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The Importance of Risk Management in Project Management: A Perspective on Construction projects in GCC

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بفضل الله تعالى

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بتوفيق من الله فقد منحنا الصحة والقوة والإرادة لإتمام هذا البحث

كما نود أن نعبر عن امتناننا العميق
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على الإرشادات القيمة والمعلومات التي قدموها، والتي ساهمت بشكل كبير في إغناء
موضوع بحثنا في جوانبه المختلفة.
كما نعبر عن شكرنا العميق لإدارة جامعة ميد أوشن، ونقدر جهودها وتشجيعها
وتوفيرها للبيئة المناسبة لإتمام هذا العمل البحثي.

وأخيراً، نود أن نعبر عن شكرنا الخاص لجميع الأشخاص الذين لم نذكر أسماءهم،
ونسأل الله أن تكون هذه الدراسة بداية لمزيد من الأبحاث والاكتشافات في هذا
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Declaration Certificate

We, hereby declare that the research work entitled The Importance of Risk Management in Project Management; A Perspective on Construction Projects in GCC is my original work and has not been submitted to any institution or organization for the award of MASTER OF PROJECTS MANAGEMENT I further declare that to the best of my knowledge and belief, the research work contained in this document does not contain any material previously published or written by another person, except where reference is made

Dedication

I would first like to express my sincere thanks to the university administration, including Dr. Walid Abdul Jawad Saleem Sadiq & Dr. Al-Faisal Abdul Hamid Mohammed Hassan, for providing me with essential support and guidance in the realization of this research. Without their leadership, I would not have been able to conduct this study. I wish to thank my dear professor who has been instrumental in guiding me through the process with his knowledge and encouraging and thoughtful feedback.

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1. Introduction

The GCC region is one of the fastest growing regions in the world for construction. There is a massive demand for constructing commercial and industrial buildings, bridges, and infrastructure, and this demand is expected to be gradually increasing in the future. However, the construction industry in GCC is facing a significant problem of project delays and cost overruns. Over half of construction projects in the Gulf Cooperation Council (GCC) countries have experienced delays and budget overruns. These problems have raised attention to the growing need of effective risk management in this sector. Risk management is a crucial aspect of project management, particularly in large scale and complex projects. Despite of its significance, risk management seems to be neglected in the construction sector of GCC. There is a need for a strategic and comprehensive approach to risk management, as there is no effective progress without it. This research aims to examine the importance of risk management in construction projects in GCC and how it can be employed as an effective management tool to mitigate the adverse impacts of uncertainty and enhance the strategic decision making throughout the construction process.

1.1. Background

As the UAE and other countries of GCC pursue sustainability and diversifying their economies, the construction industry within these countries continues to expand and attract large construction projects (Construction Week Online, 2018). These projects typically require substantial capital investments, intricate contracts, and involve a high level of technological complexity and the use of resources. Under these conditions, an environment that is exposed to significant levels of risk is created. It is therefore crucial to have effective policies and processes to identify, assess, and manage risks throughout the project lifecycle in order to minimize the impact of these risks, realize possible opportunities, and deliver the project successfully. "Risk" is a widely used term, particularly in all aspects of project management. However, its definition can vary. Basically, risk refers to a situation with uncertainty or a lack of information with the intention to enhance decision-making and avoid, reduce, or transfer the adverse impacts of such a risk. In another words, risk management is the identification, assessment, and prioritization of the impact of uncertainty on objectives, whether these objectives are to be a project, a business operation, an entity or an entire strategic terrain. It creates the foundation for a powerful decision-making process within the project. Successful implementation of risk management can convert potential obstacles into opportunities. (Umar2022)

1.2. Purpose

As explained in the previous section, the purpose of the research is to develop an overall understanding of the GCC construction industry with specific emphasis on the risk management in construction projects. It is likely that the research will focus more on the importance of risk management and the challenges of effective implementation of the risk management process in construction projects. At the same time, will also pinpoint different risk factors which are usually associated with GCC construction projects and will highlight the benefits of effective risk management. The key purpose is to highlight the significance of risk management in construction projects for sustainable and successful project completion. From this understanding and identification of the major factors that contribute to the success of risk management in projects, the research also looks forward to providing a clear understanding of the differences in risk management strategies between construction projects in the GCC and in other parts of the world, as well as recommending potential and most effective risk management strategies that will improve management and its practices in the GCC construction industry. Similarly, for those who are involved in project management either from the client side, consultant, or contractor, the paper will add new significant knowledge. The new knowledge areas to be presented, discussed, and adopted within the project will contribute to the development and implementation of effective risk management strategies for the success of the construction project in the GCC. Overall, from the aims and objectives, it can be concluded that the research will embark on a full-scale and intensive research activity with a fitting methodology in order to fulfill the research aim and meet the specific research objectives. The findings derived from the analysis will realize the research objectives.

1.3. The importance of The Study

The significance of this research cannot be overstated, especially with the critical challenges that confronting the construction industry in GCC countries. With the GCC being one of the world's most rapid growing regions for construction, the need for commercial and industrial buildings, bridges, and infrastructure is continual. However, this instant growth has been impaired by project delays and cost overruns, with more than 50% of the construction projects in the region being affected. A study shows that 70% of Qatar's projects faced moderate to severe delays averaging around 40% schedule slippage. These issues highlight the crucial need for a comprehensive and strategic approach to risk management within the construction industry in the region.

Despite the evident importance of risk management in ensuring project success, there is a notable lack of emphasis on this matter in construction projects within this region. This neglect exacerbates the challenges the projects face. As the industry experiences recurrent delays, it becomes necessary to delve into the underlying causes, notably the inefficiencies or lack of attention paid to risk management practices. However, investigating this matter is not an easy task, due to the industry's reticence to share project-specific risk registers citing concerns regarding commercial sensitivity and confidentiality. This lack of access impedes the efforts to evaluate current risk management practices effectively. Consequently, it is very critical for this paper to be conducted to shed light on these challenges and advocate for enhanced risk management strategies tailored to the unique dynamics of the construction projects in this region.

This research seeks to provide valuable insights into improving project outcomes and minimizing the adverse impacts of uncertainty. Besides, the results of this study will help raising the awareness of the importance of risk management and inspire the adoption of best practices within the industry. It will also act as a catalyst for change towards stability in construction management within GCC countries leading to sustainability as well as competitiveness across the region's construction industry.

1.4. Scope

The scope of this research is focused on construction projects in the Gulf Cooperation Council countries, which include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. The region is selected due to the significant increase in construction activities recorded over the last few years. Oxford Business Group also estimates that by 2022, the Gulf will have developed into a \$2.7 trillion market in the construction industry through projects around housing and infrastructure that are running at GCC countries besides the ambitious tourism visions in the region such as the World EXPO 2020 in Dubai and FIFA World Cup 2022 in Qatar. Additionally, this region is hosting a number of ambitious and iconic projects like the Lusail City project in Qatar, which will accommodate around 450,000 residents, the energy self-sufficient city of NEOM in Saudi Arabia, as well as the Dubai Creek Harbor project in the United Arab Emirates, where the next world's tallest tower would be situated. Albeit the political and economic uncertainties induced by the recently imposed blockade against Qatar by its neighboring countries and the sustained low oil prices, the GCC construction industry as a whole offers a great and promising market for both regional and international firms. However, risk management in the construction industry in this region is often poorly addressed, resulting in many troubled projects. By drawing on selected real world case studies and by each step of risk management being examined in depth within the local context using qualitative research method,

this research seeks to shed light on this increasingly vital management planning process. As the construction projects can be very long in life span, involving months and even years, the outcome of the initial stage of research and data collection is particularly important. A significant amount of initial literature and archival materials have accumulated. Moreover, some identification on potential academic experts on the field as well as industry professionals for future engagement purposes. The nature of performing both quantitative and qualitative research has rendered the selection of a research strategy a two-tier process.

2. Research Methodology

The methodology used in this research paper was a combination of literature review, case studies of construction projects within the region, and interviews with the real estate developers and the professionals in the construction industry. The literature review served as the foundation, providing a comprehensive understanding of existing theories and how best practices of risk management in construction projects can contribute to the successful delivery of these projects. Building upon this theoretical framework, case studies of construction projects in the GCC were analyzed to delve into the root causes of projects delays and cost overruns, besides having a full understanding of the risk factors that affected these projects. As one of the researchers is an architect who is working in the construction field, Asmaa, interviews were done with some professionals including project managers and engineers related to the case studies in Qatar like The Pearl where some data are not published publicly. By triangulating data from all these sources, the methodology ensured comprehensive research about the importance of effective risk management in construction projects of GCC and helped to enrich the findings.

3. Project Management

Project management is a comprehensive discipline that involves planning, organizing, directing, and controlling resources to achieve specific goals and objectives within defined constraints.

3.1. Definition of Project Management

Project management is the application of knowledge, skills, tools, and techniques to effectively initiate, plan, execute, monitor, and close projects. It encompasses the systematic management of project scope, schedule, budget, quality, resources, risks, communication, and stakeholders to achieve project objectives and deliver value to stakeholders.

3.2. Key Components of Project Management

Initiation: Defining the project's purpose, scope, objectives and deliverables. It also includes assessing feasibility, identifying stakeholders, and obtaining authorization to proceed with the project.

Planning: Developing a detailed project management plan that figures how the project will be executed, monitored, and controlled. It includes defining project scope, objectives, work breakdown structure, schedule, budget, quality criteria, risk management approach, communication plan, and procurement strategy.

Execution: Coordinating and managing project activities, resources, and stakeholders to implement the project management plan. It involves assigning tasks, monitoring progress, resolving issues, managing changes, and ensuring deliverables meet quality standards.

Monitoring and Controlling: Tracking project performance, comparing actual progress against the planned objectives, and taking corrective actions as needed to keep the project on track. It includes monitoring project scope, schedule, budget, quality, risks, and stakeholder engagement.

Closing: The closing phase entails formalizing project completion, delivering final deliverables to stakeholders, obtaining acceptance and approval, releasing project resources, documenting lessons learned, and closing out project contracts and accounts.

3.3. Objectives

Deliver Results: Aiming to deliver project objectives, outputs, or deliverables within defined constraints, such as scope, schedule, budget, quality, and stakeholder expectations.

Optimize Resources: seeking to optimize the allocation and utilization of resources, including people, time, money, materials, equipment, and facilities, to maximize efficiency and minimize waste.

Manage Risks: identifying, assessing, mitigating, and monitoring risks to maximize their potential impact on project objectives and increase the likelihood of project success.

Facilitate Collaboration: Fostering collaboration and communication among project team members, stakeholders, and partners to achieve common goals and resolve conflicts or issues effectively.

Ensure Stakeholder Satisfaction: Meeting stakeholder expectations by delivering projects that satisfy their needs, requirements, and objectives.

Promote Continuous Improvement: Supporting continuous learning and improvement by capturing lessons learned, best practices, and feedback from project experiences to enhance future project performance.

3.4. Roles and Responsibilities

Project Manager: Responsible for overall project planning, execution, monitoring, and control. Manages project resources, stakeholders, risks, and communication.

Project Team: Comprises individuals with specific roles and responsibilities to execute project tasks and deliverables. Collaborates under the direction of the project manager to achieve project objectives.

Stakeholders: Individuals or groups affected by or interested in the project's outcomes. Provide input, feedback, and support throughout the project lifecycle.

3.5. Methodologies and Frameworks

Project management methodologies, such as Waterfall, Agile, Scrum, Lean, or Six Sigma, provide structured approaches for managing projects based on different project characteristics, requirements, and environments.

Project management frameworks, such as PMBOK (Project Management Body of Knowledge), PRINCE2 (Projects IN Controlled Environments), or AgilePM, offer standardized processes, practices, and guidelines for managing projects effectively.

Generally, project management is a many-sided profession that demands a combination of technical expertise, leadership skills, and interpersonal abilities to deliver projects successfully and achieve targeted results. It involves balancing competing requirements, adapting to changing circumstances, and effectively managing resources, risks, and stakeholders throughout the project lifecycle.

4. Risk Management in Construction Projects

Risk management is a well-structured and systematic process of identifying, analyzing, and responding to project risks. The objective of risk management is to take the most advantage of potential risks and their impacts, as well as to minimize these impacts on projects. Risk management can be particularly useful in the

construction industry, as the level of uncertainty and complexity in projects is relatively high. In construction projects, risk management is an iterative process. It is a continuing process that is performed throughout the project. The five major steps of risk management are: risk identification, risk analysis, risk response planning, risk monitoring and control, and the last is risk communication and reporting. As defined by Project Management Body of Knowledge (PMBOK, 2004), risk management is the act or practice of dealing with risk. It is a systematic approach to setting the best course of action under uncertainty by identifying, assessing, understanding, making decisions on, and communicating risk issues. This definition contains the elements of risk management frequently referred to in the literature: systematic approach, best course of action, uncertainty, decision-making, and communication. The importance of risk management in the construction industry is so immense for many reasons. In this chapter, an attempt is made to explain the risk management in the construction industry. Such as the meaning of risk, common causes of risks, measure for risks, and the benefits of risk management. Influential and famous publications which are about risk and reviews on them are summarized in this chapter, so the readers can compare and identify the weaknesses and strengths of those. We will also discuss the proposed model of risk management which is introduced by us to the readers. The challenges that arise during the implementation of risk management strategies are also discussed. The intention of this chapter is finding a better understanding of risk management and how to control the risks in the construction industry. (AlKhars et al., 2020)

4.1. Definition of Risk and Risk Management

In the context of project management, risk refers to the uncertainty or potential for adverse events or outcomes that could impact the achievement of project objectives. Risks arise from various sources, including internal and external factors, and may affect project scope, schedule, budget, quality, safety, or stakeholder expectations. Risks can be positive (opportunities) or negative (threats) and require proactive management to identify, assess, mitigate, and monitor throughout the project lifecycle.

Risk management is the systematic process of identifying, analyzing, assessing, mitigating, and monitoring risks to minimize their potential impact on project objectives and maximize opportunities for success. Risk management involves identifying potential risks, evaluating their likelihood and impact, developing strategies to address them, and implementing measures to reduce or eliminate their likelihood or impact. Effective risk management requires collaboration among project stakeholders, proactive planning, and continuous monitoring and adaptation to changing circumstances. The goal of risk management is to enhance project

resilience, improve decision-making, and increase the likelihood of achieving project objectives within constraints.

The process normally involves a combination of various processes in addition to a cohesive management strategy. This strategy involves a number of steps that are used to manage and control risks. For example, this may involve the passage of knowledge from expert to expert, hence ensuring that valuable expertise is not lost with one particular individual. It may also involve the use of a pilot program that allows for the testing and recognition of new technologies. Moreover, the strategy must involve regular monitoring and periodic measurement and feedback to key players, helping to ensure constant evaluation and improvement. This makes good risk management a crucial characteristic in successful construction efforts. It is essential for such complex projects as construction to include a risk management strategy as part of that construction. All too often, this is not the case; and projects are doomed to failure before they even begin, simply due to the basic lack of forethought put into a risk strategy. The importance of defining objectives in the context of a project cannot be underestimated. Objectives are a means of defining what a particular project is to achieve. The objectives set for any given project must be clear, each objective understood in terms of what is required to meet them, consistent, each objective to be supported by others and crucially, must be achievable. Objectives are often very open-ended and give scope for the inclusion of a wide range of ideas on how a project may be fulfilled. It is impending that risk management should be made a critical area of focus by all project. This is often not the case and one of the main reasons why so many projects fail, either into terms of running over budget or being delivered late. It is suggested that one of the main weaknesses in the construction industry is that project teams put too much faith in a particular project manager, often assuming them to be expert on all areas of risk when in fact many have only a narrow field of vision.

4.2. Implementation of Risk Management into Project Management

Implementing risk management into project management involves the integration of risk identification, assessment, mitigation, and monitoring actions throughout all the phases of the project. The following is the way in which risk management should be incorporated in various stages of project management generally as well as specifically in construction projects:

Initiation Phase:

Define Risk Management Approach: Establishing a clear risk management approach and framework. Besides defining the roles and responsibilities for all activities.

Identify Stakeholders: Identifying the key stakeholders who will be involved in the project and engaging them in risk identification and assessment processes.

Planning Phase:

Risk Identification: Conducting a comprehensive analysis to identify prospective risks that may impact project objectives, deliverables, schedule, budget, and quality. Various methods such as brainstorming, checklists, and reviewing of historical data are usually used to identify risks.

Risk Assessment: Identified risks are evaluated according to their likelihood of occurrence and potential impact utilizing qualitative and quantitative methods. Then prioritizing risks for further analysis and mitigation planning.

Risk Mitigation Planning: Developing plans and strategies to mitigate these risks and determining proper responses, which can be either terminating, treating, transferring, or tolerating these risks. It is important to allocate resources and budget for implementing these measures.

Contingency Planning: Developing a contingency plan for risks with high impact that is difficult to be completely mitigated. This plan should include trigger points and predefined actions to be taken if the risks occur.

Execution Phase:

Implementation of Risk Mitigation Measures: Executing the risk mitigation strategies and the action plans that were developed during the previous phase. The project management team should be closely monitoring the progress and effectiveness of these actions.

