a decision to go ahead with a project, as the risk will be identified in advance, and hence, the need for management will be obvious. Additionally, in circumstances where risks are identified systematically at the start of a project, they can be acknowledged in the formal contract drawn up between the client and the contractor. Obviously, this is common sense, and in fact, clients, and construction managers do engage in risk analysis ahead of large projects, and they do involve trained project managers such that their future plans regarding risk management (and the training required for it) are solid. However, they do all tend to concentrate more on disaster management rather than risk management when trying to create an effective response, with the result that those risk management strategies that do exist are inadequate. Indeed, such inadequate risk management is very obvious, even in extremely reputable organisations with good financial standing that are involved in major projects. This has led to the importance of research in various dimensions of risk management. Specifically in relation to the construction sector, it is observed that this industry has been responsible for the gross fixed capital formation during the last three decades. Consequently, it would seem crucial to identify the risks and their effects within the construction sector, and to devise strategies that would enable appropriate, successful, and effective responses that will satisfy both clients/end users as well as all other project stakeholders.

5.2 Analysis of Case Studies

The results are obtained from a group of six case studies which were chosen to reflect problems in project risk management and risk response, and in the hope of highlighting the strengths and weaknesses possessed by each case study organisation in respect of each key area. The outcomes indicate the existence of weaknesses in construction projects, and an assessment was made of the extent of delays in several projects.

In Chapter Four, six case studies (A,B,C,D and E) were seen to demonstrate unstructured risk management sequences. Figure (5.8) visualises how the Risk Management and Risk Response differ in terms of theory and practice. A summary of the results of the six case studies can be found in Table (5.14).

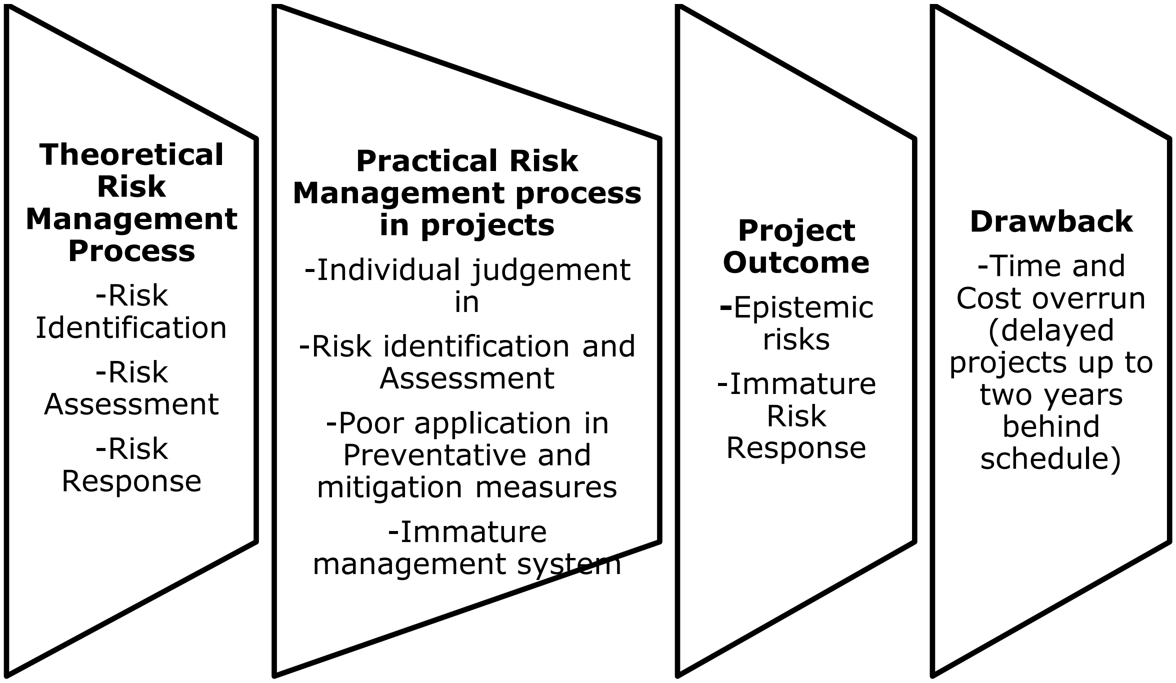

Figure 5.8: Unstructured Risk Management Practice in the field

As shown in Figure (5.8). A review of the case study companies' documentation revealed that the construction companies were only able to provide a weak risk response in project delays. There was no evidence of any clear organisational directive and the necessary supporting risk response process within mature systems or models. In essence, the traditional type of management used to control delay risks in projects was dominant, since the effort to exercise such control was characterised by simply extending the timeframe of the projects, without consideration of the risk response effectiveness.

Many practitioners were seen to control their projects risks by individual judgment that determined the risk management system, resulted in poor KSFs of preventative and mitigation measures, and an overall immature management system. These types of practice were evident irrespective of whether there was a practical risk management process, thereby highlighting that managers acted in a more or less subconscious way in their risk identification and assessment. Basically, the risk management process appeared as an unplanned activity within the general construction process.

Table 5.14: A Summary of Case studies

Description	**Case A**	**Case B**	**Case C**	**Case D**	**Case E**	**Case F**
Number of interviews	2	2	3	1	1	1
Delays factors	Change order by client Weather	Lack of site manage me-nt by Project manager	Change order by client Municipali-ty approval delay	Delay of material by Sub-contractor Inadequate site manageme nt by PM	Difficult access to site (site mis-managemen -t)	Electricity and Power supply by authority
Effect of delay	Time and cost overrun	Time and cost overrun	Time and Cost overrun	Time and cost overrun	Time and cost overrun	Time and cost overrun
Traditional Risk Response	Reduction and Acceptance	Avoidanc e	Reduction	Acceptance and avoidance	Reduction	Reduction
KSFs of Preventative measures	None	None	None	Lesson learned (not used) Risk manageme nt training (ineffective because of inefficient trainers)	Project team performance in risk definition	Lesson learned practical use
KSFs of Mitigation measures	Change Request Manageme-nt Overlapping Activities-Contingenc-y Plan for any new risk Item	Continge nc-y plan for design change	Contingenc -y Plan for any new risk Item	Delay Analysis Template	optimal resources allocation plan	Contingen -cy Plan for any new risk Item
PMMM level of Risk response	Level 2	Level 2	Level 1 and 2	Level 1 and 2	Level 2 and 3	Level 3

As shown in Table 5.14, in all cases (A,B,C,D,E and F) presented in Chapter Four have been summerised in Table (5.14) that attempts to control delays were made using the traditional approach, detailed work plans, and individual judgment by project managers, managers and contractors, all of which affect time and cost.

Additionally, the practice in all the six case studies was to measure risks as they arose. It was rare to see the formulation of any mitigation strategies in the determination of contingency plans for the future, or indeed of informal gatherings to even discuss strategies for dealing with risk events. No formal Risk Management plan existed because the documents necessary to consult in this respect were also not in existence, and no attempts were made to foresee potential problems in the long term. It was only in respect of near-term risks associated with larger projects that contingency plans were drawn up.

Hence, projects are always behind schedule thereby resulting in 90% of original decisions made subsequently being inappropriate. The interviewees in the case studies identified their risk response as conforming to the reduction, avoidance, and/or acceptance types, and with each type it was found that cost and time overrun were features of the projects and that sometimes this led to a drop in quality. Moreover, the interviewees related that unexpected risks had emerged that could not be identified, assessed and responded to properly.

It was clear that the interviewees in each case study were aware that many of the staff in their organisations believed the risk response of management to be ineffective and needed to be developed. Indeed, many staff were said to be insisting on improvements. However, whilst one mechanism for organisational change is initiative, it was said that this was not visible to the project team or the stakeholders because senior management simply do not encourage this among their workforce. Consequently, there are no attempts to solve the problems that arise.

Further discussion with the interviewees confirmed that 'maturity' should be the next option for delays control. In fact, the interviewees were united in this opinion showing their belief in the concept of risk response development by the maturity model. However, the KSFs of preventative and mitigation measures will not be effective unless the need to make improvements is taken on board by the company management system. And it is clear that the overall agreed level of maturity required was not evident in the practice adopted by the case study companies, since Case A and Case B were classified as high-risk projects, they were running behind schedule and had experienced re-scheduling three separate times, therefore being perceived as unsuccessful projects, poor in defining the KSF of preventative and mitigation measures, and showing a poor maturity level in their risk response. Case C was clearly established in the pre-construction stage but not effective in its communication and representation between the client and end user. The project had been classified as a simple unexpected risk project, and the formulation of contingency plans for the future was infrequent, and there were no informal strategies in place to deal with (foresee) the risk events. In Case D, the company possesses the Delay Analysis Template as one KSF of mitigation measures for risk response. However, since there had been no development on the way, the template was neglected, and the 'maturity' level test showed low levels of maturity within the company strategy in mitigation risks. The interview assessment was conducted in a similar manner in Case E and F, which provided examples of good risk response process practice. For example, Case study F had tailored organisational standards and processes. The KSFs of preventative measures in respect of the lesson learned was identified in practical use. In addition, the contingency plan for any new risk item was well established as a KSF of mitigation measures, and the regular use of templates shaped the company in level 3 (the maturity level for risk response development).

In Chapter Six, there is further discussion to verify the levels of maturity in PMMM for risk response development. Thereafter, a model for risk response development is outlined.

5.3 Chapter Summary

In this chapter, the results obtained from the data have been reviewed. Quantitative analysis of descriptions in delays factors that affect time and cost for construction projects, and key success factors (KSFs) in preventative and mitigation measures for risk response practices was undertaken, and ANOVA was used to allow for the identification of variations in practice among the professionals in the sample, thereby determining where the risk response in construction projects delays can be improved, and thereby where overall improvement in the field can be expected. Feedback of a qualitative nature from the practitioners in the case study companies helped to support the data obtained from the quantitative results presented by the questionnaire, and ultimately to answer the research questions.

The next chapter, Chapter Six will explicitly discuss the entire research outcomes, and outline a model for risk response development.

Chapter Six

Discussion

6.0 Discussion of the Results

This study has focused on the development of risk response for construction projects delays in the United Arab Emirates, and has specifically concentrated on the delay risks that mainly affect time and cost since costs associated with delay risks in construction projects in the UAE have reached $767billion, and 60% of all such projects are on hold as a result of the recession. The choice of the UAE was made because of the territory's strategic location in the region and the fact that the revenue from construction projects contributes more than 14% of the gross domestic product (GDP).

In the UAE, the undesirable impact associated with delay risks has been attributed to two factors, these being: 1) limited research, and 2) traditional management used by construction companies. However, the global financial crisis of 2008-9 was (and remains) a major delays risk, and little understanding has emerged as yet of the extent of the influence occasioned by the financial crisis, on the delays experienced in projects. At the same time, it can be said that few studies in construction management have concerned themselves with exploring how a more developed approach to project risk management, rather than the traditional one, could be more valuable. Hence, the significance of this research lies in the fact that the findings could be used to increase the control of delay risks, thereby generating greater value for the country and the region.

Risk response process is critical in construction projects management and risk management, and this study has addressed several issues in this field which are embodied in the research objectives in order to find answers to the particular research questions raised.

- The **first objective** was to undertake a critical literature review that explored the importance of risk management theory in project success as identified by the Association of Project Management (APM), and the Project Management Institute (PMI). In total, 39 research studies were reviewed in which the causes of delay risks were identified and the measures for delay risks control (MDRC) that have traditionally been used, were considered. In 34 of these studies, the limitations of this approach to delays control were also highlighted. The cyclical nature of the MDRC as shown in the existing research, is characterised by traditional management approaches, with the main focus being on the theoretical impacts upon projects rather than on the practical risk response. In addition, the MDRC cited in previous studies were not properly validated because only traditional management approaches that do not involve the use of a maturity level scale, were used. The concept of 'maturity' in this concept is, however, found to have the potential to create the essential conditions for optimal risk response in respect of the identification and assessment of risks, and therefore, the literature was reviewed quite specifically for contributions under the umbrella of 'maturity' since such an approach allows managers to determine whether a risk has changed in nature, increased or decreased.

- An empirical investigation into delays factors that have affected time and cost in construction projects in the UAE post the financial crisis was conducted. Prior to undertaking that investigation, the researcher analysed the questionnaire to ensure that the informants' backgrounds were suitable to answer the questions being posed. From the results, the researcher found that the sample of respondents was restricted to Dubai and Abu Dhabi Emirates, with 87 of the 200 respondents (85.29%) coming from Abu Dhabi Emirate (the Capital), and 15 respondents (14.71%) respondents from Dubai Emirate. The project managers, contractors, consultants and others who participated numbered 37, 16, 23, and 26 respectively. The respondents came from different sectors within the construction industry as follows: 16 (15.7%/) Governmental organisations, 43 (42.2%) Private Consultancy Companies, 9 (8.8%) Private Construction Companies, 31 (30.4%) Private Contracting

Companies, and 3 (2.9%) Developers and Financier organisations. The companies were also classified by their turnover as small/medium-sized, or large sized and in this respect, 15 (15.2%) respondents worked for small or medium-sized companies (with turnover less than $5 million), whilst the remaining 84 (84.8%) respondents worked for large-sized companies (with turnover more than $5 million). It is also noticeable that more than 50% of all respondents with experience between 5-10 years only, were involved in many types of construction projects, more than 40% being infrastructure projects. This diversity of respondents resulting from company type, company size, and experience of different kinds of project, reflects the fact that the construction projects companies involved have the facilities to undertake different types of project and particularly that they are capable of working on civil engineering and infrastructure projects. Indeed, the UAE is considered to be the most developed country in the Gulf area by 2020 and consequently, the potential for infrastructure projects is high. Nonetheless, it was revealed in the findings that 46 factors are known to exist that influence on-time completion, and completion within budget, and hence, more motivation is required in the risk management area to address these problems.

- Surprisingly, the top factors seem to be related to the client and financial groups. The current analysis of the professional groups of respondents showed no significant difference (full agreement) between the groups in the identification and assessment of delays factors influencing project completion. Change orders, and slow-decision making by the client ranked the 1st and 2nd factors, and fund approval delay, the client's financial difficulties, and contractor payments (delayed approval) related to the financial group, ranked 3rd, 4th, and 5th. The inaccurate time estimation by the project manager shared the 5th rank with the financial problem in contractor payments (delayed approval). Returning to the financial effect, the developer's financial difficulties resulting from the effect of the crisis, came in the 7th rank. The contractor then appeared in the 8th position by virtue of his late delivery of materials, and then the 9th rank was taken by late approval starting/completion certificate. This particular problem, occasioned by the government authority, is categorised as 'unforeseen'. The consultant and contractor shared the 10th rank, in respect of poor design and/or delays in the design, and dedication/reliability of sub-contractors. From 12th to 15th factors, there are: difficulties in the supply of electricity and water (unforeseen), unqualified project managers (project manager), unreasonable constraint by the client (client), and increased cost of materials. The 16th delay factor was shared by the client and related to lack of capability of the client's representative, and the project manager in terms of lack of team communication/co-ordination, and by the consultant in terms of a slow response and poor inspection. The last two top delay factors (19th) and

(20th) are related to the project manager in terms of poor site management and supervision, and incompetent project team.

- There are also new top delays factors like late approval starting/completion certificate, poor design and delays in design, poor dedication/reliability of sub-contractors, difficulties in supply of electricity and water, unqualified project managers, increased cost of materials, lack of team communication/ co-ordination, and slow response and poor inspection by consultants. These factors are seen to occupy the 9th, 10th, 10th, 12th, 13th, 15th and 16th, and 16th ranks. The achievement of the **first objective** enabled the researcher to answer the first research question: *do construction organisations identify and assess delays factors that affect time and cost at any stage of the project life cycle post the financial crisis in the UAE?*

- Given that two similar studies have been conducted in the UAE construction industry (Faridi and El-Sayegh, 2006, Motaleb and Kishk, 2010), a comparison between the results obtained by those researchers and the current study was made, and the results are included in Table 6.1.

Table 6.1: Ranking Comparison of Factors Causing Delays -2013, 2010 and 2006

Group	Delays Factor	2013 RANK	2010 RANK	2006 RANK
Client	Change orders	1st	1st	27th
Client	Slow decision-making by client	2nd	3rd	---
Financial	Fund approval delay	3rd	---	---
Financial	Client's financial difficulties	4th	13th	10th
Financial	Contractor payment (delayed approval)	5th	---	---
PM	Inaccurate time estimating	5th	8th	---
Financial	Developer financial difficulties - crisis effect	7th	---	---
Contractor	Late delivery of materials	8th	9th	6th
Unforeseen	Late approval starting/completion certificate	9th	---	---
Consultant	Poor design and delays in design	10th	---	---
Contractors	Dedication/reliability of sub-contractors	10th	---	---
Unforeseen	Difficulties in supply of electricity and water	12th	---	---
PM	Unqualified project managers	13th	---	---
Client	Unreasonable constraint by client	14th	14th	17th
Unforeseen	Increased cost of materials	15th	---	---
Client	Lack of capability of client representative	16th	2nd	2nd
PM	Lack of team communication/co-ordination	16th	---	---
Consultant	Slow response and poor inspection by consultants	16th	---	---
PM	Poor site management and supervision	19th	5th	19th

- Hence, within Table 6.1, the top 15 factors causing delay in the current study, and in studies carried out in 2010 and 2006 are summarised. From Table 6.1 it can be seen that eight of the top factors identified in this study were also reported in 2010, but that only six were reported in 2006. Apart from change orders by the client, ranked 1st in both studies in 2013 and 2010, the ranking order of all other common factors changed. The 'change orders' factor has moved considerably, from 27th place in 2006 to become the most important factor in 2010 and 2013. This is followed by the client's financial difficulties, which moved up from 10th (2006) and 13th (2010), places to be the 4th in 2013. However, the UAE was able to recover in 2010 particularly DUBAI due to the sharp rise in oil prices which helped to solve the debt problem, and enabled the UAE to show the fastest recovery of all nations. In addition, Abu Dhabi helped Dubai by providing $10 billion to support its economy at the start of the crisis and then subsequently increased this amount to a total of $20 billion in the aftermath of the crises. Late delivery of materials moved up two places from 2010 to be the 8th factor in 2013 but moved down by two place from 2006. Inaccurate time estimating was is exclusively in study 2010 and 2013, moved up by three places in 2013. Unreasonable constraint by client, however, moved up the list two places from 2006 and by zero place (stays the same) from the 2010 study. Surprisingly, lack of capability of the client representative moved down from the 2nd

order in 2010 and 2006, to the 16th in 2013. Poor site management and supervision is irregular, moving down the list by fourteen places from 2010 and no change from 19th order in 2006 to 2013. The remaining factors like fund approval delay, contractor payment (delayed approval), and developer financial difficulties due to the crisis effect, were not applicable in either of the earlier studies, yet they ranked 3rd, 5th, and 7th respectively in the current study. This is understandable, and in fact, many financial factors are featured in this study since the period of investigation is after the recent financial crisis and the same challenges were not present earlier.

- The **second objective** of the study was designed to answer the second research question**,** that being: *do construction organisations identify any key success factors (KSFs) of preventative and mitigation measures for risk respond development for construction project delays?* In order to pursue this objective, the practitioners/respondents were invited to provide the most effective key success factors (KSFs) of preventative and mitigation measures from their experience.

As mentioned earlier, it is important to be aware of the KSFs of preventative and mitigation measures for risk response development in order to deliver projects on time and cost-effectively. These measures provide an appropriate scale for developing construction projects and ensuring their success. As seen from the data analysis, mature practice can be developed and found in preventative measures, and the improvements are identified as being in the following top 16 KSFs of *Preventative Measures* out of 22 (see Table 5.8), the most significant are: *Anticipate risk (identification),Technology Utilisation, Planners' knowledge for effective risk plan, Funds-budget management by experience personnel,* Cash flow *management, Municipality process for new design approval (governmental issue), Project crisis programme (financial crisis).*

Implicitly, these findings indicate the improvements in the connection between the delay factor and the KSFs of preventative measures for risk response development. For examples, the delay risks placed in the top rankings relate strongly to the client and the financial group, being ranked in the 1st and 2nd places. When the KSFs of preventative measures were investigated for the suitability towards the delay factors control, it was found that senior management lacked in its ability to support effective project delivery by not anticipating the risk, as for example in respect of change orders, and the time taken for decision-making. Consequently, a need was seen to provide effective risk management training and regular updating for senior managers in order to respond appropriately.

Additionally, the prevalence of inaccurate time estimation which featured as one of the delays factors, requires that project managers are provided with particular tools, technology, and performance techniques, and that they are trained in project risk planning and possess the appropriate knowledge to improve their project management. Only when the project managers themselves possess these skills and abilities, can the skills of the labourers under their control be effectively utilised.

- The presence of a project crisis programme (financial crisis), in which Bidding re-analysis and appraisal of the Contract performance take place, can improve the delays factors related to the financial group, such as fund approval, client's financial difficulties, and contractor payment by banks.
- Finally, the KSFs of the municipality's process for new design approval can assist in issuing on-time certificates. However, it was noticed by the respondents' comments that there was limited understanding of the KSFs of preventative measures, and this may be the reason behind the lack of project team productivity. Consequently, there appeared to be a need to re-examine the effectiveness of team training, and the amount of knowledge possessed concerning the civil code of the country especially since foreigners comprise the dominant workforce in the UAE construction industry.
- These steps should be taken in addition to support the financial crisis programme if exists, and the associated decision support system for the future. Furthermore, according to the respondents' comments, there is an immature risk response in many construction companies, although

fortunately, in a small number of high scale companies, this is seen as being stable. Clearly, progression to a mature risk response can only occur when the KSFs of preventative measures are developed and satisfied by the project stakeholders.

- Six real case studies have been explored in three high scale companies, and the survey revealed that Cases A, B and C did not use any KSFs of preventative measures. Case D was seen to possess the Lesson Learned template and to conduct Risk Management training, but the Lesson Learned template was not used and the Risk Management training was ineffective because of the lack of competence of the trainer. Case E was able to demonstrate experienced Project Team performance as a KSF for preventative measures, and Case F did consider the Lesson Learned in its practical activities. Clearly, there is still much work that can be done by these case study organisations to improve their approach to delays risk management.
- The results obtained in respect of the KSFs of *Mitigation Measures* showed that a gap between what is advocated in the literature and what is happening in the field. However, the top ten KSFs of mitigation measures for risk response development that are useful during the construction stage are identified. They are ranked as follows: Lesson learned practical use - 1st, Co-ordination with sub-contractors development - 2nd, Optimal risk allocation plan - 3rd, Project team productivity optimization - 4th,

Change request management -5th, Contingency plan for each new risk item - 6th , Delay analysis template - 7th, Supervision for risk identification - 8th, New risks reviews (update) in the risk plan - 9th, and Overlapping activities management - 10th. These top KSFs of mitigation measures have been considered as appropriate for risk response development, although only four of these are addressed in the literature, these being: Contingency plan for each new risk item, Change request management, Delay analysis template, and Overlapping activities. That said, there was an attempt to measure the actual gap between theory and practice in those companies that have risk management in their management system. In this effort, the respondents demonstrated their own background knowledge and experience. It is clear that there is a difference practice for each project and partial agreement between the respondents (Project managers, Contractors, Consultants, and others) in their prioritisation of the KSFs of mitigation measures that they have implemented recently in the case study companies to achieve on-time project completion, and hence, avoid the risk of delays. Commonly, the way in which risk is responded to is different, and relies on informal identification and assessment processes in as traditional management, but in those companies that do not have risk management systems or no documented management systems, the gap between theory and practice in the risk response process is large. The outcomes of the survey (questionnaire and case studies) are appropriate to the study's hypotheses. Not surprisingly, mitigation measures can be the driver for the risk response process, and this is highlighted in the testing of the hypothesis that shows no significant difference between the groups of respondents (project managers, contractors, consultants, and others) in the degree of importance they place upon particular KSFs of mitigation measures for risk response (questionnaire survey) except in the 'supervision for risk identification'. A multiple comparison was used to further discover which pair of groups differ in respect of 'supervision for risk identification', and the finding was that there was a clear significant difference between the consultants and the contractors, and between the consultant and the others. Therefore, the supervision for risk identification was fully accepted by the project manager, thereby indicating as it is considered an important factor for mitigation measure success.

- **The third objective** of the research was to identify the priority of stakeholder capability for handling risk response development. In this matter, the study revealed that professionals in the field of project management were considered as being more important than any other stakeholders in handling the complexities of risk response development. In this respect, more than 50% of respondents agreed on the need for the assistance of Expert Project Managers in the development of the response to control delay risks. After prioritising the need for such experts, the respondents believed that Clients, Construction Managers and others came next in the order of importance in handing the risk response development.

- At the same time, 40% of respondents agreed on the need for a strong contribution by Consultants, Construction Managers, and Trained Project Managers in risk response development.
- As discussed previously, the risk response should be scaled in 'maturity' in order to make effective and efficient decisions regarding a project, and to do so with a full appreciation of the impact of those decisions on other projects. Associated with this aspect which are formulated to allow for an answer to the last research question to be found. This question is: *do construction organisations use any 'Maturity' model to measure the levels of risk response development?*
- The individuals involved in the six case studies were categorised according to their approach to risk management, respective projects, and years of experience (more than 20 years in project management) in the Gulf, whereas the questionnaire respondents' years of experience ranged between 5 to 10 years.

6.1 Development of the Risk Response Model

The **fourth objective** of the research is addressed in this section, which shows the development of the Risk Response Model. In Figure 6.1 certain KSFs of the mitigation measures as identified from the six case studies, have been identified as useful connections to the project maturity model (PMMM) for risk response development. These additions are proposed on the grounds that the interviewees do not believe that benefits will ensue from using the traditional risk management system for the risk response process unless that system is developed to include new measures. The interviewees emphasised that they struggle in terms of training individuals and groups in the theory and practice of risk management, since their companies invite trainers who only possess theoretical understanding, and who consequently have very limited knowledge of how to actually control real-life projects. This overall problem helps to foster the agreement among the stakeholders in the six case studies in respect of the need to improve risk response within PMMM. Implicitly, the findings indicate the belief that improvements in risk response will result from the implementation of the KSFs of mitigation measures (see hypotheses outcomes, Figure 6.1).

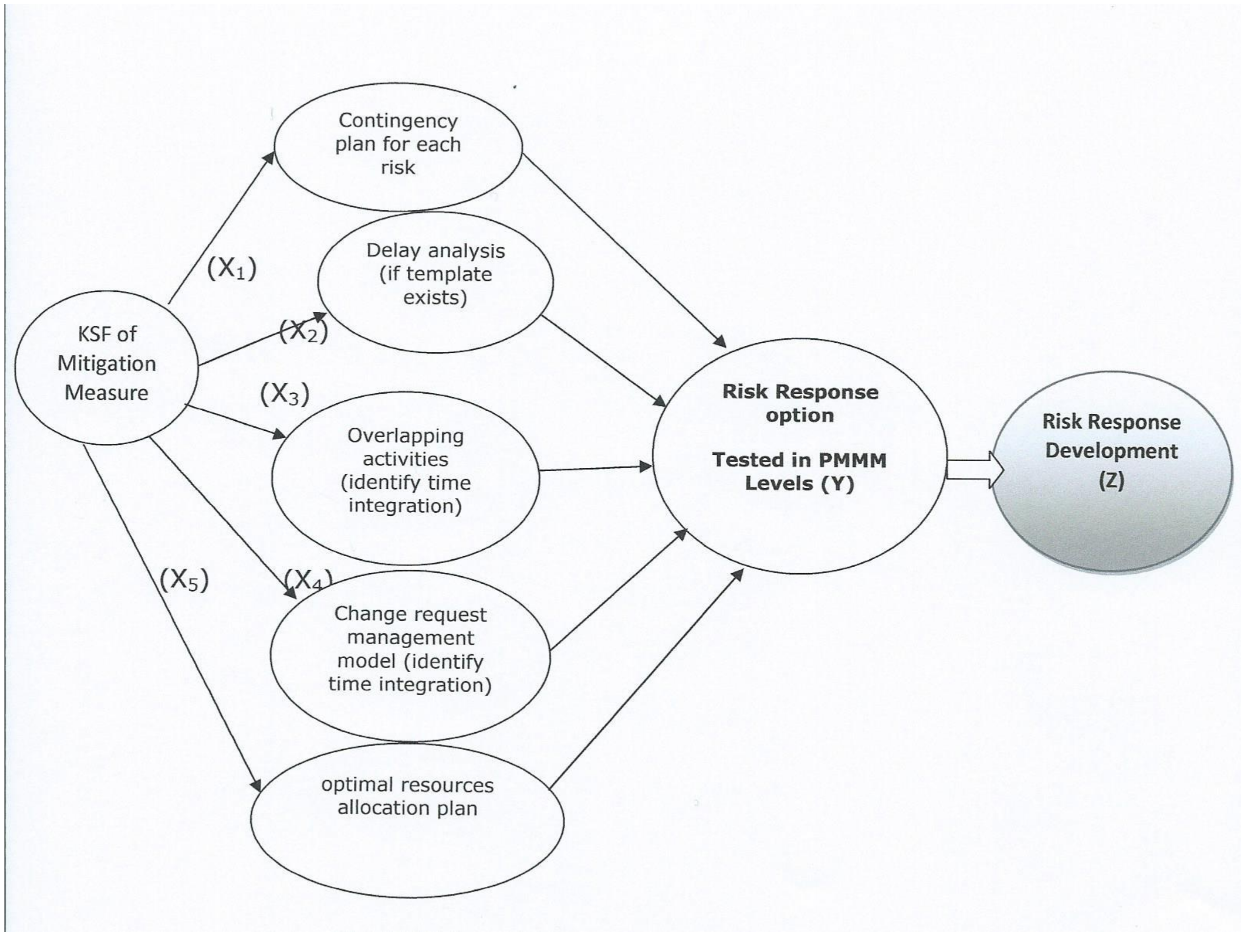

Figure 6.1: Hypotheses of Mitigation Measures and Maturity levels in PMMM for Risk Response Development

Evidence was clear during the interviews with the case study companies' personnel that model development was indeed necessary, since when asked 'What level of maturity do you implement?' the interviewees replied to the effect that the maturity was at levels 1 and 2 only. For example, Case Study Organisation A has informal gatherings to discuss the strategies to deal with the risk events (level 2), contingency plans for near-term risks, and mitigation strategies only for larger projects (level 2), applying three types of KSFs of mitigation measures for risk response (the Change Request Management (X_4), Overlapping Activities (X_3), and Contingency Plan for any new risk item(X_1)). Case Study Organisation B applies a Contingency plan for any new risk item (X_1) for design change (plan B) and as planned this should be should be provided on time, but it does not reach the satisfied maturation level in PMMM, since it is only for larger projects that a Contingency plan for near-term risks and mitigation strategies is provided (level 2). At the same time, in Case Study Organisation C, while a Contingency Plan for any new risk item(X_1) has been considered for risk response, scaling by determination of contingency plans for the future is infrequent (level 1), and there are only informal strategies in place to deal with (foresee) the risk events (level 2). In Case Study Organisation D, risks are measured as they arise (level 1) and determination of mitigation strategies or contingency plans for the future is seldom (level 1), informal gatherings are held to consider strategies to deal with the risk events (level 2), there is a Risk Management plan that documents the procedures to manage risks (level 2), contingency plans for near-term risks and mitigation strategies exist only for larger projects (level 2), and the Delay Analysis Template (X_2) is applied as a KSFs of mitigation measures for risk response. In Case Study Organisation E, the Optimal Resources Allocation plan (X_5) is identified as one of the KSFs of mitigation measures, the risk response option is classified in PMMM by the Risk management plan that documents applicable procedures to manage risk (level 2), and identifies each risk and mitigation strategy (level 3). In the last Case study, Organisation F, the risk response is characterised by: Regular use of templates (level 3) and Identify Contingency plans and mitigation strategies for each risk item (level 2), using Contingency Plan for any new risk Item (X_1) as a KSF of mitigation measures. As a result, in terms of the way forward for the six case study organisations, the risk response in Cases A, B and C should focus on the key process at level 3 and identify any issues not addressed by the previous maturity level. In Cases A and B, the problem identified was extremely sensitive because the re-work on site was required half-way through the construction stage, having been made necessary because of the sewerage line that was obstructed by those villas that had already been erected. In this case, the drain work being undertaken was so close to the villas that the villa owners complained and resisted the ongoing site work. The risk response problem was related to poor Change Request Management, inadequate Overlapping Activities, and incomplete Contingency Plan.

In the examples of Cases C and D, levels 1 and 2 must be performed adequately. Consequently, there is a possibility of amendments to the critical path and the potential for using a complete Contingency Plan and Delay Analysis Template as KSFs of mitigation measures. Case Studies E and F are characterised by more stability in risk response maturation. Case

Study Organisation E used the Optimal Resources Allocation plan, and it is in level 2 of the Risk Management plan that documents applicable procedures to manage risk. Fortunately, the risk response reached level 3 in PMMM by the identification of each risk and mitigation strategy. In Case Study Organisation F, a Contingency Plan for any new risk item was used wisely by the project manager to catch up on the completion date of the project. In this respect the risk response process involved the regular use of templates, showing the acquisition of level 3 in the PMMM and reflecting the capability of the organisation to capture and share the best practice in risk management. However, when identifying the Contingency Plan, the mitigation strategies for each risk item (level 2) were not fully addressed.