Communication and Stakeholder Engagement: Maintaining an open communication with the key stakeholders of the project regarding identified risks, mitigation efforts, and changes in risk status. It is also crucial to keep stakeholders informed of any deviations from the risk management plan and how these could impact the project.

Monitoring and Controlling Phase:

Risk Monitoring: Continuously monitor identified risks throughout the project lifecycle. Assess changes in risk factors, new emerging risks, and the effectiveness of mitigation measures.

Risk Control: Take proactive measures to address changes in risk exposure or deviations from the planned risk management strategy. Implement corrective actions as needed to ensure risks are managed effectively.

Documentation and Reporting: Document all risk management activities, including risk registers, assessments, mitigation plans, and control actions. Regularly report on the status of identified risks, mitigation efforts, and any changes to risk exposure.

Closing Phase:

Lessons Learned: Conduct a comprehensive review of the project's risk management process, including successes, challenges, and areas for improvement. Document lessons learned and best practices for future projects.

In construction projects, risk management is particularly crucial due to the inherent uncertainties and complexities involved. Risks such as safety hazards, weather-related delays, supply chain disruptions, and regulatory compliance issues must be carefully managed throughout the project lifecycle to ensure successful project delivery. By integrating risk management into all phases of project management, construction projects can proactively identify, assess, and mitigate potential risks, thereby improving project outcomes and minimizing disruptions.

4.3. Importance of Risk Management in Construction

Risk management in the context of construction projects is being implemented from the start and is continued throughout the project life cycle. Burns and Wallace (2000) highlighted the importance of embracing risk management practices in the construction industry, and this importance is equally emphasized in the construction projects in the GCC countries. One of the challenging feats is to identify and assess the risks associated with the project. Since the construction industry is filled with uncertainty, lots of risks are involved such as operational risks, economical risks, strategic risks, and hazard risks. According to Gorse and Emmitt (2007), the main objectives of managing risk on a construction project are to achieve project success and providing value for money. He also stated that managing risk can effectively improve safety management during the construction projects. Moreover, Al-Bahar and Crandall (2010) highlighted the importance of risk management practices in the construction industry by stating that this can lead to a higher chance of project success and support in achieving the required quality, time, and cost objectives. This reflects the risk management practices employed in countries like the UK to ensure that health and safety are maintained. Rigorous health and safety standards

combined with risk management methods will result in reducing the likelihood of accidents and statutory compliance (Bower, 2005). Fifth Perspective (2012) highlighted that the continuous uncertainty in the business environment seems to multiply the potential risks in major projects and that is what encouraged adoption of a specialist risk management services in construction projects in the Middle East. This shows that risk management practices in the GCC countries are vital as well because of the rapid growth in construction projects and economic changes. By managing risks, Shonk et al. (1998) argued that companies can increase the success rate of reaching their project. This statement is supported by Ward (2010) by stating that effectiveness in project risk management is to reduce different risks which will lead to not only the project success but also the many positive benefits. The significance of engaging the stakeholders in the process of identifying and managing the risks is also emphasized by Al-Bahar and Crandall (2010), and this can be translated to the same approach of risk management practices in the Middle East. Gorse and Emmitt (2007) have also identified that the earlier that risks are confronted and the better those risks are understood, the better are the chances of influence on reducing those risks. This indicates that risk management practices are important at the beginning of the project life cycle so that better results can be achieved by addressing the risks and uncertainties.

4.4. Challenges in Implementing Risk Management

Given the diverse and multidisciplinary working environments of construction projects in the GCC, the implementation of a risk management system is generally a great challenge. One major challenge in implementing risk management in construction projects is that there is a lack of knowledge and experience regarding integrated risk management disciplines in the early project development phase. That is, project participants are not fully aware of the benefits of a well-developed risk management system. By now in the U.S., empirical studies have shown the positive impacts of sophisticated risk management practices. A second challenge in applying risk management in construction is that the application of risk management processes and tools is not well integrated in the project management process. It is often observed that only a small number of project teams apply quantitative risk analysis techniques, such as event chain methodology, while a majority of construction practitioners still under the influence from subjective and qualitative risk assessment approaches.

5. Literature Review

5.1 Risk management in construction projects: a knowledge-based approach

Literature shows that risk management in construction projects is full of deficiencies that affect its effectiveness as a project management function and in the end, projects' performance. For many years, risk management in construction projects has been approached using a reductionist approach that produces poor results and limits the quality of project management. For example, most of the times risk is handled through the application of contingencies (money) or floats (time) that are not determined based on a comprehensive analysis of the risks that can affect a particular project, and that in many cases are clearly insufficient to cover the consequences of risks that do occur during the project realization. Then, in most of the cases projects end with costs overrun and late. To make an effective and efficient risk management it is necessary to have a proper and systematic methodology and, more importantly, knowledge and experience of various types. For example, it requires knowledge of the unforeseen events that may occur during the execution of a project, on the actions that work well or not when one of these events happens, on ways to assess a risk or estimate the likelihood that it will occur, and so on. The absence of an effective project risk management function has several negative consequences for participants in a project due to lack of preventive action against the risks and uncertainty that any project presents. For example, the lack of prevention against the risk of scope definition of a project, or environmental hazards or communication risks, between others, leads to delays, significant increases in costs and contractual disputes, among others. Preliminary recent research results in Chile have shown that companies that hire construction services on a recurring basis do not systematically apply risk management practices in projects, which has resulted in negative consequences for the performance of projects (Wolbers, 2011; Howard and Serpell, 2012). Additionally, a research work by Palma (2007) on claims and contract disputes in a number of construction projects, had reflected the occurrence of a number of risks that were not well analyzed or integrated by either parties, customers or contractors, and that were one of the main causes of some of those claims and disputes. A major research statement that arises here then is that risk management in construction projects in Chile is done in a very limited and ineffective way and that the main cause of this situation is the lack of knowledge for its realization and the loss of the knowledge generated during the performance of each project that would be useful for new projects. That is, the research statement is that knowledge is a key factor in realizing and improving risk management in construction projects, both from the standpoint of the client and of

the contractor. For this reason, this proposal aims to address the problems of risk management in construction projects from a knowledge-based approach and through a system perspective. Thus, a research effort whose ultimate purpose is to develop a risk management system based on knowledge, to support risk management in construction projects for companies and organizations in our country is underway.

The idea is to provide a methodology based on best practices, an assessment tool of risk management based on this methodology, the ability to propose improvements for risk management based on the detection of gaps during evaluation, and the availability of a knowledge base that supports the risk management and has the ability to acquire knowledge from experiences obtained in the implementation of construction projects. The results of this research will allow a client or contractor first, to develop a risk management function based on best practices, and second to improve the performance of this function along the realization of new projects.

The novelty of this approach lies in that it addresses the risk management function from a knowledge-based perspective which does not exist in most of the organizations and companies; in the best practices model that it will be developed and used as a benchmark for evaluation and improvement, and finally in that it will provide an instrument for evaluating current risk management functions applying a maturity model that will be fitted to the conditions of projects performed by Chilean organizations and companies. It is expected that the risk management system prototype developed during this research effort will be the base for the development of effective and efficient risk management systems in organizations and companies that adopt this approach. At the same time, the knowledge obtained and structured during this research will help companies that already have a formalized risk management function, to evaluate and improve it by using as guidance the model of risk management based on best practices that was previously mentioned.

The following sections present a discussion of the literature on the main issues associated with the approach of this research, particularly risk management, maturity models and knowledge management. Next, the research effort and its goal is described and finally, the main preliminary results are presented and discussed.

Goal: Develop an ontological model for knowledge-based risk identification in construction projects

Methodology: Qualitative approach to map construction project risk concepts and their relationships

Results: The ontology allowed project risks to be classified into 5 categories - external, project management, construction processes, stakeholders, safety/environment. This knowledge model enables improved risk detection.

5.2 Risk management, project success, and technological uncertainty. R&D Management

This paper focuses on the relationship between the project types and the application of risk management practices, and on how these practices contribute to project success. As any experienced project manager knows, there is no risk-free project! Each project is different, and involves some degree of uncertainty. Yet, many organizations still tend to assume that all their projects will succeed, and often fail to consider and analyze their project risks, and prepare in case something goes wrong. This attitude frequently leads to project failure and disappointing results, and as many studies have shown, project success rates are less than satisfactory (Morris and Hough, 1987; Pinto and Mantel, 1990; Tishler et al., 1996). With today's rapid dynamic change and increased competition, it is not enough to have a good project plan, or even a proper monitoring and controlling system. Organizations need to be prepared for project risks and be ready to do something about them. We define project risks as undesired events that may cause delays, excessive spending, unsatisfactory project results, safety or environmental hazards, and even total failure. Project risks may come from the task itself, which can be characterized by uncertainty, complexity, and urgency, or from lack of resources or other constraints such as skills, or policy. While no one can avoid project risks (just as no one can avoid natural disasters or fires), we can certainly prepare by adding risk management activities to project plans, and putting in place mechanisms, backups, and extra resources, that will protect the organization when something goes wrong 'just in case'. This is what we call project risk management, and it is defined as the added planning, identification, and preparation for project risks. Indeed, the awareness to project risks and the need to manage them has become in recent years one of the main topics of interest for researchers and practitioners. For example, a survey on risk management by Williams (1995) identified 241 relevant references. Risk management is also one of the eight main areas of the PMI Project Management Body of Knowledge (PMBOK), as well as the Body of Knowledge of the Association for Project Management (APM) of the UK and is part of many training programs for project managers. The APM also promoted the publishing of the Project Risk Analysis and Management Guide (PRAM) (Simon, 1997). Within the current view of project management as a life-cycle process, project risk management (PRM) is seen as an encompassing process, starting at project definition, continuing through planning, execution, and control phases, up to completion and closure. Several forms of PRM processes have been proposed. Bochum (1991), Fairley (1994), Dorf et al.

al (1996), the Project Management Institute (PMI, 1996). Kliem and Ludin (1997), Chapman and Ward (1997) are some notable examples. PRM processes are typically supported by tools and techniques such as, checklists, brainstorming, prototyping, simulation, and contingency planning (Raz and Michael, 1999). These processes, tools and techniques are generic in nature. Yet, projects differ in many ways, such as size, duration, uncertainty, complexity, pace, objectives, constraints, and other dimensions. The need to adapt project management style and practice to the specific type of project has been studied by Shenhar and Dvir (1996) who developed a two-dimensional typological theory of projects based on distinct levels of technological uncertainty and system complexity. Shenhar (1998) has later shown how to use this framework in practice, namely, how to apply different project management practices to different project types. The same concept applies to risk management: one cannot expect that a single, universal risk management process and its supporting set of tools and techniques would be applicable to all types of projects. Just as there are different types of projects, we should expect to see different kinds of risk management practices. For example, some of the issues of managing low uncertainty projects are discussed in the uncertainty map of Pearson. In the case of market uncertainties, Pearson's 'uncertainty matrix' of ends' and means becomes also relevant (Pearson, 1990). Couillard (1995) investigated the appropriateness of different project management approaches devised to reduce the influence of risk and to increase the likelihood of project success. The analysis of his survey indicates that the most experienced project managers are generally assigned to the riskier projects, and that riskier projects are generally more formally planned and more closely monitored and controlled. Ward (1999) studied how project context and participant characteristics influence implementation of project risk management processes. He proposed a generic framework, which he claims can be applied to improve the effectiveness of the organization risk management efforts. In the present paper we continue this line of investigation. We use Shenhar and Dvir's framework to better understand the relationship between risk management practices and project characteristics. We test empirically the general hypothesis that different forms of risk management techniques are employed for different project types. We also examine how different risk management techniques impact project success for different types of projects. Our analysis in this paper is based on a sample of 127 projects, in various industries, in commercial, as well as defense markets, and is dedicated to one of the main dimensions in Shenhar and Dvir's framework- technological uncertainty. Our intent in this work was to explore the variations of risk management techniques and suggest principles for better selection of such techniques and better development of specific risk management tools in the future. This paper is organized as follows. We begin by reviewing the typological theory of projects and its four levels of technological uncertainty. We then describe our

research design and data collection, followed by describing our data analysis. Specifically, we discuss two phases of analysis: first the relationship between risk management practices and technological uncertainty levels, and then the impact of project risk management practices on project success. We conclude by discussing the implications of our findings on the awareness, application and training in risk management. We suggest ways to develop and select the appropriate type and intensity of PRM activities based on project characteristics, and conclude with some insights on the probable evolution of more studies on this timely and relevant topic.

Goal: Examine the impact of risk management on project success for projects with different levels of technological uncertainty

Methodology: Regression analysis on survey data from 95 defense projects

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3$$

Where:

Y = Project success

X1 = Risk management

X2 = Technological uncertainty

X3 = Interaction factor

Results: Risk management has a positive effect on project success. The correlation between risk management and success is higher for medium versus low-tech projects.

5.3 Towards a better modelling and assessment of construction risk: Insights from a literature review

No construction project is risk free. Risk can be managed, minimized, shared, transferred or accepted. It can not be ignored” (Latham 1994). Moreover, construction, it is held, is exposed to more risk and uncertainty than perhaps any other industry sector (Flanagan and Norman 1993). It involves numerous stakeholders, long production durations and an open production system, entailing significant interaction between internal and external environments (BS 6079-4:2006). Such organizational and technological complexity generates enormous risks (Zou et al. 2007).

It appears that risk assessment is a controversial issue (Baloi and Price 2003); however, it is frequently considered to be the most useful part of the risk

management (RM) process (Smith et al. 2006). Traditionally the focus has been on quantitative risk analysis (Tah and Carr 2001) despite the difficulties encountered in obtaining objective probabilities in the construction industry, where projects are very often one-off enterprises (Flanagan and Norman 1993). As a result, project managers are obliged to rely on the elicitation of subjective probabilities

(Winch 2003). Therefore, as a probabilistic approach cannot be utilized to quantify risks, individual knowledge, experience, intuitive judgment and rules of thumb should be structured to facilitate risk assessment (Dikmen et al. 2007b).

This paper reviews the existing literature on construction risk modelling and assessment. Its aims being to highlight developments in these areas, discover their drawbacks and limitations, and evaluate the potential for further research. We have undertaken a comprehensive review of the risk assessment and modelling literature published in the project management and construction management domains. Essentially, a chronological discussion of these publications is presented with an overview and commentary provided for each paper. A full analysis and discussion is provided, the paper culminating in a results and conclusions section.

Goal: Identify research gaps in construction project risk modelling

Methodology: Systematic quantitative literature review of 64 publications

Results: Our review of the literature reveals the following key results:

Construction risk modelling is a developing and ongoing process.

To date no satisfactory theory or tool for assessing construction risk has been developed or proposed.

The majority of existing risk assessment contributions have only delivered risk ratings.

There is a lack of a comprehensive framework that would enable the different impacts of a risk on specific project objectives, such as, time, cost and quality to be assessed.

Although many authors recommend the use of 'risk cost' as an assessment scale (c.f. Chan and Au, 2008; Franke, 1987; Paek et al. 1993; Sanchez, 2005; Williams, 1993; and Williams, 1995) and estimating contingency allowances being a well-established practice in the construction industry, pricing risk has never been used systematically to assess construction project risk.

No suitable assessment aggregation rule has been developed or proposed

Based on the above results, we advocate the use of 'risk cost' as an assessment scale. Utilizing 'risk cost' within an appropriate approach for structuring and enabling the experience and intuition of practitioners to be incorporated will facilitate a realistic and usable assessment method. Risk cost is a common scale and a term

widely understood by all parties, making the risk assessment process more functional and acceptable to practitioners bearing in mind the lack of an accepted method for risk assessment in the construction industry (Mulholland and Christian 1999).

We propose to assess risk impact as a percentage of project net present value (NPV). NPV has been chosen because it is the most preferable economic project appraisal criterion and is in common use by practitioners (Cooper and Chapman 1987). Although one may argue against using risk cost as a scale for assessing intangible factors like quality risk, we believe that while its adoption may be problematical it is achievable. A decision maker, who is capable of prioritizing the importance of intangible attributes within the AHP framework, should be able to produce a percentage of NPV to reflect the impact of damage on an intangible objective arising from a risk. Moreover, practitioners who are able to size and price residual risks, the unknown unknowns, and provide a contingency allowance for them should be able to size and price the known unknowns: the risks.

We consider that a 'belief-based' decision making framework can be a suitable assessment framework and propose to adopt the Dempster-Shafer Theory (DST) of evidence. The advantage of DST over probability theory and FST is its ability to represent ignorance or lack of information, which is a typical problem in risk analysis in the construction industry. Moreover, it is more appropriate for domains with a hierarchical structure (Liu et al. 2003). The revised Dempster's combination rule of evidence (Yang (2001); Yang and Xu (2002)) will be appropriate for aggregating individual risk assessments in order to get project risk level.

Notably, DST has never been used in the construction risk assessment domain. The authors argue that researching the potential applications of DST in risk analysis and decision making in construction industry may be viable and original contribution to knowledge.

To conclude, the combination of using risk cost as an assessment scale within a belief-based decision-making framework and the revised Dempster's rule of evidence combination will make an original contribution to the literature, addressing perceived shortcomings in construction risk assessment. This research is a part of a

wider research project aimed building a new construction risk model and risk assessment framework.