The null hypothesis expressed in Figure 6.1 was not rejected by the interviewees in the six case studies, since they did appreciate the important connection between the KSFs of mitigation measures and PMMM levels for risk response development. So, the step in Figure 6.1 assists in the risk response process improvement that is based on many evolutionary steps. The PMMM model organises these evolutionary steps into maturity levels that lay a successive foundation for the risk response process. Each maturity level comprises one or more goal. The PMMM is depicted in Crawford's (2006) model, and connected to five of the KSFs mitigation measures for risk response by the hypotheses in Figure 6.1. Considering any project organisation at one level of maturity in the six case studies, an assessment is made to establish which level of maturity it has reached. Then, there is a need to focus on the key processes at the next level. It is important to note that risk response development is still being researched, and that the fundamental concept being explored is that borrowed from Crawford (2006). The characteristics of the risk response process at levels 1 and 2 have been investigated in the six case studies. However, the characteristics at levels 3, 4 and 5 are based on Crawford (2006).

The case study findings were put to the project managers' panel, and the panel members found great potential for risk response development by using the maturity model as illustrated in Figure (6.2).

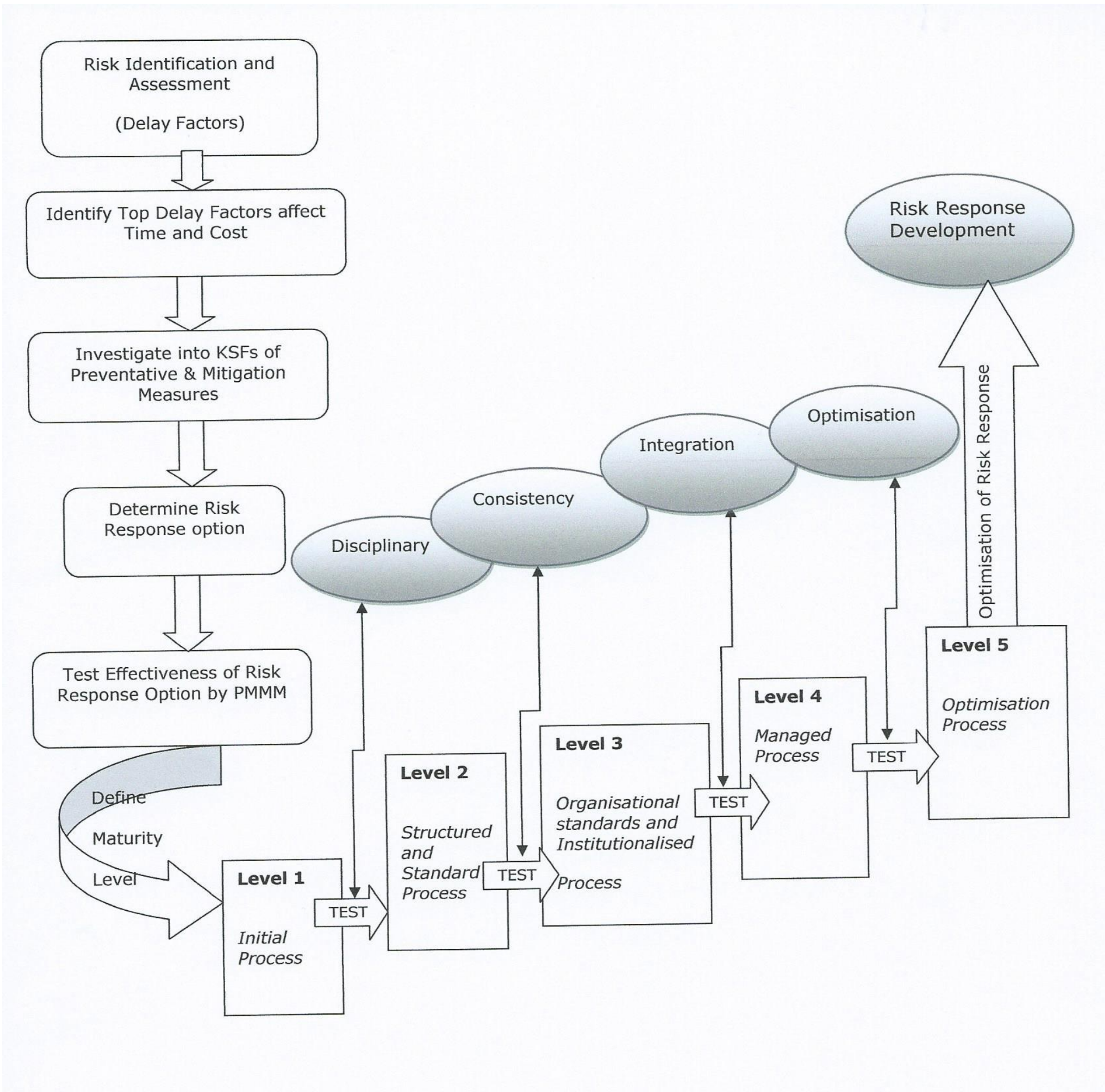

Figure 6.2: A Model of Risk Response Development

As shown in Figure (6.2), the first step is to identify the most significant factors related to delays risk, and this identification should be performed by the expert project manager together with the project team. At the same time, however, consideration should be taken of the views of other stakeholders in the construction project, like the client, end user, contractors, consultants, and developers. When the top factors potentially causing delay are decided upon, risk analysis techniques should be implemented in order to properly assess the risks involved. The most important step is to consider the KSFs of preventative and mitigation measures applicable to the project. KSFs that are not appropriate should not be considered for financial reason. Once this process is completed, the risk response option is determined and it should then be tested for effective outcomes.

Having proceeded through these essential steps, the model then moves to become involved in risk response activation, developing into the "*MATURITY*" levels. The risk response option identifies the five levels in the maturity model in the construction stage in the *Disciplinary, Consistency, Integration,* and *Optimisation* dimensions. In the Initial level**, level 1**, it is noticeable that in most case studies there is no *Disciplinary* dimension and hence, risks are not predicted and merely receive evaluation as they arise. Ineffective contingency planning and poor co-ordination was seen to undermine the organisations' good practice. This lack of discipline resulted from the incapability of the risk response process in this level. In fact, performance in the process was seen to depend upon individual judgment rather than teamwork within the organisation. **At level 2**, inconsistency was apparent at the beginning of the level test, although there was a degree of discipline in respect of managing the risk which had come through during the transition from the previous level. For example, there was a contingency plan for the short term and a risk response that was traditionally found in reduction, avoidance or acceptance. A major objective of level 2 should be to achieve consistency through a formal gathering of risk events that allows for managers to structure a risk response process of an appropriate standard within the organisation. There should not be any move to level 3 unless this stage of the process has been achieved since the presence of such *Consistency* and an indication of standards is necessary to guide project managers to make realistic decisions taking into account the time and cost of risk response options. So, at this level standards are defined and the structure of the process is faithfully identified. Therefore, **at level 3**, *Integration* of organisational standards and the process of institutionalisation should appear, and all projects should be using templates effectively and identifying the mitigation strategies in respect of each risk identified in level 2. This process allows for all risks to be properly tracked. The outcome of effectiveness at this level is that no more obstacles are present when the risk response reaches **level 4**, at which point, time, finance/accounting, cost, and strategic planning and processes are properly managed, and the risk response performance of projects is controlled and maintained within acceptable boundaries. At **level 5** the risk response starts on the road to

Optimisation by focusing on the continuous process improvements. The risk response is evaluated to prevent risk management defects and lessons learned documentation that achieves risk response development is communicated to other projects. As a result, the model is developed based on live case studies in practice as shown in Figure 6.2. To sum up, the *MODEL* for risk response development is important for any project in risk management. Risk identification (top delay factors) and assessment, identification of the KSFs of preventative and mitigation measures (top KSFs related to project case), risk response option and effectiveness, are the vital initial steps in the *MODEL*. The solid steps should be followed in the maturity levels to test the risk response option, then the transition stages should be carefully carried out between the levels. Approaching the risk response development is the target.

6.2 The Risk Response Development Model in Practice

The implementation and acquisition of a new model in practice normally requires a huge effort from organisations because they deal with complex human and financial matters and may be working to tight schedules. Project management is well served in practice (APM, 2006). Any model should be committed to high performance project management and identified by a "fit-for-purpose" motivation. The first step is for project stakeholders to demonstrate the necessary competencies to use all of the required processes effectively (Motaleb and Kishk, 2013b), and this is extremely important since without such abilities, stakeholders will be unable to prevent the failure that occurs in project delivery when risks are not properly managed. So, it is necessary for stakeholders to possess the skills and to be highly trained in risk management. In practice, the *MODEL* of Risk Response Development will follow the PMBOK and APM knowledge. The initial process should be performed by defining the scope of the *RISK RESPONSE DEVELOMENT MODEL* to the project stakeholders, and then proceeding to the stages of planning, execution, monitoring, and evaluation as depicted in Figure 6.3.

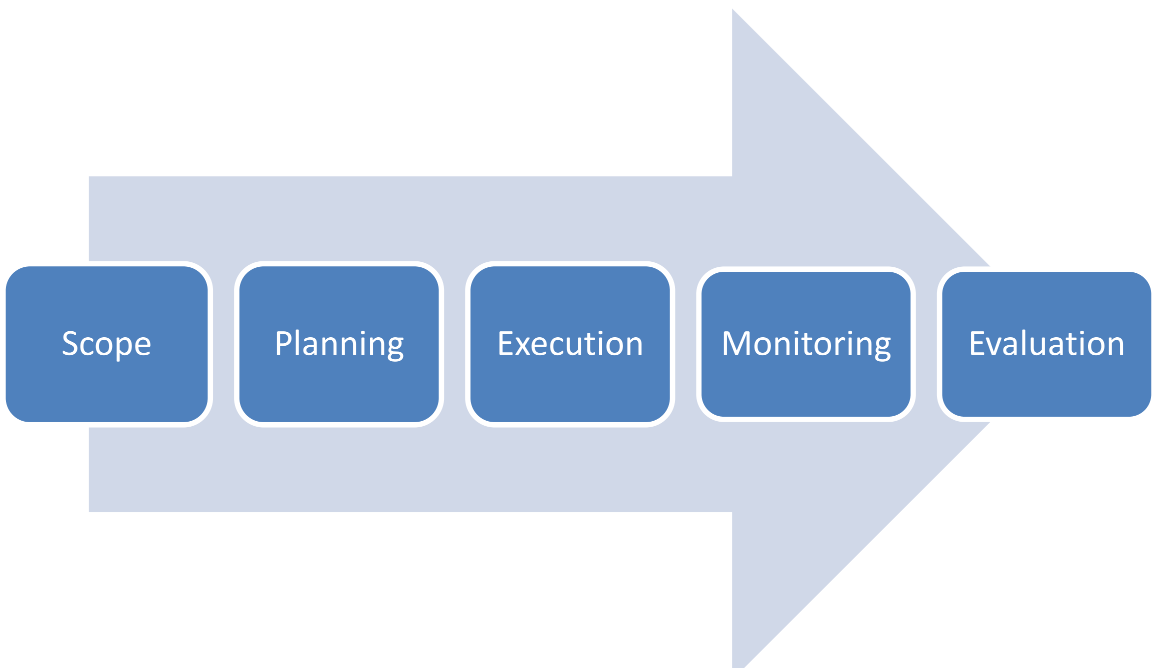

Figure 6.3: Processes within the Risk Response Model in practice

Within the Planning process that follows the Scoping activity, it is necessary to devise the Communication plan since the model will not function without effective communication. Once formulated, this Communication plan must be conveyed to all teams, staff, and stakeholders and it should include opportunities for regular updating of the project's progress. Communication begins with new workers on the project as they become involved after the required training, and continues through to performance management. All features of the work undertaken within the project should be positively reinforced in the various components of the model. For stakeholders, communication begins with the sharing of information such as risk management plans, and the construction project company budgets, and as part and parcel of these activities, there should be complete transparency such that all parties appreciate how the work actually gets completed. These are essential components in the model.

To implement/execute the *DEVELOPED MODEL* of *RISK RESPONSE*, the construction organisation must be resourced with teams that can operate effectively and in total alignment with the company strategy. These teams must possess the ability to achieve the outcomes which the model is capable of delivering in respect of risk response in practice. All team members must be well trained in applying the *DEVELOPED MODEL* and this implies being familiar with how to put the principles embodied in the model into practice, whilst following all the rules and regulations in force within the particular country/environment concerned. Teams, however, need supervision, and in order for construction organisations to be effective, they must place an emphasis on quality supervision by a skilled project manager. Hence, project managers must be capable of developing team spirit among workers, of managing teams so that the organisation's mission and values can be supported and upheld, and of directing the performance of teams so that they achieve all the planned activities. This demands that team members have the necessary technological and administrative support for success. Deliverables are produced from the various processes performed in the *DEVELOPED MODEL*.

Accountability for day-to-day operations, commitment, reports, and clear definitions of the roles and responsibilities of all team members and other stakeholders, will reinforce the implementation of the model, which should in itself be effectively monitored. Such monitoring must be part of the overall management strategy and must be performed because it can greatly assist in allowing the *DEVELOPED MODEL* to achieve its desired outcomes. Monitoring is an aspect of management performed throughout the implementation any model, and involves the evaluator/monitor in identifying what information needs to be collected, measuring performance, and distributing information about that performance, thus providing feedback on progress. Continuous monitoring gives managers valuable insight into the health of a model, identifying areas that may require special attention.

Evaluation is a recognised process that has received considerable attention in respect of how theoretical models actually work in practice. The mainstream position is that such evaluation emerges from monitoring, which in itself represents an ongoing process of data capture and analysis for the purpose of control. So, the evaluation process consists of periodic assessment for the purpose of determining what lessons can be learnt from the practice. In exploring this overall process further, it can be seen that the monitoring of a model has an internally-focused, management-driven emphasis on the *efficiency* of the model, whilst the evaluation of a model has an externally-focused, stakeholder-driven emphasis on the *effectiveness* of the model. However, the two aspects are usually seen as working in tandem, with monitoring and evaluation serving to support the implementation of a model. In respect of the proposed model, monitoring and evaluation will function to ensure a continuous process of risk management, thereby enabling overall objectives to be achieved, and overall levels of management skill to be improved.

6.3 Validation of the Model

Four professionals from the case study companies were interviewed to validate the research model. Three of these professionals were interviewed on a face-to-face basis, and the fourth interview was conducted by telephone. Each interview took an average of 65 minutes. The individuals involved were the same people who were previously involved in the six case studies. Their specific roles were as follows: Case Studies A and B - project office manager; Case Studies C, E and F – a project manager; Case Study D - a senior (regional) project manager. The interviews were structured in nature. The advantages and disadvantages of this type of interview have been discussed in the Research Methodology chapter, and as reported there, the structured interview was chosen for its greater suitability than other types (see Appendix C). During the interview which was intended to validate the results of the survey, the researcher discussed the results obtained with each interviewee with the intention of validating the model and determining its effect on the community in the future. In following this pattern, the interview process explored the strengths and weaknesses of the model as follows:

1- The interview was conducted with the Office Project Manager who was in charge of managing Case Studies A and B. After revising the details of the two case studies and consulting company documentation in order to complete any missing data, the outcome was shown to the Office Project Manager who agreed with what had been produced. The model was then introduced to the interviewee, and he was asked to give his viewpoint on the model. His answer regarding the potential of the model to be used in his company's risk response development was positive. He believed that it could be used but he also felt that the model required more work and that a team of individuals would need to be trained in order for the company to proceed to the higher levels of 'maturity' expressed within the model as the model itself presented very new approaches. The interviewee believed that companies within the UAE could overcome the problems in the initial and second levels of the maturity model and could identify the practical process better than the model currently used within his company. In this respect, he confirmed that there was no risk response plan, and that this represented an obstacle to effective projects risk management. He also believed that the model could improve the risk management for construction projects if the authority worked on a particular risk management manual to determine risk response process, and then developed it. The office project manager expressed the opinion that the model could be applied to both large and small projects and he was clear that the cost would not affect the resource system. He felt also that suggestions were needed as to how practical tests could be carried out, and that the model needed more investigation in the optimisation stage (the last transition stage in the model). In this respect, the interviewee felt it was important to conduct more practical research in the next few months to avoid any construction projects delays before EXPO 2020, since as host to this exhibition, the UAE was forecast to attract more than 30 million visitors by that date.

2- The Project Manager in Case Study C was interviewed for 70 minutes. He strongly agreed in respect of Question One, which asked whether the model could practically approach the risk response development for delays control in construction projects. He answered quite absolutely, saying 'Yes' the model could do this. The second question touched on the risk response in the model, and the interviewee was asked whether this differed from the theoretical process in his company. Again, the Project Manager answered 'Yes', and he pointed to the inconsistency in the company's process in gathering strategies to deal with the risk events. He indicated that the risk response may be of the avoidance or reduction type, dealing with the contracts on the basis of time extension, but he also said that there was no risk management plan that documented this type of risk response. Question Three asked the interviewee whether the 'maturity' model provided new knowledge for the wider audience in the UAE in respect of construction delays. He was confident in suggesting that it did, and again with Question Four, relating to the role of the model in improving the risk management within construction organisations in the UAE, the interviewee answered that the model had a positive role to play. Question Five asked whether the model might serve large and/or small projects and in response, the interviewee expressed the opinion that it could serve both. The sixth question was an open question enabling the interviewee to make any comments he wished that he believed might be helpful to the research. Surprisingly, the interviewee stressed the significance of the KSF of the preventative measures that should be applied in the pre-construction stage, despite the possibility that this step might be costly to the company. On this matter, he said "it is valuable towards the construction problems recently post the financial crisis". The interviewee also mentioned the difficulties and restrictions facing project managers in project planning costs through having to maximise the work hours in the field without any additional rewards. Additionally, he mentioned that the consultancy companies hired less expert designers and that there were restrictions on payments by the banks to the contractors. Consequently, he believed that the priorities in dealing with the problem used for the case within his company were to use the KSFs of mitigation measures in the delay analysis template, change request management, overlapping activities management, and lesson learned. He mentioned about the lesson learned from past projects and experience and the need to take these on board to maintain the relationship between the company and the end user, and between the contractor and the consultant too. There was full agreement about the risk response scale by PMMM levels, as the disciplinary dimension between level 1 and 2 was believed to be vital since all the companies in the UAE measured the risks as they arose and few were willing to develop contingency plans. The company was classified between levels 1 and 2 but it was intending to establish the standards and institutionalised process by level 3 and hopefully reach the integration transition level to enable time and cost management to be properly planned in a strategic way in the overall managed process in level 4. He said “The consistency in gathering the strategy is significant for this reputational company”. At the end of the interview the interviewee appreciated the significance of the research outcomes and the effective model. The interviewee recommended that training should be implemented for risk response knowledge, and should be supported by regulations in the country.

3- The Senior (regional) Project Manager in Case Study D was interviewed by telephone after the researcher sent the results of his company’s case study analysis and the model by e-mail for him to revise anything he believed was necessary, and to add any information which he thought had been omitted. The interview took 57 minutes. It was a very useful exercise because all the information was revised for reliability, some information was investigated for the second time, and some information in the extract sheet relating to the effects of delay was added. In this respect, the interviewee mentioned to the financial penalty being paid to the client as one issue arising from delays. Recovery progression and revised method statement were added in the traditional risk response column for delays control. Then, the interviewee was asked to consider the model according to the case study outcomes. As previously accepted by the researcher and the interviewee, the maturity level for the risk response scale should be established in order to trace the effectiveness of the risk response option and development. There was an agreement about levels 1 and 2 in the model since the risk in the initial process in level 1 was measured as it arose, but it was noticeable that there was a transition stage called the *Disciplinary* for the gathering of the strategies (there is a checklist) in the company to deal with the risk, meaning that the disciplinary stage affected the structure and the standard of the risk response process operated by the company. As a result, the company can potentially reach level 3 and introduce organisational standards if *Consistency* is tested practically. The researcher then asked the interviewee to discuss the interview questions to obtain detailed answers. The interviewee honestly evaluated the model suggesting that the risk response development in terms of identification and assessment could be achieved, and he agreed that the idea of the KSFs of preventative and mitigation measures was desirable, but in terms of the 'maturity' aspects of the model, he was unsure of the potential for the model's practical application in the UAE. In this respect he believed that there was a need for a great deal of work to convert the theoretical perspective provided by the model to practical application. Whilst being happy with the 'New Idea' in terms of its originality, he commented that "it looks like new knowledge and in order to judge the same, it is required to be applied for live projects". He added his belief that the model could improve the risk management within construction organisations in the UAE but that this would be subject to some practical format being developed. He expected that both large and small projects could benefit from the model but that usually the traditional method of analysis would be less costly for small projects, although he accepted that this would depend upon the financial situation and the turnover of the company. He recommended that a practical format be issued together with a checklist that could be used to test the levels.

4- The Project Manager who was dealing with Case Study E and F has been interviewed for one hour. The researcher reassured the traditional extract for the case study risk management and maturity test. The interviewee answered all the questions on the light of the presented research results. From the interviewee's experience, the KSFs of preventative measures were needed. For example, updating project management training, sharing high impact risks with other stakeholders, the municipality process for new design approval should be developed by the government, there should be better skills among the workforce, and better technology utilisation within the company. The interviewee also mentioned the great need for delay risk analysis as a KSF of mitigation measures, the use of the lessons learned from past experience, and the significant of good relationships with sub-contractors and their continuation with the company. However, he also felt that in order to develop the risk strategy, attention must be directed towards change request management, supervision of risk identification, new risk reviews in the risk plan, and the development of a contingency plan for each new risk. He considered the model as a practical tool that could be used, and regarded this as definitely different from the theoretical process. He acknowledged the maturity modeling as a means of handling the delays in the UAE and as providing new knowledge for a wider audience and professionals in the area. He also agreed on the effect of the model on the risk management as a whole and believed that the size of the projects could be accommodated by the model; hence it could be used with large or small ones. Additionally, the interviewee recommended the publication of a regulation book in the Emirate of Abu Dhabi for risk management and risk response to assist professionals in changing their traditional view of how to handle delay risks. He considered that using semi–permanent sub-contractors would enhance the organisational standard and institutionalisation process in level 3 in the maturity model for risk response development, and thereby allow the identification of an effective mitigation strategy. At the same time, the interviewee also appreciated the idea of consistency as a transitional step in the model, believing that this should be a focus of development in order to obtain integration of processes and to optimise the opportunity for risk response development.

6.4 Limitations of the Research

There were 2 main limitations encountered during the research. These are:

- Most construction companies in the UAE are still conservative about disseminating information to external agencies, and are often unwilling to provide data, and/or to meet with researchers. This situation might be enhanced because of the recent financial crisis, which has caused companies to guard their private information more carefully, believing that they need to keep certain details confidential. The effect of this belief filters down to individual managers who can be reluctant to divulge information for fear that this may affect their position in the company.
- Due to the distances between the seven emirates in the UAE, and the climatic and other logistical problems associated with a woman travelling, it was not possible to involve all emirates, and therefore, the focus is on two emirates only, these being Dubai and Abu Dhabi.

Chapter 7

Summary, Conclusion, Contribution, and Recommendations for Future Work

7.1 Summary

The aim of the research that underpins this thesis was to develop a model for effective risk response to help in controlling delay risks effects. An extended literature review has been carried out. Thirty nine research studies were critically reviewed to identify the causes of the delay risks (factors) in projects. Most of these factors have been affected by the recent financial crisis of 2008-2009. Then, measures for delay risks control that have traditionally been used were discussed and their limitations as shown in 34 of the studies were highlighted. Overall, the review allowed for a focus on the methodology used for identification, assessment, and for determining the effect of the control measure. Initial descriptive analysis was conducted to identify the knowledge gap in the literature review. The traditional criteria (time and cost) have been reviewed to establish whether a project has performed well or otherwise.

The greatest deficiencies in all published measures of delay risks control in construction projects are related to the lack of risk response development and appropriate measures (preventative/mitigating), within the risk management aspect of the project life-cycle. This is believed to be a crucial element which is overwhelmingly absent. Indeed, none of the studies explored from 2000 to the present time contribute anything to knowledge in this respect.

Surprisingly, there is another sizeable gap in knowledge, this relating to stakeholders' ability to manage identified risks and control their effects on time and cost. Only 0.09% of the studies surveyed mentioned this, and none were from the Middle East.

Measures cited in previous studies were not properly validated because only traditional management approaches, that do not involve the use of a maturity level scale, were used. Besides, there is only one model of maturity for risk response development and that is proposed by Crawford (2006). So, the literature has been narrowed to focus more on Project Risk Management and how it is influenced by 'maturity' in the risk response. Then, the Key Success Factors (KSFs) of preventative and mitigation measures related to the risk response development are partially identified in the literature and later in the survey (questionnaire). In fact, the literature review is successful in confirming the relationship between the delays control mechanisms and the risk response development. It does this firstly, by connecting the KSFs of preventative and mitigation measures and the delays factors for risk response, and secondly by connecting the risk response with a 'maturity' level to allow for the risk response development.

The revenue associated with construction projects in the UAE contributes more than 14% of the gross domestic product (GDP) and the strategic location in the region. It has been shown that as the UAE is the most developing country in the Gulf it is characterised by a very large number of construction projects, and that effective risk management has thus far been a challenge in this context as delays still occur that could be mitigated. Consequently, better use of project management knowledge and skills sets in construction projects should be made in order to bring about improvements in the risk response. If this were to occur, the social and economic life within the UAE would be enhanced. So, in order to identify the precise area that would benefit from risk response development, the research findings have been able to show:

Improvement in the risk response to construction project delays in the United Arab of Emirates (UAE) will only come about if there is a concerted effort from many different parties in construction organisations because within those organisations the traditional management practice prevails and this is ineffective in controlling delay risks.

The methods which are intended to control delays in construction projects rely only on the identification and assessment of risks, and it is rare that KSFs for any method or measure are seen. Additionally, there is no a manual for risk management for risk response in existence within the UAE with the exception of just one emirate.

However, the critical review revealed that the contribution of the risk response development model proposed by Crawford (2006) is significant as in attempting to apply this in the UAE, it has emerged that the new knowledge it is able to provide is available for a wider audience and professionals in the field.

Additionally, the known impacts of delay risks in the construction sector have been attributed to two factors, these being: limited research, and the traditional management approach used by construction companies that relies on experience and personal judgments of individuals. In addition, the traditional way of controlling risks is characterised by a lack of success in the risk response process and for this reason, it is not to be as regarded as the modern risk management approach, and in any way as best practice in the field.

The core value of any risk response strategy lies in its ability to handle the continuing risks, which in turn affect the construction project positioning. However, the global financial crisis of 2008-9 was (and remains) a major delay risk, and little understanding has emerged as yet of the extent of the influence occasioned by the financial crisis, on the delays experienced in projects.

A standard Likert-type questionnaire constructed with four sections was developed to collect the required data. 102 questionnaires out of 200 were scaled with Likert measurements and subjected to statistical analysis to determine the variable contribution in the outcome of this research. The questionnaire was pre-tested by three experts (a project manager in the governmental public sector, a consultant in the private sector, and a university associated professor in statistics) each of whom was asked for feedback in order to refine the instrument where necessary. This procedure was in accordance with the best practice advocated in the literature. Analysis of data was done in descriptive and one-way ANOVA F-tests analysis at 0.05 alpha levels. Case studies, sampling, and the validity and reliability of the research outcomes were discussed, and the findings were presented in Chapter Five.

The multiple case study approach used by the researcher in Chapter four has proved to be effective in allowing the overall study to claim validity because real-life projects were investigated. In approaching each case study organisation, the researcher indicated the purpose of the research and sought participation from the appropriate personnel in order to collect data from live or very recent projects. The review of the case studies conducted through the interviews, document analysis, and site visits, revealed the great potential for employing some KSFs of mitigation measures in the risk response development. It was believed that delays could be controlled by this approach. Consequently, convincing evidence relating to the ability of preventative and mitigation measures to minimise the effects of delay risks was produced to put to the case study organisations as a means of persuading developments in the company management system.

Typical findings, reported in Chapter Five, support the significance of the need for appropriate risk response. Fourty seven causes of delay risks have been highlighted. In addition, 22 KSFs of preventative measures and 15 KSFs of mitigation measures have been identified. Then informant's ranking of the 16 top KSFs of preventative and 10 KSFs of mitigation measures in order of the priority have been carried out. These measures are then considered in delays risk response development.

As a means of validating the outcomes, four professionals were selected from the six case studies and interviewed to ensure critical discussion of all the issues present in the questionnaire survey. It is believed, this model represents an innovative strategy for controlling construction projects delay.

7.2 Conclusions

Based on the research work, the following conclusions can be drawn:

An extended literature review of construction delay risk has been carried out. Previous attempts to identify and assess delay risk factors in the UAE construction industry is conducted with ineffective processes that not embrace proper risk response strategies for delay risks control. On-time completion since the financial crisis of 2008-9 has been negatively affected by factors relating to clients, and to financial aspects concerning clients and other stakeholders. This finding supports the outcome of previous research conducted by the researcher in 2010 and later published as a joint paper with her supervisor. It is clear from earlier research conducted in 2006 that changes in the top factors associated with delay risks in construction projects in the UAE have occurred. In addition, the cyclical nature of the measures of delay risk control (MDRC) as shown in the existing research, is characterised by traditional management approaches, with the main focus being on the theoretical impacts upon projects rather than on the practical risk response and validation. However, delay risk is critical in construction project management so the first objective is embodied in this research in order to find answers to the first question raised.

In pursuing the second objective, significant key success factors (KSFs) of preventative and mitigating measures have been identified. These measures provide an appropriate scale for developing construction projects and ensuring their success. It has been shown that mature practice can be developed and found in top preventative and mitigation measures, and the improvements can be identified. The significant gap between what is advocated in the literature and what is happening in the field has also been contrasted. Not surprisingly, mitigation measure in particular can be the driver for risk response process development.

The third objective has also been achieved. It has been revealed that professionals in the field of project management were considered as being more important than any other stakeholders in handling the complexities of risk response development. In this respect, more than 50% of respondents agreed on the need for the assistance of Expert Project Managers in the development of the response to control delay risks. After prioritising the need for such experts, the respondents believed that Clients, Construction Managers and others came next in the order of importance in handing the risk response development. At the same time, 40% of respondents agreed on the need for a strong contribution by Consultants, Construction Managers, and Trained Project managers in risk response development.

To achieve last objective, a risk response model to control delay risks has been outlined. The model can be used in construction companies with high turnover in the UAE. In this respect, the five levels of risk response maturity identify the KSFs of the mitigation measures in the *Disciplinary, Consistency, Integration,* and *Optimisation* dimensions throughout the model. Furthermore, the model can be considered as presenting new knowledge in a wider field since delay risks since the recent financial crisis of 2008-9 are common to many areas.

The model has been carefully validated, both theoretically and in practical terms, through the discussions with interviewees from the selected case studies. In all case, there was an agreement that will enable more effective mitigation strategy for delay risks control. The responsive risks by the model as agreed by the four interviewees will be determined before the negative impacts on construction stage. It is argued, the model will also enable the project stakeholders disputing to agree on unambiguous risk events at an earlier stage. In addition, certain barriers associated with ineffective risks response will certainly unavoidable without implementation a maturity model. Notably, achievements in KSFs of preventive and mitigation measures should be obliged in the model for successful, on-time project completion, and should be recognised and updated in the organisation management structure.

To format the test stage for the maturity levels (level 1 – level 5) at the transition stages (Disciplinary, Consistency, Integration, and Optimisation) is agreed to achieve the effectiveness for any further risk analysis. consequently, it pursues the transparency of the model for a specific risk event.

It is anticipated that by developing the risk response model, the process itself will be more objective, particularly in delay risks control. This research produces new knowledge that makes an important contribution in the risk response realisation in construction projects in the UAE.

7.3 Contribution to Knowledge and Achievements

Recently, there have been some large disagreements occurring between construction project stakeholders in the UAE, in achieving a fair resolution in respect of incomplete/on-hold projects/delayed projects still persist. In an effort to address this problem, the researcher has carried out an investigation into the use of the participating methodology in a new community, to add knowledge of how to embody the ideas, perspectives, prejudices, language, culture and practices of that community. There has been benefit deriving from this investigation. This has assisted in the development of best recommendations associated with the problem.

The major contributions to knowledge are as follows:

- There has been a review of the existing methodology in delay risks identification and assessment as reported in the literature, and this has brought value-added to the investigation performed by the researcher in seeking to identify where new knowledge is required.
- The delay risks management measures currently used in UAE construction projects are based on the evaluation of risk factors only, and control

measures influencing project success do not exist, so project managers sacrifice much time and cost in risk response that cannot be complete. Risk response in studies is neglected as stated by Syedhosini et al, (2009:753). This study addresses that problem.