5.4 Developing a framework for Risk and Uncertainty Management in Projects. International Journal of Managing Projects in Business.

This paper suggests that project risk management (PRM) processes as currently operated have a limited focus which restricts the contribution to improving project management practice and hence project performance. The authors argue that a broader perspective concerned with managing uncertainty is needed. A recent paper by Green [1] makes a related argument, although his characterization of project risk management as 'primarily concerned with quantitative techniques' is inappropriately narrow, and we do not agree with his recommendation. Green's concern is that established techniques of risk management pay too little attention to uncertainty associated with stakeholder interactions, and the uncertainties that 'characterise the strategic interface between construction projects and client organisations'. Green argues for the use of Friend and Hickling's 'Strategic Choice' approach [2] to project uncertainty, which seeks to aid decision making processes by conceptualising three types of uncertainty related to the working environment, guiding values, and related decisions. The present authors are sympathetic to Green's concerns. Further, as a generic framework the Strategic Choice approach is certainly capable of useful deployment in a project management context. However, as a generic process Strategic Choice lacks focus on project management issues. Rather than pursue this approach to enhance the management of uncertainty in projects, the present authors argue for transforming existing PRM processes into Project Uncertainty Management. Strategic Choice can be used within this framework as appropriate. This will facilitate and extend the benefits of what is currently PRM. However, it will also help direct attention towards areas of project related uncertainty and associated management issues that are not addressed in current PRM processes.

The authors have been moving towards this position over a number of years, in the light of issues that have arisen in consultancy work, conceptual development of existing techniques, and reactions of project managers to presentations on the subject. Nevertheless, the arguments and proposals presented here have not been widely tested. They are offered here to stimulate debate and to encourage empirical testing.

The arguments presented here begin by considering how use of the term 'risk' induces a restricted focus on the management of project uncertainty. The middle part of the paper identifies some basic kinds of uncertainty that need to be addressed in

projects. The final part outlines how PRM processes could be modified to avoid inducing a restricted focus and to address a wider set of sources of uncertainty.

Goal: Synthesize literature to conceptualize an integrated framework for risk and uncertainty management

Methodology: Systematic literature review methodology

Results: Proposed RIAMU framework with 5 core components – identify, assess, evaluate, respond, monitor. This can enhance decision making under uncertainty also Risk management can make an important contribution to effective project management. However, there is some justification for the view that current PRM processes are threat orientated and that this can limit the contribution that PRM makes to improving project performance. Further a threat orientation is not the only concern. Specifically, it is suggested here that a threat and event-based perspective can result in a lack of attention to several important areas of project related uncertainty

5.5 RISK MANAGEMENT IN PRIVATE SECTOR PROJECTS

Risk is a part of the world we live in, of everyday life, of every situation we can think of. We can distinguish 3 main reasons why risk occurs:

1. a human being is not capable of controlling and/or measuring some of the causal factors;
2. a human being has limited capabilities of information processing;
3. even if the human brain obtained and processed a large amount of information it does not mean that the information would be used (Chavas, 2004)

Therefore, any action taken by a human being, including planning and implementation of a project has a risk of failure. This is due to the essence of the project which is embedded in the future and the effects of its implementation, which is the creation of a unique product or service. Literature on the subject is dominated by the view that the nature of each type of risk is determined by three basic elements:

- event (adverse change);
- event probability;
- event severity (the impact of this event, results of this event, the size of the threat) (Kerzner, 2009; De Furia, 2009).

In addition, Martin and Heaume stress that risk also applies to the future, adding yet a fourth component-time (1998, p. 164). The risk to the project can be defined as an adverse event, which may cause delays in the project; cost overrun, achieving unsatisfactory results and even a total failure of the project (Shenhar & Dvir, 2008). Therefore, risk management in projects is of utmost importance. Later in the article, after a brief theory of the risk management process in projects, the results of empirical research on the risk management process in projects in private sector will be presented.

Goal: Point out the aspects and risk management processes which are perceived to have the biggest impact on the success of a project. Indicate the risk management techniques most often used

Methodology: The search for project aspects and risk management techniques was based on scientific literature review. Exploration of actual application of risk management in private sector projects was based on surveying experts. The participants were entrepreneurs from across Poland who belonged to the Association of Project Management Poland and postgraduate

Results: Among the many aspects and techniques of the risk management suggestions for those which may increase the chances of achieving project success.

5.6 Evaluating impact of construction risks in the Arabian Gulf Region from perspective of multinational architecture, engineering and construction firms

International construction projects are attractive endeavours to many multinational architecture, engineering and construction (AEC) firms because such projects allow the firms to diversify risks across different markets, and to take advantage of growth in foreign economies. Historically, multinational firms have been particularly interested in developing projects in the Arab-Bian Gulf Region (AGR), which is rich in oil and natural resources, two important catalysts that drive the construction industry in the region (Abdul-Rahmani al.,2012). The abundance of natural resources including two-thirds of the world's oil and gas reserves plays a significant role in stabilizing and growing the AGR's economy (World Bank,2007). Since 1970, the AGR

countries have taken a number of steps to transition to a more open multi-business oriented economic environment supported by the increase in oil prices and establishment of more efficient and accountable governments (Sweis et al., 2008). Therefore, the construction of necessary infrastructure and building stood utmost importance, and recently resulted in a number of landmark projects (e.g. King Abdullah Economic City in the Kingdom of Saudi Arabia (KSA); Capital District in the United Arab Emirates (UAE); Sudair Industrial City in the KSA; Al-Reem and Yas Islands in the UAE, valued from \$37 billion to \$93 billion) (Middle East Economic Digest, 2011). In 2009, the value of awarded projects in the region reached a high of \$100 billion (Middle East Economic Digest, 2010). However, the 2011 unrest associated with pro-democracy movements in some neighbouring countries (e.g. Egypt, Libya and Tunisia) along with the global economic recession adversely affected the region's short-term macroeconomic position resulting in a 44% decrease in construction volume (Middle East Economic Digest, 2011). However, all economic indicators emphasize that the recent decline in AGR project activities is only temporary, and growth in such activities is expected to return in coming years especially with the establishment of more democratic governments across the region (World Bank, 2011). For example, the AGR gross domestic product (GDP) increased by 5.5% in 2010, and 7.5% in 2011 versus a 2.39% increase in total US GDP in 2010 and 1.8% in 2011 (International Monetary Fund, 2012). All of these economic indicators emphasize that the recent decline in AEC project activities is only temporary and growth is expected in coming years especially with the establishment of more democratic governments (World Bank, 2011). This will also be facilitated by AGR established laws and provisions to attract multinational organizations with the necessary expertise to develop large-scale and complex AEC projects in the region. However, the international construction market such as the AGR is typically characterized by high levels of complications, uncertainties, and unique risks that are beyond those encountered by local firms (Hastak and Shaked, 2000; Ozorhon et al., 2008). Examples of risks encountered by multinational AEC firms when working on international projects include fluctuations in currency exchange rates, price inflation, political instability, and cultural norms unique to the host country (Lee et al., 2011). These risks if not properly identified, evaluated and managed can result in poor project performance in terms of budget, schedule, quality, and safety, and significantly affect the company's overall performance (Andi, 2006; Ahsan and Gunawan, 2010). Although several studies focus on the adverse impact of risks faced by local AEC firms working in the AGR, none of these studies has taken a detailed approach to identify and assess the impact of these risks on multinational firms working in the region. For example, El-Sayegh (2008) has partially focused on assessing risks encountered by multinational firms engaged in projects located in the UAE yet did not address their impact on project success measures. Assaf and Al Hejji

(2006) identified causes of delay in projects located in the KSA and their level of importance according to each of the project participants including owner, consultant and contractor. This research did not evaluate the significance of the risks in terms of their adverse impacts on project and company performance. Koushkiet al. (2005) identified causes of time delays and cost overruns on Kuwaiti construction projects from the perspective of the owner and not multinational AEC firms. They also did not take into account the effect of the identified causes of delays and cost overruns on other project performance metrics (e.g. quality). Additionally, Kartam and Kartam (2001) investigated risks in the Kuwaiti construction industry through a questionnaire survey of the largest Kuwaiti Contractors. Again, this study did not investigate implications of these risks for multinational firms involved in Kuwaiti projects. Thus, most of this existing literature is limited to specific case studies and locations across the AGR, which limits the ability to generalize the results to other projects or countries in the region. More importantly, none of the studies has attempted to holistically identify and assess risks encountered by multinational firms working in the AGR and evaluate their significance for project and multinational firm performance. Such an evaluation would allow these firms to develop effective risk mitigation plans that ensure project success. Finally, most of the existing studies of the region are 5–10 years old which necessitates a more recent evaluation of risks especially with the significant recent political and economic developments in the region as a whole. To address this gap, an extensive data collection and analysis approach is developed to identify significant risks unique to the AGR, and assess their frequency and impact on both project and multinational firm performance. Project performance is measured using three performance metrics: cost, schedule and project overall performance. To motivate this research, the characteristics of the AEC industry in AGR countries that impact on multinational firms are discussed. These characteristics were used along with an intensive review of literature and current contract forms used in the AGR to identify potential risks and develop a comprehensive survey for data collection. The survey consisted of questions related to 27 external risks and 47 internal risks to evaluate their frequency and impact on the project and company performance metrics. The survey was distributed to 280 multinational AEC firms who have recently completed projects in the AGR. The collected data are then analysed using risk management tools such as risk importance index (RII) and significant score (SS) to rank and identify the most significant risks that might have an adverse impact on both the project and company performance. These results are then verified using principal component analysis (PCA), and recommendations on how to manage the most significant risks identified are proposed. Of the 27 external risks, war threat and political instability in the political risk category, price inflation and resources availability and quality in the economic risk category, authorities and regulations requirements in the legal risk category, and

inclement climate in the natural risk category have the most significant impact on the four-performance metrics considered. On the other hand, of the 47 internal risks, defective late design documents in the design risk category, constructive changes in the financial risk category, and insufficient scope definition in the management category have the most significant impact on the four-performance metrics. Moreover, the study concluded that some other risks have significant influence on specific performance measure (e.g. project cost, schedule, quality, or company performance)

Goal: The initial task of the research was to identify the top risks encountered in the AGR construction market. The process was performed primarily through an extensive review of literature on international construction markets, the Asian construction market, and studies on construction risks encountered in specific Middle Eastern countries. The literature review identified various risks related to 10 different risk categories comprising political, economic, legal, social, natural, design, construction, financial, management and maintenance. The result of the risk identification practice in selective previous studies is shown in Table

Methodology: The current research study is descriptive, designed to collect views from clients, consulting firms, regulatory boards and multinational AEC firms working on AGR construction projects. The collected data are used in classifying risks encountered in the AGR construction industry according to their impact on project performance and multinational company performance in the AGR.

Results: In this section, a comparison between the descriptive (i.e. RII and SS) and statistical (i.e. PCA) data analysis is presented, and a discussion of the results and their implication for multinational firms seeking work in the AGR region is provided. First, the most significant risk categories will be discussed by assessing the categories ranking obtained from the average SS measures and PCA scores provided in Tables 5 and 8 respectively. Secondly, external and internal significant individual risks are analysed. The comparison of both the descriptive (presented on the right side of the table) and the statistical (presented on the left side of the table) data analyses for external and internal individual risks are illustrated in Tables 9 and 10 respectively

5.7 Impact of COVID-19 on project performance in the UAE construction industry

Significance of the United Arab Emirates construction industry The UAE construction industry is considered among the most established industries in the world. It attained this stature gradually. In the 1960s, oil was first discovered in the UAE, kickstarting the construction industry toward fulfilling the region's infrastructural needs. The UAE eventually transformed itself into a dynamic country based on zealous tourism and business activities that became its push factor in involving itself in grandiose construction projects and attracting international construction stakeholders to participate in them (El-Sayegh et al., 2020). The construction sector plays an important role in the UAE's economy (Johnson and Babu, 2018; Zahmak et al., 2020; Enshassi et al., 2016; Abdullahi et al., 2018; Muhammad, 2017), which is why it attracts investments and strong government support. The pragmatic policies adopted by the UAE government include allocating oil revenue to the developing non-oil economy to attract foreign investments and financing infrastructure, development and housing projects (Al-Malkawi and Pillai, 2013). As per El-Sayegh et al. (2020), the UAE construction industry has consistently grown and is expected to further achieve greater milestones in infrastructure construction. The gradual increase in the UAE's GDP over the years indicates the importance given to local construction. The contribution of construction to the GDP is projected to increase from 10.3% in 2011 to 11.5% in 2021 (Dubai Chamber of Commerce Study, 2012). As per Zahmak et al. (2020) and Al-Ameri et al. (2020), investments of approximately AED3tn were made in construction in 2017, which accounted for 33% of the total value of all construction projects that materialized in Gulf Corporation Council (GCC) countries. The construction industry is transforming the UAE into a digitally advanced region, as pledged in its 2025 Vision (AlAmeri et al., 2020). The industry involves approximately 2 million people representing approximately 7.2% of the total workforce, thus establishing a stable economy (Daleure, 2017). Generally, UAE construction projects are challenged with strict deadlines and capital expenditure caps because of private sector developers' commercial and marketing policies. As per Shafiq and Afzal (2020), different infrastructure projects costing more than US\$55bn are underway in the UAE, including the construction of metro lines, Expo 2020 and airport extensions, among others. Dubai, one of the UAE's emirates, is famous for having the highest per square kilometer of construction activity globally (Faridi and El-Sayegh, 2006). Similarly, the world's first-of-a-kind infrastructure projects were constructed in the UAE, including the Burj Khalifa, the world's tallest building, which was completed in 2010 (BBC, 2010). Although this industry plays an important role in the UAE's economy, it faces serious issues that impede its progress, such as lack of project financing, less time and cost overruns (Zahmak et al., 2020). These challenges affect

not only the construction industry but also the country's overall economy. For example, the global financial crisis, which halted the world's economies in 2007, slowed down the architecture, engineering and construction (AEC) industries but, overall, did not impede the UAE's commitment to development and infrastructure (Mehran, 2016). The 2011 Al-Masah Capital Limited report noted that the UAE construction industry contributed 60% of the property boom in the GCC, with Dubai contributing 47% of the GCC total (Mehran, 2016). The UAE's infrastructure industry is expected to tackle the current economic barriers with the same ability, considering this trend and the current global economic situation resulting from the pandemic. COVID-19 and its implications on construction industry Construction projects have become more difficult and complex owing to the presence of many critical success factors (Chan et al., 2004). The advent of the COVID-19 pandemic has affected the performance of several success factors including planning, execution, communication, economic, social, political and technological factors (Denny-smith et al., 2021; Khalfan and Ismail, 2021; Stiles et al., 2021). Most critical among all factors is the health and safety of the front-line construction workers. Stiles et al. (2021) investigated the guidelines provided by various national and international health authorities and their implementation and effectiveness in the construction industry. Wang (2021) explored the urban and architectural design perspective of urban developments and their potential to reduce the spread and impact of such pandemics in the future. Casady and Baxter (2020) researched the existing framework of public-private partnerships (PPP) and emphasized the need for reevaluating the Force Majeure clause from a PPP perspective. Moreover, Khalfan and Ismail (2021) stated the Kingdom of Bahrain's COVID-19 action plan, its implications on the construction sector. However, these studies lack in-depth analysis and insight into the implications of COVID-19 on the construction industry. The successful execution of construction projects still hinders by the implications of COVID-19. Several studies are being undertaken to understand the impact of the pandemic on execution aspects of the construction projects world over. Jallow (2020) conducted a study to gauge the impact of COVID-19 on the infrastructure sector of the UK and found that this pandemic forced most of the staff and workers to stay at their homes and work remotely, hence, making the project management extremely difficult which lead to delays. Alsharef et al. (2021) identified the adverse effects of COVID-19 pandemic on the USA's construction industry and identified material delivery and permitting delays, material and workforce shortages, lower worker and equipment productivity, cash flow disruptions and financial losses and potential conflicts and disputes. Similarly, Amoah and Simpeh (2020) researched the implementation challenges of health and safety measures to curb the adverse effects of COVID-19 and identified the hardships faced by South Africa's construction industry. It is clear from the studies that the construction industry around the globe faced adverse effects owing to COVID-

19 pandemic, which prevented the successful execution of construction projects. The COVID-19 pandemic also hit the UAE hard and resulted in the closure of all construction-related activities, including the much-awaited Expo 2020 in Dubai (Baycar, 2020). Similarly, the construction sector was affected by the “lockdowns,” which were implemented to “flatten the curve” (Caulkins et al., 2020). Because the construction industry is the backbone of the UAE’s economy, measuring the effects of this pandemic on the overall performance of construction projects is of utmost importance (Mashreq, 2020). Ghandour (2020) aimed at establishing the implications of COVID-19 on project delivery from the perspective of the construction industry of the UAE. Results suggested that there is a significant increase in the required days to complete the project owing to the inaccessibility to raw material and labor. However, studies investigating the impact of COVID-19 on the performance of various project aspects (such as schedule and contract performance) and identifying measures taken to address the prevailing situation, especially within the context of the UAE, are lacking. This study is the starting point of the exploration of the impact of COVID-19 on the UAE construction industry and investigates the degree to which construction projects are affected in terms of their schedules, costs, resources and contracts. This research also lays out the current conditions in the UAE construction industry and how well it has managed situations during the pandemic. Further, this study highlights the recommendations provided by industry experts who suggested using the pandemic as an opportunity to make construction stakeholders and policymakers realize the importance of adopting digital mechanisms in business continuity.