- There is a lack of attention given to the relationship between risk response and maturity levels in project management. This study addresses that problem.

  The study brings forward findings that can be promoted as the means to enhance opportunities to control delay risks, and benefit practitioners in the UAE given that so far, there has been no model of risk response development by maturity levels for delay risks control. Moreover, one of the unique features of the study is the creation of new knowledge by focusing on the UAE. At the same time, the use of maturity modeling to handle construction delay risks provides new knowledge for a wider audience.
- The findings of the research as it has progressed have been published in peer-reviewed international journals (See Appendix G) and presented and at international conferences and published as proceedings (See Appendix D). The publications will enforce the research in the UAE construction sector and academic institutions and will encourage professionals, and particularly academics, to open a new area of research.

7.4 Recommendations for Future Work

- In practical terms, risk management organisations in the UAE should provide integrated training containing appropriate knowledge for society in general. This should become part of a well-defined approach to risk management, and it requires more experts in risk management who can provide both general and specific training of various kinds to ensure that effective risk response processes are developed.

- The model should be developed further to become more practical and ensure that the lesson learned aspect is highlighted. It is accepted that the research into the KSFs of preventative and mitigation measures seems to ease the approach to the identification of the maturity levels associated with risk response development.

- This model should be trialed with more real-life cases that have experienced delay risks since the recent financial crisis that began in 2008-2009. Observations related to the case studies were conducted from the senior project managers' departments, and these revealed that the project staff were more comfortable discussing the risk response process problems, and hence, more information was forthcoming. Hence, more research could be undertaken with project staff to enhance the knowledge and understanding in the area.

- Generally, project managers perceive the model as being suitable for risk response development with both large and small projects, but some of them believe the model is too resource-intensive for small projects. In addition, some project managers recommend the development of regulations to ensure process integration and optimisation.

References

1- ABDEL-RAZEK, M.E., BASSIONI, H.A., and MOBARAK, A.M., (2008). Causes in building construction projects in Egypt. *Journal of Construction Engineering and Management*, 134(11), pp. 831-841.

2- ABDELSALAM, H.M.E., and GAD, M.M., (2009). Cost of quality in Dubai: An analytical case study of residential construction projects. *International Journal of Project Management*, 27(5), pp. 501-511.

3- ABDUL-RAHMAN, H., BERAWI, M. A., BERAWI, A. R., MOHAMED, O., OTHMAN, M., and YAHIYA, I. A., (2006). Delay mitigation in the Malaysian construction. *Industry Journal Construction Engineering and Management*, 132(2), pp. 125-133.

4- ABDUL-RAHMAN, H., TAKIM, R., and MIN, W., (2009). Financial-related causes contributing to project delays. *Journal of Retail and Leisure Property*, 8(3), pp. 225-238.

5- ABDUL-RAHMAN, H., WANG, C., TAKIM, R., and WONG, S., (2011). Project schedule influenced by financial issues: Evidence in the construction industry. *Scientific Research and Essays*, 6(1), pp. 205-212.

6- ABRAHAM, W., RAFAEL, S. (2004). Practical multifactor approach to evaluating risk of investment in engineering projects. *Journal of Construction Engineering and Management*, 130(3), pp.357-367.

7- ADAM, F.K. (2008). Construction contract risk management: a study of practices in the United Kingdom. *Journal of Cost Engineering,*50(1), pp. 22-33.

8- ADEDOKUN, O., OGUSEMI, D. AJE, I., AWODELE, O., and DIRO, D. (2013). Evaluation of qualitative risk analysis techniques in selected large construction companies in Nigeria. *Journal of Facilities Management*, 11(2), pp. 123-135.

9- ADENFLT, M., (2010). Exploring the performance of transnational projects: Shared knowledge, co-ordination and communication. *International Journal of Project Management*, 28(6), pp. 529-538.

10- ACHARYA, N., LEE, Y., KIM, S.Y., and KIM, S.M., (2005). Delay in building construction projects in developing countries: A case study of Nepal. *Journal of the Korean Society of Maintenance Engineers*, 10(3), pp. 81-95.

11- AHMED, S. M., AZHAR, S., KAPPAGANTULA, P., and GOLLAPUDI, D., (2003). Delays in construction: A brief study of the Florida construction industry. *ASC Proceedings, 39th ASC Annual Conference*, pp. 257–266, 11-12 April 2003, Clemson University, South Carolina, Available http://ascpro0.ascweb.org/archives/cd/2003/2003pro/2003/Ahmed03.htm [17 July 2012].

12- AHSAN, K., GUNAWAN, I., (2010). Analysis of cost and schedule performance of international development projects. International Journal of Project Management 28 (1), 68–78.

13- AIBINU, A., and JAGBORO, G., (2002). The effects of construction delays on project delivery in Nigerian construction industry. *International Journal of Project Management*, 20(8), pp. 593-599.

14- AIBINU, A., and ODYINKA, H., (2006). Construction delays and their causative factors in Nigeria. *Journal of Construction Engineering and Management*, 132(7), pp. 667-677.

15- ALAGHBARI, W., RAZALI, M., SALIM A., and ERNAWATI, (2007). The significant factors causing delay of building construction projects in

Malaysia. *Engineering Construction and Architectural Management*, 14(2), pp. 192-206.14.

16- Al-MOMANI, A.H., (2000). Construction delay: A quantitative analysis. *International Journal of Project Management*, 18(9), pp. 51-59.

17- AL-NUAIMI, A., TAHA, R., MOHSIN, M., and AL-HARTHI, A., (2010). Causes, effects, benefits and remedies of change orders on public construction projects in Oman. *Journal of Construction Engineering and Management*, 136(5), pp. 615-622.

18- ALONSO, J., DE SORIA, I. M., ORUE-ECHEVARRIA, L., and VERGARA, M., (2008). Enterprise Collaboration Maturity Model (ECMM): Preliminary Definition and Future Challenges. Available at: http://www.coin-ip.eu/research/coin results/Papers/abstracts-m25-m36/ECMM-IESA.pdf/view [30th January 2013].

19- AL-TMEEMY, S., ABDUL-RAHMAN, H., and HARUN, Z., (2010). Future criteria for success of building projects in Malaysia. *International Journal of Project Management,* 29(3), pp. 337–348.

20- AL-ZAROONI, S., ABDOU, A., and LEWIS, J., (2011). Public healthcare project appraisal in the United Arab Emirates: Towards better feasibility. *Architectural Science Review*, 49(1), pp. 31-41.

21- ANDERSEN, E., and JESSEN, S. (2003). Project maturity in organizations. *International Journal of Project Management,* 21(6), 457-461.

22- APM, (2006). A guide to the project management body of knowledge, 5th edition.

23- ARAIN, F., (2005). A framework for developing a knowledge-based decision support system for the management of variation order for institutional buildings. Available from: http://www.itcon.org/data/works/att/2006_21.content.04149.pdf. [9 May 2011].

24- ARDITI, D., and PATTANAKITCHAMROON, T., (2006). Selecting a delay analysis method in resolving construction claims. *International Journal of Project Management*, 24(2), pp. 145–155.

25- ARDITI, D., POLAT, G., and AKIN, S., (2010). Lessons learned system in construction management. *International Journal of Project Organisation & Management*, 2(1), pp. 61-83.

26- ASNAASHARI, S., FARAHANI, S., HOSEINI, A., KNIGHT, A., AND HURST. A., (2009). Causes of delay in Iran construction projects. In: *Fifth International Conference on Construction in the 21st Century* (CITC-V), May 20-22, 2009, Istanbul, Turkey.

27- ASSAF, S., and AL-HEJJI, S., (2006). Causes of delay in large construction projects. *International Journal of Project Management*, 24(4), pp. 349-357.

28- ATKINSON, R., (1999). Project management: cost, time and quality, two best guesses and a phenomenon- it's time to accept other success criteria. *International Project Management Journal*, 17(6), pp. 337-342.

29- ATKINSON, R., (1999). Project management: cost, time and quality, two best guesses and a phenomenon, it's time to accept other success criteria. *International Journal of Project Managemen*t, 17(6), pp. 337-342.

30- AYUB, A-R, ISA, N.M., and SAID, I., (2007). Identification of construction industry risks in Malaysian construction industry: A case study of Penang area, Vol. B, pp. 1-12, in*: Proceedings of Management in Construction Research Conference* (MICRA), Johor: Faculty of Architecture, Planning & Surveying, Universiti Teknologi Malaysia.

31- BAKENS, W., FOLIENTE, G., and JASUJA, M., (2005). Engaging stakeholders in performance-based building: Lessons from the performance-based building (PeBBu) network. *Building Research & Information*, 33(2), pp. 149-158.

32- BAKER, M.J., (2003). Data collection- questionnaire design. *The Marketing Review*, 3(3), pp. 343-370.

33- BOGDAN, R. C., and BIKLEN, S. K., (1992). Qualitative Research for Education: An Introduction to Theory and Methods, Allyn and Baccon, Boston.

34- BOGUS, S.M, MOLENAAR, K.R, and DIEKMANN, J.E., (2006). Strategies for overlapping dependent design activities. *Construction Management and Economics*, 24, pp. 829-837.

35- BOWER, D., (2002) Project and Project Management, Engineering Project Management, Edited by N. J. Smith, 2nd Edition. Blackwell Publishing, pp.1-15.

36- BRENDEL N, BARRETTE A., and EL-RIACHI W., (2010). Availability in UAE of liens to secure payment under construction contracts. *Arab Law Quarterly*, 24(3), pp. 309-317.

37- BRYDE, D.J., and BROWN, D., (2005). The influence of a project performance measurement system on the success of a contract for maintaining motorways and trunk roads. *Project Management Journal*, 35(4), pp. 57-65.

38- BRYMAN, A., and Bell, E. (2003), Business Research Methods, Oxford University Press.

39- BURNS, R. B. (2000). Introduction to Research Methods, 4th edition, London: Sage Publication.

40- BURTONSHAW, S., (2009). *Risk and Financial Management in Construction,* UK: Gower.

41- CARMEL, Y., PAZ, S., JAHASHAN F. and SHOSHANY, M. (2009). Assessing fire risk using Monte Carlo simulations of fire spread[J]. Forest Ecology and Management, 257, pp. 370-377.

42- CARMICHAEL, S., and MURRAY, M., (2007). Record keeping for contemporaneous delay analysis: a model for effective event management. *Construction Management and Economics,* 24, pp. 1007–1018.

43- CHAN, I.P.C., SCOTT, D., and LAM, E.W.M., (2002). Framework of success criteria for design/build projects. *Journal of Management in Engineering*, 18(1), pp. 120-128.

44- CHAPMAN, C.B., P. Venmore-Rowland, P. Brandon, and T. Mole (Eds.): *Risk in investment, procurement and performance in construction*. Proceedings of the First National RICS Research Conference, London, 10-11 January 1991, London: E & FN Spon.

45- CHAPMAN, C., and WARD, S., (2003). Motives for formal risk management processes, pp. 33-54, in: *Project risk management: Processes, techniques and insights*, 2nd edition, Chichester (UK): Wiley.

46- CHOUDHURY, I., and PHATAK, O., (2004). Correlates of time overrun in commercial construction. In *ASC Proceedings of the 40th Annual Conference*, Brigham Young University - Provo, Utah.

47- CLELAND, D.I., (1986). Project stakeholder management. *Project Management Journal*, 17(4), pp. 36-43.

48- COLLABORATION, MANAGEMENT and CONTROL SOLUTION (CMCS), (2007). Portfolio Project Management Solution. [Technical Report]. Dubai, the organization, 42 pages. Unpublished.

49- COLLINGE, W., (2012). Re-thinking stakeholder management in construction: Theory and research. *The Project Perspective*, XXXIV, pp. 16-23. Available at: http://ipma.ch/assets/re-perspectives_2012.pdf [22 September 2012].

50- COOPER and DALE, F., (2005). Project Risk Management Guidelines: managing risk in large projects and complex procurements, John Wiley and Sons.

51- CONSTRUCTION MANAGEMENT GUIDE, (2008). Available at: http://www.cmguide.org/archives/140 [4 November 2009].

52- CRAWFORD, J. K. (2002) *PM Solutions Project Management Maturity Model: Providing a Proven Path to Project Management Excellence*, New York: Marcel Dekker, Inc.

53- CRAWFORD, J. K., (2006). *Project Management Maturity Model*, 2^{nd} edition, Taylor and Francis, pp. 165-180.

54- CRESWELL, J. W., (2003).Research Design: qualitative quantitative and mixed approaches, 2^{nd} edition. Sage Publications, Thousand Oaks, CA.

55- CRESWELL, J. W., (2007). Qualitative Inquiry and Research Design: Choosing Among the Five Approaches, 2nd Ed. Sage Publications, Thousand Oaks, CA.

56- DAINTY, A.R.J., (2007). A review and critique of construction management research methods, in Hughes, W. (ed), proceedings of Construction Management and Economics 25^{th} Anniversary Conference. University of Reading, 16-18 July.

57- del CANO, A. and PILLAR de la CRUZE, M. (2002). Integrated methodology for project risk management. *Journal of Construction Engineering and Management*, 128(6), pp. 473-481.

58- DE MEYER, A., LOCH, C.H., and PICH, M.T. (2002). Managing project uncertainty: from variation to chaos. *MIT Sloan Management Review*, 43(2), pp. 60-67.

59- DE VAUS, D. A., (2002). Surveys in Social Research, 5th Ed., Routledge, London.379 pp.

60- De-WIT, A. (1988). Measurement of project success. *International Journal of Project Management*, 6(3), 164-170.

61- DUMBRAVA, V., MAIORESCU, T. (2013). Using Probability – Impact Matrix in Analysis and Risk Assessment Projects. Journal of Knowledge Management, Economics and Information Technology (special Issue). Scientific Papers (www.scientificpapers.org)

62- DWEIRI, F.T., and KABLAN, M.M., (2006). Using fuzzy decision making for the evaluation of the internal project management efficiency. *Decision Support Systems*, 42(2), pp. 712–726.

63- EASTERBY-Smith, M., (1991). Management Research: an Introduction, London: Sage Publications.

64- ECONOMY WATCH, (2010). Available in: http://www.economywatch.com/economic-statistics/country/United-Arab-Emirates/ [27th May 2013].

65- ELINWA, A., and JOSHUA, M., (2001). Time-overrun factors in Nigerian construction industry. *Journal of Construction Engineering and Management*, 127(5), pp. 419-425.

66- ELKJAER, M., and FELDING, F., (1999). Applied project risk management- introducing the project risk management loop of control. *Project Management*, 5(1), pp. 16-25.

67- ELLIS, R.D. and THOMAS, H. R. (2002). The root causes of delays in highway construction," presented at the 81st Annual Meeting of the *Transportation Research Board*, Washington, D.C., Jan. 13–17.

68- ENSHASSI, A., AL-NAJJAR, J., and KUMARASWAMY, M., (2009.) Delays and cost overruns in the construction projects in the Gaza Strip. *Journal of Financial Management of Property and Construction*, 14(2), pp. 126-151.

69- FABER, M.H. and STEWART, M.G. (2003). Risk assessment for civil engineering facility: critical overview and discussion. *Journal of Reliability Engineering and System Safety,*80(2), pp. 173-184.

70- FARIDI, A.S., and EL-SAYEGH, S.M., (2006). Significant factors causing delay in the UAE construction industry. *Construction Management and Economics*, 24(11), pp. 1167-1176.

71- FELLOWS, R., and LIU, A., (2003) *Research Methods for Construction*, UK: Blackwell Ltd.

72- FERNIE, S., GREEN, S., WELLER, S., and NEWCOMBE, R., (2003). Knowledge sharing: context, confusion and controversy. *International Journal of Project Management*, 21(3), pp. 177–187.

73- FIELD, A. (2009) Discovering Statistics Using SPSS. Third Edition. Sage Publication.

74- FLANAGAN, R., and NORMAN, G. (1993) *Risk Management and Construction,* London: Blackwell Scientific Publications.

75- FLYVBJERG, B., HOLM, M., and BUHL, S., (2002). Underestimating costs in public works projects-error or lie?. *APA Journal*, 68 (3), pp. 279-295.

76- FONG, N.K., WONG, L.Y., and WONG, L.T., (2006). Fire services installation related contributors of construction delays. *Building and Environment*, 41(2), pp. 211–222.

77- FOWLER, F.J (2002) *Survey Research Methods*, Third edition, Thousand Oaks: Sage publications.

78- FRIMPONG, Y., and OLUWOYE, J., (2003). Significant factors causing delay and cost overruns in construction of groundwater projects in Ghana. *International Construction Research*, 4(2), pp. 175-187.

79- GARTH, A., and HALLAM, S. (2008). Analysing data using SPSS. Available at: https://students.shu.ac.uk/lits/it/documents/pdf/analysing_data_using_spss.pdf [retrieved May 18th 2014).

80- GERALDI, J.G., LEE-KELLEY, L., & KUTSCH, E., (2009). The titanic sunk, so what? Project manager response to unexpected events, *International Journal of Project Management,* 28 (6), 547-558.

81- GERK, J.E.V., and QASSIM, R.Y., (2008). Project acceleration via activity crashing, overlapping and substitution, *IEE Transactions on Engineering Management,* 55(4), pp. 590-601.

82- GILLHAM, B. (2000) *Case study Research Method*, London: Real World Research.

83- GILL, J. and JOHNSON, P. (2002) *Research Methods for Managers*, 3rd edition, London: Paul Chapman.

84- GLOBAL REAL STATE NEWS CENTER, Real State Channel (2009), Available at: http://www.realestatechannel.com/international-markets/residential-real-estate/dubai-construction-uae-real-estate-emil-rademeyer-proleads-global-alma-kadragic-429.php [15 APRIL 2011].

85- GONZÁLEZ, P., GONZÁLEZ, V., MOLENAAR, K., and OROZCO, F. (2013). Towards an Understanding of Delay Causes and Time Performance in Construction Projects. *Journa of. Construction Engineering Management.* 10.1061/(ASCE) CO.1943-7862.0000721.

86- Griffis, F.H. and Christodoulou, S., 2000. Construction Risk Analysis Tool for Determining Liquidated DamagesInsurance Premiums: A Case

Study. *Journal of Construction Engineering and Management,* ASCE , 126(6), pp. 407-413.

87- HAMDAN, Y. (2012). The UAE Country Risk Analysis. *European Journal of Business and Management*, 4 (18)-Online.

88- HARRIES, F.C. and McCAFFER, R. (2001) *Modern construction management*, 5th edition, Oxford: Blackwell Science.

89- HASNA, A., and RAZA, S., (2010). The status of project portfolio management practices adoption and awareness in Gulf Cooperation Counties: An empirical study. *International Journal of Project Organisation and Management*, 2(2), pp. 174-192.

90- HILLSON, D. and MURRAY-WEBSTER R. (2007) *Understanding and managing risk attitude*, [various pages], 2nd edition, Hampshire: Gower, 180p.

91- Howell, D. C. (2002) *Statistical Methods for Psychology,* 5th edition, Belmont, CA: Duxbury Press.

92- HILLSON, D., (1999). Developing Effective Risk Responses. *Proceedings of the 30th Annual Project Management Institute*, Seminars & Symposium Philadelphia, Pennsylvania, USA: Papers Presented October 10-16.

93- HULETT, D. (2006). Decision Tree Analysis for the Risk Averse Organization. PMI EMEA Congress in Madrid, Spain, May 9, 2006.

94- HULETT, D. (2004). Using Quantitative Risk Analysis to support Strategic Decision. Consult GEE Executive Briefings in Business Risk Management.

95- HUMPHREY, W. (1989) *Managing the Software Process*, Massachusetts: Addison-Wesley.

96- IBBS, C.W., WONG, C.K., and KWAK, Y.H., (2001). Project change management system. *Journal of Management in Engineering*, 17(3), pp. 159-165.

97- INSTITUTE OF RISK MANAGEMENT (IRM), the public sector risk management association (ALARM) and Association of Insurance and Risk

Managers (AIRMIC), (2002). A Risk Management Standard, IRM/ ALARM/AIRIMIC , London.

98- ISIK, Z., ARDITI, D., DIKMEN, I., and BIRGONUL, M. T., (2009). Impact of corporate strengths/weaknesses on project management competencies. *International Journal of Project Management,* 27(7), pp. 629-637.

99- JALLOW, A., DEMIAN, P., and BALDWIN, A. (2009). BPM-driven Construction Client Requirements Change Management. Proceedings of CIB W078 26th International Conference, Managing IT in Construction, 1-3 October 2009, Istanbul Technical University, Istanbul, Turkey. pp 249 – 256.

100- Jankowicz, A.D. (1995) Business Research Projects, 2nd Edition, London: Chapman and Hall.

101- JIANG, J.J., EDWARD, C., and GARY, K. (2002). The importance of building a foundation for user involvement in information system projects. *Project Management Journal*, 22(1), pp.20-26.

102- KAGIOGLOU, M., COOPER, R., AOUAD, G., HINKS, J., SEXTON, M. and SHEATH, D., (1998). Cross-industry learning: the development of a generic design and construction process based on stage/gate new product development processes found in the manufacturing industry. In: Engineering Design Conference 98. Brunel.

103- KALIBA, C., MUYA, M., and MUMBA, K., (2009). Cost escalation and schedule delays in road construction projects in Zambia. *International Journal of Project Management*, 27(5), pp. 522-531.

104- KASSEM, M. (2014). Abu Dhabi to refinance $20 billion Dubai loans at lower rate. Available at: http://www.thenational.ae/business/industry-insights/finance/abu-dhabi-to-refinance-20-billion-dubai-loans-at-lower-rate. [Retrieved 6th May2014]

105- KERZNER, H., (2012). The changing role of stakeholder involvement in projects: The quest for better metrics. *The Project Perspective*, XXXIV, pp. 6-9. Available at: http://ipma.ch/assets/re-perspectives_2012.pdf [2nd June 2013].

106- KHOSHGOFTAR, M., ABU-BAKAR, A., and OSMAN, O., (2010). Causes of delays in Iranian construction projects. *International Journal of Construction Management*, 10 (2), pp. 53-69.

107- KIM, S. and BAJAJ, D. (2000). Risk management in construction: an approach for contractors in South Korea. *Cost Engineering*, 42(1), pp. 38-44

108- KNIGHT, A. and RUDDOCK, L. (2009) *Advanced research methods in the built environment*, Chichester (U.K.): Wiley-Blackwell Publisher.

109- KOUSHKI, P., PARVIZ, A., and KARTAM, N., (2004). Impact of construction materials on project time and cost in Kuwait. *Engineering, construction and Architectural Management*, 11(2), pp. 126-132.

110- KOUSHKI, P., AL RASHID K., and KARTAM, N., (2005). Delays and cost increases in the construction of private residential projects in Kuwait. *Construction Management & Economics*, 23(3), pp. 285–294.

111- KRANE, H.P., ROLSTADÅS, A., and OLSSON, N.O.E., (2010). Categorizing risks in seven large projects which risks do the projects focus on? *Project Management Journal,* 41(1), pp. 81-86.

112- KULULANGA, G., and KUOTCHA, W., (2009). Measuring project risk management process for construction contractors with statement indicators linked to numerical scores. *Engineering*, *Construction and Architectural Management*, 17(4), pp. 336-351.

113- KUMARASWAMY, M.M., and YOGESWARAN, K., (2003). Substantiation and assessment of claims for extensions of time. *International Journal of Project Management*, 21, pp. 27–38.

114- KWAK, Y., and IBBS, C., (2002). Project Management Process Maturity (PM) ² Model. Journal of Management in Engineering, 18(3), pp.150-155.

115- LANDIN, A., (2000). Impact of quality management in the Swedish construction process. PhD thesis, Department of Construction Management, Lund University.

116- LEE, S., PEÑA-MORA F., and PARK, M., (2005a). Quality and change management model for large scale concurrent design and construction projects. *Journal of Construction Engineering and Management*, 131(8), pp. 890-902.

117- LEE, H., RYU H., YU, J., and KIM, J., (2005b). Method for calculating schedule delay considering lost productivity. *Journal of Construction Engineering and Management*, 131(11), pp. 1147-1154.

118- LONG, L.H., LEE Y.D., and LEE J.Y., (2008). Delay and cost overruns in Vietnam large construction: A comparison with other selected countries. *KSCE Journal of Civil Engineering*, 12(6), pp. 367-377.

119- LIN, J., CHAI, K.H., BROMBACHER, A.C., and WONG, Y.S., (2009) optimal overlapping and functional interaction in product development. *European Journal of Operational Research*, 196(3), pp. 1158-1169.

120- LINGARD, H. and ROWLINSON, S. (2005) *Occupational Health and Safety in Construction Project Management*, Spon press-Business and Economics, several pages.

121- LOOSEMORE, M., RAFTERY, C., and HIGGON, D. (2006) *Risk Management in Projects*, 2nd edition, Oxon: Taylor and Francis.

122- LOW, S., and CHUAN, Q., (2006). Environmental factors and work performance of project managers. *International Journal of Project Management*, 21(1), pp. 24–37.

123- LUU, V., KIM, S., TUAN N, and OGUNLANA, S., (2009). Quantifying schedule risk in construction projects using Bayesian belief networks. *International Journal of Project Management*, 27(1), pp. 39–50.

124- MANAVAZHIA, M.R., and ADHIKARIB, D.K., (2002) Material and equipment procurement delays in highway projects in Nepal. *International Journal of Project Management*, 20(8), pp. 627–632.

125- MANASE, D. (2010) The impact of the global financial crisis on client procurement 268behavior in the UK construction industry: the case of PFI Available at: http://www.rics.org/site/scripts/download_info.aspx?fileID=8072&categoryID=720 [12th June 2011].

126- MACIASZEK, L. A. (2007) *Requirements Analysis and System Design*, 3rd edition, Harlow: Addison-Wesley.

127- MERNA, T. and F. F. Al-Thani. (2005) *Corporate Risk Management: An Organisational Perspective,* Chichester: John Wiley & Sons Ltd.

128- MIRANDA, A.P. (2004) *Requirements Management a Challenge to the Product Development Engineering*, Warrendale, Pennsylvania, USA: SAE International.

129- MOE, T.L., and PATHRANARAKUL, P. (2006). An integrated approach to natural disaster management: Public project management and its critical success factors, *Disaster Prevention and Management,* 15 (3), pp.396-413.

130- MOTALEB, O., and KISHK, M., (2010). An investigation into causes and effects of construction delays in the UAE. *26th Annual Association of Researchers in Construction Management* (ARCOM) *Conference*, 6-8 September 2010, Leeds, UK, pp. 1149-1157.

131- MOTALEB, O., and KISHK, M., (2011a). Construction projects delay in the Middle East: State-of-the-art review. *Tenth IPGRC Proceedings*, 14-15 September 2011, University of Salford, Salford, Manchester, UK.

132- MOTALEB, O., and KISHK, M., (2011b). Controlling the risk of construction delay in the Middle East: State-of-the-Art Review. *COBRA, Proceedings of RICS*, 12-13 September 2011, University of Salford, Salford, UK.

133- MOTALEB, O., and KISHK, M. (2012). A Risk Response Plan Framework for Housing Construction Project Delays in the UAE. *COBRA, Proceedings of RICS*, 11-13 September 2012, Arizona State University, Las Vegas, USA.

134- MOTALEB, O., and KISHK, M., (2013a). An investigation into the risk of construction project delays in the UAE. *International Journal of Information Technology in Project Management*, 4(3), 50-65.

135- MOTALEB, O., and KISHK, M. (2013b). Towards the Development of a Risk Response Model for Construction Projects Delays in the UAE. 11th IPGRC Proceedings, 8-10 April 2013, University of Salford, Media City, Salford, Manchester, UK.

136- MOTALEB, O., and KISHK, M. (2013c). Towards a Maturity Model for Construction Projects Success in the UAE. International Journal of Decision Science (IJDS), in press.

137- MOTALEB, O., and KISHK, M., (2013d). Assessing Risk Response Maturity: A framework for construction project success in the United Arab Emirates. *International Journal of Managing Projects in Business*, in press.

138- MULKAHY, R. (2009). PMP Exam Preparation for the PMBOK Guide- sixth edition.

139- NGUYEN, L., OGUNLANA, S., and LAN, D., (2004). A study on project success factors in large construction projects in Vietnam. *Engineering, Construction & Architectural Management*, 11(6), pp. 404-413.

140- NG, S.T., DENG, M.Z.M., LAM, K.C., and SKITMORE, R.M., (2000). A conceptual case-based decision model for construction delay mitigation. *International Journal of Construction Information Technology*, 8(2), pp. 1-20.

141- NOULMANEE, A., WACHIRATHAMROJN, J., TANTICHAtTTANONT, P., and SITTIVIJAN, P. (2000). Internal causes of delays in highway construction projects in Thailand. Compendex Abstract.

142- ODEH, A., and BAITTAINEH, H., (2002). Causes of construction delay: traditional contracts. *International Journal of Project management*, 20(1), pp. 67-73.

143- OLADAPO, A., (2007). Quantitative assessment of cost and time impact of variation orders on construction projects. *Journal of Engineering, Design & Technology*, 5(1), pp. 35-48.

144- OLAWALE, Y.A., and SUN, M., (2010). Cost and time control of construction projects: inhibiting factors and mitigating measures in practice. *Construction Management and Economics*, 28(5), pp. 509-526.

145- OLIVAS, R. (2007). Decision Trees. A Primer for Decision-making Professionals

146- OLIVEROS, A., and FAYEK, A., (2005). Fuzzy logic approach for activity delay analysis and schedule updating. *Journal of Construction Engineering & Management*, 131(1), pp. 42-51.

147- OMRAN, A., LING, O., PAKIR, A., and RAMLI, M., (2010). Delays factors in construction project development: The case of Klang valley, Malaysia. *Journal of Academic Research in Economics*, 2(2), pp. 135-158.

148- OTHMAN, A., (2006). Factors influencing the construction time of civil engineering projects in Malaysia. *Engineering Construction and Architectural Management*, 13(5), pp. 481-501.

149- OTHMAN, A., (2008), Incorporating value and risk management concepts in developing low cost housing projects. *Emirates Journal for Engineering Research*, 13(1), pp. 45-52.

150- PANAS, A., and PANTOUVAKIS, J.P., (2010). Evaluating research methodology in construction productivity. *The Built & Human Environment Review*, 3 (Special issue-1), 23p.

151- PATTON, M. Q. (1990). Qualitative Evaluation and Research Techniques, 2nd Ed, Sage, Newbury Park, California.

152- PENGELLY, J. (2002). Monte Carlo methods. Available at http://www.cs.otago.ac.nz/cosc453/student_tutorials/monte_carlo.pdf

153- PETERSON, R.A., (2000). Constructing effective questionnaires. Sage Publications, Thousand Oaks, CA.

154- PMBOK, (2004) Editions, Body of Knowledge. Pennsylvania: Project Management Institute, Inc; 1996. USA.

155- PMBOK, (2008). A Guide to Project Management Body of Knowledge. Fourth Edition.

156- PMI, (2002). Risk Management Maturity Level Development. Project Management Institute, London, UK. Available at: http://www.pmi-switzerland.ch/fall05/riskmm [31 January 2013].

157- PRICE, A.D.F., and CHAHAL, K., (2006). A Strategic Framework for Change Management, *Construction Management and Economics*, 24(3), pp. 237-251.

158- POLISH CONSTRUCTON COMPANIES REPORT, (2012). Maturity of Construction Project Management. Retrieved on 15 Dec. 2012 from, www.deloitte.com/...Poland/.../pl_MaturityofConstructionProjectManagement_ENG.PDF.

159- PRESTON, M. (2010). Gulf Construction – Legally Bound: Financial risk part of every project. Press in Gulf Construction, available at http://www.nortonrose.com/news/inthepress/news30861.aspx?lang=en-gb [15th May 2011].

160- RAD, P. and LEVIN, G., (2003). Archieving Project Management Success Using Virtual Teams. Ross Publishing.

161- RAFTERY, J. (1994). Risk analysis in project management.London: E & FN Spon, 1994.

162- RASLI, A., and MASERI, W., (2008). Project performance framework: the role of knowledge management and information technology infrastructure. *Asian Journal of Business and Accounting*, 1(2), pp 39-64.

163- RAZ, T., SHENHAR, A.J., and DVIR, D., (2002). Risk management, project success, and technological uncertainty. *R&D Management*, 32(2), pp. 101-109.

164- REA, L. M. and PARKER, P. A., (1997). Designing and Conducting Survey Research, 2nd Ed. USA. San Francisco. Jossey-Bass Publishers.

165- REMENYI, D., WILLIAMS, B., MONEY, A. and SWARTZ, E., (1998). Doing Research in Business and Management. London. Sage Publications.

166- REN, Y. T. and YEO., K. T., (2009). Risk management capability maturity model for complex product systems (CoPS) projects, in: *Systems Engineering, 12*(4).