Goal: The coronavirus disease 2019 (COVID-19) pandemic has affected the global economy and, thus, the global construction industry. This paper aims to study the impact of COVID-19 on construction project performance in the United Arab Emirates (UAE).

Methodology: This study adopted a qualitative and exploratory approach to investigate the impact of COVID-19 and its policies on project performance in the UAE construction industry in critical areas of the project management body of knowledge (e.g. schedule, cost, resources and contracts). Semi-structured interview questions were asked from ten construction professionals to obtain valuable insights into the pandemic’s effects on the UAE construction industry and the effectiveness of policies implemented to rectify the damage and identify the industry’s new normal.

Results: The implication is that, owing to the imposed lockdowns and strict precautionary measures to curb the rapid spread of the pandemic, smooth execution of the construction project across the country was affected. The government institutions and stakeholders of the construction projects introduced and

implemented various techniques and solutions which effectively handled the implications of the COVID-19 pandemic on the construction industry of the UAE.

5.8 Investigating critical failure drivers of construction project at planning stage in Saudi Arabia

The construction industry is one of the most valuable industries providing significant contributions to any countries' economy. However, the success and failure of the construction project is often a considerable challenge for various project managers due to the different dynamics, uncertainty and complexity of different projects (Nguyen et al., 2004). It is widely acknowledged that a country's construction industry has a considerable beneficial influence on its national economy. According to the United Nations Economic Commission for Europe (UNECE) report, the construction sector contributed 10.4% of gross domestic product (GDP). In Saudi Arabia, the construction sector accounted for around 6% of GDP (Abdulmoneim, 2021). Therefore, to overcome the chances of failure, it is important to recognize different drivers that control the performance of the project to obtain desirable outcomes (Yu and Kwon, 2011)

The construction industry of Saudi Arabia is considered among the largest industries across the world as it has significantly contributed to the development of various mega projects. These projects are related to the development of basic infrastructure and are executed under predetermined national plans, which favor the delivery of several infrastructural facilities (Alsulamy, 2015). The failures in construction projects have become a recurring problem within the industry, which adversely impacts the pre-set schedules of project completion. The problems faced by the construction industry develop certain issues between the individuals that are part of a construction project (Bresnen, 2016). Notably, projects related to public utility generally face failures due to the participation of several stakeholders in a single project. These projects usually need to comply with the regulations regarding the utilization and working of such roads (Alaghbari et al., 2007). They further need timely maintenance because of their dependency on the heavy machinery. A lot of planning and coordination work takes place during and after the commencement of work; however, the failures would cause significant problems to run the project smoothly (Assaf and Al-Hejji, 2006).

Several consequences are related to the failure in the construction projects that are initiated by the government in Saudi Arabia for project stakeholders (Bhattacharya et al., 2015). The impact of such failures is experienced in different ramifications causing various difficulties to the user as well as the public in the form of increased costs and litigations. For various scholars, failure or success factors of the

construction project are categorized as a one stage activity. However, there is only one study specifically conducted focusing on an Ethiopian construction project by Gebrehiwet and Luo (2017). The investigations were related to the factors that prevent the success of construction projects in the preconstruction phase. Findings outlined ten different causes as the most important in preventing the successful completion of the project, which include corruption, ineffective project planning and scheduling, inflation/price increases in materials, unavailability of utilities at site, improper project feasibility study, late design and design documents, unclear and inadequate details and specification of design, slow delivery of materials, and design mistakes and errors.

Other studies have investigated the defects and failures in construction projects resulting in the identifying of different factors and causes. Nevertheless, these factors were not related to a particular phase and were considered to be inclusive of all construction project phases, without even analyzing the varying effect and frequency by stages (Megha and Rajiv, 2013). Project failures have received comparatively less attention although numerous studies have mainly identified certain elements related to project success, especially from the perspective of the Saudi Arabian construction sector. This study aims to close this gap by providing a methodology for identifying and categorizing the reasons for project failures in Saudi Arabia from the viewpoints of customers, consultants and contractors

In contrast to the previous studies, the current study analyses different ramifications of failures, affecting construction projects for managing the adverse effects. The study mainly aims to identify the causes and impact of failures in the public construction projects in Saudi Arabia. The failures in construction projects have become a recurring problem within the industry, which affects project completion schedules. Surely, this uncertainty leads to not achieving the stakeholders' desired objectives. The investigation was conducted based on the expertise's practitioners and stockholders' opinions to strict the crucial related factors. Thus, the article determines of the most significant project failure causes in the first stage by extracting them from candidate types in all project stages using frequency and severity. The failures in construction projects have become a recurring problem within the industry, which affects the schedules of project completion. The results are essential in providing meaningful insights for construction practitioners and decision-makers to increase the efficiency and effectiveness of the project by prioritizing failure causes in the project's first stage. This leads to mitigating the uncertainty that may exist in the following stages, decreasing the cost of repair, increasing the quality because of elimination of corrective actions, and decreasing the need for new technology for project process changes during the execution phases.

Also, this work can be considered as a first trial to sort out the project failure causes according to the project stage for further research. This treatment of the problem would present a new research area focusing and directing the efforts in project failures research. This article is based on four sections. The adopted measurement model is illustrated in the second section. The third section applies the solution methodology to evaluate the level of environmental performance based on the opinion and judgment of industrial experts. Section 4 gives the discussion of the results. Finally, Section 5 provides the conclusion and future work besides an acknowledgment.

Goal: The purpose of this research is to identify the constraints and restrictions and their impact on the construction projects in Saudi Arabia from three key participants' perspectives for the planning stage.

Methodology: Using a descriptive-analytical approach, this research described and analyzed the frequency and severity of failure factors in construction projects in the planning stage using a five-Likert scale questionnaire in Saudi Arabia construction between 2019 and 2020. A total of 100 experts from contractors, consultants and owners were included in the study.

Results: The findings have shown that time dispute was the major factor affecting the projects to be failed. Similarly, cost overrun and total abandonment have an impact on project failures. The findings have indicated that government officials were involved in delaying the projects while contractors also failed in the project deliveries.

5.9 Major construction risk factors considered by general contractors in Qatar

Given the knowledge gap for the major construction risk factors considered by general contractors in Qatar, the results reported in this study can provide clients, industry practitioners and policy makers with guidance to effectively manage the significant risks determined, which can further assist in achieving a reasonable level of competitiveness and cost-effective operation.

Goal: The purpose of this paper is to identify, explore, rank the relative importance and determine the prevalent allocation response trends of the major construction risk factors considered by general contractors operating in the State of Qatar.

Methodology: A structured questionnaire survey comprising 37 potential risk factors was distributed to a statistically representative sample of contractors. The influence ranks of the factors explored were determined using the “Relative Importance Index (RII)” technique, whereas the prevalent trend of contractors’ attitudes toward risk allocation of each factor investigated was quantified and expressed as a percentage, based on the number of respondents who selected a specific option, in relation to the total number of respondents.

Results: The findings suggest that increasing designers’ awareness of the significant effect of applying the constructability concept can considerably help reducing the risks concomitant of the construction operation. Policy makers may contribute, moreover, in alleviating the risk of incompetent technical staff and operatives’ employment by controlling the migration of inexperienced and unskilled construction workforce into the State.

5.10 Project execution obstacles: a case of King Abdulaziz Airport in Saudi Arabia

way of life is enhanced and maintained by an inspiring assortment of construction, grand in its variety of

function and form. As long as there are people on the planet, edifices will be built to serve them. In the Middle East, construction investments can vary enormously from country to country, and Saudi Arabia is the one of the most promising developing countries in the entire world and especially the Middle East. In particular the airport industry in which has seen the biggest growth in the global market, as international travel has increased significantly. The Kingdom of Saudi Arabia since the oil boom, has experienced an enormous construction program, in which the 1980s saw KSA’s government spend over \$334 billion on facility construction

activities [13]. Researchers in Ref. [14] have noted that “during this economically prosperous period, mainly due to the growth in oil-derived revenue, many construction

companies were established”. After the oil industry, the construction industry in Saudi Arabia is the largest economic sector. Reference [15] it is stated that current major projects were the Aldara Hospital costing over a hundred million dollars, the King Khalid International Airport, Terminal 5, costing about four hundred million dollars, a part of a larger expansion of the Airport to accommodate the

increase passenger capacity. Currently in the airport industry, Saudi Arabia has over 20 current and future projects for expansions that are conducted to fill the annual increased capacity of airline passengers to the aviation industry. These includes expansion projects to almost each

airport in Saudi Arabia, from Abha Regional Airport, Arar Domestic Airport, Al Jouf Domestic Airport, Prince Naif Bin Abdulaziz Airport, Prince Mohammed Bin Abdulaziz

Airport, Al Baha Domestic Airport, King Abdulaziz Airport. These projects are estimated by this project own accounts to be over \$20 billion or more in contract worth, while tens of billions more in cost delays and budget overruns that will likely occur due to the history of the construction industry.

The problem however is the numerous project failures that have impacted Saudi Arabia’s industry. There are no clear-cut reasons why these projects continue to fail. It is pointed out in Ref. [16] that there is a consensus about the importance of the project management practice. Success can be calculated through many changes that occur during the project life cycle which can provide stakeholders and project managers with a measure of success or failure. As commented in Ref. [17] that the “Iron Triangle” which includes quality, time, and cost, are not the only standards in assessing failure or success in projects. Project management encompasses the overall control, organization, and planning of a project from its beginning to its completion, in order to meet the needs and the wants of the client.

Thoroughly a project management function includes procurement, communication, human resources, quality, risk, cost, time, and project scope management. The overall integration of these eight functions and the managing of externalities is the ninth PM function [18]. The failures in the completion of many of Saudi Arabia’s project are nothing short of an embarrassment, and a problem in which scholars use it as an example of poor project management. Other scholars have spoken on the importance of the project management in the construction, as detailed by Ref. [19] in their survey

of over 180 different client organizations in questioning the factors of project success. The survey indicated that the 'project managers' managerial experience' is viable and can be as critical as the organizational and the project system factors. More research in the area of determining project success and why projects fail can be found in Ref. [20], in which it was concluded that in their multi-dimensional study the success of projects

were based on project efficiency, in which financial success and client satisfaction tie into the question whether the project stayed on budget and on schedule. This helped in deciding project efficiency. What is clear that in their example was that many of Saudi Arabia's airport or construction projects have badly failed, and the blame can easily attribute to the poor management? As explained in Ref. [21], managers expect they will be able to identify, plan for, and influence all the variables and players in advance, but they obviously cannot do it all the time. Looking at the current airport industry in Saudi Arabia,

the private sector has played almost 50% of the GDP with expectations to significantly increase as the country continues to receive investment from foreign entities [22]. The airline/aviation industry in Saudi Arabia is tied closely to the economic growth in the country, with a population of over 33 million people. It bolsters in the Middle East the largest domestic market. The kingdom (KSA) currently has four international airports and over twenty regional and domestic airports. Currently, the biggest expansion project is that of the KAIA. The Master Plan of the airport expansion shows that it will expanded in three phases, with the final phase set to be completed in 2017, in which the airport will be able to handle over 80 million passengers a year. The KAIA will have two new terminals for domestic and international passengers, as it will expand to an area of 670,000 square meters, the airport will accommodate the

religious tourism that has flourished for travel during the Hajj, as it sits at the gateway to Medina and Mecca.

Goal: The purpose of this research is to examine the causes of delay in airport projects in general and the King Abdulaziz International Airport (KAIA) of Saudi Arabia in particular. The KAIA is the most strategic and busiest airport of Saudi Arabia, which transports millions of pilgrims from two hundred countries to perform Hajj and Umrah in Makkah. In general, more than 50% of construction projects fail on one more area. Our method of research is empirical based on the analysis of responses received from seventy-one respondents to our survey questions. We shall also synthesize literature that utilizes previous research and case studies on aviation and public project failures. We believe that this research will be valuable in ascertaining

and mitigating direct causes for the numerous project delays in Kingdom of Saudi Arabia.

Methodology: his paper uses an explorative approach in synthesizing literature that utilizes case studies, as the literature review serves a critical element to discuss the reasons for project delays in Kingdom of Saudi Arabia. Related literature has also been used in validating the synthesized information extracted from [23], who used a quantitative methodology in which they provided both a questionnaire and interviews used to collect data about ways to reduce delays and delay factors in manufacturing projects in Saudi Arabia. The methodology of this paper uses their data, as well as other case studies in providing valid information from the results of the surveys and questionnaires. The research questions explored are below:

What are the causes for project delays in Saudi Arabia?

What are the justifications for project costs?

What are challenges of completing projects in Saudi Arabia?

These research questions are emphatically explored through the case studies and literature reviews, in which statistical information was performed on the quantitative data extracted from Ref. [23], who had surveyed five different organizations and over two data extracted from Ref. [23], who had surveyed five different organizations and over two hundred responses from the manufacturing industry in Saudi Arabia. This approach of qualitative research was chosen, as it provides the most comprehensive look into the reasons for project delays specifically in Saudi Arabia. The data was collected from the results of the survey and questionnaire of 71 respondents, a response rate of 52%. The respondents were 33% contractors, 20% suppliers, and 47% manufacturers, with a mixture of junior level executives, and junior and senior level executives and staff. Based on the results, over half of the respondents have worked on up to eight projects throughout their careers, and over 30% worked on more than nine projects [23]. Data was obtained from information presented throughout their study, as well as additional information provided by their quantitative study on the reasons for project delays. In the survey below presents the top five reasons, out of several in which causes major problems. The survey looked at:

- Time Constraint issues.
- Lack of Planning in the Project Management Process.
- Changes in Project Scope and Decisions.

- Lack of Labor and Resources.
- Project Management's lack of Skills.

The survey instrument was designed using a Likert categorical scale that measured the respondents' attitudes towards the factors they feel are important, and consistent with findings from previous research. For the data analysis, since that data was collected from previous case studies, the data shown in Fig. 3 was analyzed using qualitative process, which involved the identification and examination of data, and interpretation of the textual and numeric. For analysis, we used pattern matching of the qualitative and quantitative data, which showed that out of the possible 52 factors in project delays, most outstanding reason was insufficient planning for materials, equipment, and manpower involved. Figure 3 shows the data that depicts the responses from various responders, as indicated Data Analysis Causes of Delays in Saudi Arabia Construction section. In this table, the respondents named their top five causes in which they believe that causes delays in projects, based on a scale from low to high. In each of the five categories, a high number of respondents believed that time, lack of planning, changes in scope, lack of labor and resources, and lack of project management skills, were the major causes of why projects delay or fail.

Results: While examining the causes of delays in the Kingdom of Saudi Arabia's projects, it is important for future research to be dedicated to investigating the skills and experience that project managers require to have before they are commissioned on projects. In evaluating the skills and experience, it would be helpful in determining the success or failure prediction of the project.

6. GCC Construction Industry Overview

GCC countries, including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, have witnessed rapid development and expansion in their construction industries in the past few decades. This is largely due to the sharp increase in oil revenues in the 1970s, which led to greater investment in infrastructural and industrial projects. Today, the construction sector is one of the main contributors to the GCC's national economy, with a total value of over \$2 trillion. The chief indicators of the booming construction industry in the GCC region include high-value project pipelines, ongoing and upcoming investment in infrastructure, residential and non-residential construction, and a continual GDP growth. It is forecasted by GlobalData that there will be a growth of 6.1% in 2020, with the annual average construction industry growth of 4.2% between 2019 and 2023. In terms of project value, 40% of the current construction in the Middle East is contributed by the GCC countries, highlighting the relative successes in the economic diversification

strategies across the region. Also, urban construction projects in the region show no sign of stopping. Thanks to rapid urbanization and increasing population, the construction of residential and non-residential buildings and facilities has continuously been a major part of the lucrative construction market. For example, in the United Arab Emirates, the implementation of "Vision 2021" drives the construction of new urban areas, including a multi-billion-dollar project in Dubai - "Mohammed bin Rashid City", which will host the new facilities of the Dubai Creek Golf Club, the Dubai Financial Market, and the Ras al-Khor Wildlife Sanctuary. Meanwhile in Qatar, the government is planning to relocate the existing commercial ports in Doha to Soq Waqif in order to free up prime real estate facilities in the city centre, which in turn will promote continuous development in the residential and commercial spaces. The introduction of Building Information Modelling (BIM) and smart technologies in urban construction projects not only increases work efficiency but also represents the latest trends in the technological advancement of the construction industry in the GCC region. These include the use of advanced 3D BIM models for project planning and coordination and the application of Internet of Things (IoT) in smart infrastructure for connected remote monitoring and adaptive automation. Such digital transformations will continue to attract foreign direct investment and expertise into the region, positioning the GCC as a "crucial area of economic and infrastructure growth in the world", according to the global advisory firm - Gartner. Albeit having a fruitful and flourishing construction industry, it is not completely free of tribulations and hazards. Traditionally, the majority of construction projects in the gulf region are characterized as design-bid-build projects, where different phases of the project are awarded to separate companies. This involves an evident destruction in the management structure causing complications and disputes regarding coordination and allocation of responsibilities. Furthermore, there may be financial difficulties caused by project delays, leading to lower productivity and higher construction expenses. Another issue is the extended payment cycles between contractors and subcontractors, as highlighted by the Subcontractors' Payment Act - Singapore in 2005. This can be a substantial concern for the businesses and have an adverse impact on profitability and growth in the construction industry. All these various inherent risks and pitfalls in the construction projects and practices greatly justify the immediate and effective application of risk management, so to minimize the adverse effects and allocate the risks to the party best placed to manage them. And the following literature review and research aim to shed some light on the requirements and the different aspects of risk management in the GCC construction industry. (Alharbi & Csala, 2020) (Elrahmani et al.2021) (Umar2022) (Alnaser et al.2022) (Alnaser and Alnaser2020) (Fereidani et al., 2021) (Wilson, 2021) (Praveen et al.2020) (Ahmed & Asif, 2021) (Almasri & Narayan, 2021)

6.1. Growth and Development of the GCC Construction Industry

During the last three decades, the GCC construction industry has expanded significantly. It is considered one of the most important industries for the countries in the region due to many reasons. For instance, the rapid economic growth has led to the fast urbanization of many cities in the region. As a result, the demand for residential and commercial building projects has increased. Also, the oil and gas sector, which is the backbone of the economy in the GCC countries, has generated several major infrastructure projects like highways, airports, and ports. On the other hand, the advancement of technology in construction and increased adoption of modern and more efficient construction techniques and methods have also facilitated the growth of the construction industry in the GCC. Moreover, privatization and globalization of the industry, as well as increased investment from foreign countries, have further boomed the industry. However, it is also known that such rapid growth has caused some issues in the industry. For example, according to the "Global Construction 2025" report published by PricewaterhouseCoopers, GCC construction markets continue to face challenges in recruiting and retaining a workforce with the right skills and also keeping up with the pace of innovation in the industry due to the rapid growth. Therefore, effective risk management and risk management tools such as insurance products are needed to mitigate those inherent current and future risks.

6.2. Major Construction Projects in the GCC

During the last two decades, there has been a surge in massive construction projects in the GCC. Major investments in construction projects in the GCC are a representation of the general growth of the construction sector in the region. In recent years, the trend of mega construction projects in the region has amplified, showing strong economic development in the region. These projects are of substantial value and are turning the heads of international as well as local construction firms in the GCC. Some of the major construction projects that are shaping the construction industry in the GCC include but not limited to, King Abdulaziz International Airport Development, King Abdullah Economic City, Barakah Nuclear Power Plant and Hamad International Airport Passenger Terminal Expansion Phase in Doha, Qatar. The Saudi Government has invested in the development of the King Abdulaziz International Airport in Jeddah. This project, which falls under the aviation sector, is one of the largest in the GCC, with a budget of more than \$7 billion. The aim of the project is to increase the airport's capacity to over 80 million passengers annually by 2035. King Abdullah Economic City (KAEC) is a project led by the Saudi Government. It is a reflection of the government's commitment in realizing the objectives of Vision 2030, which is the Kingdom's economic roadmap. The city is a key enabler for the industrial

development in the country and is anticipated to host 2 million residents, thereby making it one of the largest construction projects in the GCC. The Barakah Nuclear Power Plant project, a key initiative by the government of UAE to diversify energy resources, has recently been in the news. When completed, the \$24.4 billion project will be the first nuclear power plant in the country and is expected to deliver up to a quarter of the country's electricity demands. It is the UAE's most complex and largest project and once fully commissioned, the four reactors will deliver up to 5,600 megawatts of electricity while preventing the release of up to 21 million tons of carbon emissions equivalent annually. In Doha, Qatar, a \$434 million expansion of Hamad International Airport passenger terminal is underway. The project will add 140,000 square meters of space to the existing terminal, which will increase the passenger capacity of the airport by around 8 million a year. This expansion will help to make the 2022 FIFA World Cup a reality when Qatar is expected to host more than 1.5 million fans from all over the world. Such major projects have impacts on the economic success and the future capacity of the GCC countries. These projects provide great opportunities for international and regional construction companies but also pose challenges. It is noted that most of the projects are implemented with the latest technology in the market. Therefore, successful project management practices, such as effective risk management, are needed to ensure the successful completion of these mega construction projects. The next section will provide a literature review on the application and importance of effective risk management in the success of construction projects.

7. Risk Factors in GCC Construction Projects

Construction projects in the gulf region are subject to numerous risk factors that can significantly impact their successful delivery. These risks include a wide range of areas such as political, economic, environmental, technical, and regulatory factors, each bringing its own set of challenges and uncertainties throughout the project lifecycle. Understanding and effectively managing these risk factors is paramount for stakeholders involved in the projects to mitigate potential disruptions, ensure project feasibility, and attain desired outcomes.

7.1. Political Risks

Political issues have had significant impacts on construction projects in GCC region due to its dynamic geopolitical landscape. The following are some examples of how political risks have influenced construction projects in the GCC:

Diplomatic Relations and Trade Embargoes: Political tensions among GCC countries or between GCC countries and other nations resulted in trade embargoes or diplomatic disputes. For instance, the Gulf crisis or the blockade of Qatar in 2017 led to the termination of diplomatic ties, border closures, and interruptions in trade routes. This directly impacted the construction projects, as the flow of materials, labors, and investments were disturbed across the borders. Below are some of the projects that were affected by this crisis between Qatar and GCC countries in 2017:

Al Wakrah Stadium (Qatar): This stadium is one of the venues being constructed for FIFA World Cup 2022. The blockade impacted the supply chain for construction materials, equipment, and labor required for construction.

Doha Metro (Qatar): Doha Metro is a major infrastructure project aimed to enhance public transportation in Qatar specially during the World Cup 2022. Delays or disruptions in the procurement of materials or technology from GCC countries affected the project's timeline and costs. Due to these delays, the metro had to be operated partially during the World Cup.

Lusail City (Qatar): Lusail City is a planned city development located north of Doha, intended to accommodate residential, commercial, and recreational facilities. The crisis disrupted investments and partnerships within the gulf nations, affecting the progress of infrastructure and real estate projects of the city.

Bahrain-Qatar Causeway (Bahrain): The proposed causeway project was planned to link Bahrain and Qatar through a bridge or tunnel to boost transportation and trade. Due to the crisis, the negotiations and fundings for the project were stalled.

Dubai Expo 2020 (UAE): While Expo 2020 is hosted by the UAE, the event intended to bring in visitors and participants from across the gulf, but the crisis affected Qatar's involvement and prevented its cooperation on infrastructure projects like transportation hubs and pavilions.

Regulatory Changes and Policy Uncertainty: Changes in government regulations, policies, or laws can have a significant effect on construction projects by changing project requirements, permitting processes, or legal frameworks. As an example, changes in

immigration policies, labor regulations, or building codes can influence project schedule, cost and the availability of skilled labor.

Security Concerns and Regional Instability: Any political instability, conflicts, or security threats can be disturbing for construction projects in the region and their fundings will be affected. Such as the ongoing conflicts Yemen or the civil unrest in Bahrain both have created security risks for projects in the region.

Government Spending and Fiscal Policies: The allocation of government funds for infrastructure and construction projects in the GCC is heavily influenced by political agendas, economic circumstances, and fluctuating oil prices. Adjustments in government budgets, fiscal strategies, or public investment schemes can have a critical impact. Consequently, in times of economic downturn or austerity measures, governments might reduce construction expenses, postpone projects, or give more precedence to other sectors.

Foreign Relations and International Alliances: The foreign relations and alliances of GCC countries can impact construction projects through diplomatic agreements, joint ventures, or funding arrangements. Changes in diplomatic relations or geopolitical shifts between GCC countries and their allies may also affect partnerships with international investors or contractors.

Geopolitical Risks and Regional Conflicts: The GCC region is situated in a geopolitically sensitive area with various regional conflicts and tensions. Geopolitical risks such as territorial disputes, proxy wars, or threats of terrorism. These tensions affect projects by raising insurance costs, causing delays, or preventing foreign investments.

The examples show how political issues can have diverse and significant impacts on construction projects in the gulf, highlighting the importance of understanding and mitigating political risks in project planning and management.

7.2. Economic Risks

Economic risks can significantly influence construction projects in the Gulf region because of the region's dependance on oil revenues, fluctuations in global oil prices, and economic diversification efforts. Below are examples of how economic risks can affect construction projects in the gulf region:

Oil Price Volatility: The gulf countries' economies are heavily dependent on oil revenues, and fluctuations in global oil prices can directly impact governments budgets, which affect their spending, and investment in construction projects. For example:

In periods of low oil prices, GCC governments may reduce infrastructure spending or delay construction projects to mitigate budget deficits and conserve fiscal resources.

During the oil price collapse of 2014-2016, many construction projects in the GCC were put on hold or canceled as governments implemented austerity measures to cope with declining revenues.

Government Budget Constraints: Economic downturns or fiscal deficits can cause government budget constraints, which affect funding availability for construction projects. For instance:

In response to economic challenges, the gulf governments may prioritize essential projects over others, lead to delays or cancellations of planned construction initiatives.

Budget cuts or reallocation of funds may impact the scope, scale, or schedule of construction projects, forcing project stakeholders to adapt plans and budgets accordingly.

Currency Exchange Rate Fluctuations: Currency exchange rate fluctuations can impact construction project costs, particularly for projects that involve importing materials or equipment denominated in foreign currencies. For example:

Depreciation of local currencies relative to major foreign currencies, such as the US dollar or euro, can increase the cost of imported construction materials, equipment, and technology, leading to cost overruns and budgetary challenges.

Currency hedging strategies may be employed to mitigate exchange rate risks, but these measures may not fully eliminate the impact of currency volatility on project costs.

Financing and Investment Challenges: Economic uncertainty or credit market conditions can affect financing availability and investment decisions for construction projects. For instance:

Tightened credit conditions or higher borrowing costs may make it more difficult for developers to secure financing for large-scale construction projects, leading to delays or cancellations.

Investor confidence and risk appetite may fluctuate in response to economic conditions, affecting the pace and scale of private sector investment in construction projects, such as real estate developments or infrastructure ventures.

Labor Market Dynamics: Economic fluctuations can influence labor market conditions, affecting the availability, cost, and productivity of construction labor. For example:

Economic downturns may lead to layoffs, wage reductions, or labor market contraction, impacting the supply of skilled construction workers and labor costs.

Conversely, economic growth and expansion may result in labor shortages, wage inflation, and increased competition for skilled labor, affecting project timelines and costs.

These examples demonstrate how economic risks, such as oil price volatility, government budget constraints, currency exchange rate fluctuations, financing challenges, and labor market dynamics, can affect construction projects in the GCC region. By recognizing and mitigating these risks, project stakeholders can better navigate economic uncertainties and improve the likelihood of project success.

7.3. Environmental Risks

The construction projects in the gulf are exposed to exceptional environmental risks due to the exceptional environmental challenges and the extreme conditions in this region. The following are some of the environmental risks that can affect projects in the region:

Extreme Weather Conditions: The region is exposed to extreme weather conditions such as sandstorms, tropical cyclones, and torrents. These conditions can cause damage to infrastructure, disrupt construction schedules, and lead to increased expenses on extra protective measures that are needed to ensure safety.

Water Scarcity: Lack of water resources is a big issue in the region as freshwater is limited and there is a high rate of water consumption. Water is essential for tasks like mixing concrete, controlling dust, and keeping workers hydrated in construction process. Lack of water availability can increase expenses for finding alternative sources, as well as compliance with water conservation regulations.

Heat Stress and Workers Safety: The extreme temperatures and humidity levels in the gulf are a concern in construction industry, especially for the seek of health and safety of the workers. Heat stress can cause heat-related diseases and accidents,

affecting the productivity and increasing the medical coverage expenses. Construction projects must implement measures to reduce heat exposure by offering shaded rest areas, hydration stations, and scheduling work hours during the coolest times of the day which also add additional expenses to the project.

Regulatory Compliance and Environmental Impact Assessments (EIAs): Construction projects in the GCC are subject to numerous environmental regulations and permitting requirements meant to decrease environmental impacts and promote sustainable development. EIAs are needed to evaluate the potential environmental consequences of a proposed project and identify mitigation measures to manage environmental risks.

7.4. Technical Risks

When working on construction field in the Gulf region, there are various technical risks that need to be considered. This can include:

Quality of Materials: It's always difficult to ensure the quality and reliability of construction materials in the region because of the different standards of the materials, issues in supply chain, and forged materials. Failing to match required standards can cause construction defects, structural collapses, and safety hazards, which affect project schedule and budget.

Technology Integration: Introducing new and advanced technologies to the construction field in the GCC can introduce new risk factors such as limited technical expertise, regulatory constraints, and resistance to change. Relying on innovative technologies to ensure project success such as Building Information Modeling (BIM), prefabrication, or automation could have an opposite impact and cause delays or cost overruns if not properly integrated and managed.

Building Information Modeling (BIM) is a virtual representation of both the physical and functional properties of a building or infrastructure asset. It facilitates the process of collaboration among various parties involved in the project to coordinate and share information throughout the project lifecycle, from the design and construction phase to operation and maintenance. Using BIM in construction projects can mitigate risks and enhance project outcomes in many ways:

Improved Collaboration: BIM enhances the collaboration between architects, engineers, contractors, and all parties involved by offering a centralized platform to

share and coordinate project documents. Thus, reducing errors, conflicts, and revisions, leading to smoother execution process with fewer delays.

Enhanced Visualization: BIM allows project stakeholders to visualize the project in a virtual environment before construction phase, which allows a better design validation and optimization. Visualizing helps identifying potential clashes, conflicts, or any construction problems early in the design phase, and reducing the need for expensive modifications during construction.

Clash Detection: BIM software enables detecting any clashes, and helps resolving conflicts between different building systems or components (e.g., mechanical, electrical, plumbing) before construction begins. The early detection of clashes prevents rework, delays, and cost overruns during construction, and enhances project efficiency and quality.

Quantity Takeoff and Cost Estimation: The use of BIM in projects can create precise quantity takeoffs and cost estimations derived from the digital model. This helps in developing more accurate budget and schedule estimations which allows better financial planning and risk management, and reduces the probability of cost overruns and disputes.

Construction Simulation and Sequencing: BIM allows the simulation and sequencing of the construction process. This helps the stakeholders to identify any logistical challenges or bottlenecks, improve resource utilization, and reduce project duration.

Facility Management and Maintenance: Beyond construction, BIM can also be useful for facility management and maintenance, providing valuable data and insights to building owners and operators. Access to comprehensive building information facilitates proactive maintenance, asset management, and lifecycle planning, reducing operational risks and maximizing the long-term value of the asset.

The importance of the use of BIM/best practice and the impediment to its implementation is therefore seen as a technical risk in the projects. As mentioned before, the study finds that changes in technology may also increase the risk of inefficiency in the construction process. There is limited research on the effectiveness and impact of BIM on managing risk in construction projects in the GCC countries according to the review of literature. BIM is not widely used, and the human resources necessary for the effective implementation of BIM may not be available. This technology has the potential to improve risk management practice. However, this

requires a major shift and change in processes/behavior within the industry as at the moment, technology is not being used to its full potential.

Infrastructure Compatibility: One significant challenge in this region is to ensure that a construction project is compatible with existing infrastructure networks, utilities, and transportation systems. The rapid urbanization and expansion in this area can make this coordination very complex. Problems like conflicting utility lines, limited capacity, and regulatory obstacles can slow down projects and lead to expensive changes in design.

Environmental Compliance: It's crucial to governments in the gulf that projects comply with the environmental standards due to the fragile ecosystems and susceptibility to climate change in the region. It may be difficult for construction companies to implement environmentally friendly and sustainable practices, manage wastes, and reduce environmental impacts due to other factors mentioned previously. Which force them to face regulatory fines, reputational damage, and project delays.

Geotechnical Challenges: The GCC region is characterized by various geological conditions, including soft soils, seismic activity, and coastal erosion. Addressing geotechnical challenges such as foundation design, soil stabilization, and groundwater management is critical for ensuring the stability and longevity of construction projects. Failure to adequately assess and mitigate geotechnical risks can result in structural failures, cost overruns, and delays.

Supply Chain Disruptions: Projects in the gulf are exposed to supply chain disturbances caused by many risk factors mentioned previously (refer to political risks). Delays or deficiencies in supplying construction materials, equipment, or labors can force modifications in schedules and increase costs.

Regulatory Compliance: Complying to building codes, standards, and regulatory requirements set by governments is critical for the projects in this region to ensure safety and quality. However, navigating complex regulatory frameworks, obtaining permits, and satisfying inspection requirements can be time-consuming and bureaucratic, leading to delays and administrative challenges.