167- REZAIE, K., AMALNIK, M.S., GEREIE, A., OSTADI, B. and SHAKHSENIAEE, M. (2007). Using extended Monte Carlo simulation method for the improvement of risk management: Consideration of relationships between uncertainties. *Journal of Applied Mathematics and Computation*, 190, pp. 1492-1501

168- RISK MANAGEMENT: Guidelines and Best Practices (2003), Available at: http://oa.mo.gov/itsd/cio/projectmgmt/PDF/risk_manual.pdf [20th May 2013].

169- ROBERTS, B.B., (2001). Lessons-learned: round 2. In: *2001 INCOSE Proceedings of a Symposium on Risk Management*, 3.

170- ROY, R., KERR, C.I.V., SACKETT, P.J., and CORBETT, J., (2005). Design Requirements Management using an Ontological Framework, *CIRP Annals - Manufacturing Technology*, 54(1), pp. 109-112.

171- SAID, M., (2009). *Improved schedule analysis considering reworking impact and optimum delay mitigation*-MSc Thesis (Unpublished), University of Waterloo, Canada.

172- SARSHAR, M., HAIGH, R., FINNEMORE, M., AOUAD, G., BARRETT, P., BALDRY, D., SEXTON, M. (2000). SPICE: A Business process diagnostics tool for construction projects, *Engineering, Construction and Architectural Management,* 7(3), pp.241-250.

173- SAMBASIVAN, M., and SOON, Y.W., (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management*, 25(5), pp. 517-526.

174- SANGHERA, P., (2010). *Project Management Professional Study Guide for the PMP Exam*, 2nd edition, Course Technology: Boston.

175- SALTELLI, A. (2004). Global Sensitivity Analysis: An Introduction. In Proceedings. 4th International Conference on Sensitivity Analysis of Model Output (SAMO -04).

176- SAlTELLI, A., RATTO, M., ANDRES, T., CAMPOLONGO, F., CARIBONI, J., GATELLI, D. SAISANA, M., and TARANTOLA, S.(2008). Global Sensitivity Analysis. The Primer, John Wiley & Sons

177- SALTELLI, A., Chan, K. and Scott, M. (2000). Sensitivity Analysis. Probability and Statistics Series.

178- Saunders, M., Lewis, P. and Thornhill, A., (2003). Research methods for Business students. Third edition ed. England: person Education limited.

179- Saunders, M., Lewis, P. and Thornhill, A., (2007). Research methods for Business students. 4th edition. London. Prentice Hall.

180- SHAHALIZADE, M., and FARHADYAR, A., (2006). A study on delay causes of the gas transmission pipeline projects in Iran: A risk and knowledge management approach. *Proceedings of the 7th Asia Pacific Industrial Engineering and Management Systems Conference*, 17-20 December 2006, Bangkok, Thailand.

181- SHENHAR, A.J., DVIR, D., and LEVY, O., (1997). Mapping the dimensions of project success. *Project Management Journal*, 28(1), pp. 5-13.

182- SHENHAR, A. J., RAZ, T., DVIR, D., (2002). Risk management, project success, and technological uncertainty. R&D Management, 32(2), pp.101–109.

183- SHENHAR, A.J., (2004). Strategic project leadership: Toward a strategic approach to project management. *R&D Management*, 34(5), pp. 569–578.

184- SHI, J., CHEUNG, S., and ARDITI, D., (2001). Construction Delay Computation Method. *Journal of Construction Engineering and Management*, Vol. 127, No. 1, pp. 60-65.

185- SIANG, L., and ALI, A., (2012). Implementation of risk management in Malaysian construction industry. *Journal of Surveying, Construction & Property* [e-journal], 3(1), 15p.

186- SIMU, K., (2009). *The construction site manager's impact on risk management performance*- PhD Dissertation, Luleå (Sweden): Luleå Tekniska Universitet, 143p.

187- SMITH, N. 1995. *Engineering Project Management*, Oxford: Blackwell Science.

188- SÖDERHOLM, A. (2008). Project management of unexpected events, *International Journal of Project Management,* 26 (1), 80-86.

189- STEFANOVIC, M. and STEFANOVIC, I. (2005). Decisions, Decisions. Proceedings of the Project Management Institute Global Congress. Toronto, Canada.

190- STUMPF, G.R., (2000). Schedule delay analysis. *Cost Engineering*, 42(7), pp. 32-43.

191- SUN, M., SEXTON, M., AOUAD, G., FLEMING, A., SENARATNE, S., ANUMBA, C., CHUNG, P., EL-HAMALAWI, A. & MOTAWA, I. (2004). *Managing Changes in Construction Projects*, MCD, Research Project, University of the West of England.

192- SWEIS, G., (2008). Delays in construction projects. *Project Management Journal*, 26(6), pp. 665-674.

193- SYEDHOSINI, S.M., NOORI, S., and HATEFI, M.A., (2009). An integrated methodology for assessment and selection of the project risk response actions. *Risk Analysis,* 29 (5), pp. 752-763.

194- TAH, J. H. M. (1997). Towards a qualitative risk assessment framework for construction projects In: Kahkonen K., Arrto KA, editors. Managing risks in Projects. London: E&EN Sponsor, 265-74.

195- TANG, W.Z., QIANG, M.S., DUFFIELD, C.F., YOUNG, D.M., and LIU, Y.M., (2007). Risk management in Chinese construction industry. *Journal of Construction Engineering and Management*, 133(12), pp. 944-956.

196- THEN, D.S-S., (1996). *A study of organizational response to the management of operational property assets and facilities support services as a business resource- Real estate asset management*-PhD Thesis (Unpublished) - Vol. 1-2, Heriot-Watt University, Edinburgh.

197- THOMPSON and PERRY, J. (1992). Engineering construction risks: a guide to project risk analysis and assessment implications for project clients and project managers, London, UK: Thomas Telford.

198- TOOR, S., and OGUNLANA S., (2010). Beyond the 'iron triangle': Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects. *International Journal of Project Management*, 28(3), pp. 228-236.

199- TUMI, S., OMRAN, A., and PAKIR, A., (2009). Causes of delay in construction industry in Libya. *The International Conference on Economics and Administration* (ICEA), 14-15 November 2009, University of Bucharest, Romania.

200- TURNER, R., and VIEL, C., (2002). Group efficiency improvement: how to liberate energy in project groups. *International Journal of Project management*, 20(2), pp. 137-142.

201- UNITED NATIONS DEVELOPMENT GROUP. (2010, March). (1st Quarter). *Iraq Trust Fund Project#66992: C10-08.* Retrieved from http://www.unesco.org/filead-min/multimedia/field/Iraq/pdf/Reports /Quarterly/Fiche_C10_08_Samara_Al_Askari_Shrine_1st_Quarter_ 2010. pdf.

202- WANG, X., and HUANG, J., (2006). The relationships between key stakeholders project performance and project success: Perceptions of

Chinese construction supervising engineers. *International Journal of Project Management*, 24(3), pp. 253-260.

203- WIGUNA, I.P.A., and SCOTT, S., (2005). Analysing the risks affecting construction delay and cost overruns in Indonesia building projects, pp. 841-850. *Proceedings of the 3rd International Conference on Innovation in Architecture, Engineering and Construction*. 15-17 June 2005, Rotterdam, The Netherlands.

204- WILLIAMS, R. (2008). Underwriting T5 – The Perfect Storm. Speech at the IMIA Conference, 16 September 2008, Gleneagles.

205- World Bank Iraq Trust Fund Project. (2008, March). (1st Quarter). *#: P087907.*Retrieved on January20, 2011 from: http://siteresources.worldbank.org/IRFFI/Resources/ConsolidatedITFPSSwithpagenos.pdf.

206- WILLIS, C. J. and RANKIN, J., (2009). Maturity Modeling in Construction: Introducing the Construction Industry Macro Maturity Model. Canadian Society for Civil Engineers Annual Conference, St. John's, Newfoundland.

207- YANG, J., YANG, C., and KAO, C., (2010). Evaluating schedule delay causes for private participating public construction works under the Build-Operate-Transfer model. *International Journal of Project Management*, 28(6), pp. 569-579.

208- YAZICI, H., (2009). The Role of Project Management Maturity and Organizational Culture in Perceived Performance. *Project Management Journal*, 40(3), pp. 14–33.

209- YEO, KT. and REN, Y., (2009). Risk management capability maturity model for complex product systems (CoPS) projects. System Engineering, 12(4), pp 275-294.

210- YIN, K. (1994) *Case Study Research: Design and Methods*, Newbury Park, CA : Sage Publications.

211- YIN, R. K. (2003a). *Case study research: Design and methods*, 3rd edition, Thousand Oaks, CA: Sage Publication.

212- YOUNG, T.L., (2006). Successful Project Management, Second Edition, UK: Kogan Page.

213- YUMING, L., QIANG, Y., FENGPING, W., and Bojian, L., (2005). Study on the Application of ERP, CMM and OPM3 in China. China Science and Technology Information, 13 (1), pp.20-21.

214- YUSUWAN, M., ADNAN, H., OMAR, A., and JUSOFF H., (2008). Clients' perspectives of risk management practice in Malaysian construction industry. *Journal of Politics and Law*, 1(3), pp. 121-130.

215- ZANELDIN, E., (2006). Construction claims in the United Arab Emirates: Types, causes, and frequency. *International Journal of Project Management*, 24(4), pp. 453–459.

216- ZHI, H., (1995). Risk management for overseas construction projects. *International Journal of Project Management*, 13(4), pp. 231-237.

217- ZOLIN, R., CHEUNG, YK. and TURNER, J., (2012), Project Managers: Understanding of stakeholders' satisfaction. *The Project Perspective*, XXXIV, pp. 10-15. Available at: http://ipma.ch/assets/re-perspectives_2012.pdf [22 September 2012]

Appendices

Appendix A

Piloting Questions (Interviews)

Omayma Motaleb, PhD Student, The Robert Gordon University, UK.

Section A: General information

Name (Optional)………………………………………………………..

Position…………………………………………………………………

Type of organisation ………………………………………………..

Years of experience:…………………………………………………

Address: …………………………………………E-mail……………………………………………..

Telephone…………………………………………Fax…………………………………………………

Section B: Structured questions with open answers

1- Risks are antonymous to construction projects successful completion; do the construction project companies identify and quantify delay risks in construction projects?

2- Does your construction organisation adopt measures for delay risks to meet the project success? If yes, Please specify

3- Does your organisation adopt a plan for stakeholders management in risk control?

4- In the view of the recent financial crisis, can it be said that construction companies owned/prepared financial effective/mature method/model to control delay risks?

5- Project failure brings dissatisfaction to stakeholders' community. Do the construction organizations appropriately use risk response process to prevent project failure? If yes, Please specify

6- In the light of project control performance, do project managers/team practice is determinant on project performance?

7- Do construction companies in UAE have implemented any preventative/mitigating measures for risk response development instead of the traditional management in the determination of minimizing delay risks?

Please Comment generally on what you think to solve the problem of projects risks delays

Thank you very much for your contribution. Feedback will be provided

THE ROBERT GORDON UNIVERSITY ABERDEEN

Appendix B

QUESTIONNAIRE

Development of a Risk Response Model to handle Delays of Construction Projects in the United Arab Emirates

The main aim of the questionnaire is to gather and assess data on your perceptions in relation to the risks of delays in construction projects for academic purpose (PhD research). The questionnaire is in four parts. Part I seeks to collect information on your organization's background and recent projects. Part II assesses your views about risks/factors causing delays in completion of construction projects. Part III assess/ asks your opinion/s on risk response development based on the Key Success Factors (KSFs). Part IV assesses the interconnection between risk response development and stakeholders contribution. The research is targeted at companies and organizations (Public & Private sectors) including academics within the UAE. Confidentiality will be provided and the data will be used for academic purposes only.

Please kindly fill the Questionnaire below:

Part I

BACKGROUND INFORMATION

Please kindly respond to the following

1. Your name (optional): ______________________________________

2. Your organization name (optional): ______________________________

3. Your title in your organization: _________________________________

4. Your location (Emirate): ______________________________

5. Your professional role in your company/organization:

☐Contractor Project Manager ☐ Developer

☐Contractor ☐Financier

☐ Consultant ☐ Other, please specify…………..

6. Which a sector do you work in?

☐Government Authority ☐Construction Project Company

☐Consultant Company ☐Contractor Company

☐Other, please specify…………..

7. Please indicate which of the following describes the nature of your company/organization's projects.

☐Transport projects ☐ Civil Engineering Projects

☐Stadium/ Exhibition/shopping centre ☐ infrastructural projects

☐Power (energy) projects ☐Water/Waste water treatment project

☐Health service projects ☐ others, please specify…………

8. Please indicate the number of employees in your company/organization.

☐Less than 20, ☐ 21 to 50

☐ 51 to 80 ☐81 to 110

☐ 111 to 140 ☐ Others

9. Please indicate your company's annual estimated turnover.

☐ Less than $5 million

☐Over $5 million

10. Please estimate the duration of the last executed project

☐ Less than 12 month, ☐ 12 month to 18 month

☐18 month to 24 month ☐24 month to 30 month

☐ 30 month to 36 month ☐ other……………..

11. Please indicate the actual time spent by your company to complete the last executed project.

☐Less than 12 month ☐ 12 month to 18 month

☐ 18 month to 24 month, ☐ 24 month to 30 month

☐ 30 month to 36 month ☐ other, please specify……………

12. Please indicate your personal experience in the following:

	Years of experience				
	0-5	5-10	10-15	15-20	≥20
Project management	☐	☐	☐	☐	☐
Consultancy	☐	☐	☐	☐	☐
Contracting	☐	☐	☐	☐	☐
Developers	☐	☐	☐	☐	☐
Other, please specify……	☐	☐	☐	☐	☐

Part II

13. RISK FACTORS CAUSE DELAYS

Please rate the risk factors caused delay and affected time and cost in your recent construction projects: 1=less likely, 2=likely, 3=highly likely

No	Risk factor	1	2	3
	CLIENT			
1	Change orders			
2	Lack of capability of client representative			
3	Slow decision- making by client			
4	Lack of experience of client in construction			
5	Unreasonable constraint by client			
	FINANCIAL			
6	Inflation/prices fluctuation			
7	Fund approval delay			
8	High interest rate			
9	Client's financial difficulties			
10	Developer financial difficulties- crisis effect			
11	Contractor payment (delayed approval)			
	CONTRACTOR			
12	Inappropriate construction methods			
13	Late delivery of materials			
14	Inaccurate cost estimating by contractor			
15	Unskilled labours			
16	Technical difficulties			
17	Commitment by contract to changes agreement			
18	Dedication/reliability of subcontractors			
19	Poor technical performance			
	CONSULTANT			
20	Inadequate consultant experience.			

21	Poor design & delays in design			
22	Slow response and poor inspection			
23	Designers do not incorporate with client's Requirements			
24	Inaccurate documentations			
25	Poor awareness of cultural design			
	PROJECT MANAGER			
26	Poor site management & supervision			
27	Incompetent project team			
28	Unqualified project managers			
29	Misdirection of team members			
30	Improper project planning / scheduling			
31	Inaccurate time estimating			
32	Improper feasibility studies			
33	Lack of team communication /coordination			
34	Lack of site safety			
35	Outdated of site information			
36	Inadequate team knowledge			
37	Irregular project reporting			
38	Inadequate of fund allocation			
39	Lack of project team formal training			
	UNFORESEEN			
40	Weather condition			
41	Lack of technology			
42	Late approval starting/completion certificate			
43	Difficulties in supply of electricity and water			
44	Problem with neighbors.			
45	Increase cost of materials			
46	Financial crisis effects (deduct salary, accommodation, etc)			

Part III

14. Key Success Factors (KSFs) of Preventative Measures priority for delay risk response development by professional group, average score based on a Likert scale of 1 to 3, 1= Less likely, 2=Likely, 3= Highly likely

No	Preventative Measures	1	2	3
1	Planners' knowledge for effective risk plan			
2	Bidding re-analysis and Contract performance			
3	Anticipate risk (identification)			
4	Technology utilization			
5	Stakeholders competency (communication)			
6	Share high impact risks with other stakeholders(risk owner)			
7	Decision support system (decision-making)			
8	Funds-budget management			
9	Project team performance in risk definition			
10	Quantitative & Qualitative risk analysis template			
11	Risk assessment			
12	Labours' personal skills			
13	Contingency plans review			
14	Risk management training			
15	Project management office (PMO)			
16	Update project management training			
17	Construction techniques update			
18	Project crisis programme (financial crisis)			
19	Team Knowledge in civil codes of the country			
20	Product positioning (market success)			
21	Cash flow management			
22	Municipality process for new design approval (governmental issue)			

15. KSFs of Mitigation Measures priority for delay risk response development by professional group, average score based on a Likert scale of 1 to 3, Less likely, 2=Likely, 3= Highly likely

No	Mitigation Measure	1	2	3
1	Lesson learned practical use			
2	Contingency plan for each new risk item			
3	Practice and learning in the field			
4	Delay analysis template			
5	Overlapping activities management			
6	Optimal risk allocation plan			
7	Coordination with sub-contractors			
8	Project team productivity optimisation			
9	Construction method technique			
10	Municipality approval process			
11	Supervision for risk identification			
12	Incentives and rewards adequateness			
13	Change request management			
14	Risk transfer (integration in insurance consultation)			
15	New risks reviews (update) in the risk plan			

Part IV

16. Please predict the level of contribution that can be achieved by one of the following project stakeholder(s) for risk response development. 1= no contribution, 2= less contribution, 3=moderate contribution, 4=high contribution, 5= extremely contribution

Please tick as applicable (You may tick more than one box)

	1	2	3	4	5
Client	☐	☐	☐	☐	☐
Consultant	☐	☐	☐	☐	☐
Construction Manager	☐	☐	☐	☐	☐
Financier	☐	☐	☐	☐	☐
Site engineer	☐	☐	☐	☐	☐
An Expert Project Manager	☐	☐	☐	☐	☐
A Trained project manager	☐	☐	☐	☐	☐
A Functional manager	☐	☐	☐	☐	☐
An external analyst	☐	☐	☐	☐	☐
Other, please specify……	☐	☐	☐	☐	☐

17. Please indicate any comment on what you think generally on the main constraints on your project progress/completion and appropriate delays risk control

18. Would you like to receive the summary results of this questionnaire survey?

☐ Yes, please. My email address is ________________________________

☐ No, thanks.

Thank you very much for your co-operation. Your contribution will be added significantly to this research.

If you have further questions relating to this survey, please contact Omayma Motaleb

Email: o.h.motaleb@rgu.ac.uk or omaimahashim@hotmail.com

Appendix C

Interview Questions for Validation of the Model

1- Do you consider the Model practically can approach the risk response development for delays control in construction projects?

Yes……………………………No……………………………….Explain?……………………………………

2- Does the risk response process in the Model differ from the theoretical process?(close)

Yes…………………………………No…………………………Explain?……………………………………

3- Originality: Do you think the use of maturity modeling to handle construction delay risks provides new knowledge for a wider audience in the UAE?(close)

Yes……………………..No……………………………….Explain?…………………………………………..

4- Do you think the Model can improve the risk management for construction project organization in the UAE?(close)

Yes……………………..No…………………………….Explain?………………………………………………

5- What do you consider to be the most important the Model usefulness to large projects or/and to small projects?(open)

6- Do you have any recommendations?(open)

……

…….

Appendix D

Refereed Conference Papers

1- Motaleb, O., and Kishk, M. (2013c). Towards the Development of a Risk Response Model for Construction Projects Delays in the UAE. 11th International Postgraduate Researchers Conference, Salford, Media City, 8-10th April 2013, UK.

2- Motaleb, O., and Kishk, M. (2012) A Risk Response Plan Framework for Housing Construction Project Delays in the UAE. COBRA, Proceedings the Royal Institute of Chartered Surveyors (RICS), 11-13 September 2012, ASU, Monte Carlo Hotel, Las Vegas, USA.

3- Motaleb, O., and Kishk, M. (2011a) Construction Projects Delay in the Middle East: State-of-the-Art Review. 10th IPGRC Proceedings, 14-15 September 2011, University of Salford, Salford, Manchester, UK

4- Motaleb, O., and Kishk, M. (2011b) Controlling the Risk of Construction Delay in the Middle East: State-of-the-Art Review. COBRA, Proceedings the Royal Institute of Chartered Surveyors (RICS), 12-13 September 2011, University of Salford, Salford, Manchester, UK.

5- Motaleb, O., and Kishk, M. (2010) An Investigation into Causes and Effects of Construction Delays in the UAE. 26th annual Association of Researchers in Construction Management (ARCOM) conference, 6-8 Sept. 2010, Leeds, UK, 1149-1157

Appendix E

Supplementary Questionnaire

This is a supplementary questionnaire related to research "**Development of a Risk Response Model to handle Delays of Construction Projects in the United Arab Emirates"**

Please kindly answer the questions below:

The questions will test the "Maturity" of your organization dealt with recent projects for risks response development to control delay risks.

Definition of "**Maturity"**: An organization being in a perfect state of condition to achieve its objectives or means fully developed or perfected, in general usage.

Q1: Does your company use/own any "Maturity" model for risk response development in delay risks control. Please choose from the scale below:

1- Less likely

2-Likely

3-Highly likely

Q2: Please choose the suitability of your recent "maturity level" in the case study for risk response development

Level 1	- Risks are considered as they arise - Determination of mitigation strategies or contingency plans for future is seldom
Level 2	- Informal gatherings on the strategies to deal with the risk events - A risk management (RM) plan that documents the procedures to manage risk - Contingency plans for near-term risks and mitigation strategies for large projects
Level 3	- Templates are used - Contingency plans and mitigation strategies are identified for each risk item
Level 4	-Integrated with cost management, time management, finance/accounting, strategic planning processes and project office
Level 5	- Lessons learned are being captured - A process for tracking the use of project reserves is in place

Thank you very much for your co-operation. Your contribution will be added significantly to this research.

If you have further questions relating to this survey, please contact Omayma Motaleb Email: o.h.motaleb@rgu.ac.uk or omaimahashim@hotmail.com,

Appendix F

Sample Companies' Documents

مؤسسة الفارعة الهندسية للمقاولات العامة

AL FARA'A ENGG. GEN. CONT. EST.

Ref: GC/AM/004AB/169/11

Date: 15th March, 2011

To:

Eng. Ibrahim O. Elias,
Projects Director,
Projects Dept.
M/s. TMKN Property,
Al Ain – U.A.E.

Project: New Chalets At Al Ain Rotana Hotel.

Ref. No. GC/AM/004AB/0015/10 dated 9th December, 2010.
GC/AM/004AB/168/11 dated10th February, 2011

Subject: Progress of Works. (Delay due to Change in Design)

Dear Sir,

Reference to above letter we would like to advice the following

1. Revised Architectural Drawing Submitted recently by the Consultant to Al Ain Municipality not yet approved. Reference: RFI No. 6 dated: 15.02.2011
2. Revised Structural Drawing not yet submitted to Al Ain Municipality for their approval.
3. Revised M.E.P. Drawings (HVAC, Electrical, Water Supply Etc.) not yet issued by the consultant.
4. Revised Swimming Pool Drawing not yet provided by Consultant.
5. After approval of the above drawings from Al Ain Municipality **Revised Bldg. Permit to be obtained from Municipality.**

The above mentioned points are causing delays **(4.83% actual against 20.93% Planned)** and disruption to the contract construction programme and subsequently lead to extend the contract period **86 days** as shown in attached report. As well as effecting Cash Flow very badly**(AED 3.0 million actual against AED 13.36 million planed)** Al Fara'a will endeavor to avoid this happening for the benefit of all the parties concerned.

We would appreciate your immediate assistance in addressing the above issues which we have again brought to your attention, to avoid any further negative impact on the project.

This is for your information and necessary action.

Best Regards,

For Al Fara'a Engg. Gen. Cont. Est

AL FARA'A ENGINEERING GENERAL CONTRACTING ESTABLISHMENT
Tel: 03 754 57 05

Mr. Maher Al Nahhas
Area Manager

Enclosed-
1.Delay Impact on Construction Programme.
2.RFI's for Architectural Drawings (RFI 6) and Structural Drawings (RFI 12)

Received
Biju Raj Nair
15/3/11

مؤسسة الفارعة الهندسية للمقاولات العامة
AL FARA'A ENGINEERING GENERAL CONTRACTING EST.

Ref: GC/PM/004AB/241/12

Date: 8th March' 2012

To:
M/s. TMKN Properties
P.O.Box No. 1143,
Abu Dhabi – U.A.E.
Phone # 03-7545208 Fax # 03-7541139

Attention	:	**Eng. Ibrahim O. Elias** **Director of Projects**
Project	:	**New Chalets at Al Ain Rotana Hotel – (ID Package)**
Subject	:	**Impacted Programme**

Dear Sir,

Please find enclosed the Time Impact Programme that shows the new Completion Date as 15th Jan.'2013 due to delay in Mock-up finalization. This programme is based on receiving all the Concept Approved Drawing/Revised Specification/ Approved from Consultant on 10th March for mock-up.

We reserve our right for the above as well as Associated Cost Impact which will be submitted at the earliest.

This is for your kind approval.

Thanking you.

Yours faithfully,
For **Al Fara'a Engg. Gen. Cont. Est.**

Eng. Ajay Nigam
Sr. Project Manager

Anjali

Enclosed: As stated

AL FARA'A

CONSULTANT:

AL MEEDAN

CONSULTANTS

ARCHITECTS & ENGINEERS

Projects Director,
M/s IMKN Property,
P.O.Box:3853,
Abu Dhabi-UAE

Change Order

Project: New Chalets at Al Ain Rotana Hotel

Contractor: Al Fara`a Engg. Gen. Cont. Est.

Date: 29.04.2012

Ref.: Al Meedan/0403/12, 05/04/2012
GC/PM/004AB/0181/11, 5/04/2012,
GC/PM/004AB/204/11, 6/09/2011

Change Order No.: 4

Classification: Variation Order due to Structure & Architecture drawings revised with major changes

The following changes have been approved for this project:

Extension of Height of substructure and Interior design Changes.

Original contract value:	Dhs. 63,862,000.00
Sum of Previous Add Change Order:	Dhs. 3,683,104.00
Sum of previous Deduct Change Order:	Dhs. 0.00
Contract Value Prior to this change Order:	Dhs. 67,545,104.00
Sum of Consultant Fee	Dhs. (2,456,230.00)
Amount of this Change Order:	Dhs. 8,709,736.00
New Contract Value:	Dhs. 73,798,610.00

Time Extension / Completion Period------- 31st Jan 2013

Agreed:

Contractor

مؤسسة الفارعة الهندسية للمقاولات العامة

AL FARA'A ENGINEERING GENERAL CONTRACTING ESTABLISHMENT

1980

Tel: 03 754 57 05, Fax: 03 755 14 03, PO Box: 15915 - Al Ain, UAE

Date:

Owner

1/5/2012

Date:

TMKN
TMKN PROPERTY
Projects Department

AL FARA'A
engineering general contracting

CONSULTANT:
AL MEEDAN
CONSULTANTS
ARCHITECTS & ENGINEERS

Projects Director,
M/s TMKN Property,
P.O.Box:3853,
Abu Dhabi-UAE

Proposed Change Order

Project: New Chalets at Al Ain Rotana Hotel

Contractor: Al Fara`a Engg. Gen. Cont. Est.

Date: 29.04.2012

Ref.: Al Meedan/0403/12 , 05/04/2012
GC/PM/004AB/0181/12, 5/04/2012,
GC/PM/004AB/204/11, 6/09/2011

Proposal No. : -4-

Classification: Variation Order due to Structure & Architecture drawings revised with major changes.

The following changes have been approved for this project:

Extension of Height of substructure and interior design Changes.

Time Extension / Completion Period--------31st Jan.`2013

Approved ☐ Approved with comment ☐ Not approved

Approval:

Owner: ____________ Date: 01/05/2012

Contractor`s Representative: ____________ Date: ____________

مؤسسة الفارعة الهندسية للمقاولات العامة
AL FARA'A ENGINEERING GENERAL CONTRACTING ESTABLISHMENT
Tel: 03 754 57 05, Fax: 03 755 14 03, PO Box: 15615 - Al Ain, UAE

Appendix G

Peer -Refereed Journal Publications (Full Citation)

1- Motaleb, O., and Kishk, M. (2014), "Assessing Risk Response Maturity: A Framework for Construction Projects Success in the United Arab Emirates", *International Journal of Managing Projects in Business*, Vol.7 No.2.

Assessing Risk Response Maturity: A Framework for Construction Projects Success in the United Arab Emirates

Abstract

A construction project is considered to be successful when it is fully developed and completed according to its objectives and intended process, and within the stipulated timescales. Maturity is a key requirement for risk response. This is especially true for construction projects within the United Arab Emirates (UAE) since the costs associated with the delay of construction projects have reached $767billion, and more than 50% of all such projects are on hold as a result of the recession that began in 2008-2009. Given that construction projects operate with immature management systems, there is still a need for the development of approved measures to ensure project success. The objective of the research work that underpins this paper is, therefore, to examine the effectiveness of project management maturity in mitigation measures for risk response within construction companies to influence project success. Ninety-three questionnaires were collected from respondents in different construction companies in the UAE, in order to assess project maturity in construction projects. Fifteen key success factors emerged from the literature and the questionnaire survey as being susceptible to improvement with increasing the project success. The results reveal that maturity can be improved by developing mitigation measures which positively influence risk response for project success. Based on these results, a framework is proposed to improve the practical functioning of risk response. This framework provides a better risk response to achieve a higher level of maturity. One of the unique features of the study is the creation of new knowledge by focusing on the UAE. At the same time, the use of maturity modelling to handle construction delays risks provides new knowledge for a wider audience.

Keywords: *Maturity, project management, project success, risk response, UAE.*

1 Introduction

All projects are unique in respect of their content and scope, but there are certain inherent risks that pertain to them all, and unexpected changes can occur with any project. Risk response has been discussed and classified in systematic management standards to be of the '*acceptance*' type or the '*reduction*' type, it being suggested that '*acceptance*' should be the strategy if the risk impact is relatively insignificant (using a contingency plan) and it is possible for mitigation in new risks reviews and to update the risk plan (Flanagan and Norman, 1993), and that '*reduction*' should be adopted where immediate action is required. It is also suggested that in this reduction activity, the costs, savings and benefits should be compared. Another option exists, that being to '*transfer'* the risk to another party, and in this case it should be transferred to the party most capable of managing it. Hillson (1999) suggested warranties and guarantees as effective risk transfer measures for response. Other research by Zhi (1995), observes risk response to be dealt with through the three channels of: response by contracts, by retention, and by insurance. Elimination of risks is obviously preferable where such risks are unacceptable, but in reality it is impossible to totally remove such risks.

Risk response is not usually cost effective because projects face unexpected changes varying from simple to chaotic changes or variations (De Meyer et al., 2002). One further option exists, that being to manage the risk response with matured systems, and in this case, the response should be developed and then managed by the party most capable of managing it. This act of management is seen in the work undertaken by Turner (2000), who claimed that the concept of project management (PM) in construction organisations generally includes the notion that management actually focus on a single project, a single location, and on project output and input rather than on the actual project process. In this case, there is no attention paid to '*process maturity'*. 'Maturity' in this sense refers to the level of organisational development, and the degree to which it operates in perfect conditions (Andersen and Jessen, 2003; Cooke-Davis, 2005), and works according to best practice benchmarks (PMI, 2002). Clearly, the formal identification and discussion of theses aspects of risk response indicate the importance of the issue within the United Arab Emirates (UAE) since the costs associated with delays risks of construction projects have reached $767 billion, and 60% of such projects are on hold as a result of the recession that began in 2008-2009 (Motaleb and Kishk, 2013). In fact, research in the area of risk response is still neglected (Syedhosini et al., 2009), and this is a situation that should be redeemed since *reduction, protection, contingency*, *acceptance,* and *transfer* types (Risk Management Guidelines, 2003) are all known to affect the overall strategy of the project, albeit in limited areas of risk (APM, 2006). In addition, since it is not possible to provide a comprehensive list of mitigation measures, the authors claimed the commitment for specific risk mitigation measures by assessing key success factors.

The next sections identify the critical view for risk response development. A framework is then developed to operationalise these plans.

1.1 Risk Response Strategic Development

Risk response development in terms of delays risks is a crucial process within the wider field of risk management, but as already intimated, it has not yet been fully implemented in many construction companies in the United Arab Emirates (UAE). Furthermore, few studies provide evidence of the usefulness of risk management practice in controlling delays risks. That said, risk response is known as a guiding process in decision-making to reduce conflicts and increase co-operation among the project stakeholders and to create the essential conditions for optimal risk identification and assessment to determine whether a risk has increased or decreased. This has encouraged construction companies to focus more on the development of risk response strategies to avoid such delays risks through risk mitigation measures. Demonstrating a close-fit view with past and recent research as published in the literature, the paper now discusses mitigating measures for risk response development from several options. In general, there is a very great noticeable lack of knowledge in the area of risk response in the UAE since risk identification and assessment have been carried out in many projects by construction professionals and stakeholders, but still the risks have not been removed. Although, such development has generally been considered to ensure comprehensive identification and assessment of risks through project planning in risk management (Cooper and Dale, 2005), identification and assessment is worthless in the risk management process unless risk response can be developed and defined.

As already mentioned, risks response in construction has not yet been fully addressed, but over the years, many studies have been undertaken in quite different environments, and have critically reviewed the issue of delays risks in order to determine the causal factors. From these studies, significant factors related to the client and project managers, the contractors, and financial problems, have emerged in the latest research in the UAE (Faridi and El-Sayegh, 2006; Motaleb and Kishk, 2013) and in such cases in other countries (Kaliba et al., 2008; Long et al., 2008; Low et al., 2009). In particular, the quantified risks like change orders, and on-time performance, would benefit from such inputs of this research since the traditional project management approach omits these completely, and hence, does not consider the potential for change nor the way to deal with it. Additionally, the traditional management technique has failed to ensure that the most appropriate tools for evaluating the way to respond to risk are used. Consequently, it can be appreciated that the management of the outcomes from each category-related delay risk may require a mature risk response in its development rather than the traditional management, and accordingly, there would be a need to allocate certain priorities in the risk response mitigation measures.

1.2 Risk Response-Maturity Relationship

Having reviewed the literature relevant to risk management, it appears that risk response is the most important process since this determines the ability of managers to enhance opportunities and reduce threats in projects. More specifically, the risk response development has the potential to create the essential conditions for optimal risk maturation in respect of the identification and assessment of risks. This would allow managers to determine whether a risk has changed in nature or not. Earlier research has encouraged the risk response through contingency plans that should be provided by the project manager (Risk Management Guidelines, 2003).

However, although mitigation measures are useful, and indeed commonly used in the development of a risk response process, the mitigation route is identified as the most expensive (Cooper and Dale, 2005). Hence, it is advisable for clients to take responsibility for each agreed risk response (Burtonshow, 2009), and deal effectively with risk severity for cost effective, time success, positive procurement, quality, and schedule plan outcomes (Sanghera, 2010). Consequently, it can be understood that in order to assist risk response development, it is essential to implement a maturity scale, and to conduct practical research to make an assessment of its potential usefulness. According to Loosemore et al. (2006), maturity is the knowledge of how to mitigate risks, it is a continuity system for any form of business that needs to cope with, and recover from, risk events. In addition, typical risk-mature organisations have awareness and sensitivity towards risks and social and financial responsibilities to stakeholders. Loosemore et al. (2006) confirm these arguments, claiming that risk-mature organisations encourage those within the supply chain to take responsibility for the own risks. Furthermore, organisations with risk-mature systems tend to have a permanent risk management team, are continuously communicating and co-ordinating with each other, and reviewing risks for the slightest change. It can be seen that only a few studies in construction project management have concerned themselves with exploring how a more developed approach to risk response development, rather than the traditional one, could be more valuable. It is also reasonable to expect that all stakeholders in construction projects should possess sufficient knowledge to enable their effective participation in decision-making (Motaleb and Kishk, 2013), yet stakeholders' experience of contributing to risk management efforts is limited because of the emphasis on the traditional approach that excludes them. Therefore, risk response in a maturity system is a vital process in risk management and appears to be the most important tool for project success. In addition, the review of mitigating risk response measures, as discussed in the literature, supports the contention that such measures are adapted when considering project risk response development in ‘maturity’ levels. In Table 1, scales for risk response development are indicated and tested by one of the Risk Management Maturity Models called the Project Management Maturity Model (PMMM), which has five levels: level 1 - initial process, level 2 - structured process and standards, level 3 - organisational standards and institutionalised process, level 4 - managed process, and level 5 - optimising process. The components of risk response development within the overall framework of risk management have been provided for complete definition and benchmarking by the previous five levels, as outlined by Crawford (2006). So, the suitability of the test framework for risk response development has been confirmed since detailed descriptions are provided for each component. In particular, in this study, efforts to explore what occurs at each risk response development maturity level will answer the question of ***why*** the issue of risk response mitigation measures is the least developed and studied among all project management components in the knowledge area, and ***how*** and ***when*** it such measures can achieve the goals required for project success.

Table 1: Component-maturity Level Matrix of PMMM (Crawford, 2006)

Level 1	- Risks are measured as they arise - Willingness to determine mitigation strategies or contingency plans for the future is low
Level 2	-Informal project team thinking about the strategies to deal with the risk events - Risk response may be in avoiding, mitigating or accepting (risk management plan that document applicable procedures to manage risk) - Mitigation strategies implemented for large projects and contingency plans for short-term risks
Level 3	- Use of templates - Identification of contingency plans and mitigation strategies for each risk item
Level 4	-Integrated with time management, finance/accounting, and cost management strategic planning and processes
Level 5	-Lessons being learned -Project reserves tracked in place by a process

2 Research Design

The overall aim of the research was to assess the relationship between project management maturity (PMM), and three types of risk response mitigation measures (*reduction, transfer* and *absorption)* have been chosen. Fifteen key success factors enhanced the risk response maturity (development) related to mitigation measure in construction projects in the UAE (see Table 2).

Variables are proposed as follows: X stands for PMM as a dependent variable. Fifteen key success factors are considered as independent variables, Y relates to mitigation measures groups (*reduction, transfer* and *absorption*); these measures have been identified in many cases by construction companies in the UAE. The consequent dependent variable relating to risk response development for project success is called Z.

In order to assess the value of the PMM (Crawford, 2006) in promoting project success, maturity levels within the project were explored. Participants were asked in a questionnaire, to evaluate the suggested mitigation measures for risk response development in the PMM in respect of fifteen key success factors related to mitigation measures.

3 Research Methodology

Accordingly, the research involved a literature review, questionnaire, and statistical analysis (descriptive and by ANOVA) to answer the research question. The questionnaire was adopted as a means of collecting reliable and quantifiable data at a reasonable cost (Peterson, 2000). Hence, a quantitative approach was used to secure the data. The questionnaire was completed by 93 individuals (project managers, contractors, consultants, and others [i.e. engineers, developers and financiers]) in high scale construction companies that provide semi-formal risk management programmes for their managers in order to enable them to be more effective in their project management. The companies concerned were located in both

Abu Dhabi and Dubai Emirates. The Project Management Maturity (PMM) was assessed in order to consider the basic layers in project maturity that allow for developing mitigation measures to be addressed throughout project management practice. In addition, the questionnaire was designed to test the influence of the 'maturity knowledge' about the fifteen key success factors related to mitigation measures in risk response in practice. All candidates were asked the same questions, and asked to choose answers from among the same set of alternatives on either a three-point, or five-point Likert-Scale, hence being asked questions with the opportunity only for fixed responses. The questions covered the following areas:

- Demographics (informant details concerning professional role, years of experience, types of project, sector).
- The significance of the mitigation measures for risk response development for project success.
- The perceived maturity level for effective risk response that can be improved by the assigned mitigation measures (15 key success factors) and capabilities from assigned stakeholder(s) participation.

Therefore, hypotheses are based on the questionnaire and presented as follows:

H_0: There is no significant difference in opinion between the group of stakeholders (project managers, contractors, consultants, and others) in respect of the belief that PMM (X) can be improved by development in mitigation measures (Y), and consequently achieve risk response maturity higher level(s) for risks control.

H_A: At least one from the above factors is different from others

Table 2: Assessment of Mitigation Measures in PMM

No	Key Success Factors-related Mitigation Measure	Matching Maturity Level
	REDUCTION	**According to Crawford (2006)**
1	Practical use of lessons learned from past experience	Level 5
2	Contingency plan for each new risk item	Level 3
3	Practice and learning in the field (active project manager support for long term mitigation strategy in time management)	Level 4
4	Delay analysis template	Level 3
5	Overlapping activities management considering budget and schedule integrated management	Level 4
6	Optimal risk allocation process plan	Level 5
7	Coordination with sub-contractors - time integration	Level 4
8	Project team productivity optimisation – integrated resources (Expert manpower/efficient equipment/ technology)	Level 4
9	Construction method technique as a mitigation strategy for large projects	Level 2
10	Municipality approval process for change requests - time integration	Level 4
11	Risk identification supervision – optimization	Level 5
12	Adequate incentives and rewards - strategic planning	Level 4
13	Develop change management (variations) - lesson learnt	Level 5
	TRANSFER	**According to Crawford (2006)**
14	Insurance integration consultation – cost management	Level 4
	ACCEPTANCE	**According to Crawford (2006)**
15	New risks reviews and update the risk plan	Level 3

4 Results

- The questionnaire was completed by 93 professionals in 35 construction, consultancy, and contracting companies in the UAE, 88% from Abu Dhabi Emirate, 12% from Dubai emirate in public and private sector. They were completed in a four-month period. Respondents occupied different professional roles (see Figure 1), more than 50% had 5-10 years' experience (see Figure 2), and the type of construction projects in which they were involved varied in size and number (see Figure 2), with a higher percentage being engaged in civil and infrastructure engineering projects.

- Firstly, descriptive analysis was undertaken of the responses to questions relating to the overall positive expectations of risk response development in project practice with reference to the development in the fifteen key success factors related to mitigation measures and matched **through the PMM five levels** (see Figure 3). It is clear that %50 of: i) Project managers scored 2.133, ii) Contractors scored 2.133, iii) Consultants scored 2.267, and iv) Others scored 2.067.
- Then one-way ANOVA was used to confirm the fact that all average scores for the different groups (Project managers, Contractors, Consultants, and Others) were almost the same. It was noticeable that there was no significant difference between the groups in *RISK*

RESPONSE BY DEVELOPING REDUCTION MEASURE in the following factors : *practical use of lessons learnt from past experience* (p=0.341> α=0.05), *contingency plan for each new risk item* (p=0.489 > α=0.05), *practice and learning in the field (active project manager support)* (p=0.756 > α=0.05)*, delay analysis template* (p=0.171> α=0.05)*, optimal risk allocation plan* (p=0.828 > α=0.05), *co-ordination with sub-contractors development* (p=0.215 >α=0.05), *project team productivity optimisation* (p=0.835 >α=0.05), *construction method technique* (p=0.270 >α=0.05), *municipality approval process* (p=0.166 >α=0.05), *adequate incentives and rewards - between contractors and clients* (p=0.252 >α=0.05), *develop change request management* (p=0.093 >α=0.05), and marginal significance difference BETWEEN THE GROUPS i*n supervision for risk identification (*p=0.045 <α=0.05). *RISK RESPONSE BY DEVELOPING TRANSFER MEASURE in the case of insurance* (p=0.988 >α=0.05), and *RISK RESPONSE DEVELOPMENT BY ACCEPTANCE MEASURE in new risks reviews (update) in the risk plan* (p=0.680 >α=0.05), meaning that the null hypothesis in Variable Y (see Table 3) was not rejected.

- In addition, the null hypothesis was not rejected in Variable Z, as a strong relationship was indicated between mitigation measures, and

PMM levels. Two respondents pointed to level 1, four to level 2, whereas 28, 34 and 25 respondents believed the developing mitigation measures can affect risk response through maturity in the higher levels of 3, 4 and 5 respectively. This confirms the assessment in Table 2 and results in Figure 5.

- One-way ANOVA was also used to confirm that there was no significant difference between the groups in their beliefs that the client, consultant, contractor, expert project manager, trained project manager, construction manager, functional manger, external analyst and site engineer, can work together as a team to development mitigation measures to higher levels of maturity and identify risk response development for project success and delays risks control (see Table). The exception was with financiers ($p=0.022<\alpha=0.05$).

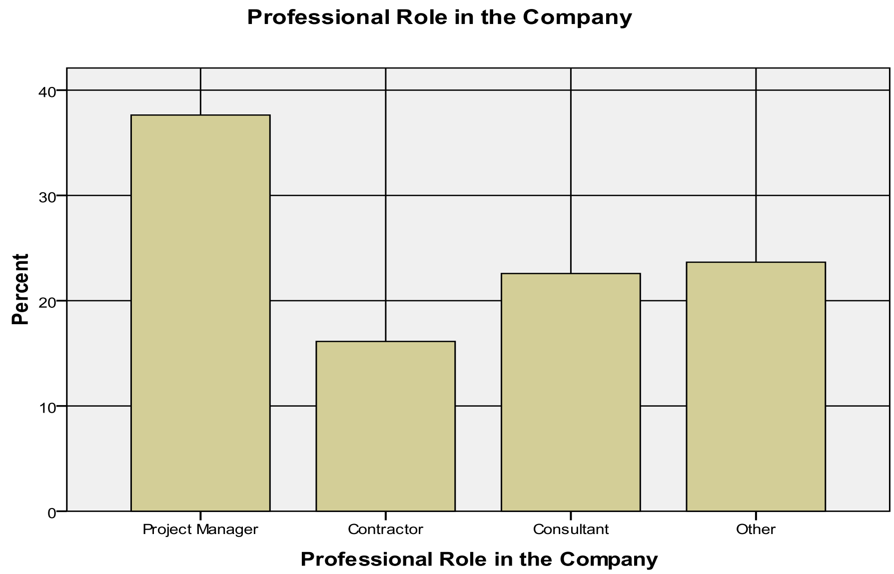

Figure 1: Professional roles in the construction companies

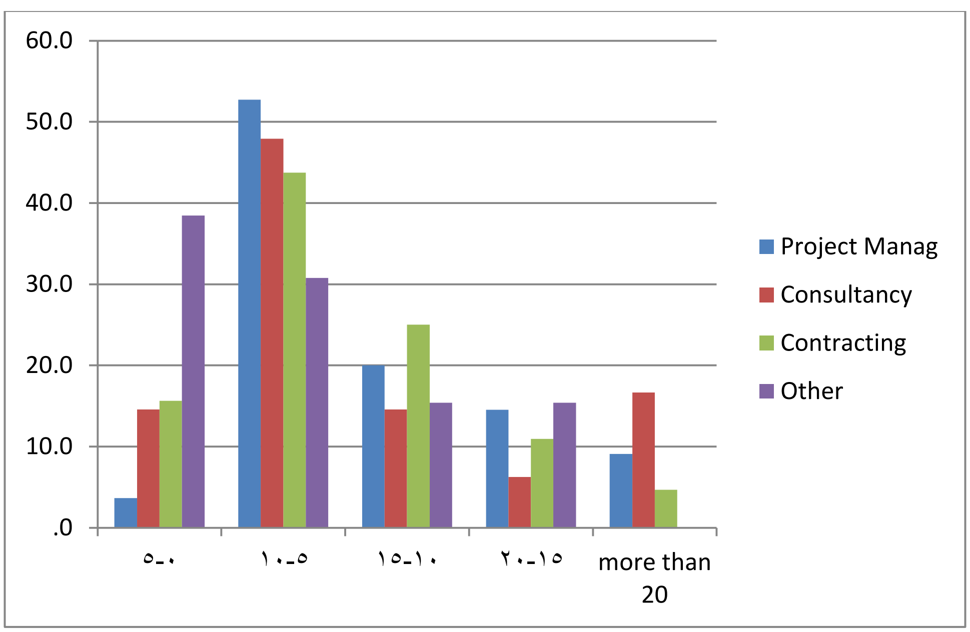

Figure 2: Professionals' Years of Experience

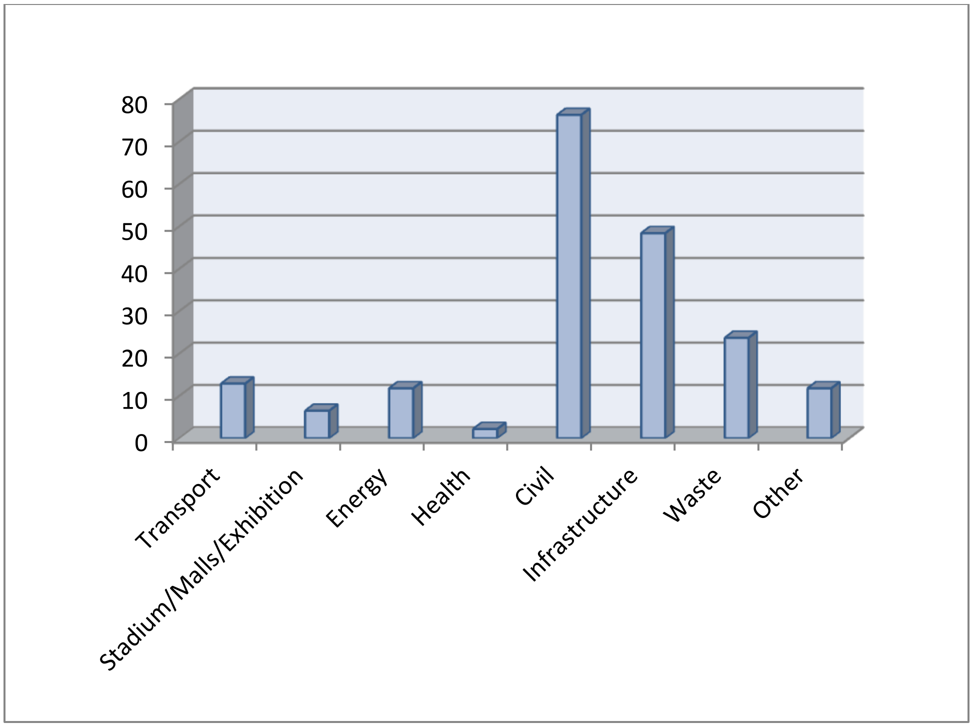

Figure 3: Type of Construction Projects

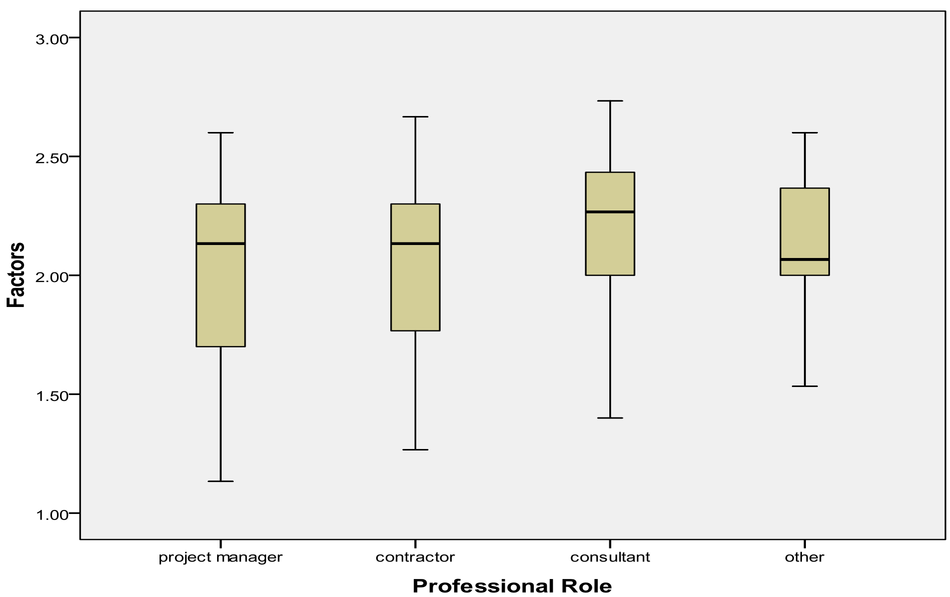

Figure 4: Development of mitigation measures factors

Table 3: ANOVA Test for Significant Difference between Groups in Developing Mitigation Measures in PMM

No.	Mitigation Measure	Key Success Factors	ANOVA ANALYSIS RESULT	
	Reduction		F	p-value
1		Practical use of lessons learnt from past experience	1.131	0.341
2		Contingency plan for each new risk item	0.815	0.489
3		Practice and learning in the field (active project manager support)	0.396	0.756
4		Delay analysis template	1.710	0.171
5		Overlapping activities management considering budget and schedule	0.434	0.729
6		Optimal risk allocation plan	0.296	0.828
7		Coordination with sub-contractors	1.520	0.215
8		Change the construction method	1.329	0.270
9		Project team productivity optimisation – resources	0.286	0.835
10		Municipality approval process	1.733	0.166
11		Supervision for risk identification	2.788	0.045
12		Adequate incentives and rewards	1.386	0.252
13		Change request management (variation)	2.203	0.093
14	Transfer	Integration of INSURANCE consultation	0.043	0.988
15	Acceptance	New risks reviews review (update) in the risk plan	0.505	0.680

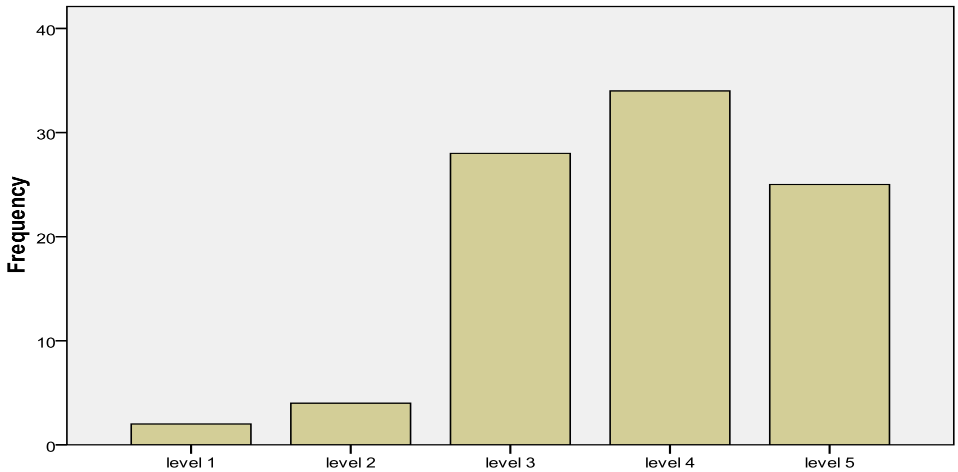

Figure 5: Effective of Mitigation Measures through PMM for Risk Response Development

Table 4: Descriptive Analysis of Improving Risk Response in PMM by Project Stakeholders

Stakeholders	**Percentile 50%**	**Percentile 75%**	**Range**	**Maturity Level**
Client	4	5	Level 4-Level 5	Level 4
Consultant	4	4	Level 4-Level 4	Level 4
Construction manager	4	5	Level 4-Level 5	Level 4
Financier	4	5	Level 4-Level 5	Level 4
Site engineer	3	4	Level 3-Level 4	Level 3
Expert project manager	5	5	Level 5-Level 5	Level 5
Trained project manager	4	4	Level 4-Level 4	Level 4
Functional manager	3	4	Level 3-Level 4	Level 3
External analyst	3	4	level 3-Level 4	Level 3
Contractors	2.5	5	Level 3-level 5	Level 4

Table 5: Assessing Professionals' Capabilities for Risk Response Development in PMM

Stakeholders	F	p-value
Client	0.296	0.828
Consultant	1.954	0.127
Construction manager	0.962	0.415
Financier	3.366	0.022
Site engineer	1.960	0.126
Expert project manager	1.028	0.384
Trained project manager	1.660	0.182
Functional manager	1.484	0.225
External analyst	0.711	0.549
Contractor	0.707	0.707

5 Discussion

As mentioned earlier, the level of project management maturity within the company is important for delivering projects on time and cost-effectively. The five levels in the maturity model (Crawford, 2006) provide an appropriate scale for developing construction projects and success as suggested in Table 2. It is clear that %50 of each group of Project managers, Contractors, Consultants, and Others have scored almost the same median (see Figure 4) when they assessed the key success factors-related mitigation measures for risk response development by maturity suggested by Crawford (2006). As seen from the data analysis, the practice can be developed and found at higher levels of maturity, and the improvements are identified as being in the following key success factors related to three mitigation measures (*reduction, transfer* and *acceptance*) for risk response in Table 2: *practical use of lessons learnt from past experience* (level 5), *up-dating project schedule for any new identifying risk (contingency plan for each risk item)* (level 3), *more practice learning in the field (active project manager support for long term mitigation strategy in time management)* (level 3*), use template for delay re-analysis* (level 3), *Manage the overlapping activities* considering budget and schedule integrated management (level 4)*, proper plan* for optimal risk allocation (level 5), *co-ordination with sub-contractors* for time integration (level 4), *Increase project team productivity* – integrated resources (Expert manpower/efficient equipment/ technology) - risk buffering (level 4), *change the construction method* as a mitigation strategy for large projects only (level 2), *municipality approval process for change requests* - time integration (level 4), *exchange of adequate incentives and rewards - strategic planning* (level 4), *develop change management* – lesson learnt (level 5), and marginally, there is significant difference in *regular supervision for risk identification checklist* (level 5).

There was also agreement by stakeholders (with the exception of the financier) concerning their capabilities to improve risk response within the project maturity model. Implicitly, these findings indicate improvements in risk response mitigation measures within maturity in higher levels 3, 4 and 5 (see Table 4), and consequently the construction company can: i) optimise senior management support for project delivery, ii) integrate tools and techniques required for the process, iii) identify strategic organizational goals for long-term planning, and iv) develop levels of project management maturity through training, workshops, etc. provided by the company, since there were improved personal skills, and previous experience was used. However, it was also noticed from the survey findings that there was limited understanding of the project management maturity models, and this may be the reason behind the lack of mature management systems. As a result, there appears to be needed to re-examine the effectiveness of project maturity levels in live cases in the UAE construction companies in order to re-define the risks response for project success in the future. Furthermore, according to the survey, there are many construction companies at maturity levels 1 and 2 in the UAE, although fortunately, high scale companies are seen as being at level 3 with a few at level 4. Clearly, progression to the higher levels can only be made when the preceding level is satisfied, thus meaning that there is still much work to do. The results obtained show that maturity functions to provide a competitive edge in construction project management in the UAE, thereby revealing the effectiveness of the scale of project management maturity.

The expectations of construction professionals in the UAE is that matured mitigation measures for risk response in construction project settings can ensure adequate use of skills and can put the knowledge acquired from previous experience into practice with new projects. These professionals were demonstrating practice at least at level 3 of the maturity model. However, in order to expose and avoid any pitfalls, and indeed to ensure that all professionals have adequate levels of competency, more focus should be given to 'Maturity' in the project management training provided for professionals who are earmarked to assume responsibility for project control, since such enhanced training will bring benefits to all the stakeholders and to society in general. Such training should involve project co-ordination, project management systems development, and active reporting, as well as knowing how to benefit from the lessons learnt from past experience in order that a higher level of maturity can be achieved.

The main problem seems to be that traditional management is adopted by project managers in organisations dealing with construction projects, and that this is done as a matter of the managers' preference. However, where Level 3 and 4 maturity was evident, it was clear that this had been built upon Levels 1 and 2, and that a good basis in these lower levels enabled adequate developments at higher levels. Nonetheless, the survey in several companies and in the private sector in particular, revealed deficiencies in

Levels 1 and 2, and the need for their companies to introduce generic training to remedy this problem. In the absence of such training within the private sector, there was no knowledge-sharing, and no consistency in job roles and responsibilities specifically for those involved in project management. Clearly, it is not possible to aspire to the subsequent levels unless the levels before those are reached to a satisfactory standard. Nonetheless, it is still possible to make plans for the higher levels in a framework (see Figure 6).

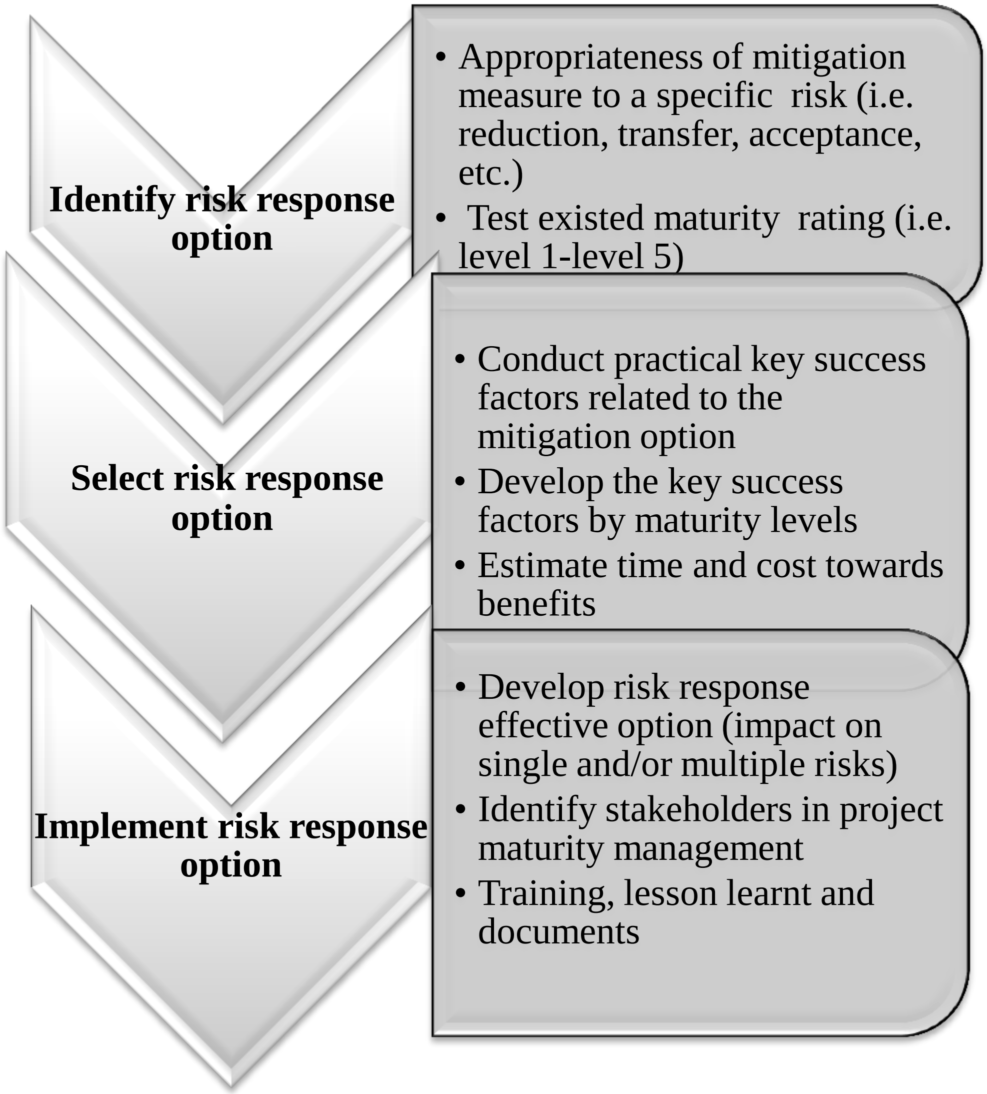

Figure 6: A Framework for Risk Response Development

Orientation and change efforts in organisational maturity were invisible and, therefore, respondents felt a need for more visibility in this area so that could operate as a benchmark against which companies could assess the performance of their projects business.

This study has shown an approach to project maturity that could ultimately produce better project performance and delivery. More specifically, the stages should be sequenced according to the framework outlined in Figure 6. In this framework the steps are identified. At Layer 1 there is a need to identify risk response from options so that the mitigation measures are appropriate to specific risks (i.e. reduction, transfer, acceptance, etc.) and not to follow traditional approaches. At Layer 2, there is a need to build foundation risk response selections which are in themselves generic practical key success factors related to the mitigation option, to develop the factors by maturity levels, and then estimate the time and cost for a solid option. These first two *LAYERS* are considered as crucial in providing the building blocks for subsequent maturity. At Layer 3, among the option(s) identified are the risk response effect, develop risk response effective option (impact on single and/or multiple risks), identify stakeholder(s) in project maturity management, and finally, training, lesson learnt, and documents for future use.

The critical gap that has been exposed in this study, that being the lack of knowledge concerning 'maturity' in the management of construction projects, emphasises that there are few examples of applications of the 'maturity' concept in UAE construction projects. Moreover, there is also a lack of global research concerning this topic. This study represents a new understanding of the situation in the UAE construction companies, and the findings must be noted in all efforts to achieve success in these companies in the future. If at Level 1, 2 or higher, there was greater consideration given to the requirements of these stages by project managers, consultants, contractors and other professionals, PMM may reach more advanced levels and maturity could be accomplished in the framework. The suggested developing levels of the maturity are most importantly identified from project management methodology for project standards in Level 4 and 5 as a driver for further research. At Level 4, project management should be institutionalised by senior management commitment, and lessons should be learnt from the database so as to optimise outcomes. At Level 5, such outcomes should be verified through auditing procedures that search for evidence of best practice, and ensure the potential for this by promoting stakeholders' development in PM. In this respect, a proper training and career programme must be in place for project managers. The assumption remains that the organisation's competency is characterised by the relationship between project maturity, and project success, and hence, we concentrated on the maturation in the five levels that could be accomplished by stakeholders in mitigation measures, concluding that in prestigious or high scale construction companies, such accomplishments were possible.