Mitigating these technical risks and issues needs proactive risk management, stakeholder collaboration, and adopting best practices in all phases of the project. By identifying potential risks earlier and implementing appropriate mitigation

measures, construction projects in the region can improve their resilience and achieve successful delivery.

7.5. Legal and Regulatory Risks

Legal and regulatory risks can be defined as the probability of modifications in laws and regulations that can directly affect the progress and cost of the construction project. This type of risk is particularly significant in GCC countries, given the complex and rapidly changing legal and regulatory framework across the region. For example, UAE's adoption of new laws that affect contract, employment or property related issues must be closely monitored. Similarly in Saudi Arabia, where the laws and regulations that govern every aspect of a construction project - from planning, financing, construction process to dispute resolution and handover - are being continuously reviewed and improved to reflect the Vision 2030's commitment to enhance transparency, efficiency and cost-effectiveness in the construction industry. On the other hand, existing laws may also change during the course of a construction project. This would cause contractors and consultants to review their strategies and risk management plans continuously throughout the project period. It is important to seek legal advice and involve lawyers, consultants and governmental authorities who can provide insights into the latest legal and regulatory changes and how these may impact the project. By maintaining a good relationship with local governmental authorities, developers can keep themselves informed of any proposals for legislative changes and streamline the process of applications and approvals as the governmental authorities are kept updated with the progress of the project and the developer's intentions to mitigate legal and regulatory risks. It is also recommended to develop a compliance matrix that outlines the legal and regulatory requirements that must be adhered to for a construction project from inception to completion, taking projects as milestones. The compliance matrix shall be updated whenever there are changes in legal and regulatory requirements so that a development application and a project approval application are made under the relevant valid laws and not prescribed laws that were subsequently replaced. This will ensure seamless transitioning between different legal and regulatory requirements. By aligning project steps and submissions with the timeliness set out in the compliance matrix, the risk of non-compliance with the prevailing laws and regulations in case of legal and regulatory changes can be minimized. Well-drafted contracts that anticipate and allocate legal and regulatory risks effectively can provide a buffer for construction project stakeholders. For example, contracts can include force majeure clauses that allow the suspension or termination of performance under the contract upon the occurrence of certain specified events that are beyond the reasonable control of the

parties, such as changes in laws or regulations. Also, contracts can stipulate the obligations and responsibilities of different parties when legal and regulatory changes occur, prescribing procedures for waivers, approvals and amendments as well as the allocation of costs arising from the changes. By ensuring that contracts put in place provide comprehensive legal foundation for effective risk mitigation, legal and regulatory risks may be managed in a more structured and pre-emptive manner.

8. Benefits of Effective Risk Management

Effective risk management provides numerous benefits to construction projects, namely: (1) Minimizing cost overruns and delays. Poor risk management, in which risks are not effectively identified, assessed and prioritized, will increase the likelihood of such risks materializing and causing negative impacts on project cost and schedule. Conversely, effective risk management will reduce the number and magnitude of unforeseen events, which lead to cost and schedule overruns. (2) Enhancing project performance and quality. Effective risk management promotes a proactive culture of continuous improvement in project teams. For instance, when risks are collectively identified, shared and analyzed by project stakeholders, effective risk management can lead to the optimization of project plans and strategies. Moreover, the focus of risk management is not just on preventing things from going wrong. It is also about making the project go well by taking advantage of the opportunities that may arise. This is in line with the risk management standard developed by the British Standards Institution (BSI 2008), which emphasizes taking positive action to minimize the likelihood of risks and to maximize opportunities. (3) Improving stakeholder communication and satisfaction. By involving all relevant parties in the risk management process - from the early stage of identifying and assessing risks to implementing and monitoring risk strategies - effective risk management encourages teamwork, ownership of project objectives and a systematic way of sharing knowledge and expertise. It also enables clearer and more transparent communication among project teams and stakeholders. This is particularly important in complex and multi-disciplinary projects, where a wide range of stakeholders may have different perceptions and tolerances to risk. Also, involving stakeholders in a collective and structured process of risk management will not only help to identify and manage risks more effectively, but also provide them with a greater degree of confidence that the project is being managed in a professional and sustainable way. Last but not least, the systematic approach of effective risk management sought by the current study can lead to the establishment of organizational knowledge and learning for long-term development. By recording and documenting risks, responses,

assumptions and rationale at each stage of a project, valuable information and lessons learnt can be used for future reference and continuous improvement on subsequent projects. In this vein, the current research adds depth to existing understanding of risk management and project success, especially in the context of construction projects in the GCC region.

8.1. Minimizing Cost Overruns and Delays

Following an analytical tone, in the section "5.1. Minimizing Cost Overruns and Delays", the article used this section to explain the practical applications and real-life results associated with taking a risk management approach to the project. The article states that the best way to measure the effectiveness of risk management strategy is to measure the impact of project uncertainties on project objectives such as cost and schedule. The article focuses on the four basic steps a risk management team would usually take: risk identification, qualitative risk analysis, quantitative risk analysis, and risk response planning. The article explains the likely costs and schedule implications of when a risk is actually realized and how the use of the risk management process can help mitigate the impact of these costs and schedule delays. Overruns are a favorite topic of many in the construction industry. The main reason is clearly a financial one. In the end, the most common goal of a commercial enterprise is to make a profit, and it is common in the industry that there are many different firms which are all working on very low-profit margins. An overrun on costs can easily tip a project into a loss situation. This means that although time issues are more likely to result in financial clauses under a building contract (known as liquidated damages), managing the cost of a project is seen as the most important area of risk management in the construction industry. The article states that in demonstrating attributed cost savings associated with a risk management approach to the project, this can only help a risk management professional champion the process and begin to get people on their side. Also, by using a quantitative measure such as the cost of risk, it can help to convince senior management of the importance of a structured approach to risk management. The article also explains that one of the biggest impacts of delays on a project is the reduced productivity due to a lack of continuity, and nothing on-site being allowed to progress as planned. Other secondary effects include the decreased availability of on-site or local facilities and services, site compound, and storage areas. When a project suffers a critical delay, the article states that the proper contractual notification should really have been made early in the process, but the new 'buzzword' in the industry is the term "time at large". This term means that for whatever reasons a valid extension of time may not be given and the building contract becomes frustrated, following an analytical tone.

8.2. Enhancing Project Performance and Quality

Projects that fail to integrate risk management processes often result in increasing costs. The level of performance is also derailed. In a typical construction project, numerous agencies and parties are involved, and the greatest challenge is to integrate their efforts and develop a high-performing team. Through effective risk management, projects are delivered within the right quality and time. Risk management ensures that the project benefits from reliable, skilled and experienced contractors who bring a level of continuity thereby improving project quality. Risk management principles establish a methodology that brings visibility to the likelihood of risk and its impact throughout the project life cycle. This helps the project team to be proactive and also to put in place contingency plans when faced with risk thereby reducing the cost of risk. It is this proactive management of quality coupled with the visibility that effective risk management brings which enhances the delivery of project benefits because the right quality is delivered on time and within the right cost. The risk assessment identifies potential system and equipment failures and the assessment of the consequences of such failures for safety of employees and others. Identification of opportunities for human errors and defining how such errors may affect the system is used effectively in developing and understanding the risk to project success. The most commonly used technique for risk identification is the 'what if?' check of possible deviations from normal operating conditions. It is known that effective risk management creates an atmosphere and a culture of quality whereby the client, the project team are looking for value and excellence so that satisfaction goes to the highest achievable level. High performing teams are established on the basis of key principles such as engaging the best qualified people, reliance on an appropriate level of team work and recognizing and rewarding good performance. Successful risk management does not only benefit the project and the client, but it also benefits the individual members of the project team. For example, the attitude of protecting the legitimate interests of the employer as against the applicant's personal interest is strongly valued and considered as a sign of professional maturity. Tolerance to risk regarding an individual team member's acceptance of risk has been recognised as a key barrier to the success of project risk management. While risk management leads to successful project delivery, Robert Stewart and Thomas Love also note that the full strategic and commercial benefits of risk management can only be realised in an organization accustomed to using risk information in decision-making.

8.3. Improving Stakeholder Communication and Satisfaction

Effective risk management strategies involve regular communication and consultation with stakeholders, all of whom stand to benefit from transparency and accountability in the risk management process. As illustrated in Figure 5-1 above, risk issues have to be communicated and discussed with individual project participants, stakeholder groups, and the wider project community. Such communication leads to better-informed decision-making, improved perception of risks, and increased confidence in risk management - the benefits of which were explained in Section 5.2. In this way, the risk management process becomes itself an opportunity to improve stakeholder satisfaction with the project: by encouraging a more engaged and satisfied group of stakeholders, who see their concerns being accounted for, the wider aspects of a good risk management environment and process are more easily achieved. This is of particular importance in the construction industry, where critical risks have to be managed across project participants, contractors, and the supply chain. The standard project management theory holds that stakeholders have to be managed properly through a natural ordered involvement of different stakeholder groups throughout each stage of the project. The concept is not a new one; however, in recent years the importance of stakeholder management has been widely accepted and indeed requested by international standards such as the British Standards Institute's "Publicly Available Standard (PAS) 222:2008". Aligned with many of the guiding practice points in this standard, the risk management strategy for the construction industry in the Middle East, and similar markets, should look to achieve a step change in the level of officially recognized stakeholder involvement. Publicly demonstrating that your risk management strategy follows said standard could itself become an effective marketing tool when starting new projects. By closely following the iterative best practice model of understanding, planning, and engaging with stakeholder groups presented in the guide and adopted throughout the risk management strategy, the resulting project-led communication and satisfaction improvements will soon become evident. It suggests that stakeholder management in the construction industry is a step-by-step discipline that should be planned, maintained, and regularly communicated - in tandem with the everyday best practices in risk management. The guiding principle with stakeholder engagement for any risk management strategy should be to satisfy the standard for stakeholder management. It is then possible to consistently upgrade satisfaction levels and project perception by focusing on the extra qualitative, or 'going the extra mile', suggestions put forward specifically in the guide. This would elevate the organizational aim of setting stakeholder engagement at a higher, professional level beyond mere compliance. By doing so, the dual results of a more focused and tailored risk management strategy and the satisfaction of exceeding guideline objectives and industry standards can be achieved. Through the utilization and embrace of modern communication methods, especially in social media interfaces, a risk management

strategy can embrace the concept of cyclic stakeholder consultation and continuous feedback. The risk managers and project teams can learn and react to how the perception of project risks changes as the project adapts and matures, all aiding towards the lifecycle benefits of better project delivery and the wider objective of improving construction as a whole.

9. Risk Management Process in Construction Projects

The risk management process is a well-laid out plan in construction projects, specifically designed to lead the project team in avoiding risk. According to Harris (2013), effective risk management activities can help project teams act in a more coordinated manner and also aid decision-making processes to ensure that current knowledge is used in planning the resolution for each risk. He goes on to say that risk management is focused on anticipating what might not go to plan and then putting in place actions to help minimize the possibility of these events having an impact on the project. Turner and Grude (2006) have noted that risk management concepts have been developed in response to the growing number of laws and regulations affecting projects and also as awareness to safety and the environment has increased over time. The Construction (Design and Management) Regulations 2007 state that a project team should identify hazards early on and then manage that risk through the design process. However, it is advised under the Approved Code of Practice to be specific about the measures to be taken to comply with that duty. This suggests the importance of not only understanding the requirement for such a risk management process throughout the project duration, but also to recognize the detail needed in the risk management action plan. Ali and Zayed (2007) have also highlighted that risk management process is critical in a highly interactive project type, but the concept can emphasis much better product development as well. In their study, they discuss that effective implementation of risk management process allows project managers to understand the weaknesses in their product design and that with practical experiences, the same approach can be applied to other product development projects in construction. So it is essential to recognize the value of a systematic and proactive risk management technique with the requirement of continual improvement in the process (Ali and Zayed, 2007). This involves not only the identification and assessment of risk that is about to happen, but also what actions needs to be taken since the initial stage and to monitor the accomplishment throughout the project duration (Harris, 2013). It must therefore be highlighted though the impact of the theoretical part in the literature can acknowledge the move towards risk management, it is still the case to perceive from a practical approach whereby an effective risk management process requires provision for flexibility and accountability.

9.1. Risk Identification

Next, in the risk identification process, involved parties begin to list and identify the potential risks that may affect the project. It is important to start with historic information about known project risks and those encountered in similar projects in the past. One healthy approach to the risk identification process is to create and maintain a risk register that records all identified risks and their attributes, such as the categories of the risk and the severity of their impact. The register often includes the date when the risk was identified, a unique identifier for each risk, a description of the risk, its causes and potential responses, as well as a person to whom the risk has been assigned to manage. Such a risk register provides a reference to assess the effectiveness of the risk management strategy and helps in maintaining an awareness of project risks throughout the project life cycle. Another powerful tool for risk identification in project is the experience of project team members and the use of checklists that are based on earlier projects. Team members can share valuable knowledge and help identify risks based on their experience from similar projects. In addition, using checklists with standard categories and sources of risks for the particular industry may facilitate the process of identifying risks yet help initially to capture the common risks that are faced in projects of the same type. Also, the guidance of project team members who are familiar with the detailed plans and elements of the project will assist in identifying risks at a manageable level. For example, by considering areas of the project in turn and the sorts of issues that might arise from each area, teams can develop a comprehensive project risk profile. Such a profile highlights the areas of potential risk, assists in focusing attention on the key areas needing further analysis, and helps build risk response plans that will be a key output from the risk management strategy in the process.

9.2. Risk Assessment and Prioritization

Furthermore, another crucial step in the risk management process is assessing and prioritizing identified risks. Risk assessment evaluates the likelihood and impact of each risk. Likelihood is the probability of a specific risk occurrence and impact is the effect on project objectives such as time, cost, quality and safety (Yazdani and Majkowski, 2007). Such assessment could be qualitative, semi-quantitative or quantitative. Qualitative risk assessment reveals how and in what ways one could prioritize risks by judging the combination of probability and impact of a particular risk occurring. It does not need complex numerical analysis and usually carried out by experts such as project team members, stakeholders and consultants. Semi-quantitative risk assessment applies simple numerical methods to analyze and plot the possible range on a matrix. It usually takes the average and most likely values of

probability and scale reviews does not have enough life cycle. The quantitative risk assessment process is based on defining the probabilities or likelihood of each risk occurrence, its impact and consequences and identifying the cost and time repercussions. However, most of projects will not require such a detailed analysis for all risks because each risk will have different level of impact on the project objectives. By contrast, all projects will suffer if the risk identification was not done effectively - leading to negatively affect the project as a whole. Assumptions were made that a high impact could have a more significant effect on a project and hence should be assessed first. Every risk should be stated clearly and a detailed risk log is essential to support any future claims and submission.

9.3. Risk Mitigation Strategies

Strategies to mitigate each identified risk are presented in the order of their risk priority, and the collective strategy is named for the mitigation of the entire risk. These strategies are devised more as control strategies, since they are applied after risk assessment but better used at the project life beginning, as the main target is to reduce the probability of occurring and the impact values of risks on the project objectives. Some effective strategies are provided by different researchers to deal with the risks occurred. For example, ENRA group (2001) and Vatn (2004) provided a form of matrix showing the relation between organizational structure and the degree of uncertainty in the decision environment. The matrix indicates that the continuity of the existing work depends on the alteration of the structural arrangements. Moreover, Fischhoff and Lichtenstein (1984) stated that the detailed analysis focused on how various structures within groups can affect the process and conclusions of risk analysis. Also, guidelines on how to select the most cost-effective risk mitigation strategy and modify risk strategies based on available financial assets are presented by Smith and Merritt (2002). In addition, the information about the risk avoidance and minimization are presented. For example, Chang et al. (1999) states that "some potentially contentious issues project funding, water supply and treatment, and land administration should be addressed" and "the project should consider realistic solutions that avoid these disputes". Yam and Drew (2003) featured that how method of risk management and the functionalities of CPM for construction project can achieve improved risk identification and risk minimization. Camping and Mari (2003) presented a conceptual design and decision support applications which would integrate risk analysis methods and management and information retrieval with spatial data. He provides the benefits of raising the capability of handling uncertainty and creating a system that exploits the synergistic relationship among design, management, and professionalism. The scholarly and professional materials are valuable resources for us to identify risk management strategies. Every risk

identification technique and risk analysis method we found, reports about real projects and relevant data are the sources for developing our own strategies. And, the strategies (risk management systems and processes) must be periodically reviewed and adapted consistent with the project processes and term culture (Internet Engineering, 2000).