6 Contributions to Knowledge

Recently, there have been some large disagreements between construction project stakeholders in the UAE, and problems in achieving a fair resolution in respect of incomplete/on-hold projects/delayed projects still persist. In an effort to address this problem, the researcher has carried out an investigation into the use of the participative methodology in a new community, to add knowledge of how to embody the ideas, perspectives, prejudices, language, culture and practices of that community. There has been benefit deriving from this investigation, despite the fact that the developing ideas contradicted professionals in the discipline. This has assisted in the development of best recommendations associated with the problem.

The major contributions to knowledge are as follows:

- There has been a review of the existing methodology in delays risk response development and assessment as reported in the literature, and this has brought value-added to the investigation performed by the researcher in seeking to identify where new knowledge is required.

- The delays risks management measures currently used in UAE construction projects are based on the evaluation of risk factors only, and control measures influencing project success do not exist, so project managers sacrifice much time and cost in risk response that cannot be complete. Risk response in studies is neglected as stated by Syedhosini et al. (2009:753). This study addresses that problem.
- There is a lack of attention given to the relationship between risk response and maturity levels in project management. This study addresses that problem.
- The study brings forward findings that can be promoted as the means to enhance opportunities to control delays risks, and benefit practitioners in the UAE given that so far, there has been no framework of risk response development by maturity levels for delays risks control. Moreover, the new idea to test the risk response development according to maturity level can ensure a new strategy for construction companies.

7 Conclusion and the Way Forward

Both the literature and findings from the study support the argument for developing mitigation measures for risk response through maturity in project management within construction companies, in order to favourably influence project success. Significant findings were reported for project maturity by the following developing key success factors-related risk response mitigation measures in respect of the practical use of lessons learnt in the past (level 5), up-dating the project schedule for any newly-identified risk (level 3), more practical learning in the field (active project manager support) (level 3), delay re-analysis (level 4), proper plan for optimal risk allocation (level 3), co-ordination with sub-contractors (level 4), increase project team productivity – resources (level 5), change the construction method (level 4), municipality approval process for change requests (level 4), exchange of adequate incentives and rewards (level 4), develop change management (level 5), and a marginally significant difference in regular supervision for risk identification checklist (level 5). In addition, stakeholders' management development in respect of construction project delivery was associated with the PMM maturity in each of the five levels. This was agreed by the groups of project managers, consultants, contractors and other professionals (developers, financiers, engineers) who were involved in this research. The framework presented in this study shows and supports the sequential interaction between maturity and risk response development through three layers (identify risk response option, select the risk response option, and then implement it) in themes associated with each. The literature supports the contention that the success of organisations that are concerned with construction projects is positively affected by higher levels in project management maturity.

Finally, a framework for construction projects success in the UAE has been proposed. Unique characteristics of this framework include

- It acknowledges the significant need for development in risk response mitigation measures.
- Matured risk response option is selected and maintained by key success factors related mitigation option(s), considering time and cost management.
- Roles and responsibilities are carefully defined for project management maturity.

Another unique feature of this research work is the creation of new knowledge by focussing on the UAE. Additionally, the use of maturity modeling to handle construction delays risks provides new knowledge for a wider audience. This study, however, reflects the general view but for greater confirmation, in-depth investigation is required, and the suggestion is that more primary data should be gathered by the survey method in other project organisations that have adopted risk management maturity, in order to validate the preliminary findings in this paper. This research is being carried out and will be reported in a future paper.

8 Acknowledgements

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9 References

Andersen, E., & Jessen, S. (2003), "Project maturity in organizations. *International Journal of Project Management*, VOL.21 NO.6., pp. 457-461

APM. (2006), *Body of Knowledge*, 5th ed., APM, Princes Risborough.

Burtonshow, S. (2009), *Risk and Financial Management in Construction*, Gower, Aldershot.

Cook-Davis, T. (2005), "The Executive Sponsor-the Hing upon which Organizational Project Management Maturity Turns?", paper presented at PMI Global Congress, Edinburgh, Scotland.

Cooper and Dale, F. (2005), *Project Risk Management Guidelines: Managing Risk in Large Projects and Complex Procurements*, Wiley, New York, NY (various pages).

Crawford, J. K. (2006), *Project Management Maturity Model,* 2nd ed. Taylor & Francis, London, pp. 165-180

De Meyer, A., Loch, C.H., Pich, M.T. (2002), “Managing project uncertainty: from variation to chaos”, *Engineering Management Review*, IEEE, Vol. 30 No.3, pp.91-98.

Faridi, A. S., and El-Sayegh, S. M. (2006), “Significant factors causing delay in the UAE construction industry”*. Construction Management and Economics,* Vol.24, pp. 1167-1176.

Flanagan, R. and Norman, G. (1993), *Risk Management and Construction,* Blackwell Scientific Publications, London.

Hillson, D. (1999), “Developing Effective Risk Responses”. *Proceedings of the 30th Annual Project Management Institute 1999 Seminars and Symposium Philadelphia, PA, USA: Papers Presented October* 10 - 16.

Kaliba, C., Muya, M., and Mumba, K. (2008), “Cost escalation and schedule delays in road construction projects in Zambia”. *International Journal of Project Management,* Vol.l27 No.5, pp. 522-531.

Long, L. H., Lee, Y. D., and Lee, J. Y. (2008), “Delay and cost overruns in Vietnam large construction: A comparison with other selected countries”. *KSCE Journal of Civil Engineering,* Vol.12 No.6, pp.367-377

Loosemore, M., Raftery, C. and Higgon, D. (2006), *Risk Management in Projects*, 2nd ed, Taylor & Francis, Abingdon.

Low, S., Pheng, L. J., Ying, and Tan, I. (2009), "PSSCOC and causes of construction delays in Singapore and four selected Asian countries". *International Construction Law Review,* Vol.26 No.3.

Motaleb, O., and Kishk, M. (2013), "An Investigation into the Risk of Construction Projects Delays in the UAE", *International Journal of Information Technology in Project Management,* Vol. 4 No.3.

Peterson, R.A. (2000), *Constructing Effective Questionnaires*, Sage, London.

PMI. 2002, *Risk Management Maturity Level Development*, Project Management Institute, London, Available at: http://www.pmi-switzerland.ch/fall05/riskmm.pdf (accessed January 31, 2013).

Risk Management (2003), *Guidelines and Best Practices*, available at: http://oa.mo.gov/itsd/cio/projectmgmt/PDF/risk_manual.pdf

Sanghera, P. (2010), *Project Management Professional Study Guide for the PMP Exam,* 2nd ed, Boston, MA.

Syedhosini, S.M., Noori, S., and Hatefi, M.A. (2009), "An integrated methodology for assessment and selection of the project risk response actions", *Risk* Analysis, Vol.29 No.5, pp.752-763.

Turner, R., and Viel, C. (2002), "Group efficiency improvement: how to liberate energy in project groups", *International Journal of Project management,* Vol. 20, pp.137-142

Zhi, H. (1995), "Risk Management for Overseas Construction Projects", *International Journal of Project Management,* Vol. 13 No.4, pp.231-23.

2- Motaleb, O., and Kishk, M. (2013b). Towards a Maturity Model for Construction Projects Success in the United Arab Emirates (UAE). International Journal of Decision Science, Vol. 4, No.2.

Towards a Maturity Model for Construction Projects Success in the UAE

Abstract

The construction projects have been at serious risks during the recent financial crisis in late 2008. However, despite expectations that delays risks control might be achieved by project management maturity (PMM). Current research is ambiguous in its support for this argument. What is clear is that construction projects do operate with immature management systems. Hence, the objective of this study is to examine the effectiveness of "maturity" in construction companies. An exploratory survey by a questionnaire was conducted with thirty-seven individuals in prestigious companies in the UAE. The candidates were asked to identify areas they believed were susceptible to improvement for project maturity. Eight preventive measures factors (PMF) out of twenty-two have been identified and supported by the literature. The results reveal "maturity" can be achieved in level 4. Additionally, a consequent external effect in project market positioning for competency is expected. A case study was

undertaken, and a model to achieve high levels of PMM and competency for construction project success, developed.

Keywords: Competency, Maturity, Project Management, Project Success, UAE

1 Introduction

The concept of project management (PM) in construction organizations generally includes the notion that management actually focus on a single project, a single location, and on project output and input rather than on the actual project process (Turner, 2000), and hence, there is no attention paid to "maturity'. 'Maturity' in this sense refers to the level of organizational development, and the degree to which it operates in perfect conditions (Andersen and Jessen, 2003; Cooke-Davis, 2005), and works according to best practice benchmarks (PMI, 2002). A comparison between mature and immature organizations is provided in Table 1.

Table 1: Comparison between Mature and Immature Construction Organizations

Mature	Immature
-Have planned processes which are precisely communicated to the project team. In addition, maintenance activities are managed by wide ability alongside with a supportive organizational culture (Sarshar, *et al.*, 2000). - Roles and responsibilities are definite and apparent for projects and organization (Sarshar, *et al.*, 2000). - Besides, product quality and client satisfaction are monitored (Sarshar, *et al.*, 2000).	-Immature organizations may conduct projects with efforts of a dedicated team with no planning rather than repeating systematic and proven methods (Humphrey, 1989) -Construction processes are unambiguous and formed by project managers and practitioners during project execution (Sarshar, *et al.*, 2000). -There is no objective basis for quality and solving product and process problems (Sarshar, *et al.*, 2000). -It is reactionary and dealing with the problems as they arise (Sarshar, *et al.*, 2000).

The importance of maturity development from one level to another in the project process has been modeled by the Project Management Institute (PMI, 2004), in recognition of the need to integrate, assess and improve project management practice. The effects have been recognized in the ability to execute projects successfully (Kerzner, 2005).

It is acknowledged that to ensure future competency in construction project management, in-depth research is required to enable organizations to reach higher levels of maturity (Barber, 2004; Jha and Iyer, 2007). This is reflected in the fact that in the UAE and the Middle East in general, the demand for skilled and knowledgeable practitioners in construction projects is increasing; moreover, this demand has been more noticeable since the financial crisis which began in 2008-2009. It is also noted that there is limited research in project management maturity (PMM) in the area of construction projects, and that simultaneously, the belief within construction organizations in the need for competent project management is becoming stronger. The concept is used both to understand the organization's current project management (PM) standing, even if there are no formal standards in place, and to develop a roadmap for future improvements in PM processes and practices.

Companies need innovative forms of PM in order to compete and focus in the global market, and it is believed that combining maturity in this respect, with sound business management, constitutes best practice (Alonso et al., 2008).

This study examines how the implementation of maturity in PM mechanisms influences and interacts with the more traditional roles and routines associated with PM practice. In recent years, Project Management Maturity (PMM) has been attracting measures of organizational PM sophistication and capability. The project portfolios of the more mature companies in the UAE, for instance, have lower standard deviations for schedule performance (0.08) and cost performance (0.11) than companies with lower PMM scores (average 0.16)(CMCS, 2007). So, the overall aim of this study is, therefore, to examine the effectiveness of project management maturity within construction projects in the UAE to influence project success. This study investigates two things; firstly, how maturity can be achieved through the five levels in the application of suitable project management, and secondly, what suggestions can be offered to improve the selected factors for internal effect post-management maturation as preventing measures. The paper is organized as follows. First, attention is paid to the effects of maturity in the five levels in project management methodology. The importance of competency in bringing project success is then considered. Thirdly, there is a discussion of the data and the presentation of a model emerging from the results obtained in the data analysis and the accompanying discussion. Finally, a case study is carried out for validation, and a conclusion to the study is made, in which its limitations are indicated, and suggestions for further research are given. Accordingly, in Figure 1, the research has been conceptualized in a cycle.

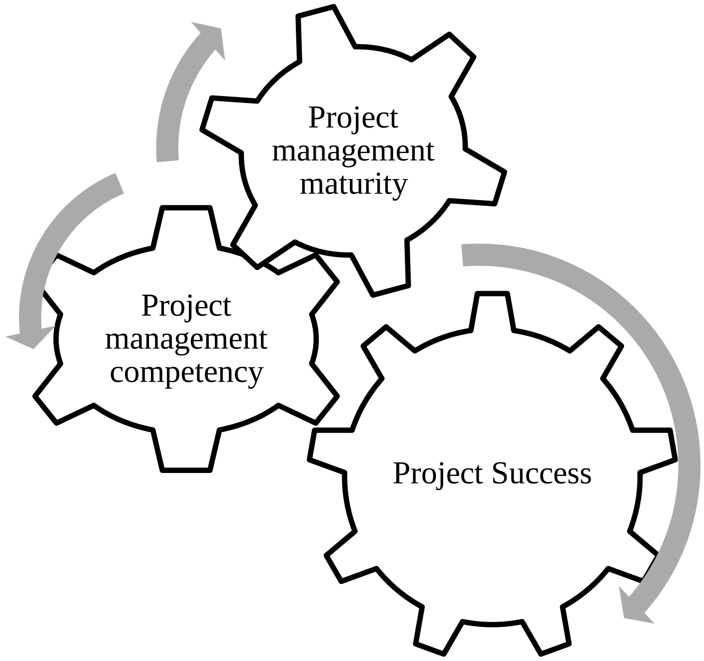


Figure 1: The Conceptual Research

1.1 PM Influenced by Project Maturity

Shi et al. (2001) have concluded that unsuccessful projects occur because of the accumulated effects of individual activities that are enacted without any project management maturation (PMM). They observed that the maturity concept is being used increasingly to map out logical ways to improve an organization's services and resources. In their research, conducted in the 1990s, Shi et al. (2001) examined several maturity models, and concluded that different kinds of PMM models with common features were in existence, specifically to provide organizations with a methodology for assessing and improving the capability of their project management team. It has been found that productivity increases between 10% to 20% and that the capability of enterprises to assess and control their project performance increased by 40% to 50% on average by adopting PMM models (Yuming et al., 2005). More mature PM practices are definitely seen to deliver better project performance. For example, it has been demonstrated in studies that companies with more mature practices deliver projects on time and on budget, whereas less mature companies may miss their scheduled targets by 40% and their cost targets by 20% (Collaboration, Management and Control Solution [CMCS], 2007). Furthermore, the good PM companies have lower direct project costs than poor PM companies. In addition, highly mature companies have PM costs in the 6-7% range, while their counterparts average 11% (and in some cases reach 20%). This is just the direct cost spent on PM. Moreover, organizations with low PMM face other undesirable events such as increased indirect costs, late project deliveries, missed market opportunities, and dissatisfied customers. PMM has assisted in improving the organizational use of technology by providing guides for the most important processes to achieve high PM maturity levels (Kwak and Ibbs, 2002). In addition, capabilities and personal skills like leadership, and labours can be observed when issues are reflected by team leaders in mature systems (Willis and Rankins, 2009). Furthermore, construction companies with developed project management techniques are able to acquire good market positions (Polish Construction Companies Report, 2012). In addition, project team development is actively engaged to provide reviews and input to the project execution in level 3 maturity (Kwak and Ibb, 2002), Hence, there is emphasis on effective performance of the team members maturity (Rad and Levin, 2003, p138). For instance, performance improvement may change knowledge in risk definition. Along with the performance, the technology utilization, technology related- risk in particular faces inadequate expertise and inability to minimize the technical problems for risk analysis, hence its impact on project success (Yeo and Ren, 2009). On the other hand, the poor project planning is inadequate in risk, consequently the weak risk management plan emerged (Yeo and Ren, 2009). Therefore long planning horizon is applicable (Chapman and Ward, 2003). In Table 2, PMF are assigned new dimensions and tested by Project Management Maturity Model (PMMM) for complete definition and benchmarking in five levels, as outlined by Crawford (2006). However, the presence or absence of a certain factor, one or more can arrive to higher levels of maturity.

Table 2: PMM Model (Crawford, 2006)

Level 1 *(Initial)*	- There are project management (PM) processes but with no practice and standards. - Documentation is loose and metrics are informally collected on ad hoc. -Management is aware of the need for PM.
Level 2 **(***Structured &Standards)*	-PM exists but not considered an organization standards. -Documentation exists on these basic processes. -Management support the PM implementation but there is no involvement, consistent understanding to comply for all projects. -Functional management is involved in PM -Basic metrics for tracking costs, schedule and technical performance. -Data collected manually. -Information is available between level data and detailed level data for managing the project
Level 3 *(Organizational Standards& Institutionalised)*	-All PM processes are in place, established the organizational standards. -Active and integrated Clients and internal customers for project team. -Formal documentation exists on all processes and standards. -Management is involved in input and approval of key decision and document. -The project is evaluated and managed in light of other projects. -PM processes should be tailored to the characteristics for each project.
Level 4 *(Managed)*	-Lesson learnt, how the project performed in the past and what is expected in the future. -Management uses effective and efficient metrics to make decision regarding the project and understands the impact on other projects. -Project changes and issues are evaluated upon metrics of cost estimation, baselines and earned value. -Project information is integrated to optimize business decision -Management understands roles and responsibilities in PM. -Differentiating management style for different size and complexity of projects -Integrated PM processes and standards
Level 5 *(Optimising)*	-Active use of PM processes -Lesson learnt are regularly examined and used to improve PM processes. -PM continuous improvement -Metrics for future use

1.2 Why PMO?

According to the PMI 2011, PMO reduces the number of failed projects, delivers projects under budget, improves productivity, and increases cost savings. So, all project managers and leaders must be focused on creating value across the organization, since PMO is sensitive towards projects and programmes, and that means ensuring the optimal mix of resources within businesses to achieve economies of scale (Craige, 2007). A study conducted by Toney and Powers (1997, cited in Dai and Wells, 2004) demonstrated that the use of project management best practice in a large functional organization, sustained the link between best practices and PMOs. It concluded that a well established PMO improves: project management effectiveness, learning from experience, the development of procedures, individual skills and competencies, and knowledge, and that all of these increase management confidence in the organization. In construction organizations, however, the structure and PMO Maturity need to be aligned with the stability of the market.

1.3 Competency

In earlier research, competency has been defined as a group of skills and knowledge that influence performance (Parry, 1996), and as a result, lead to superior outcomes. Furthermore, competency is seen to consistently produce the desired results (Frame, 1999). However, these previous studies have only emphasized the traditional management approach in relation to desired managerial skills, whereas the complexity of project management knowledge is not yet fully determined so the direct relationship between competencies and project success has not yet been examined in depth. Hence, the increasing number of unsuccessful projects means this approach should be accorded adequate research attention. This entails, for example, that existing standards should be developed and influenced by high-scale project resources through maturity. However, the implementation of maturity cannot occur in the absence of competency, and in providing an explanation for differentiation in maturity levels, researchers are increasingly interested in addressing the role of competency in handling the specific processes, since this is believed to increase project success (Skulmoski, 2001; Lee and Anderson, 2006; Isik et al. 2009; Adenfelt, 2010). Indeed, many projects have related competency with project effectiveness. Ghorbanali (2011) has concluded that if project-based organizations want to improve the effectiveness of their projects, they should raise the standard of their project management competences by: 1) enhancing their assessment of the current knowledge and skills abilities to deliver projects, and 2) creating a strategic path that focuses on advancement on the road to excellence. In construction project management, competency-based measures represent the potential resource for engendering the professional development of construction project managers (CPMs) (Dainty and Moore, 2004; Cheng et al., 2005; Skipper and Bell, 2006) because it has been observed that projects have met with varied success (Fitzgerald, 2009). Indeed, there are always new skills to learn in the project management profession (Crawford, 2006).

Within the construction industry, it is becoming increasingly clear that benefits can be realised from investment in project management competency, since this brings increased levels of maturity in the practice of project management (Ghorbanali et al., 2011). The assessment and determination of construction project maturity should be extended from focusing predominantly on action, to including maturity and competency, in order to increase project success since competency is considered to be a combination of knowledge, skills and attitudes that influence performance (Andersen and Jessen, 2003).

2 Research Design

The overall aim of the research is to investigate the relationship between the development in Preventing Measures Factors (PMF) and project management maturity (PMM) levels by Crawford (2006) and the consequent effect of competency for project success, in construction projects in the UAE. Variables are proposed as shown in Figure 2. The preventing measures factors (PMF) as an independent group of variables X (internal effect) as follows:

- The project team by training,
- Project team performance in risk definition,
- Labours' personal skills,
- Technology utilisation,
- Stakeholders competency (participation/communication),

- Knowledge of construction techniques,
- Knowledge base for planners, and
- Management by PMO

The dependent variable Y stands for PMM, matches by level, and the consequent dependent variable Z achieves competency for project market positioning (external organizational effect).

In order to assess the value of the PMM in promoting project success, maturity levels within the project are examined for apparent effects from the developed factors, internally and externally. Candidates were asked in their interviews, to evaluate the effect of the development in eight factors related to preventing measures for project success mentioned above.

3 Research Methodology

Accordingly, the research involved a literature review, a questionnaire, and statistical analysis. 80 copies of the questionnaire were distributed, 37 responses (9 project managers, 9 contractors, 9 consultants and 10 others) in high scale construction companies were returned. The questionnaire was designed to test the influence of *DEVELOPING* the PMF in practice for desired “maturity” levels.

All candidates were asked the same questions relating to the preventing measures factors (PMF) and “maturity”, and asked to choose answers from among the same set of alternatives on a five-point Likert-Scale, hence essentially being asked questions with the opportunity only for fixed responses. The questions covered the following areas:

- Demographics (informant details concerning their professional role, years of experience, types of project, sector).
- The significance of PMM area in developing the project organization internally and;
- Externally towards competency and market positioning, the for project success

To sum up, questions concentrated on the issue of project organization (Internal and External effects) in a questionnaire being asked to identify improvements in respect of internal and then external effect according to the nature of the organization and practitioners in the field and the literature review. Therefore, hypotheses are based on the questionnaire and presented as follows:

H0: There is no significant difference between the group of project managers, contractors, consultants and others refers to the Preventing Measures Factors (PMF) (Variable X) development in internal effect in:

- Variable Y: Project Management Maturity (PMM) levels, and consequently in:
- Variable Z Competency for market positioning (external effect).

H1: At least one from the above factors is different from others

-PMM refers to the effect of the development in the preventing measures factors (PMF)

-PMF is presumed cause, and

-Competency refers to the cause of PMF and effect of PMM.

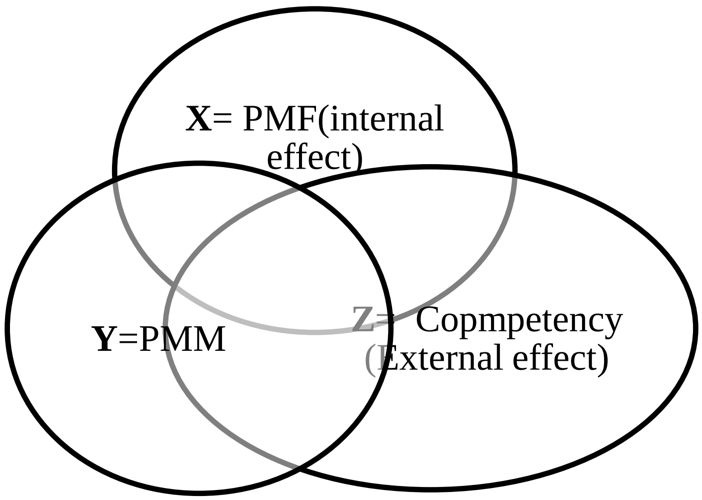


Figure 2: The Interconnection of the Variables Relationship for project success

This questionnaire format enabled quantitative data (Knight and Ruddock, 2009) to be obtained, thereby facilitating the analysis in SPSS. The questions were in a relative scale 1 to 5. ANOVA analysis used to establish the significance of the eight PMF as one group as stated above in the hypothesis, PMM levels and competency for marketing positioning. All in all, internal and external effects that are believed to be influence projects success (see Figure 3) in construction project management practice were tested between the groups (project managers, contractors, consultants and others). The Alpha level was set at 0.05 confidence interval.

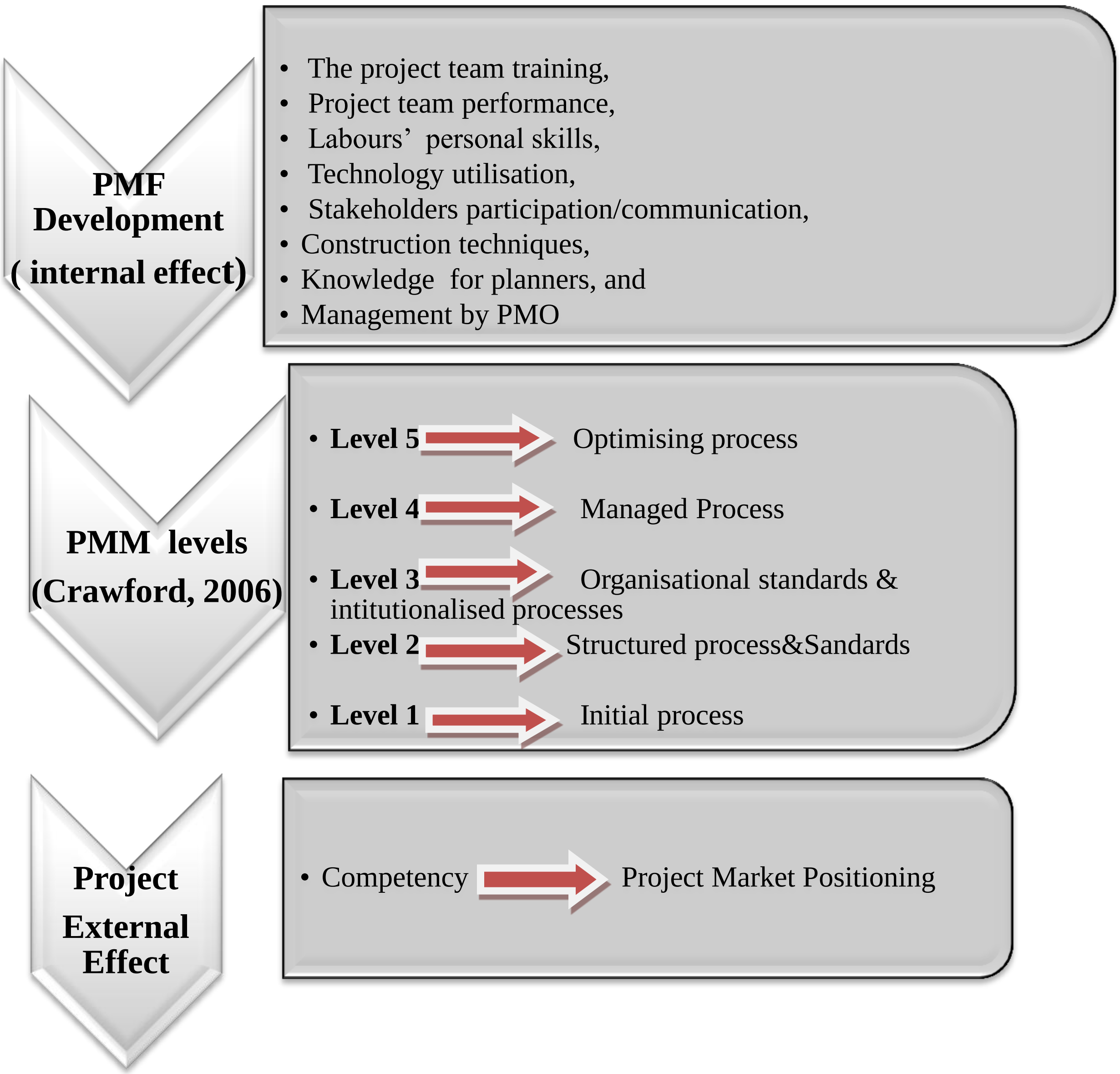


Figure 3: The Research Focus

4 Results

- The questionnaire was responded by nine project managers, nine contractors, nine consultants and ten other professionals (developers, engineers and site engineers) from high scale UAE construction companies from the public-private sectors employ more than 140 in Abu Dhabi Emirate. They were completed in a couple of months. More than 80% of the respondents had 5-10 years experience in project management (see Table 3) and the type of the construction projects they were involved in, were varied in size and number (see Table 4), most were in infrastructure and civil engineering projects.

- Descriptive analysis was undertaken firstly; according to the questionnaire's responses to questions relating to the overall positive expectations of project maturity in project practice refers to PMF development, the eight factors through the PMM five levels (see Figure 4). It is clear that %50 of i) Project managers have scored 4.00 stands for Level 4, ii) Contractors have scored 4.125 almost stands for Level 4, iii) Consultants have scored exactly 4.00, so stands for Level 4 and finally iv) Other professionals scored 3.875 which almost matches Level 4 .

- One-way ANOVA for significance difference between the four groups (Project managers, Contractors, Consultants and others) was used. Reasons were given as being that these indicated level 4 as a level of maturity effect by developing the PMF in project practice internally. This is among the five levels with no significant difference between the above group ($F=0.398$, $P=0.755 > \alpha=0.05$) refers to the eight PMF ($\mu1= \mu2= \mu3= \mu4= \mu5= \mu6= \mu7= \mu8$). As a result, the null hypothesis was not rejected in variable Y (see Table 5).

- In addition, the null hypothesis was not rejected in variable (Z); such relationship was indicated between PMF, PMM and Competency for project market positioning. 35 people said Yes (95%), one person said No (9%) and one person refused to evaluate the discipline.

- Accordingly, the significance of PMM for project success was rated as follows: 12 (32%) believe PMM is effective for project success. However, 15 (40%) rated a high effect whereas 10 (27%) rated very high effect.

Table 3: Years of Experience of Candidates

Years of Experience	%Valid Percentage
0-5	5.0
5-10	80.0
10-15	10.0
more than 20	5.0

Table 4: Type and Number of Projects assessed by the Project Manager and Consultants

Project Type	Number of Projects
Transport project	8
Civil Engineering	30
Shopping Malls	4
Infrastructure	24
Power/treatment	10
Water/waste	19
Health service	2
Other	3

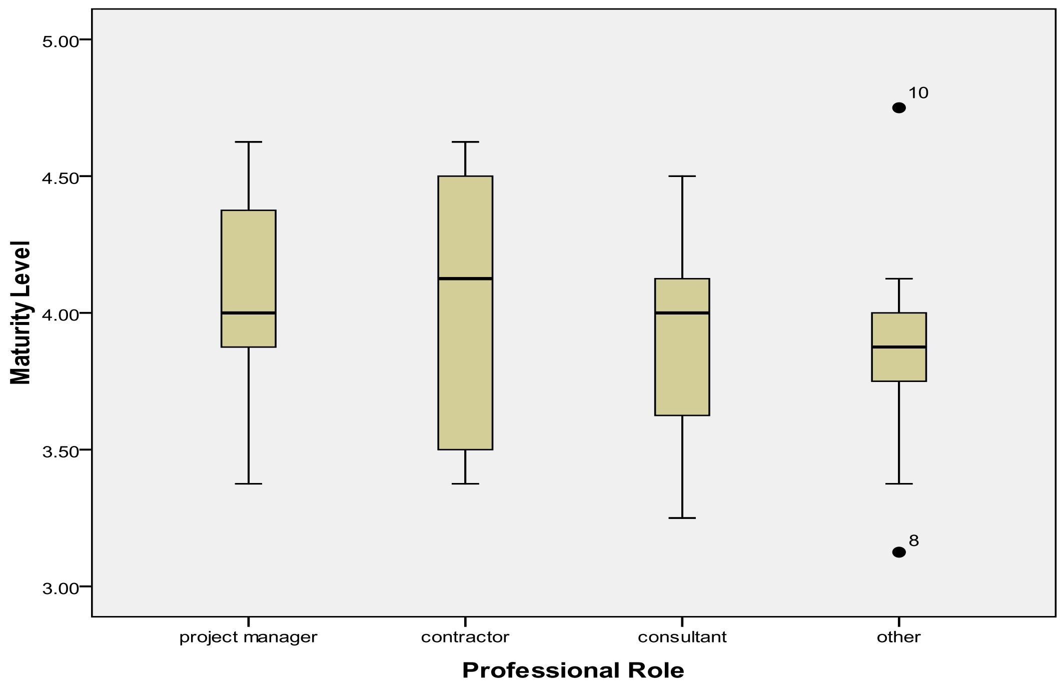


Figure 4: Expected Maturity levels refers to PMF by professional Roles

Table 5: ANOVA Test for significance difference in PMM refer to PMF

ANOVA Test	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.238	3	0.079	0.398	0.755
Within Groups	6.375	32	0.199		
Total	6.613	35			

5 Discussions

As mentioned earlier in this research, the maturity level of the company business is important for delivering projects on time and cost-effectively. The five levels in the maturity model provide an appropriate scale for developing construction projects and success. As seen from the data analysis, the practice can be developed and found at level 4 post PMF development, and the improvements are identified as being in the following factors: *The project team by training, Project team performance in risk definition, Labours' personal skills, Technology utilisation, Stakeholders competency (participation/communication), Knowledge of construction techniques, Knowledge base for planners, and Management by PMO* (for internal project organization effect). Implicitly, these findings indicate the improvements in: i) senior management support for project delivery ii) the tools, technology and techniques performance required for the process, and iii) project risk planning, iv) the levels of project management through PMO development, since there were improved personal skills and previous experience was maintained. However, it was noticed by the respondents that there was limited understanding of the roles and responsibilities of team members, and that this may be the reason behind the lack of productivity. Consequently, there appeared to be a need to re-examine the effectiveness of team roles and to re-define these and their associated responsibilities for the future. Furthermore, according to the respondents comments, there is maturity at levels 1 and 2 only in many construction companies in the UAE, although fortunately, small number of high scale companies are seen as being at level 3 in the maturity model. Clearly, progression to the next level can only be made and not limited when the preventing measures factors

(PMF) are developed and satisfied by the project stakeholders. Thus, meaning that there is still much work to do.