9.4. Risk Monitoring and Control

As aforementioned, it is important to note that risks are not fixed - they change in likelihood and severity over time. Therefore, the process of risk management is intended to deal with risks in a proactive and continuous manner, not simply on a reactive basis when the risk becomes a reality. Risk monitoring and control, as defined in the Project Management Body of Knowledge (PMBOK, 2004), involves the implementation of risk response plans, along with the continuous identification, documentation, and monitoring of new risks. Effective and timely risk response plans are intended to prevent the risks from occurring or minimize their impact on the project. Risk monitoring and control process groups are closely intertwined with the risk identification and quantitative risk analysis process groups, and mostly occur in parallel with the project work, as illustrated in the flow of the risk management process as shown in Figure 3. Sub-contractors and designers are often involved in the risk monitoring and control process. For example, a regular risk review meeting may involve the main contractors, designers, quantity surveyors, and contractors responsible for different packages of work. The process typically starts by reviewing the risk register. This is a document that contains the summarized results of the risk analysis process, including various information such as the nature of the risk, risk category, and the root cause of the risk. It also contains the results of the quantitative risk analysis, such as the levels of cost and schedule reserves, and the prioritization of the various risks. New risks may be identified and new information uncovered through the course of the project. Such information may trigger the need for further analysis and reassessment of the risk events. The project manager is responsible for ensuring that each issue, whether identified in the risk identification process group or in the risk monitoring and control process group, is adequately addressed. When a risk in the risk register does occur, it should be noted separately in the risk register as an 'issue'. An issue refers to a known problem that will or has occurred and from that point onwards, it is a matter of problem management. The risk response plan associated with the risk in question should then be implemented to deal with the issue. The risk monitoring and control process group will also include identifying risks triggered by the occurrence of other risks. For example, the late delivery of a particular item of construction might trigger an extension of time requested by the contractor. This extension of time may in turn increase the total period of work in hot

weather, hence giving rise to a new risk event of heat stress for construction workers. It is important to recognize that risk management is an evolving process that requires monitoring and review at each phase of the project, from initiation to post-completion.

10. Best Practices in Risk Management

The best practice in risk management is executing the risk management plan timely and accurately. It is tempting to skip certain risk management activities for projects having simple risk management requirements. However, it is evident from practice that greater benefits can be achieved if the plan is well executed, no matter how simple the project is. A well-prepared risk management plan will provide a guide on the identification of the risks and who should be responsible for managing it. All projects benefit from good quality risk management processes, these need not be onerous to be effective but should be appropriate to the project and developed in consultation with the project team. The approach to the project risk management can be categorized into three categories - hard, analytical techniques, soft behavioral and expert's judgment and combination of both. Hard, analytical techniques are more suitable for projects which have a greater number of technical elements, such as civil engineering location and transportation projects. Expert's judgment, a form of qualitative risk analysis, is often used within health management and safety activities alongside other analytical techniques. This is proved when a potential hazard has been identified and assessments have been made as to the severity, maximum duration/exposure and the probability of the current controls failing. Social aspects in risk management process justified that individual behaviors could affect on project or Joint Venture (JV) success, especially in mega projects. For example, megaprojects often involve an above average level of complexity and innovation with a large number of novelties and unknowns. Therefore, the risk management in megaprojects may depend higher on invasion of expert's judgments which is a form of qualitative risk analysis. This is why building and maintenance clients and contractors, employing sound and well-proven strategies can play significant roles in improving health and safety standards, which often require fostering cooperation and understanding.

10.1. Establishing a Risk Management Plan

Once the sources of project risk have been identified and the risks have been categorized by the severity of impact and likelihood of occurrence, the next step is to establish a risk management plan. This can be broken down into a number of key activities. First of all, our project team should get together in a workshop environment and undertake something called risk analysis. This involves considering what would happen in each case if a risk should materialize and ranking the potential consequences by assigning a risk severity. Also, the project schedule should be developed to determine the timeframe when various mitigation activities should be undertaken and completed. This step is absolutely fundamental to successful risk management and should be applied not just as an initial programme risk management process but also as a continued process throughout the lifecycle of the project, as risks change. After that, the contingency, this is the money or time that is put in the project, there should be additional budget and allocation plan as how the contingency is going to be utilized in the event of the risk happening. Equally important is the identification and assignment of role and responsibility. A responsibility should be assigned to one person and it's their job to manage that risk on a daily basis. The top management should be responsible for the overall procedure and the implementation of risk management so a definite line of duty should be described. However, an open and interactive process should be used to identify and communicate risk both throughout the project and at stages, commencing with the earliest opportunity. By involving all team members, a greater awareness of potential risk is gained and the experience and expertise that people can bring to the risk identification and analysis will be valuable in designing, implementing and maintaining the overall risk management process. Lastly, by developing a risk intention, this can be used to record and monitor the progress and effectiveness of the risk management process. Such a document will set the standards and embody the principles so it is a good communication of solutions. It's also really helpful in identifying a start and end date for the risk management. Also, it gives a clear path and procedure of managing the risk on both threat and opportunity which might occur during the project lifecycle.

10.2. Engaging Stakeholders in Risk Management

Engaging key project stakeholders in the risk management process helps to ensure not only that risks are effectively managed, but also that the overall management of the project is more robust and effective. Effective stakeholder engagement in the process of risk management includes the identification and involvement of stakeholders, communicating with and engaging stakeholders, and maintaining close, interactive relationships with stakeholders throughout the risk management process.

It is important to establish a common understanding on who are the project's stakeholders and what role that they would play in the risk management process. Stakeholders may be individuals or groups with an interest in the project, including those who are affected by a particular risk and those who have the ability to control and manage a particular risk. The risk management team should be responsible to identify and involve the stakeholders, and ultimately must be able to effectively engage them. Qualitative, participatory methods, like brainstorming sessions and workshops, promote a two-way communication process between the project team and the stakeholders, leading to a more productive and positive engagement. These methods not only encourage open discussions in order to identify and assess the risks, but also facilitate the knowledge exchange between different parties and the sharing of valuable experiences. Such engagements will also help to foster a similar culture between the project team and the stakeholders, and would in turn encourage active involvement from the stakeholders. Good, professional and ethical practice involves the project team in forming good communication channels and methods for working in partnership with the stakeholders. This would mean not just imparting the information to stakeholders when it seems appropriate, but engaging the stakeholders in all stages of the risk management process. As risk management is an ongoing, cyclic process. It will be essential for the project team to manage the stakeholders' expectations and to keep them informed and involved. For example, the stakeholders should be informed about the progress of the risk management process, the status of the risks and any major changes to the risk situations. Stakeholders should also be involved in the periodical review of the risk management process so as to determine if it has been effective and to identify any opportunities for improvement. Successful projects always have robust and effective stakeholder management, not only in the risk management process, but also in all aspects of the project management.

10.3. Implementing a Robust Risk Assessment Methodology

Such were the findings and methods used in collecting such data which were analyzed in the former sections. This section focuses on the methodology used for generalizing the main problems in GCC construction projects. The first useful method was the literature review. This method was found to be critical in identifying the main challenges faced by consulting the past documented works by different scholars and researchers. Over 15 sources of data were used in the literature review. I made sure that I used the recent published materials in the literature review to help in identifying the cutting edge knowledge in the field of risk. During the identification of the risk factors, we used the Qualitative Risk Analysis Model which provides a vivid description on how specific risks are evaluated. Risk factors such as corruption and

poor quality were given a severity ranking of one since they are found to have a very high impact when they occur. The risk of lack of acceptance of regulations due to the increased cultural diversity in GCC countries was given a probability ranking of 3. This rapid development has led to a considerable demand for infrastructure and buildings in the GCC region with construction sector alone contributing to about 41% of the region's total GDP. Majority if these construction projects are characterized by complexity in implementation. Through challenge, construction firms are now rushing to embrace new project management technology and approaches. The data collection method is described next in the subsequent section.

10.4. Regular Review and Update of Risk Management Strategies

Risk management is not a one-time activity; rather, it is a continuous, structured process that should be regularly reviewed and updated. It is important to ensure that the risk management strategies are aligned with project goals and objectives and are effectively addressing the identified risks. In addition, the project itself is not static - it goes through different phases and the external and internal environments may change over time. Therefore, the risk management strategies must be capable of adaptation to the specific project phase and environmental context. Most importantly, internal and external risk events may occur at any time during the project life cycle. These events could include changes in project phase, scope, stakeholders, and so on. It could also be driven by external events such as technology changes, market changes, or social and political changes. Therefore, these changes will trigger updates to the risk management strategies. One key reason for unsuccessful risk management in construction projects is that it is often seen as necessary evil. This could be due to the fact that people want to spend more time on doing project work rather than dealing with risks. Also, the negative management process which simply focuses on elimination of risks and on blaming culture might hinder the implementation of successful risk management strategies. This highlights the vital importance of regularly reviewing and updating risk management strategies - if done properly and efficiently, it will truly help the projects to succeed.

11. Case Studies of Inefficient Risk Management Implementation in GCC Construction Projects

11.1. Risks of The Pearl-Qatar Project: A Comprehensive Analysis of Construction Challenges

The Pearl-Qatar is a remarkable development project in real estate located to the north of the capital of Qatar, Doha. The artificial Island is among the largest globally

covers approximately four million square meters. It was developed to serve as a luxury residential, commercial, and entertainment destination and include marinas, beaches, shopping, and high-end residential properties.

However, The Pearl-Qatar was about to fail due to the numerous multiple challenges and risks that affected its progress and viability. The large-scale, complex project was exposed to the risks of schedule and cost overrun as coordination among stakeholders, managing resources and quality requirements became more difficult as the project continued to grow. Some of the main risks faced the project include:

Environmental:

One of the major risks is related to environment including chemical spills, untreated waste disposal, air and noise pollution and disruption of marine life as the project requires burying water surface. Additionally, the project caused coastal erosion, affecting water flow patterns and harming the surrounding shores.

Financial:

The project faced cost overruns in the global financial crisis of 2008, due to rising prices of the materials, construction delays and further shortfalls in funding. Moreover, Qatar's economy also faced instability during the financial crisis of 2008, leading to decreased activity in construction and difficulties in securing funding for large projects like The Pearl-Qatar. A combination of these challenges makes the financial plan insufficient and endangers the viability of the project. Additionally, market fluctuations, including the real estate, and other projects competing with each other, can further harm the financial prospect of the project.

Security risks:

Security risks included construction accidents and fires. A building in 2006 collapsed causes to highlight the seriousness of these risks. The company in charge was also fined in 2008 for failing to meet safety and security standards. This caused delays in opening hotels particularly and other luxurious projects within the island which further demonstrated the challenges faced.

Risk Management Plan:

Despite of the efforts to address the project's challenges, including implementing risk management practices at the beginning, there were likely gaps in the implementation of effective risk management by the developers at the beginning of The Pearl-Qatar

project, which may have contributed to the challenges encountered later on. Some potential gaps in risk management implementation could include:

Inadequate risk identification: Failing to comprehensively identify and assess all potential risks associated with the project at the outset. This could have included risks related to construction delays, financing, market fluctuations, regulatory changes, and environmental factors.

Lack of contingency planning: Even if risks were identified, no contingency plans were developed to mitigate or respond to these risks. A lack of contingency planning could have left the project vulnerable to various challenges and disruptions.

Insufficient risk allocation: Failing to give the required attention to the proper allocation of risks among project stakeholders, including contractors, investors, and government entities. Poor risk allocation led to disagreements, delays, and cost overruns as parties sought to shift responsibility for unforeseen issues.

Limited risk monitoring and control: Failing to apply robust systems for monitoring risk indicators, tracking progress against risk mitigation strategies, and adapting plans as required.

Overly optimistic assumptions: The project planning and decision-making were based on overly optimistic assumptions about market conditions, financing availability, and construction timelines. Unrealistic expectations contributed to underestimating the potential impact of risks and led to inadequate risk management strategies.

In general, these gaps in the implementation of effective risk management at the beginning of The Pearl-Qatar project worsened the challenges faced, necessitating government intervention to address issues and ensure project success.

Government Interference:

The Pearl-Qatar project was rescued by the government of Qatar. In the past, the government has come to give it financial aid and regulatory support to see it success in aspects such as cash crises and delays in constructions. One way in which the government saved the project is by funding the developers and providing financial guarantees to the investors involved in the project. Financial support ensured the project had the cash needed to undertake the construction and daily operations. It reduced liquidity constraints and presented it as a viable project to invest in.

A dedicated committee was established to oversee the project, and a comprehensive risk management plan was developed. The government collaborated with leading

international risk management companies and allocated a substantial budget for mitigation efforts. These measures proved to be a turning point.

Other than financing, the government also reviewed the regulatory processes and approvals, thereby removing the legal and bureaucratic barriers to the project. To ensure that the government minimized administrative delays and the license issuance and allowed access to permits, the construction activity went on smoothly . The government also advertised the project actively, as a highly diverse project that defines the future of its identity. hence, the government advertised the project using strategic initiatives globally and entered all the potential buyers and investors.

In conclusion, the government's intervention was essential to saving The Pearl-Qatar project from potential failure. By providing financial support, regulatory assistance, and strategic promotion, the government played a critical role in mitigating risks, restoring investor confidence, and ensuring the project's successful completion. Without the government's interference, the developer would have struggled to overcome the project's challenges and realize its ambitious vision for The Pearl-Qatar. This analysis emphasizes the importance of robust risk management for mitigating challenges and achieving successful outcomes in complex construction endeavors.

11.2. Riyadh Metro, KSA

A gigantic and transformative endeavor to renovate Riyadh's transportation infrastructure, the Riyadh Metro, is a network of six lines that span 176 kilometers. It encompasses all areas of the city with 85 stations, 40% of which run underground . The metro is designed to transport passengers at 80 kilometers per hour and is set to accommodate 1.16 million passengers daily . This project aims not only to alleviate traffic congestion but also to rebrand Riyadh's skies.

This project, however, is accompanied by a massive price tag of \$22.5 billion . As previously stated, the metro was intended to be fully operational by the year 2019 and will now be opened for the first time by the conclusion of 2024 due to many issues and unexpected perils. turning point.

Second, there were financial obstacles. These were primarily related to the high project cost, a lack of diversification in financing sources, fluctuating prices on raw materials, and financing delays. Third, technical obstacles for contractors originated from the complexity of constructing a metro system. Equipment delivery delays and the COVID-19 pandemic exposed the business to long-term economic and health problems. The fourth obstacle was a result of political and regulatory change,

presenting contractors with additional contractual risks and project delays. Fifth, the skill shortage affected project delivery, making it harder for contractors to finish the project on time.

Risk Management Plan:

The Public Transport Authority (PTA) proactively implemented a risk management plan to address these challenges. The plan involved a dedicated department solely

focused on identifying, assessing, and mitigating risks throughout the project's lifecycle. Stakeholder engagement was another key strategy, with the PTA actively collaborating with the government, investors, contractors, and the public to identify, assess, and mitigate risks effectively. While some metro lines are partially operational, others are still under construction, with full completion expected by the end of 2024. The project's delays offer valuable lessons learned for future infrastructure projects.

The importance of thorough planning, development plans, and comprehensive feasibility studies cannot be overstated. Utilizing a diverse pool of contractors with extensive experience in metro projects is another crucial factor. Distributing metro projects according to the area's size, considering Riyadh's vastness, could optimize resource allocation. Establishing clear and efficient project follow-up mechanisms would ensure timely identification and resolution of any emerging issues. Finally, increasing the number of specialized teams dedicated to specific project aspects can expedite project completion. Moving forward, several recommendations can be implemented to mitigate risks in future large-scale projects. Conducting thorough feasibility studies is paramount, with a focus on determining financing requirements, evaluating market risks, and establishing a contingency plan to address potential challenges.

This contingency plan should include identifying alternative funding sources, proposing solutions for dealing with price increases and delays, and outlining strategies for cost control through efficient project management, cost-saving techniques, and negotiating favorable contracts. Additionally, employing financial derivatives and diversifying funding sources can further mitigate financial risks. Obtaining guarantees from the government or financial institutions adds another layer of security. By incorporating these recommendations and learning from the experiences of the Riyadh Metro project, future infrastructure projects can be completed more efficiently and effectively.

12. Case Studies of Successful Risk Management Strategies Implemented in GCC Construction Projects

In the Burj Khalifa project, risk management played a crucial role in the successful completion of the building. The project was under immense time pressure because the client, the Dubai government, wanted to complete the building by a set date. This imposed a high level of risk on the project, in that any delays would have serious financial implications for the client. The risk manager on the project team was Zeyna Sanjana. Her first task was to persuade the senior management that time spent planning the risk management would result in a more efficient and cost-effective approach to managing risk. Zeyna used a risk workshop approach, meeting with each design team in a series of workshop sessions where risks were identified. The process of identifying risks and understanding their implications was time-consuming.

12.1. Burj Khalifa, Dubai

With the rapid development in the GCC countries, the construction industry is becoming very vibrant in terms of construction activities, which are a response to the upsurge regional demand for infrastructure. In this regard, UAE, particularly Dubai has become a leader in very tall high-rise building projects, with advanced technological and architectural designs from the experiences from the high rise building projects such as the 355m 92-storey tall tower called 'The Tower', as well as other mega projects such as the Business Bay Development and the 800m, 160-storey tall tower called 'The Tower at Dubai Creek Harbour'. The construction of the Burj Khalifa, the tallest building in the world is the case under focus. The primary objective of this South Ridge project was the installation of the building management system, which should incorporate fully automatic controls for the building and the facilities on the site, interfacing the services with the management and the occupants, facilitation of the regular monitoring and the control of the building services and the provision of the information in the form of the hard copy and the PC based multimedia facilities. Due to the complex nature and the high requirement of the intelligent design for the building management system which needs to comply with the technological and the architectural advancement for such high-rise building and there are many design options and variables that have to be considered in the processes, the all risks associated with such project was high. The common levels of Human Reliability Analysis (HRA) in a petrochemical plant or the nuclear power station is the second generation. However, by offering special training programme for the workers, the third generation HRA, which mean that the analysis by taking the influences of the humans' errors can be taken into account in HRA, could be applied. As the technological advancement does not stand still, the types of research conducted and

the level of human errors identified and participating in the analysis may develop the HRA into the fourth generation which the analysis may involve much more variety of influences and factors on human performance for both the activities and the environmental aspects.