The results obtained showed that maturity functioned to provide a competitive edge in construction project management in the UAE, thereby revealing the effectiveness of the scale of project management maturity.

The expectations of construction professionals in the UAE is that, the project team development by training, Project team development in performance for risk definition, labours' development for personal skills, Technology utilisation development for risk information control, Stakeholders project competency (participation/communication), Knowledge of construction techniques for efficiency, Knowledge development for planners for risk management, and PMO development in construction project settings can ensure adequate use of skills in project management as additional key characteristics at least at level 4 of the maturity model. Moreover, level 4 in PMM model (Crawford, 2006) support the managerial level as follows:

- Lesson learnt, how the project performed in the past and what is expected in the future.
- Management uses effective and efficient metrics to make decision regarding the project and understands the impact on other projects.
- Project changes and issues are evaluated upon metrics of cost estimation, baselines and earned value.
- Project information is integrated to optimize business decision
- Management understands roles and responsibilities in PM.
- Differentiating management style for different size and complexity of projects
- Integrated PM processes and standards

However, in order to expose and avoid any pitfalls, and indeed to ensure that all professionals have adequate levels of competency, more focus should be given to the training provided for professionals who are earmarked to assume responsibility for project control, since such enhanced training will bring benefits to all the stakeholders and to society in general. Such training should involve proper quantitative and qualitative risk analysis, project decision support system development, and proper risk management training as well as lessons learnt in order that a higher level of maturity can be achieved.

The main problem seems to be that traditional management is adopted by project managers in organizations dealing with construction projects, and that this is done as a matter of the managers' preference. However, where level 4 in maturity was expectations evident, it was clear that this had been built upon levels 1 and 2 if existed and that a good basis in these lower levels enabled adequate developments at Level 3. Nonetheless, the candidates comments in several companies and in the private sector in particular, mentioned that there were deficiencies in Levels 1 and 2, and that there was a need for their companies to introduce generic training to remedy this problem. In the absence of such training within the private sector, there was no knowledge-sharing, and no consistency in job roles and responsibilities specifically for those involved in project management. Clearly, it is not possible to aspire to the subsequent levels unless the levels before those are reached to a satisfactory standard. Nonetheless, it is still possible to make plans for the higher levels (Figure 7).

Orientation and change efforts in organizational competency (more specifically in project market positioning) were invisible and, therefore, respondents felt a need for more visibility in this area to operate as a benchmark against which companies could assess the performance of their projects.

This study has shown an approach to maturity and competency that could ultimately produce better project performance and delivery. More specifically, the stages should be sequenced according to the model outlined in Figure 7. In this model the steps are identified. At Level 1 there is a need to respond on an ad-hoc basis in initial process and not to follow traditional approaches. At Level 2, there is a need to build the structures and standards of skills which are in themselves generic skills that make for a solid manager. These first two stages are considered as crucial in providing the building blocks for subsequent maturity. At Level 3, among the eight PMF previously identified as the internal effect must all be used to form the basis for evolving efficient, integrated and controlled plans for each project. The critical gap that has been exposed in this study, that being lack of knowledge concerning 'maturity' in the management of construction projects, emphasises that there are few examples of applications of the 'maturity' concept in UAE construction projects. Moreover, there is also a lack of global research concerning this topic. This study represents a new understanding of the situation in the UAE construction companies, and the findings must be noted in all efforts to achieve success in these companies in the future in higher maturity level, there was greater consideration given to the requirements of these stages by project managers, consultants, contractors and other professionals that PMM may reach more advanced levels and maturity could be accomplished in the model. The suggested developing levels of the maturity are most importantly identified from project management methodology for project standards in Level 4 as a driver result for further research. At Level 4, project management should be institutionalized by senior management commitment, and lessons should be learnt from the database so as to optimize outcomes. At Level 5, such outcomes should be verified through auditing procedures that search for evidence of best practice, and ensure the potential for this by promoting staff development in PM. In this respect, a proper training and career programme must be in place for project managers and the other professionals. The assumption remains that the organization's competency is characterized by the relationship between project maturity, and project success, and hence, we concentrated on the maturation in the five levels that could be accomplished by competency, concluding that in prestigious or high scale construction companies such accomplishments were possible.

For validation of the maturity-competency influences in project delivery, a case study was undertaken in the following section.

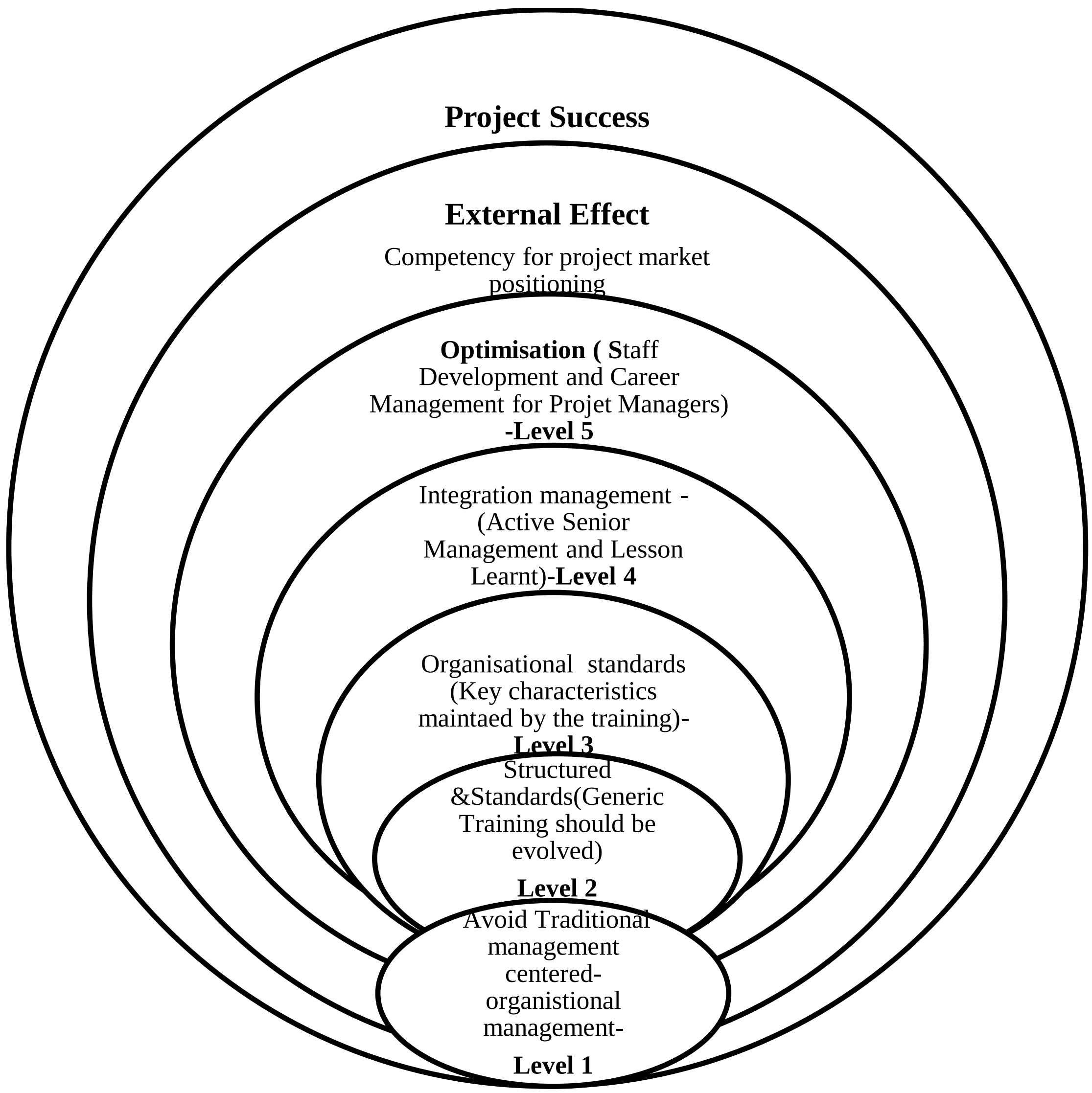


Figure 7: A Maturity Model Levels Development for Project Success

6 Case Study - *Scoping of the study*

As part of the development of the country, the Abu Dhabi Government is implementing various projects/programmes. The case study was a recently large project hotel (5 stars) extension. The construction company was founded in 1980, it is active in abroad and one of prestigious companies in the Gulf and stands as the national group leader of civil engineering, procurement and construction (EPC) and Mechanical, Electrical and Plumping (MEP) in the UAE, the approximate annual turnover of the company is over $3 billion and its number of employees is about 20,000. The group was committed in diverse projects such as hospitals, bridges, towers, heritage sites, malls and residential villas and it is certified with ISO 9001, 14001.This case study was undertaken with original contract value of 63,862,000 AED and construction duration of 410 days. The client was a public-private sector body. The consultant has been nominated by the client as well as the contractor. The design was undertaken by the nominated private consultant. The case study survey included interviews with two senior project managers, and two engineers. Copies of documents, letters from the consultant to contractor and from the project director to the consultant and the client and internal communications in the contractor company were accessed and provided. Direct observations of the project progress were permitted.

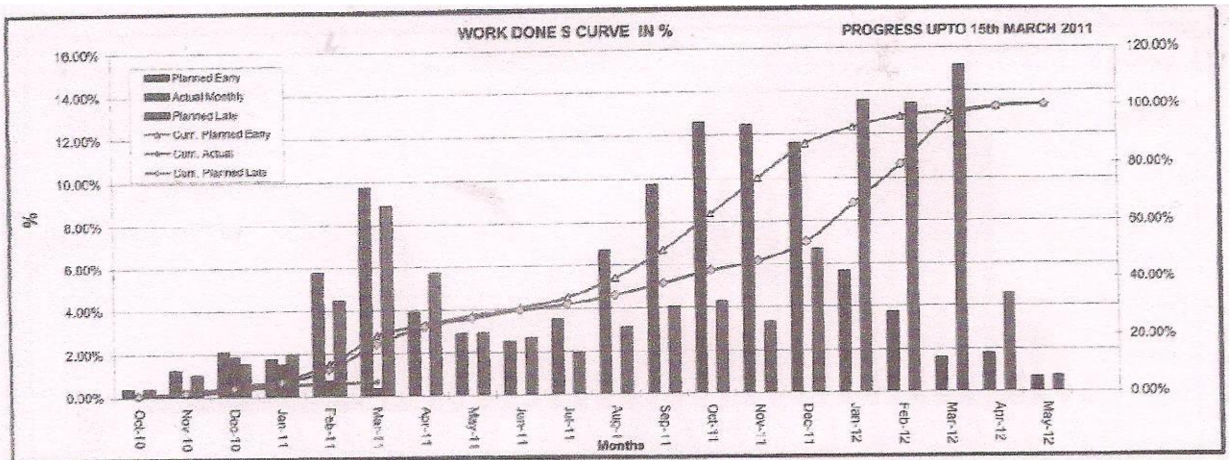
The original project starting date was on 12th September 2011 and finish on 15th January 2013. The project faced delays twice, the first delay due to change order in design dated 10th February, 2011 (delay in Municipality approval for the update design, Mechanical, Electrical and Plumping (MEP) and swimming pool drawings approvals). The consequent delay caused disruption to the contract construction programme and subsequently lead to extend the contract period 86 days and associated cost impact (see progress report in Figure 8). The second delay dated 8th March 2012 due to Mock-up finalization, with cost 8,709,736 AED for the second change order. Time extension/new completion date has been updated by 31st January 2013. Handover has been updated finally in 25th May 2013 (delay due to completion certificate issue).

In particular, the interviewees indicated the construction company by level 2 in "Maturity" in informal gathering on the strategies to deal with risk events and contingency plan failing for the near term risk. Besides, the senior managers and departmental managers did not use the lessons learnt involved from previous projects (archived), and did not benefit from such inputs since the traditional project management approach omits the development in project team, project team performance knowledge for risk definition and response, technology utilisation for previous risk information, stakeholders project communication (absence of client and end users), and development for planners knowledge to identify the long-term contingency plan, and management development by PMO for risk response. Besides, it is completely, and hence, does not consider the potential for project management maturity (PMM) in higher levels in the construction process in coping with change, nor the way to deal with it. Additionally, the traditional management technique has failed to validate a contingency plan ensure the appropriate tools for monitoring risks.

Certainly, it is reasonable to expect that all stakeholders in the PMO in construction projects should possess sufficient knowledge, and provide a briefing in risk management to project team members who should be trained and actively engaged in a proactive risk response plan to enable their effective participation in decision-making, yet their experience of contributing to project management maturity efforts is limited because of the emphasis on the traditional approach that excludes them and the failure to assign firm roles and responsibilities.

Moreover, construction organisations in the UAE were seen to interact with internal and external businesses in the market, and in order to sustain the demands of that market, it is suggested that maturity–competency should be improved and that process standardization should be fully implemented. Crawford (2006) exposed a competitive application for risk response development in a maturity model (five levels) however it could be initiated for future research.

It is recommended that construction organizations in the UAE should optimize their use of limited risk management tools and competing resources and strive for superior performance in order to meet any changing needs and expectations. Greater maturity and competency are needed in construction organizations. The example from the UAE could encourage researchers to validate and extend research in the discipline since a critical gap in the field is exposed in this study. Finally, continuous measurement and auditing of construction projects in practice can encourage investment in the region.



Month	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11
Planned Early	0.39%	1.21%	2.07%	1.74%	5.76%	9.76%	3.84%	2.83%	2.51%	3.49%	6.69%	9.75%
Planned Late	0.39%	1.01%	1.51%	1.95%	4.44%	8.88%	5.69%	2.86%	2.63%	1.91%	3.10%	4.01%
Actual Monthly	*0.13%*	*0.37%*	*1.83%*	*1.47%*	*0.68%*	*0.35%*						
Cum. Planned Early	0.39%	1.60%	3.67%	5.42%	11.17%	20.93%	24.77%	27.60%	30.11%	33.60%	40.29%	50.04%
Cum. Planned Late	0.39%	1.40%	2.91%	4.86%	9.29%	18.18%	23.87%	26.73%	29.37%	31.27%	34.37%	38.38%
Cum. Actual	*0.13%*	*0.50%*	*2.33%*	*3.80%*	*4.48%*	*4.83%*						

Month	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12				
Planned Early	12.56%	12.44%	11.57%	5.64%	3.73%	1.58%	1.77%	0.67%				
Planned Late	4.27%	3.32%	6.67%	13.56%	13.40%	15.13%	4.56%	0.72%				
Actual Monthly												
Cum. Planned Early	62.60%	75.04%	86.61%	91.25%	95.98%	97.56%	99.33%	100.00%				
Cum. Planned Late	42.65%	45.97%	52.63%	66.19%	79.59%	94.72%	99.28%	100.00%				
Cum. Actual												

Figure 8: The progress report of the case study

7 Conclusions and the Way Forward

Both the literature and findings from the study support the argument for developing maturity models in project management within construction companies, in order to favourably influence project success. Significant findings were reported for project maturity for construction organizations (internal effects) by the development in the following factors (PMF) in respect of project team training, project team performance for risk definition, labours' personal skills, technology utilisation for risk information control, stakeholders competency (participation/communication/attitudes), knowledge of construction techniques for efficiency, knowledge development for planners for effective contingency plan and risk management, and developing management by PMO. In addition, traditional management development in respect of construction project delivery was associated with the PMM maturity in each of the five levels. This was agreed by the groups of project managers, contractors, consultants and other professionals who were involved in reputational construction companies in the UAE. The model presented in this study shows and supports the sequential interaction between maturity and competency through the different levels of PMM refers to preventative measures factors (PMF) development and the themes associated with each. The literature supports the contention that the success of organizations that are concerned with construction projects is positively affected (internally and externally) by PMM development.

On the basis of the outcomes from the survey, the questionnaire analysis and the case study, a model is suggested for project success as follows:

- There is a significant requirement for development in PMM at Level 1 and 2, which are considered to be the foundation levels where important skills, attitudes and culture should be developed in the traditional management centered- organistional management, and generic training maintained by maturity levels for construction companies standerisation.

- . As a result of development at levels 1 and 2, significant changes for the better, to the structure and features of organizations should occurred in level 3.
- There is a need to recognise, as shown in the model, that Level 3 (organisational key characteristics maintained by training) is a significant level in maturity that underpins Level 4 (Integration management - active senior management and lessons learnt), and hopefully Level 5 (Optimization - staff development and career Management for Project managers)
- Actions should be recognised seriously as most important organization internal effects in providing training support, project stakeholders co-ordination, project management system and lesson learnt information are required to develop the traditional management into a more suitable and mature project management style.

Competency achieved through PMM is considered to have significant external effects and to bring success in project market positioning, and eventually result in project success. In addition, it can be perceived as valuable in bringing success to a project through the improvement in project stakeholders' knowledge and performance. However, the key challenge facing efforts to improve maturity in this area is the need to build mature project organizations that focus on project integration management and sustainable processes, and consequently, to develop resources competency and risk management.

Therefore, it is recommended that project organizations in the UAE should continue investing in PMM to improve the knowledge in the key areas in active senior management, the competencies of teams associated with their projects, and their risk response maturity.

This study reflects the general view, but in-depth investigation is required, and the suggestion is that more primary data should be gathered by the survey method in other project organizations that have adopted semi or fully project maturity models, in order to validate the preliminary findings in this paper.

This is a part of an ongoing PhD research project and further research is being undertaken and will be reported in a future paper.

8 References

Adenfelt, M. (2010). Exploring the performance of transnational projects: shared knowledge, coordination and communication. *International Journal of Project Management*, 28(6), 529-538.

Al-Ahmad, A. (2009). *Evaluation of project management maturity*: *The Role of organization influences in the GCC countries.* Unpublished doctoral dissertation, ESC- Lille University, Lille, France.

Alonso, J., de Soria, I. M., Orue-Echevarria, L., & Vergara, M. (2008). *Enterprise collaboration maturity model (ECMM)*: *Preliminary definition and future challenges*. Retrieved January 30 2013, from: http://www.coin-ip.eu/research/coin-results/Papers/abstracts-m25-m36/ECMM-IESA.pdf/view

Andersen, E., & Jessen, S. (2003). Project maturity in organizations. *International Journal of Project Management*, 21 (6), 457-461

Barber, E. (2004). Benchmarking the management of projects: A review of current thinking. *International Journal of Project Management*, 22 (4), 301-307.

Burns, J., & Crawford, J. K. (2002), Organizational project management maturity at The New York Times: Using the project management maturity model. *Proceedings of the 33rd Annual Project Management Institute, Seminars and Symposium*, San Antonio, Texas [CD-ROM]. Newtown Square, PA: Project Management Institute (PMI).

Chapman, C., & Ward, S. (2003). *Project risk management: Processes, techniques and insights* (second ed.). Chichester: Wiley.

Collaboration, Management and Control Solution (CMCS). (2007) *Portfolio Project Management Solution.* [Technical Report]. Dubai, the organization, 42 pages. Unpublished.

Craig-Jones, C. (September 2008). How to evolve the maturity level of your project management office (PMO). *CA Advisor*: *Governance newsletter-Pt.3*, 3p.

Crawford, J. K. (2006). *Project Management Maturity Model,* Second Edition. Taylor and Francis, pp 23-25, 165-180

Dai, C.X., & Wells, W. G. (2004). *An exploration of project management office features and their relationship to project performance. International Journal of Project Management*, 22 (7), 523-532

Frame, J. (1999). Project Management Competence: Building Key Skills for Individuals, Teams, and Organizations. Jossy-Bass, 232 pages.

Dainty, A. R. J., Cheng, M. I., & Moore D. R. (2004). A competency-based performance model for construction project managers. *Construction Management & Economics,* **22 (8),** 877-886.

Finn, R. (1993). *A synthesis of current research on management competencies* (Henley working paper; v. 10-93). Reading (U.K.): Henley Business College, 62p.

Fitzgerald, D. (2009). The PMOs: One size does not fit all. Retrieved January 31,2013,from:http://mediaproducts.gartner.com/reprints/computerassociates/143645.html,

Ghorbanali, A., Khosravi, S., Afshari, H., Borzabadi, M., & Valibour, M. (2011). Improving project management competency by using OPM3 approach. *2010 International Conference on Economics, Business and Management*: *IPDER Vol*.2 (pp. 166-170). Manila: IAC S IT Press.

Humphrey, W. 1989. *Managing the Software Process.* Addison-Wesley, Massachusetts.

Isik, Z., Arditi, D., Dikmen, I, Birgonul, M. (2009). Impact of corporate strengths/weaknesses on project management competencies. *International Journal of Project Management*, 27(7), 629-637.

Jha, K., & Iyer, C. (2007). Commitment, coordination, competence and the iron triangle*, International Journal of Project Management*, 25 (5), 527-540.

Kadefors, A. (2011). Organising collaboration in construction projects- formal models meeting practitioner perspectives. In: *Proceedings of the International Conference on Management and Innovation for a Sustainable Built Environment* (MISBE2011)]. Delft (Netherlands): Delft University of Technology, 12p.

Kerzner, H. (2001) *Strategic Planning for Project Management Using a Project Management Maturity Mode*. New York, John Wiley & Sons.

Kerzner, H. (2005). *Using a project management maturity model*: *Strategic planning for project management*. New York: John Wiley & Sons.

Knight, A., & Ruddock, L. (Eds.) (2009). *Advanced research methods in the built environment*. Chichester (U.K.): Wiley-Blackwell Publisher.

Kwak, Y., and Ibbs, C. (2002). Project Management Process Maturity (PM) ² Model. *Journal of Management in Engineering*, 18(3), 150-155

Lee, L. Anderson, R. (2006). An Exploratory Investigation of the Antecedents of the IT Project management Capability. E-services Journal, 5(1), 27-42.

Martin, N. L., Pearson, J. M., & Furumo, K. (2007). IS project management: Size, practices and the project management office, Journal of Computer Information Systems, 47 (4), 52-60.

Parry, S. (July, 1996). The quest for competencies. Training.

Pennypacker, J. S. (2002). Benchmarking project management maturity: Moving to higher levels of performance. *Proceedings of the 33rd Annual project Management Institute, Seminars and Symposium,* San Antonio, TX, [CD-ROM]. Newtown Square, PA (USA): Project Management Institute (PMI).

Pennypacker, J. S., & Grant, K. P. (2003). Project management maturity: An industry benchmark. *Project Management Journal,* 34 (1), 4-11.

PMI. 2002. *Risk Management Maturity Level Development*. Project Management Institute, London, UK. Available from:

http://www.pmi-switzerland.ch/fall05/riskmm.pdf, retrieved 31January, 2013

Polish construction companies. 2012. *Maturity of Construction Project Management.* Available from: www.deloitte.com/...Poland/.../pl_MaturityofConstructionProjectManagement_ENG.PDF, retrieved 15 January, 2013

Rad, P. and Levin, G. (2003) Archieving project management success using virtual teams. Ross publishing.

Sarshar, M., R.Haigh, M.Finnemore, G.Aouad, P. Barrett, D. Baldry, M. Sexton. (2000). SPICE: a business process diagnostics tool for construction projects. *Engineering, Construction and Architectural Management*, 7(3), 241-250.

Shi, J., Cheung, S., & Arditi, D. (2001). Construction delay computation method. *Journal of Construction Engineering and Management,* 127 (1), 60-65.

Skipper C. O. & Bell L. C. (2006). Assessment with 360 degrees evaluations of leadership behavior in construction project managers. *Journal of Management Engineering,* **22 (2)**, 75-80

Skulmoski, G. (2001). Project maturity and competences interface. *Cost engineering*, 43 (6), 11-18.

Toney, F., Powers, R., & PMI. (1997). *Best practices of project management groups in large functional organizations*. Upper Darby, PA (USA): Project Management Institute (PMI).

Turner, J. R. (2000). Do you manage work, deliverables or resources? *International Journal of Project Management*, 18 (2), 83-84.

Yeo, KT and Ren, Y. (2009) Risk Management capability maturity model for complex product systems (CoPS) projects. System Engineering, 12(4), pp 275-294.

Yuming, L., Qiang, Y., Fengping, W., & Bojian, L. (2005). Study on the application of ERP, CMM and OPM3 in China. *China Science and Technology Information*, 13 (1), 20-21

Willis, C. J. & Rankin, J. 2009. Maturity Modeling in Construction: Introducing the Construction Industry Macro Maturity Model. *Canadian Society for Civil Engineers Annual Conference,* St. John's, Newfoundland. May 2009

3-Motaleb, O., and Kishk, M. (2013a). An Investigation into the Risk of Construction Projects Delays in the UAE. *International Journal of Information Technology Project Management*, *4*(3), 50-65

Investigation into the Risk of Construction Projects Delays in the UAE

Abstract

The growing rate of delays in project delivery is considered a major criticism of the construction companies in the United Arab Emirates (UAE). This paper aims to investigate the causes and effects behind the delays pertaining to delivery of construction projects in the UAE. The study is exploratory in nature, and incorporates a pilot questionnaire survey and interviews. An extensive literature review indicates potential factors that have possible effects on construction completion delay. The questionnaire forms were sent to 50 construction companies. Thirty-five (70%) completed responses were received. Analysis of the survey data has revealed that about 42 potential causes and effects of delay relate to various groups of stakeholders. The results show the top fifteen factors relate to clients, project managers and finance aspects. It was found that cost and time overruns are the most significant effects. These results are in partial agreement with previous

studies. The paper argues that the key determinant in ensuring project control is on-time project delivery. The results of the study can provide moderate support for a suggested hypothesis, through a framework of project success factors. It should be of high concern to knowledge managers in various roles and decision-makers.

Keywords: Construction project success factors, client, delay risks, knowledge management, UAE.

Introduction

Construction delay is ubiquitous in construction business, as well as being one of the most common risks to project success. This phenomenon largely overlaps the roles and interests of various project stakeholders in a multicultural society. Construction delay can be defined as the time overrun either beyond the contract deadline or beyond the date on which the parties agree upon for the delivery (Assaf and Al-Hajji, 2006). Project success is considered to have been achieved when it is completed within time, cost, on specification and to stakeholders' satisfaction (Majid, 2006). Delay is considered a frequently recurring problem in many developing countries, especially those that have grown so quickly despite the recent financial crisis, for example, the UAE construction sector (Faridi and El-Sayegh, 2006, Motaleb, 2009).

Many researchers have classified the causes of construction project delay by stakeholders in groups like clients, contractors, consultants, project managers, resources (such as labour, materials, equipment), external and financial/economic factors (Odeh and Battaineh, 2002, Ahmed et al. 2003, Assaf and Al-Hajji 2006, Faridi and El-Sayegh, 2006 and Motaleb, 2009). The literature is extensive on this phenomenon. An investigation into selected global research in Table 1 has supported the way forward and future work for UAE construction projects. They have been classified into public and private sectors according to causes of group/category. It is reported as full/partial agreements beyond the studies, between 2000 -2010 to identify gaps in knowledge.

Table (1): Summary of Global Research (2000-2010)

No	Research	Project	Factors (Groups) causing delay	Effects of delay
1	Al-Momani, (2000)	Public buildings, (Jordan), **Public sector**	Designer, External, Finance, Client, Contractor	Time overrun
2	Noulmanee et al., (2000	Highway construction, (Thailand), Public sector	Resources, Designer	Time overrun
3	Elinwa and Jashwa, (2001)	Public works (Nigeria), **Public sector**	Finance, Resources, Designer, Project Manager, Contractor, Government	Time &cost overrun
4	Aibinu & Jagboro, (2002)	General construction (Nigeria), **Private and Public sectors**	Client	Time & cost overrun
5	Ellis and Thomas, (2002)	Highway (USA), **Public sector**	Project Manager, External, Contractor, Designer	Time overrun
6	Manavazhia & Adhikarib, (2002)	Highway (Nepal), **Public sector**	Resources	Time overrun
7	Odeh & Battaineh, (2002)	General construction (Jordan), **Public and private sectors**	Client, Resources, Project Manager, Contractual, External, Consultant	Time and cost overrun
8	Ahmed et.al., (2003)	Building Project (Florida, US), **Private sector**	External, Client, Designer, Consultant	Time & cost overrun
9	Frimpong & Oluwoye, (2003)	Groundwater Construction(Ghana), **Public sector**	Finance, Contractor, Resources	Cost overrun
10	Choudhury & Phatak, (2004)	Commercial construction projects, US	Client, Contractor, Finance, Design	Time overrun
11	Koukshi et al., (2004)	Residential (Kuwait)	Resources	Time &cost overrun
12	Sun et al. (2004)	Construction projects (UK)	Client	Time &cost overrun
13	Acharya et. al. , (2005)	Building project(Nepal)	Resources, External, Contractor	Time overrun
14	Koushki, (2005)	Residential (Kuwait), **private sector**	Client, Finance, Contractor, Resources	Time & cost overrun
15	Wiguna &Scott, ,(2005)	Buildings projects (Indonesia), **Private sector**	Finance, Client, Designer, External, Contractor	Time & cost overrun
16	Abdu-Rahman et. al., (2006)	Construction Project(Malaysia),	Finance, Resources, Client	Time overrun
17	Aibinu & Odeyinka, (2006)	Residential &offices (Nigeria), **Public and Private sectors**	External	Time & cost overrun
18	Assaf & Al-Hejji, in (2006)	Construction project(Saudi Arabia),**Public and Private sector**	Client	Time overrun
19	Faridi & El-Sayegh, (2006)	Construction Project (UAE),**Public and Private**	Consultant, Project manager, Client, Resources	Time overrun

Table (1): Continue Summary of Global Research (2000-2010)

No	Research	Project	Risks Factors causing delay	Effect of delay
20	Fong et al., (2006)	Building construction, fire installation (Hong Kong), **Private sector**	Project manager, Client, Governmental	Time overrun
21	Othman, (2006)	Public project (Malaysia)	Contractor	Time overrun
22	Zaneldin, (2006)	Different 124 claims of Const. projects, (UAE), **Public and Private sector**	Contractual	Time overrun
23	Alaghbari et al. ,(2007)	Building Construction Project (Malaysia)	Financial, Project Manager	Cost overrun
24	Sambasivan and Yau (2007)	Construction projects (Malaysia)	Contractor	Time &cost overrun
25	Abdel-Razek et al., (2008)	Building construction (Egypt) – **Private** and **Public**	Contractual, Financial, Client	Time overrun
26	Long L.H., (2008)	Construction project (Vietnam)	Project Manager, Resources, Designer, Financial, Governmental	Time & cost overrun
27	Sweis et al, (2008)	Residential projects(Jordan),**Private sector**	Client, Finance, Contractor, Resources, Project manager	Time &cost overrun
28	World Bank Iraq Trust Fund, (2008)	Schools and Rehabilitation (Iraq), **Public sector**	Governmental, Financial, Contractual, Resources	Time &cost overrun
29	Kaliba et. al., (2009)	Road construction (Zambia)	Financial, Designer, Project manager	Cost & time overrun
30	Motaleb,(2009)	General construction (UAE), **Public and Private sectors**	Client, Project manager, Finance	Time &cost overrun

31	Tumi et. al., (2009)	Construction project (Libya), N/A	Project manager	Time &cost overrun
32	Abdul-Rahman et. al., (2009)	Construction project (global study)	Finance	Time &cost overrun
33	Asnaashari, E. et al., (2009)	Construction Projects (Iran), **Public and Private sectors**	Resource, Governmental, Financial, External	Cost overrun
34	Enshassi et al., (2009)	General Construction,(Palestine) , **Public and Private sector**	External, Resources, Financial, Contractor	Time &cost overrun
35	Al-Nuaimi, A., et al.(2010)	Building construction project(Oman), **Public and private sectors**	Client, Contractual	Time, & cost overrun, Disputes
36	Khoshgoftar, et al., (2010)	Construction Projects (Iran), **Public and Private sectors**	Financial, Project Manager, Contractual	Time overrun
37	UN Development, (2010)	Construction projects, schools (Iraq), **Public Sector**	Governmental, External	Time overrun and dispute
38	Yang, J., (2010)	BOT projects in Public Construction (Taiwan)	Contractual, Finance Governmental.	Postponement of BOT projects

Causes of delay

The causes are grouped into 10 categories, relating to various stakeholders and factors, namely, i consultant, ii contractor, iii client, iv project managers, v financial, vi resources, vii contractual, viii governmental, ix designer, and external factors. This has encouraged the authors to outline the abstract of causes, to build the foundation of the methodology of construction project delay in the UAE and has helped in the development of a questionnaire.