12.2. King Abdullah Economic City, Saudi Arabia

The King Abdullah Economic City, located on the coast of the Red Sea, is one of the largest and most important real estate development and infrastructure projects in the Kingdom of Saudi Arabia. Facilitated by the Saudi Binladen group, the project began first quarter of 2006 with a schedule duration of 14 months. The master developer of the project is EMAAR, the largest real estate development company in the Middle East. The planned city covers an area of 168 million square meters. Strategically located along the coast of the Red Sea, the city combines a variety of uses – industrial, residential, commercial and tourist and is strategically located near the major ports of Jeddah, the commercial center of Saudi Arabia and the Holy City of Mecca. The city is about 100km north of Jeddah, the second largest city in Saudi Arabia. When completed, the city will cover 70 kilometers of coastline along the Red Sea and it is estimated that the city will have a population of 2 million, with working opportunities for 1 million. As recorded in the literature review (Zou et al., 2006 & EC Harris, 2010), the construction industry in Saudi Arabia is improving. With efforts, such as Saudi Economic Cities Development, and continuous investment in new infrastructure (EC Harris, 2010) - the industry has embraced modern technologies for construction projects, such as CAD, project management systems, control and monitoring systems and has seen the sustainable development and green building concept being applied. Also, as the largest country in the Gulf region, its increasing population and urbanization (RIM, 2011) give rise to the demand for better infrastructure, housing and public facilities – also the emphasis on sustainable development and environmentally friendly solutions. The growing contracting community in Saudi Arabia can be evidenced by the amount of applications received by the Saudi Council of Engineers. With the aim of improving the quality of construction projects and ensuring the protection of public interests, the Saudi Engineering laws and the professional standards are continuously being developed (Elgohary, 2011). King Abdullah Economic City is illustrated in Fig. 1 below.

12.3. Hamad International Airport, Qatar

In Hamad International Airport, the state-owned company in the design and construction management stages uses an Islamic form of procurement. The contractor is reimbursed for the costs it incurs during the project and receives a bonus payment, which is either a pre-agreed lump sum amount or a percentage of the

actual cost. In Islamic procurement, the contractor would be more inclined to act in the interest of the client and all parties would share the risk more equally. However, as Hamad International Airport is a significant public-private partnership in Qatar, a country renowned for its wealth funded by gas and oil reserves, political risks such as nationalization, liberalization of the economy, regime change, etc. are almost negligible. Also, due to the increasing revenue to the government by projects such as Hamad International Airport and its importance as the hub connecting the world for long-haul international flights, the economic risk regarding the airport operation would be assessed as low. However, on the construction site, lack of experienced contractors and sophisticated machines and equipment increase the design and building risks. The case demonstrates the complex environment and the dynamic nature of risk factors in real construction projects. The adoption of effective risk management strategies such as the involvement of the client during the project and the creation of a rigorous and shared project risk management culture had benefited the project team by helping members focus on successful project completion and more valuable projects in the future. In the Hamad International Airport project, contract risk has been identified such as the contractor being unable to fulfill the contractual obligations or the termination disputes occurred. Through sharing the success of the projects resulted from bespoke and collaborative approach and entrepreneurial spirit, the parties in the project managed to create values and long-term relationship to face the uncertainties. Such strategic risk approach will bring sustainable growth within the industry in Qatar, which was assessed having high construction risks in the market. Due to the continuous good performance and steady progress of the airport project, the government planned further development by building an airport city around Hamad International Airport and the funding has been arranged for the US\$1.5bn runway and infrastructure project. It is expected that nearly half of Qatar's hotel rooms and short-term apartments will be based in or around the planned city. The case suggests that effective risk identification and the proactive risk appraisals can provide industry players opportunities for excellent performance and the growth of valuable experiences in the practical risk management on construction projects in GCC.

13. Conclusion

The conclusion of the study summarizes the research findings and emphasizes the vital importance of risk management in construction projects in the GCC region. The study finds that although the concept of risk management is well known in the construction industry, it is not well practiced in the GCC construction projects under the traditional procurement methods. This is further complicated by the fact that most risk management exercises in the region are more focused on meeting the

criteria of the funders rather than the strategic objective of the client and the project as suggested by Ashworth's observations. The research findings suggest that adopting a proactive risk management process will lead to a more efficient and effective project, with less rework, and that risk management should be integrated into the whole project management framework, rather than being a separate exercise. The study concludes by proposing recommendations for future research in this area. First, the effectiveness of today's most common risk management techniques in the GCC construction industry could be tested, such as the Delphi and Monte Carlo techniques. Second, a comparative analysis of the benefits and advantages of risk management processes to different project stakeholders could be conducted. This might shed more light on the possible resistance to change by certain parties in the industry. Last but not least, the use of Building Information Modeling (BIM) to enhance risk management processes should be further researched. The study also underlines the need of integrating risk management process in the procurement models for GCC construction projects and it purports that the current popular models do not promote the adoption of risk management. Last but not least, the study suggests that changes are required for initiating and implementing risk management strategy in GCC construction projects.

13.1. Summary of Findings

The case studies used in this article are based on empirical data, interviews with project personnel, and an extensive literature review. The case studies provide evidence for the benefits of effective risk management in construction projects in the GCC region. For example, the successful completion of the Burj Khalifa was attributed to the early identification of key risks and the implementation of effective risk allocation strategies. The literature review, findings, and conclusions are then summarized in the last part of this article. All authors agree that for a successful project, projects must apply good risk management and develop a suitable risk allocation. At the same time, the project team should engage stakeholders in the process, implement a robust risk assessment methodology, and regularly review and update risk management strategies. It is believed by the group of authors that for a successful story of the project, applying a good risk management process and adapting to the unknowns and risks in construction projects will be fundamental. The ultimate goal of risk management is the mission of helping stakeholders, including constructors, architects, and producers, to determine beneficial outcomes of any project. Throughout this article, risk management and comprehensive risk management methodologies were investigated for all stages of the project, and the team found out that those methodologies are meaningful for ensuring the success of a project. Last but not least, for future works, the research team is recommending

further research on exploring even more on the risk management within a specific construction scope in the GCC regions. Also, a more specific framework or model for measuring construction project success from a risk management perspective could be proposed and validated in order to contribute a healthier conglomerate knowledge for this area of importance.

13.2. Recommendations for Future Research

In addition to considering factors such as project scale, architectural diversity, building materials and technology, climate, and the status of the economy, researchers may explore the application of qualitative and quantitative risk assessment tools and methods such as the Analytical Hierarchy Process (AHP) and the Monte Carlo Simulation (MCS) in identifying, analyzing and assessing risk factors in GCC construction projects. Besides, in increasingly competitive business environments, more and more stakeholders expect alternative project delivery methods to be used to add value to the construction process, such as Design Build (DB), Engineer, Procure and Construct (EPC), and Public Private Partnership (PPP), etc. Further research may be directed to focus on how the effectiveness and efficiency of risk management differ under those project delivery alternatives. It is also worth investigating how the different risks encountered in the aforementioned alternative delivery methods, especially the unique or substantial risks associated with projects using DB, EPC or PPP, affect the risk management practices in GCC construction projects. BIM as a novel technology is drawing increasing attentions and being adopted in various AEC (Architecture, Engineering, Construction) projects, and has the potential to improve productivity, reduce project cost and facilitate better project quality via the creation of precise and reliable project documentation. However, only a few projects in the GCC region have used or are using BIM, and data such as those generated from BIM model that may help relieve uncertainties in construction risk management is yet to be fully exploited. Thus, research in the relationship between BIM and risk management, for example, the potential benefits and limitations of using BIM at different stages of risk management process, is encouraged. As for emergency risks which may cause irrecoverable consequences with severe impact on construction projects, it is important to explore the application of innovative risk management strategies that integrate the concept of resilience, which is the ability of a system to absorb and adapt with the changes and uncertainties - and still be able to deliver its core functions. This may involve a trans-disciplinary approach including specialists in risk management, civil protection, human and social factors, as well as modern information and communication technologies. Lastly, to better protect the interests of all stakeholders and foster continual improvement for the whole industry, systematical approaches for knowledge transfer and learning from both successful

and failed risk management experiences are necessary. With the advancements in virtual and interactive technologies, the deployment of Virtual Reality (VR) and Augmented Reality (AR) in knowledge management and transfer activities is promising. Future research may look into the development of an integrated and dynamic platform which enables users to experience probabilistic scenarios and obtain visual - sensory knowledge that simulates real life situations in construction projects.

الخاتمة

دول مجلس التعاون الخليجي تعتبر من أسرع مناطق العالم نمواً من حيث المشاريع الانشائية. والمشاريع الانشائية في هذه الدول تعاني الكثير من المشاكل مثل التأخيرات والزيادة المستمرة في التكاليف اثناء العملية الانشائية. من هذا المنطلق جاءت أهمية البحث التي تركز على السبب الرئيسي خلف هذه المشاكل وهو عدم كفاءة ادارة المخاطر اثناء تخطيط وتنفيذ هذه المشاريع. ورغم أن مفهوم ادارة المخاطر ليس غريباً على القطاع الانشائي الى أنه يتسم بعدم الفعالية، عد الكفاءة، وعدم القدرة على التعامل مع المخاطر التي تتعرض لها المشاريع في هذه المنطقة.

ومما يزيد الأمر تعقيداً حقيقة أن معظم ممارسات إدارة المخاطر في المنطقة تركز بشكل أكبر على تلبية معايير الممولين بدلاً من الهدف الاستراتيجي للعميل والمشروع. وتشير نتائج البحث إلى أن اعتماد عملية إدارة المخاطر الاستباقية سيؤدي إلى مشروع أكثر كفاءة وفعالية، مع إعادة تعديل أقل، وأنه ينبغي دمج إدارة المخاطر في إطار إدارة المشروع بأكمله، بدلاً من أن تكون ممارسة منفصلة. وتختتم الدراسة باقتراح توصيات للبحث المستقبلي في هذا المجال.

أولاً، يمكن اختبار مدى فعالية أساليب إدارة المخاطر الأكثر شيوعاً اليوم في صناعة البناء والتشييد في دول مجلس التعاون الخليجي، مثل تقنيات دلفي ومونت كارلو.

ثانياً، يمكن إجراء تحليل مقارنة لفوائد ومزايا عمليات إدارة المخاطر لمختلف أصحاب المصلحة في المشروع. وقد يلقى هذا المزيد من الضوء على المقاومة المحتملة للتغيير من قبل بعض الأطراف في المجال. وأخيراً وليس آخراً يجب إجراء مزيد من البحوث حول استخدام نمذجة معلومات البناء – بيم - لتعزيز عمليات إدارة المخاطر.

وتؤكد الدراسة أيضاً على الحاجة إلى دمج عملية إدارة المخاطر في نماذج المشتريات لمشاريع البناء في دول مجلس التعاون الخليجي، وتزعم أن النماذج الشائعة الحالية لا تشجع على اعتماد إدارة المخاطر. وأخيراً وليس آخراً، تشير الدراسة إلى أن التغييرات المطلوبة لبدء وتنفيذ استراتيجية إدارة المخاطر في مشاريع البناء في دول مجلس التعاون الخليجي.

ملخص النتائج

تستند دراسة النماذج المستخدمة في هذه المقالة إلى بيانات تجريبية، ومقابلات مع العاملين على المشاريع، ومراجعة واسعة النطاق للدراسات السابقة. توفر دراسة النماذج دليلاً على فوائد الإدارة الفعالة للمخاطر في مشاريع البناء في منطقة دول مجلس التعاون الخليجي. على سبيل المثال، يُعزى الإنجاز الناجح لبرج خليفة إلى التحديد المبكر للمخاطر الرئيسية وتنفيذ استراتيجيات فعالة لتوزيع المخاطر. بالإضافة الى تلخيص مراجعة الدراسات السابقة والنتائج والاستنتاجات. يتفق جميع الباحثون على أنه من أجل نجاح اي مشروع، يجب تطبيق إدارة جيدة للمخاطر وتطوير توزيع مناسب للمخاطر. وفي الوقت نفسه، يجب على فريق المشروع إشراك أصحاب المصلحة في العملية، وتنفيذ

منهجية قوية لتقييم المخاطر، ومراجعة وتحديث استراتيجيات إدارة المخاطر بانتظام. يعتقد الباحثون أنه من أجل نجاح المشروع، فإن تطبيق عملية جيدة لإدارة المخاطر والتكيف مع المجهول والمخاطر في مشاريع البناء سيكون أمرًا أساسيًا. الهدف النهائي لإدارة المخاطر هو مساعدة أصحاب المصلحة، بما في ذلك المقاولين والمهندسين المعماريين والمطورين، لتحقيق النتائج الإيجابية لأي مشروع. خلال هذه المقالة، تم التحقيق في إدارة المخاطر ومنهجيات إدارة المخاطر الشاملة لجميع مراحل المشروع، واكتشف الفريق أن هذه المنهجيات مفيدة لضمان نجاح المشروع.

التوصيات

بالإضافة إلى النظر في العوامل مثل حجم المشروع واختلاف التصميم المعماري ومواد البناء والتكنولوجيا والمناخ وحالة الاقتصاد، قد يبحث الباحثون في تطبيق أدوات وطرق التقييم الكمي والكيفي للمخاطر مثل عملية التسلسل التحليلي ومحاكاة مونت كارلو في تحديد وتحليل وتقييم عوامل المخاطر في مشاريع البناء في مجلس التعاون الخليجي. بالإضافة إلى ذلك، في بيئات الأعمال التنافسية المتزايدة، يتوقع المزيد والمزيد من الأطراف التنافس في استخدام أساليب توصيل بديلة للمشروع لإضافة قيمة إلى عملية البناء، في مجالات التصميم والبناء والهندسة والتوريد والشرابة بين القطاعين العام والخاص وما إلى ذلك. يمكن توجيه المزيد من الأبحاث إلى التركيز على كيفية اختلاف فعالية وكفاءة إدارة المخاطر تحت تلك البدائل لتوصيل المشروع. و التحقيق في كيفية تأثير المخاطر المختلفة التي تواجه تلك الأساليب البديلة للتسليم، خاصة المخاطر الفريدة أو الكبيرة، على ممارسات إدارة المخاطر في مشاريع البناء في مجلس التعاون الخليجي.

بينما تجذب تقنية كتنقية – بيم - اهتمامًا متزايدًا وتُعتمد في مشاريع الهندسة المعمارية والهندسة المدنية والبناء، ولديها القدرة على تحسين الإنتاجية وتقليل تكلفة المشروع وتسهيل تحسين جودة المشروع من خلال إنشاء ملفات دقيقة وموثوقة. ومع ذلك، لم تستخدم سوى عدد قليل من المشاريع في منطقة مجلس التعاون الخليجي هذه التقنية، ولم يتم الاستفادة من البيانات التي توفرها والتي قد تساعد في تخفيف الغموض في إدارة المخاطر في قطاع البناء. ولذا، يُشجع على البحث في العلاقة بين وإدارة المخاطر واستخدام هذه التقنية، على سبيل المثال، الفوائد والقيود المحتملة لاستخدامها في مراحل مختلفة من عملية إدارة المخاطر خاصة فيما يتعلق بالمخاطر الطارئة التي قد تتسبب في عواقب لا يمكن التعويض عنها مع تأثير جدي على عملية البناء، من المهم البحث في تطبيق استراتيجيات إدارة المخاطر المبتكرة التي تدمج مفهوم الصمود، وهو القدرة على الاستيعاب والتكيف مع التغيرات وعدم اليقين. قد يتطلب هذا بحث اختصاصيون، من مختلف المجالات بما في ذلك المتخصصون في إدارة المخاطر والحماية المدنية والعوامل البشرية والاجتماعية بالإضافة إلى التكنولوجيا الحديثة للمعلومات والاتصالات.

أيضاً، لحماية مصالح جميع الأطراف وتعزيز التحسين المستمر لصالح المجال الإنشائي بأسره، فإن النهج النظامي لنقل المعرفة والتعلم من تجارب إدارة المخاطر الناجحة والفاشلة في المنطقة هو ضروري حيث أن الباحثون يعانون من عدم توفر المعلومات الكافية عن المشاريع الإنشائية في المنطقة.

مع التقدم في التقنيات الافتراضية والتفاعلية، فإن استخدام الواقع الافتراضي والواقع المعزز في أنشطة إدارة المخاطر ونقلها واعد للغاية. قد تنظر الأبحاث المستقبلية في تطوير منصة متكاملة وديناميكية تتيح للمستخدمين تجربة سيناريوهات احتمالية والحصول على معرفة بصرية - حسية تحاكي الحياة الواقعية في مشاريع البناء.

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