As shown in Table 1, we exposed the most significant causes of delays in different periods of time and defined them geographically. Investigation into project sectors has been considered, as well as public and private sectors. Some interesting observations have been raised in the risks of delay in construction projects, to analyse the outcomes from each category-related delay. Each category has been highlighted with either low or high exposure, and the most significant factor is related to the *Client,* by excessive change orders, lack of experience and slow-decision making (Al-Momani, 2000, Odeh & Battaineh, 2002, Aibinu & Jagboro, 2002, Ahmed et.al. 2003, Koushki, 2005). This view is supported by Wiguna &Scott, 2005, Abdu-Rahman et. al., 2006, Assaf & Al-Hejji, 2006, Faridi & El-Sayegh, 2006, Fong et al., 2006, Sweis et al, 2008, Motaleb, 2009, Al-Nuaimi, A., et al. 2010). The next significant factor is financial problems, possibly coinciding with the recession, such as poor cash flow and funding programme constraints, payments delays, and debt problems that are related to the economic situation (Alaghbari et al.,2007, Sweis et al, 2008, Long L.H., 2008, World Bank Iraq Trust Fund, 2008, Motaleb, 2009, Abdul-Rahman et. al., 2009, Asnaashari, E. et al., 2009, Kaliba et. al., 2009, Khoshgoftar, et al., 2010 and Yang, J., 2010).Project managers can be the cause of time delays, in terms of poor planning, poor coordination, site management, inadequate time estimation and lack of team communication (Elinwa and Jashwa, 2001, Odeh and Battaineh, 2002, Fong et al., 2006, Faridi and El-Sayegh, 2006, Alaghbari et al.,2007, Sweis et al, 2008, Motaleb, 2009, Tumi et. al.,2009, Kaliba et. al., 2009, Khoshgoftar, et al., 2010).

A research proposal has been developed along the lines of Morris's work (1994), who considered construction as an industry that should be placed in project management methodologies at various life-cycle stages as a *mature user*. The previous research shown in Table1 highlights different projects that have dealt with different views, such as the cases of socially related effects of construction delays on the investors/developers, or any other stakeholders. The perspectives have been built up depending on the nature of each country. Therefore, differences in factors involved in the delays would explain the reason why the same projects could be considered successful by one factor and unsuccessful by another one. The criteria of project success should be considered according to different cultures and environments. For example, causes of delays in the USA were due to improper project management in relocations, procedures and fund programmes (Ellis and Thomas, 2002). In the UK, it is reported that the changes due to excessive changed orders by the client, add to delays (Sun et el. 2004).

In Ghana, monthly payments, poor contract management, material procurement, poor technical performances, and escalation of building material prices have been identified as the most important factors responsible for time and cost overrun (Frimpong, 2003). Long et al. (2008)

reported that incompetent project teams, poor designers and estimations, and management problems related to site and procedural techniques have all been identified as major causes of delay in Vietnam. Koushki et al. (2005) found that the financial difficulties, changing orders, insufficient experience of clients and contractors are the main delay factors in Kuwait. Assaf and Al-Hejji, (2006) identified similar causes in Saudi Arabia. Fong et al. (2006) identified the factors of delay in Hong Kong as being due to project managers (site-coordination) and clients, slow decision making and government inspection, this is in partial agreement with causes of delay in Malaysia (Sambasivan and Yau, 2007). Sweis et al. (2008) concluded that inadequate planning, scheduling and financing by contractors, and changing orders by clients, were found to be the main factors causing delay in Jordan. Therefore, similarities and differences in the causes of delay can be seen, and this paves the way for more advanced research.

Effects of delay

Construction delay has an adverse impact on the project's ultimate success in terms of time, cost, quality and safety (APM, 2006; Arditi and Pattanakitchamroon, 2006). In addition, the most important effect that should be observed on the success criteria of the project, are the degree of influential variables that are related to the decision-making and variations/change orders made by the client, causing time and cost overrun, as well as other related factors (see Table 1).

Empowerment of stakeholders' decision making has been encouraged previously in different environments in project management, but it is limited under project management authority. It is more valuable for stakeholders to set their goals and keep inventories, as such managerial functions and effective plans can be born from motivated stakeholders. Moreover, project completion on time and budget within specification (Barber and Warn, 2005) are other measures of success criteria.

Effect of Knowledge management

Significant historical information and knowledge has been used to improve decision-making and the outcomes of project control (Albino et. al., 2002). Variations/change orders by clients increase projects delays, as do those by contractors or other stakeholders, due to a number of reasons, as identified in the literature. Therefore, the construction stakeholders have to think about the nature of these problems, using analytical approaches and case studies. Some efforts have, more recently, stated the importance of a project delay analysis approach, for example, analysis of particular time periods during the project (Theodore et al, 2009).Project managers can benefit from the outcomes of such analysis by more effective multiple baselines and resource allocation in project delay analysis (Menesi, 2007). In fact, there is a moderating effect on the relation between knowledge management of IT and project success (Yang et al., 2011). Arain (2005) secured the base of knowledge management during the earlier stages of a project life cycle, which means the greatest requirement for effective management of variations/change orders. Therefore, having the right technology can help the project manager to get a better project life-cycle and effective decision-making to consider whether investors are willing to proceed on the business. Furthermore, due to any responding changes the organisations' methodologies and procedures have to be supported by experts in how to manage the project rather than what has gone wrong (PMBOK, 2004).

Effects of the Financial Crisis

With reference to the construction projects situation in the UAE, and particularly in Dubai, it was published that many stakeholders have been affected by the state of project delays, the contractors and clients, the majority of them being affected by the current financial crisis (Elweshahy, 2008). As a result, clients are not able to deal with the due payments and many projects have been cancelled or postponed (Brendel et. al, 2010). The effects of construction delays; however, are not confined to clients, contractors and construction companies, but could influence the overall economy of a country such as the UAE, where the construction industry plays a major role in its national development and contributes 14% to gross domestic product (GDP). This is a common occurrence worldwide, compared with the UK which contributes about 10%, and Singapore, Malaysia, Korea, New Zealand, Australia, and India contributing 3-8% (Low et al., 2009).

In the UAE, both the national and foreign investors persist to encourage people with attractive incentives to invest in their respective properties. This investment trend has generated a bubble in the construction sector, which was then severely affected by the global financial problems of 2008-2009. Moreover, the expansion in construction and infrastructure resulted in an increase in the number of the immigrant workers and expatriate population in a very short time (Abu Dhabi Chamber of Commerce and Industry, 2009).

Faridi and El-Sayegh (2006) revealed that about half of construction projects in the UAE had encountered delays. Motaleb (2009) found that the number of construction projects encountering delays increased by about one fifth in 2009. Despite the time and cost overruns there are still a huge number of construction activities in the country. According to a recent investigation into the current and future state of the construction industry in Dubai, more than half of the construction projects in real estate, infrastructure, leisure and entertainment, worth $582 billion, are now on hold (Global Real Estate News Centre, 2009).

However, there are still construction projects going ahead that are worth about US$700 billion. Therefore, it is crucial to identify the significant causes and effects of delays of construction projects in the UAE since the construction industry represents a dynamic growth-oriented sector. It is also important to critically review the methodology and validation of the measures of control delays and project success factors, according to causes and effects of projects delays. The objective of the research work that underpins this paper is to identify the significant causes and effects of construction project delays in the UAE. This is part of a PhD study aiming to develop a framework for the effective management and control of construction delays in the UAE. In the next section, the research methodology is outlined. Then, results are discussed, before conclusions are drawn and future research work is proposed.

Research Methodology

This is an exploratory study and as such a pilot questionnaire survey has been designed with reference to previous research studies in Table1, on various causes of project delays in groups, and limited personal interviews have been conducted. The questionnaire form consists of three sections. The first section is intended to gather information about the respondents' profile.

The second and third sections are enquiring about the causes and effects of construction projects delays, respectively. In this study, the pilot questionnaire is used as a convenient and cost-effective tool to gather information from the target companies, which are geographically scattered in various parts of the UAE. The purpose of the pilot questionnaire was to assess the feasibility of a full-scale survey research. The questionnaire was emailed to two contractors and two consultants, whose feedback was used to modify the questionnaire contents, where appropriate, for the next stage.

Questionnaire Administration

The questionnaire was distributed to a random sample of fifty experts and project managers working in the UAE-based, consulting and contracting, private companies. Thirty five (70%) responded and returned complete and usable questionnaires. The participants were 15 consultants, 12 project managers, and 8 contractors (see Table 2).

Table (2): Questionnaire distribution and respondents

Description	**Number of Distributed**	**Number of Respondents**	**Percentage of Respondents%**
Consultants	20	15	75%
Project managers	17	12	70%
Contractors	13	8	61%
Total	50	35	70%

Method of Data Analysis

The data analysis was carried out in two parts using SPSS for Windows and Microsoft Excel (version 17). The survey data was manipulated in SPSS to generate the frequency (f_i) of the response category index for the cause and effect factors. The relative importance index (RII) for each factor was calculated using the frequency data for each response category generated from SPSS. The RII is the calculation of the mean frequency of each response category index for the probability and impact. It can be calculated as:

$$RII = \frac{\sum_{i=1}^{n} w_i f_i}{\sum_{i=1}^{n} f_i} \qquad \text{..............................} \textbf{ (1)}$$

Where f_i is the frequency of the i^{th} response, and w_i is the weight assigned to the i^{th} response.

Spearman rank correlation coefficient r_s was also used to determine the strength of the relationship between the consultants and project managers' ranking for various factors. It is a measure of correlation between two series using the ranks rather than the actual values (Kottegoda, 1997; Coakes et al., 2009). It can be calculated as:

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n^3 - n}, \quad \text{..........................} \textbf{ (2)}$$

Where d_i is the difference in ranking between consultants and project managers i^{th}. The higher the value of r_s approaching 1 or -1, the stronger the association between the two sets of ranking (Odeh and Battaineh, 2002).

Results and Discussion

Causes of Delay

Forty two causes of delay were identified and grouped into 5 sets, namely, i contractors, ii consultants, iii project managers, iv clients, and v financial and other external factors respectively. The top fifteen factors are summarised in Table3.

Table (3): Top fifteen factors based on all responses.

Factor Description	RII	Rank
Change orders	4.265	1
Lack of capability of client representative	4.191	2
Slow decision making by client	4.182	3
Lack of experience of client in construction	4.135	4
Poor site management & supervision	4.130	5
Incompetent project team	4.110	6
Inflation/prices fluctuation	4.075	7
Inaccurate time estimating	4.042	8
Late delivery of materials	4.025	9
Improper project planning / scheduling	4.022	10
Inaccurate cost estimating	4.020	11
High interest rate	3.995	12
Client's financial difficulties	3.987	13
Unreasonable constraint to client	3.982	14
Inappropriate construction methods	3.950	15

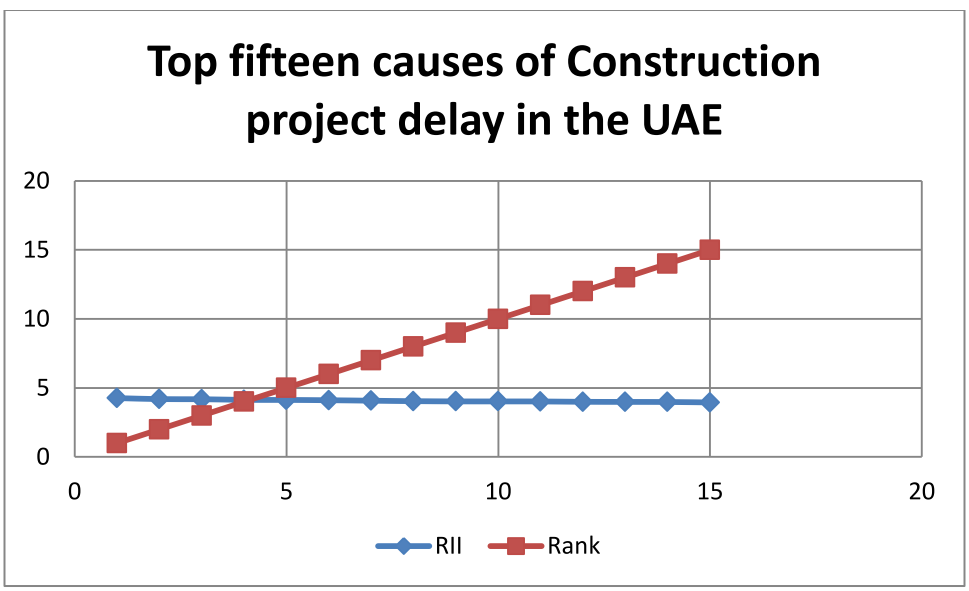


Figure (1a): Top fifteen causes of delay

Contractors' Factors

Sixteen contractor-related, frequent causes of delay were identified; two of these causes are among the top fifteen factors included in Table3. Late delivery of materials was ranked ninth, and inappropriate construction methods was ranked fifteenth. Contractors have to ensure that all resources such as materials are available throughout the project, whenever needed. Accurate time estimations of materials delivery require accurate project information, in terms of quality of information, and information flow, availability and supply of resources.

Consultants and Project Managers' Factors

The consultant and project Manager factors were not included among the list of the top fifteen factors as shown in the table 3. On the other hand, it is worth noting that the consultants and the project managers put special emphasis on the time and cost estimation, which appeared in the top list to occupy the 11^{th} and 15^{th} rank, respectively. In addition, both the consultants and project managers contribute, to some extent, to other factors including poor site management and supervision, improper project planning and scheduling, incompetent project teams, and inappropriate construction methods.

Clients' Factors

The most important client-related causes of delay are change orders, lack of capability of client representative, slow decision making by the client, and lack of experience of the client in construction. These causes are assuming the 1st to 4th ranks among the top list as shown in Table 3. Excessive change orders can cause significant disruption to project completion, as changes consequently causes changes in schedules, increase costs through rework and decrease labour efficiency. Accurate time and estimations of materials delivery require accurate project information in terms of information quality and flow, availability and supply of resources. Although contractors are perceived to cause some inaccurate estimates, as discussed earlier, they are the ultimate party who produce estimates. It can be argued that the clients are largely responsible as the party that issues excessive change orders. Poor estimation and change management reflect a lack of efficient and effective project management.

Financial Factors

Five financial-related causes of delay were identified. Three of these factors, namely inflation and price fluctuations, high interest rates and client financial difficulties are in the list of the top fifteen as shown in Table 3. These results are expected, given the recent high escalation of prices of steel and cement, the current credit crunch and the related economic crisis in Dubai

External factors

This group of causes is ranked low by consultants and project managers, and. none of these factors are among the top fifteen factors (Table 3). Problems with neighbours are not considered a serious cause of delay as it seems that affected people near sites are usually well informed about projects and satisfactory compensation is offered for their properties. Besides, environmental and social impact assessments are carried out fairly, when necessary, in the UAE. These will ensure that projects run smoothly without interruptions during the construction phases.

Conformity between Consultants and Project Managers' Rankings

A further analysis has been done to find out the conformity between consultants and project managers, by using the Spearman rank correlation coefficient (equation 2). This coefficient was found to be 0.918, indicating a strong conformity between consultants and project managers for the ranking of the causes of delays.

Effects of Delays

Six potential effects of delay have been identified as shown in Table 4. Time and cost overrun are the two most important effects of delays, ranked first and second respectively, by both consultants and project managers (see figure 1b). These results are in strong agreement with the results of important causes of delay. Out of the top causes of delay (see figure 1a), there are at least five factors that cause the effects of time overrun, including change orders, slow decision making by the client, and lack of capability of the client representative, construction financial difficulties and late delivery of materials. There are at least five factors that can result in cost overrun, including inaccurate cost and time estimations, poor site management, an incompetent project team, and improper project planning and scheduling. These results are also consistent with other published work related to other developing countries, e.g. Aibinu and Jagboro (2002) in Nigeria, and Wiguna and Scott (2005) in Indonesia.

Table (4): Ranking order of Effects of delay

Rank	Effect Description	RII		
		Consultants	Project Manager	Overall
1	Time Overrun	4.160	3.750	3.960
2	Cost Overrun	3.830	3.370	3.600
3	Dispute	2.420	2.750	2.585
4	Arbitration	2.200	2.500	2.350
5	Litigation	1.900	2.000	1.950
6	Total Abandonment	2.250	0.917	1.584

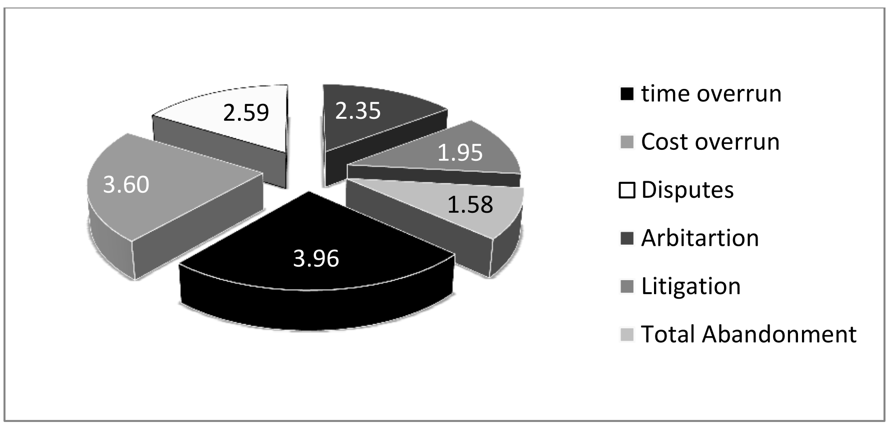


Figure (1b): Effects of delay

A Comparative Study

A similar study has been carried out for the construction industry in the UAE (Faridi and El-Sayegh, 2006). We have summarised, in Table 5, the rank order of the top 15 causes of delay in both the current work and their 2006 study. Ten of the top 15 factors were also reported in the 2006 study. Apart from lack of capability of the client representative, ranked 2nd in both studies, the ranking order of all other common factors changed.

The ‘change orders’ factor has moved considerably, from 27th place to become the most important factor. This is followed by poor site management & supervision, and improper project planning/scheduling which moved up 14 and 13 places to be the top 5th and 10th, respectively. An incompetent project team moved up six places to be the top 6th factor. Inappropriate construction methods, however, moved down the list 8 places. The remaining 4 factors moved up/down by 3 places.

Table (5): Ranking comparison between 2011 and 2006 of top causes of delay in UAE.

Factor Description	2010 Rank	2006 Rank	Rank Change
Change orders	1	27	-26
Lack of capability of client representative	2	2	0
Slow decision making by client	3	---	Not applicable
Lack of experience of client in construction	4	---	Not applicable
Poor site management & supervision	5	19	-14
Incompetent project team	6	12	-6
Inflation/prices fluctuation	7	---	Not applicable
Inaccurate time estimating	8	---	Not applicable
Late delivery of materials	9	6	+3
Improper project planning / scheduling	10	23	-13
Inaccurate cost estimating	11	8	+3
High interest rate	12	---	---
Client's financial difficulties	13	10	+3
Unreasonable constraint to client	14	17	-3
Inappropriate construction methods	15	7	+8

Interviews

In addition, typical interview results have shown that:

(1) Two governmental consultants, with more than 30 years experience, explored the importance of proper classifications and categorizations of consultants based on past learning knowledge. However, they have initiated some research ideas to recover managerial defects, but validation is required for UAE construction project performance. They added. Moreover, this will

assist public sector projects to evaluate the knowledge, experience, efficiency and past performance of other stakeholders (consultants, contractors and developers etc.).

(2)Two consultants, from the private sector, agreed on the significant forecasting budget considering the excessive change orders/variations by clients, as well as its effect on time and cost. It is argued that the insufficient monthly payments have affected the flexibility of the project progress recently.

(3) One project manager criticized the lack of co-related technical financial details. He added, full stakeholder' knowledge can prevent the unexpected delay and help clients in faster decision making.

(4) Another consultant, with 25 years experience, criticized the pre-matured project culture that disturbs any scientific pattern searching of risk control approaches; he said "a very important point is that a positive percentage of prequalified or interested users, who apply the same approach, does not exceed 5%".

(5) Two consultants from the architecture and value chain built environment sections agreed on the project complexity due to pre-bidding analysis, so the critical mission appears in the contract management.

(6)Another project manager criticized the recent client attitude towards project slow down completion by getting rid of some of the workforce and this left few posts in the recent financial crisis.

(7)All interviewees agreed that proper knowledge tools and financial methods to face a crisis could lead to improvement of project performance, to be noticed that 20% of them did not recognize the difference between financial risk management and procurement.

Conclusions and the Way Forward

The objective of the research work that underpins this paper was to investigate the causes and effects of construct project delays in the UAE. Data has been collected through interviews and a pilot questionnaire distributed to a group of experts working in local consulting, project management and contracting companies operating in the UAE.

Forty two potential causes of construction project delays have been identified and categorised into contractor, consultant, project managers, client, financial, and external categories. The significance of these factors has been investigated using the relative importance index method. Fifteen top causes include six client-related factors, four project manager-related factors, three financial factors, and two contractor-related factors. Client-related, project managers and financial factors seem to be the most significant causes of delay. These results are in general agreement with published previous studies in the UAE.

This exploratory study has highlighted a view of the many distress projects in the UAE and particularly in Dubai, in the financial crisis, the trade press have recently detailed how the UAE has been severely affected by the global economic downturn with reports of many project delays, and this may add the factor of the risk of financial crisis to the list of factors, although it has not yet been fully investigated.

The effects of construction delay have also been investigated. Time and cost overrun have been found to be the two most important effects. This is in strong agreement with the identified significant causes of delay. So, it is only a matter of time before the stakeholders begin to avail themselves of the phenomenon described above. However, some of the results are surprising and have implications regarding additional measures of project success, the need for knowledge management training for clients, and their representatives, but also project managers and their teams in risk management innovation.

Further future work could include conducting a well-grounded survey of construction delays analysis in the UAE to triangulate the initial approach adopted in these research findings and provide direction for IT project managers to adopt advanced techniques for project delay control. In addition, the effects of information flow between the organization levels, the importance of professional project management programmes and skills development. Accuracy of procedures and record keeping will also become indispensable, by the next decade, for IT project managers.

The problem of project control can be summarised as controlling additional measures to prevent delay, such as developing stakeholder knowledge management, as this may formulate good dependencies of relationship and interaction, rather than depending on the traditional success criteria; and predicting changes in the early stages can minimize the disruptive/risk effects. Moreover, to save time and help the project team in decision making, developing the project performance and confirming stakeholders' expectations.

In a way of validating variables/measures in a proposed conceptual framework to control the delays, hypotheses are set in figure (2) to resolve the great percentage of a problem related to poor knowledge of stakeholders in the preconstruction stage. Noticeably, the majority of the interviewees insisted on significant and proper knowledge management to control the risk of delay, rather than depending on local management tools only.

Limitations of the study are the sample size and the methodology adopted. Therefore, due to the small number of responses, further, more extensive studies are required to support the above findings.

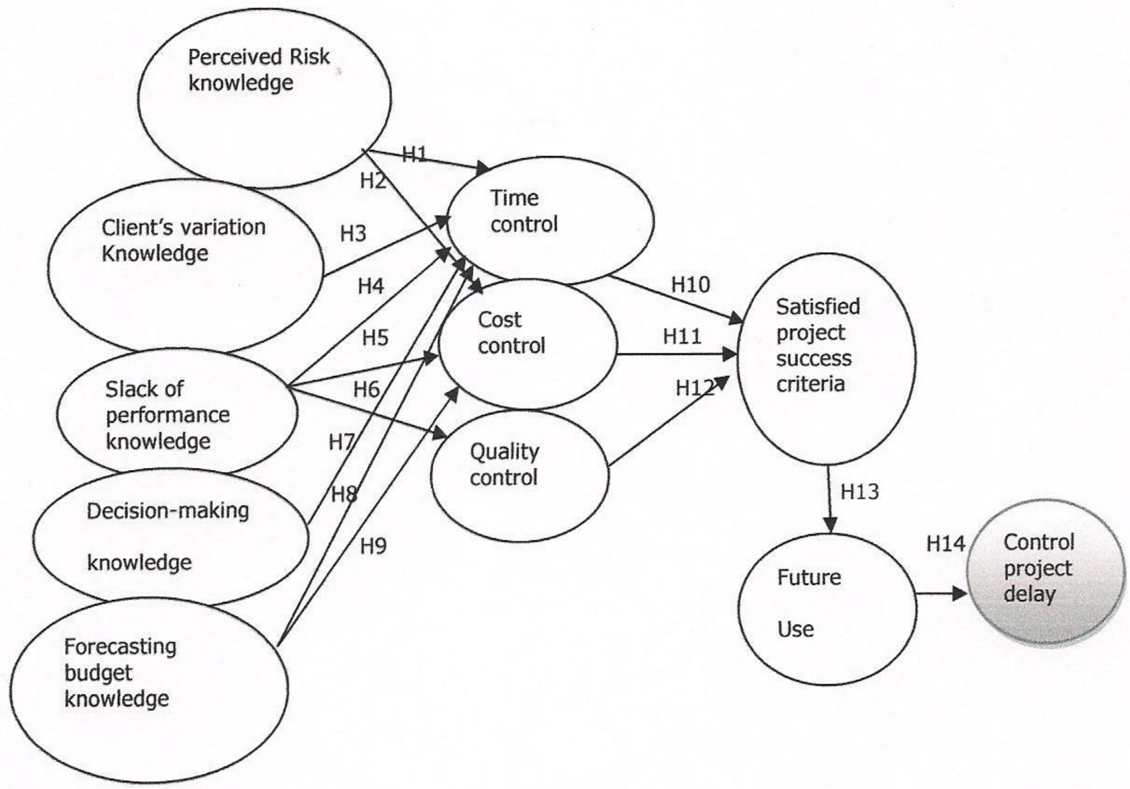


Figure (2): Determinant of control construction project delay in terms of specific Hypotheses **(H)**. ***There is a positive relationship between:*** perceived knowledge of risk in the earlier stage of construction and time (**H1**), perceived knowledge of risk in the earlier stage of construction and cost control (**H2**), appropriate client's knowledge in variations and time control at early stage (**H3**)**,** ***there is a negative relationship between:*** slack of performance and time control(**H4**), slack of performance and cost control **(H5)**, slack of performance and quality control**(H6)**. ***There is a positive relationship between:*** stakeholders' decision-making (Client, contractor, developers and governmental processor) and time control **(H7). *There is a negative relationship between***: lack of forecasting budget knowledge and time control **(H8)**, lack of forecasting budget knowledge and cost control **(H9)**. **There a positive relationship between:** the time control and project success criteria **(H10)**, the time control and project success criteria **(H11)**, the time control and project success criteria **(H12)**, the satisfied project success criteria and time future use **(H13)**, the future use of the success criteria and control delay**(H14)**.

References

Abdel-Razek, M.E., Bassioni, H.A., & Mobarak, A.M. (2008). Causes in building construction projects in Egypt. Journal of Construction Engineering and Management, 134(11), 831-841.

Abdul-Rahman H., Berawi M. A., Berawi A. R., Mohamed O., Othman M. & Yahya I. (2006). Delay Mitigation in the Malaysian Construction. Industry Journal Construction Engineering and Management, 132(2), 125.

Abdul-Rahman, H., Takim, R., & Min, W. (2009). Financial-related causes contributing to project delays. Journal of Retail and Leisure Property, 8(3), 225-238.

Acharya, N., Lee, Y., Kim, S.Y., & Kim, S.M. (2005). Delay in building construction projects in developing countries: A case study of Nepal', Journal of the Korean Society of Maintenance Engineers, 10(3), 81-95.

Abu Dhabi Chamber of Commerce (2009), http://www.abudhabichamber.ae/ Accessed 10th of May 2011.

Ahmed, S., Azhar, S., Kappagantula, P., & Gollapudi, D. (2003). Delays in construction: A brief study of the Florida construction industry, ASC Proceeding, 39th Annual Conference, Clemson University, Clemson, South

Aibinu, A., & Jagboro G. (2002). The effects of construction delays on project delivery in Nigerian construction Industry. International Journal of Project Management, 20(3), 593-599.

Aibinu, A., & Odeyinka, H.A. (2006). Construction delays and their causative factors in Nigeria. Journal of Construction and management, 132(7), 667-677

Alaghbari, W., Razali, M., Salim, A., & Ernawati (2007). The significant factors causing delay of building construction projects in Malaysia'. Engineering, Construction and Architectural Management, 14(2), 192-206.

Albino V, Pontrandolfo P, & Scozzi B. (2002). Analysis of information flows to enhance the coordination of production processes. International Journal of Production Economy, 75(1–2),7-19

Al-Momani, A. (2000). Construction Delay: a quantitative analysis. International Journal of Project Management, 18(1), 51-59.

Al-Nuaimi, A., Taha, R., Mohsin, M., & Al-Harthi, A. (2010). Causes, effects, benefits, and remedies of change orders on public construction projects in Oman. Journal of Construction Engineering and Management, 136 (5), 615-622.

APM (2006) “APM body of knowledge”. 5ed, ISBN-1-903494-25-7.

Arain, F. (2005). A framework for developing a knowledge-based decision supports system for management of variations order for institutional buildings, from: http://www.itcon.org/data/works/att/2006_21.content.04149.pdf

Arditi, D., & Pattanakitchamroon, T. (2006). Selecting a Delay Analysis Method in Resolving Construction Claims. International Journal of Project Management, 24, 145-155.

Asnaashari, S., Farahani, S., Hoseini, A., Knight, A., & Hurst, A. (2009). Causes of Delay in Iran Construction Projects. Proceedings of the Fifth International Conference on Construction in the 21st Century (CITC-V), Istanbul, Turkey, May 20-22.

Assaf, S A., & Al-Hejji S. (2006) Causes of delay in large construction projects. International Journal of Project Management, 24(4), 349–57.

Brendel N., Barrette A., & El-Riachi W (2010). The Availability in the UAE of Liens to Secure Payment under Construction Contracts. Arab Law Quarterly, 24 ,309-317

Choudhury, I., & Phatak, O. (2004). Correlates of time overrun in commercial construction. ASC Proceedings of the 40th Annual Conference Brigham Young University - Provo, Utah April 8-10, 2004.

Coakes, SJ., Steed, L., & Price J. (2009). "SPSS Version 15.0 for Windows: Analysis without Anguish" John Wiley.

Elweshahy, M. (2008). Construction Management Guide. http://cmguide.org/archives/39

Elinwa, A., & Joshua, M. (2001). Time-overrun factors in Nigerian construction industry. Journal of Construction Engineering and Management, 127(5), 419-425.

Ellis, R., & Thomas, H. (2003). The Root causes of delays in highway construction', 82nd Annual Meeting of the Transportation Research Board, Washington DC., 2003.

Enshassi, A., Al-Najjar, J., & Kumaraswamy, M. (2009). Delays and cost overruns in the construction projects in the Gaza Strip. Journal of Financial Management of Property and Construction, 14 (2), 126-151.

Faridi, A. S., & El-Sayegh, S. M. (2006) Significant Factors Causing Delay in the UAE Construction Industry. Construction Management and Economic, 24, 1167-1176.

Fong, N. K., Wong, L.Y., & Wong L.T. (2006). Fire services installation related contributors of construction delays. Building and Environment, 41, 211–222

Frimpong, Y, Oluwoye, J & Crawford, L. (2003). Causes of Delay and Cost Overruns in Construction of Groundwater Projects in a Developing Countries, Ghana as a case study. International Journal of Project Management, 21, 321-326.

Global Real State News Centre (2009). http://www.realestatechannel.com/international-markets/residential-real-estate/dubai-construction-uae-real-estate-emil-rademeyer-proleads-global-alma-kadragic-429.php

Khoshgoftar, M., Abu Bakar, A., & Osman, O. (2010). Causes of Delays in Iranian Construction Projects. The International Journal of Construction Management, 10(2), 53-69.

Kaliba, C., Muya, M., &Mumba, K. (2008). Cost escalation and schedule delays in road construction projects in Zambia. International Journal of Project Management, l27 (5), 522-531.

Kottegoda, N.T, Rosso R (1997). “Statistics, probability, and reliability for civil and environmental engineers”. New York; McGraw-Hill Company Inc.

Koushki P, Parviz, A., & Kartam, N. (2004). Impact of construction materials on project time and cost in Kuwait. Engineering, Construction and Architectural Management, 11(2), 126-132.

Koushki, P. A., Al-Rashid, K & Kartam, N. (2005). Delays and Cost increase in the Construction of Private Residential Projects in Kuwait. Construction Management and Economics, 23, 285-294.

Long L.H., Lee Y.D. & Lee J.Y. (2008). Delay and Cost Overruns in Vietnam Large Construction: A Comparison with Other Selected Countries. KSCE Journal of Civil Engineering, 12(6), 367-377

Low S. Pheng, Liu J., Ying, & Tan I. (2009) .PSSCOC and Causes of Construction Delays in Singapore and Four Selected Asian Countries .International Construction Law Review, 26, - Part 3